Kopargaon Taluka Education Society's

K. J. Somaiya College of Arts, Commerce and Science, Kopargaon

CRITERION- 1

CURRICULAR ASPECTS

Key Indicator- 1.3 Curriculum Enrichment

1.3.1 QnM:- Institution integrates crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability in transacting the Curriculum

Institution Integrates Cross-Cutting Issues in transacting the curriculum

(Subject / Issue wise)

2019-2020

Kopargaon Taluka Education Society's

K. J. Somaiya College of Arts, Commerce & Science, Kopargaon

Mohiniraj Nagar, Kopargaon, Tal: Kopargaon, Dist: Ahmednagar Pin-423601

Cross-Cutting Issues in Transacting the Curriculum 2019-2020

(Professional Ethics/ Gender/ Human Values/ Environment and Sustainability)

Kopargaon Taluka Education Society's

K. J. Somaiya College of Arts, Commerce & Science, Kopargaon

Crosscutting Issues in Syllabus of English

Crosscutting Issues in 2019 Pattern:

Sr. No.	Class	Course Code	Course Name	Addressed issues
1	B. A. English	CC-11011/11012	FYBA: Compulsory English	Professional Ethics/Gender/ Human Values /Environment and Sustainability
2	B. A. English	(General Paper-1) 11331/11332	FYBA: Optional English	Professional Ethics/Gender/ Human Values /Environment and Sustainability
3	B. A. English	CC-23001/24001	SYBA : Compulsory English	Professional Ethics/Gender/ Human Values /Environment and Sustainability
4	B.A. English	DSC-1 A 123331/24331	SYBA: Appreciating Drama	Gender/ Human Values /Environment and Sustainability
5	B.A. English	DSC-2A 23332/24332	SYBA: Appreciating Poetry	Gender/ Human Values /Environment and Sustainability
6	B.A. English	SEC-1A 23333/24333	SYBA: Advanced Study of English Language	Professional Ethics
7	B.A. English	SEC-2A 23334/24334	A Certificate Course in Skill Development	Professional Ethics
8	B.A. English	CC-35001/36001	TYBA: Compulsory English	Professional Ethics/Gender/ Human Values /Environment and Sustainability
9	B.A. English	SEC 1-C & SEC 1-D- 35331/36331	Enhancing Employability Skills	Professional Ethics
10	B.A. English	DSE-1C& DSE-1D-35332/36332	Appreciating Novel	Gender/ Human Values /Environment and Sustainability
11	B.A.	DSE-2C DSE-2D	Introduction to Literary	Gender/ Human Values

	English	35333/36333	Criticism	/Environment and Sustainability
12	B.A. English	SEC 2-C SEC2-D) 35334/36334	Mastering Life Skills and Life Values	Professional Ethics
13	M.A English	10601/20601	Paper 1.1/Paper 2.1 : English Literature from 1550 to 1798	Gender/ Human Values /Environment and Sustainability
14	M.A English	10602/20602	Paper – 1.2/ Paper – 2.2: English Literature from 1798 to the Present	Gender/ Human Values /Environment and Sustainability
15	M.A English	10603/20603	Paper 1.3/2.3: Contemporary Studies in English Language	Professional Ethics
16	M.A English	10604/20604	Paper – 1.4: Literary Criticism and Theory	Gender/ Human Values /Environment and Sustainability
17.	M.A English	30601/40601	Paper 3.1/4.1: Indian Writing in English (Core Paper)	Gender/ Human Values /Environment and Sustainability
18.	M.A English	30604/40604	Paper 3.4/4.4: Indian Literatures in English Translation	Professional Ethics/Gender/ Human Values /Environment and Sustainability
19	B. A. English	30606 /40606	Paper 3.6/4.6: American Literature	Gender/ Human Values /Environment and Sustainability
20	M.A English	30608/40608	Paper 3.8/4.8: World Literature in English	Gender/ Human Values /Environment and Sustainability
21	M.A English	30094/40094	Skill Development-3/4	Professional Ethics
22	F.Y.B. Com	111/121	FYBCom: Compulsory English	Professional Ethics/Gender/ Human Values /Environment and Sustainability
23	F.Y.B. Com	117-A/127-A	FYBCom: Additional English	Professional Ethics/Gender/ Human Values /Environment and Sustainability
24	SYBSC	23321/24321	ENGLISH (Ability Enhancement Compulsory Course-AECC)	Professional Ethics/Gender/ Human Values /Environment and Sustainability
25	SYBSC (Computer Science)	23922/24922	ENGLISH (Ability Enhancement Compulsory Course-AECC)	Professional Ethics/Gender/ Human Values /Environment and Sustainability
26	SYBCA	308/408	ENGLISH(Ability Enhancement Compulsory Course-AECC)	Professional Ethics/Gender/ Human Values /Environment and Sustainability

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Pr... al
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F. Y. B. A Compulsory English
(w. e. f. 2019-2020)
(Choice Based Credit System)
70:30-Pattern
(70-Semester-End Exam & 30-Internal Evaluation)

Prescribed Text: ***Literary Gleam: An Anthology of Prose and Poetry*** **(Board of Editors- Orient BlackSwan)**

Objectives:

a) To expose students to the best examples of prose and poetry in English so that they realize the beauty and communicative power of English

b) To instill human values and develop the character of students as responsible citizens of the world

c) To develop the ability to appreciate ideas and think critically

d) To enhance employability of the students by developing their linguistic competence and communicative skills

e) To revise and reinforce structures already learnt in the previous stages of learning.

Semester-I

Prose:
1. Engine Trouble — R. K. Narayan
2. On Saying 'Please' — A. G. Gardiner
3. The Gift of the Magi — O. Henry

Poetry:
1. A Red, Red Rose — Robert Burns
2. Leave this Chanting and Singing — Rabindranath Tagore
3. The Felling of a Banyan Tree — Dilip Chitre

Grammar:
1. Articles
2. Prepositions
3. Verbs
   Regular and Irregular Verbs
   Auxiliary Verbs: Primary and Modal
4. Punctuation

Communication Skills:
1. Greeting and Taking Leave

2. Introducing Yourself
3. Introducing People to One Another
4. Making Requests and Asking for Directions
5. Making and Accepting Apology

Semester- II

Prose:
1. In Sahyadri Hills, A Lesson in Humility — Sudha Murthy
2. The Model Millionaire — Oscar Wilde
3. The Eyes are not Here — Ruskin Bond

Poetry:
1. My Heart Leaps Up — William Wordsworth
2. Ozymandias — P. B. Shelley
3. Success is Counted Sweetest — Emily Dickinson

Grammar:
1. Tenses
2. Subject–Verb Agreement
3. Vocabulary

Communication Skills
1. Inviting and Accepting/Declining Invitations
2. Making a Complaint
3. Congratulating, Expressing Sympathy and Offering Condolences
4. Making Suggestions, Offering Advice and Persuading

- Each semester shall have 3 credits for teaching. Each credit is equal to 15 hours, so this course shall have 45 teaching hours. In addition to that there shall be three hours allotted to internal evaluation. Changes as per the university guidelines shall be communicated from time to time.

F. Y. B. A- Optional English (General Paper-1)
(w. e. f. 2019-2020)
(Choice Based Credit System)
70:30-Pattern
(70-Semester-End Exam & 30-Internal Evaluation)

Prescribed Text: ***Initiations: Minor Literary Forms & Basics of Phonology*** **(Board of Editors- Orient BlackSwan)**

Objectives:

a) To expose students to the basics of literature and language and develop an integrated view about language and literature in them

b) To acquaint them with minor forms of literature in English and help them to appreciate the creative use of language in literature

c) To introduce them to the basics of phonology of English so that they can pronounce better and speak English correctly.

d) To prepare students to go for detailed study and understanding of literature and language

e) To enhance the job potential of students by improving their language skills

Semester - I

Prose Pieces:

1. A Lesson My Father Taught Me - A.P.J. Abdul Kalam

2. Toasted English - R. K. Narayan

Short Stories:

1. The Romance of a Busy Broker - O. Henry

2. The Open Window - Saki

Poetry:

1. Sonnet 29: 'When in disgrace with Fortune and men's eyes' - William Shakespeare
2. The World is too much with Us - William Wordsworth
3. The Listeners - Walter de la Mare
4. No Men are Foreign - James Kirkup

Language Studies:

Introduction to the Sounds of English: Part - I

(Discrepancy between English Spelling and Pronunciation, Phonetic Symbols and Transcription, The Concept of Phoneme and Minimal Pairs.)

Semester - II

Short Stories:

1. The Doll's House - Katherine Mansfield
2. The Thief – Ruskin Bond

Poetry:

1. I remember; I remember – Thomas Hood
2. Where the Mind is without Fear - Rabindranath Tagore
3. The Mountain and the Squirrel - R. W. Emerson
4. Up – Hill - Christina Rossetti

One Act Plays:

1. The Monkey's Paw - W.W. Jacobs
2. Swansong - Anton Chekhov

Language Studies:

Introduction to the Sounds of English: Part - II

(The Concept of Syllable, Monosyllabic and polysyllabic Words, The Concept of Word Stress and Different Standards of Pronunciation i.e. British Received Pronunciation, General American English and General Indian English.)

F. Y. B. Com Compulsory English
(w. e. f. 2019-2020)
(Choice Based Credit System)
70:30-Pattern
(70-Semester-End Exam & 30-Internal Evaluation)

Prescribed Text: ***Success Avenue*** **(Board of Editors- Orient Blackswan)**

Objectives:

a) To offer relevant and practically helpful pieces of prose and poetry to students so that they not only get to know the beauty and communicative power of English but also its practical application
b) To expose students to a variety of topics that dominate the contemporary socio-economic and cultural life
c) To develop oral and written communication skills of the students so that their employability enhances
d) To develop overall linguistic competence and communicative skills of students

Semester- I

Prose

Unit-1- The Beggar- Anton Chekhov

Unit-II- Black Money and the Black Economy- C. Rammanohar Reddy

Unit-III- The Nightingale and the Rose- Oscar Wilde

Unit-IV- Muhammad Yunus: An Economics for Peace- Farida Khan

Poetry

Unit-V- Up-Hill- Christina Rossetti

Unit-VI- Stay Calm- Grenville Kleiser

Communication and Life Skills

Unit-VII- Meeting and Greeting People and Dialogue Writing

Unit-VIII- Group Discussions, Interview and Interviewing Skills

Unit-IX- Presentation Skills

Semester- II

Prose

Unit-I - Indra Nooyi: A Corporate Giant- Indra Krishnamurty Nooyi

Unit-II- Appro JRD- Sudha Murthy

Unit-III- Fur- Saki

Unit-IV- After Twenty Years- O' Henry

Poetry

Unit-V- O Captain! My Captain- Walt Whitman

Unit-VI - The Prayer for My Daughter- W. B. Yeats

Communication and Life Skills

Unit-VII- Letter Writing, Report Writing and Blog Writing

Unit-VIII- Resume Writing and E-Mails

Unit-IX- Non-Verbal Communication

As indicated in the CBCS (Choice Based Credit System) Restructured Programme of Savitribai Phule Pune University at undergraduate level to be introduced from the academic year 2019-20, this subject (Compulsory English), like other subjects under B. Com. Degree Course, shall have 70+30 pattern. There will be written examination of 70 marks of 3 hrs duration for this subject at the end of each semester. The class work (internal evaluation) shall carry 30 marks. Each semester shall have 3 credits for teaching. Each credit is equal to 15 hours so this course shall have 45 teaching hours. In addition to that there shall be three hours allotted to internal evaluation. Changes as per the university guidelines shall be communicated from time to time.

F. Y. B. Com (Additional English)
(w. e. f. 2019-2020)
(Choice Based Credit System)
70:30-Pattern
(70-Semester-End Exam & 30-Internal Evaluation)

Prescribed Text: ***Pearls of Wisdom*** **(Board of Editors-Orient Blackswan)**

Objectives

a) To expose students to a good blend of old and new literary extracts having various themes that are entertaining, enlightening and informative so that they realize the beauty and communicative power of English
b) To make students aware of the cultural values and the major problems in the world today
c) To develop literary sensibilities and communicative abilities among students

Term-I

Unit-I

1. The Sporting Spirit – George Orwell
2. The World Is Too Much With Us – William Wordsworth

Unit-II

1. Do Insects Think? - Robert Benchley
2. The Fortune Teller - Joseph Furtado

Unit-III

1. Good Manners – J.C Hill
2. Where the Mind is Without Fear - Rabindranath Tagore

Unit-IV

1. My Financial Career-Stephen Leacock
2. I Sit and Look Out - Walt Whitman

5. Interpersonal skills: Understanding and Cooperating with Others
6. Management of Stress and Emotions

Question paper pattern

SEMESTER-V (SEC 2-C)

Question-1- Attempt any ONE of the following. 10 Marks
(1 Out of 2- Unit-I)
Question-2- Attempt any ONE of the following. 10 Marks
(1 Out of 2- Unit-II)
Question-3- Attempt any ONE of the following. 05 Marks
(1 Out of 2- Unit I- & II)

Total Marks- 25

SEMESTER-VI (SEC 2-D)

Unit-I **Life Values**

1. Meaning and Nature of Values
2. Importance of Human Values
3. Moral Values
4. Ethical Values

Unit-II

5. Professional Values
6. Aesthetic Values
7. Psychological Values
8. Self-Awareness and Self-Management

Question paper pattern

SEMESTER-VI (SEC 2-D)

Question-1- Attempt any ONE of the following. 10 Marks
(1 Out of 2- Unit-I)
Question-2- Attempt any ONE of the following. 10 Marks
(1 Out of 2- Unit-II)
Question-3- Attempt any ONE of the following. 05 Marks
(1 Out of 2- Unit- I & II)

Total Marks- 25

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M. A. (English) Part I (w.e.f. June 2019-20)

(Credit and Semester System-CSS)

Rationale for studying/teaching literature

• The rationale for studying Literature in English is that it primarily reinforces the guiding principles for education reform outlined in the UGC guidelines.

• The Literature component in English Curriculum provides learners with learning experiences to appreciate and enjoy literature, encourage self-expression and creativity, enhance their critical and analytical skills, improve their competence in the use of English, develop their cultural understanding as well as positive values and attitudes conducive to lifelong learning, and prepare them for further study or work.

• The aims of studying/teaching the Literature component in English curriculum are to enable learners to appreciate and enjoy a wide range of literary or creative texts and to appreciate other related cultural forms.

• The curriculum helps learners to develop a humanistic outlook on life. Through a close interaction with literary/creative works, which portray a range of human thoughts, emotions and experiences, learners gain knowledge and an understanding of the nature of human existence and of the world.

• The study of Literature has many practical advantages—it provides ample opportunities for learners to develop their creativity, sharpen their critical and analytical skills, and enhance their language proficiency.

• It broadens students' awareness of the general culture of different places where English is used and enhances their appreciation and understanding of culturally diverse societies.

• The intellectual, aesthetic and emotional qualities which learners develop by studying literature in English prepare them for further study or work, particularly in areas such as publishing and the media, where creativity, critical thinking and intercultural understanding are highly appreciated.

Rationale for studying English Language/Linguistics and English Literature: English has attained the status of a global language and it is being taught world over for various purposes. In India, English has always been an important language and it has also been a second language in our country. Its importance has increased further in the recent times when it began to be considered as a language of opportunities, a language that can enhance geographical and social mobility. Young people with a good command of English are in great demand in the IT-BPO sectors and in many other prominent domains of profession. A sound knowledge of the English language can also secure lucrative jobs in the world of media. A similar knowledge is a need for many students who seek to work as teachers in schools and centres of higher learning. While teaching English for communicative purposes is an important activity in schools and colleges, teaching/studying the language scientifically is an absolute necessity for those students who

Paper 1.1: English Literature from 1550 to 1798

1) AIMS AND OBJECTIVES

1) To introduce students to the major movements and figures of English Literature through a study of selected literary texts/pieces published during the period prescribed for study.

2) To enhance learners' literary sensibility and their emotional response to literary texts and to help them understand the thematic and stylistic preoccupations of the writers prescribed for study.

3) To enable them to critically examine the writers' thematic concerns and to point out the (in)significance of such concerns in the postcolonial context.

4) To help them recognize the distinctive ways in which the writers differed, in their ideological positions, from their counterparts belonging to different ages.

5) To provide learners some basic information about England's political, social and cultural developments during the period prescribed for study.

6) To enable them to critically assess the 'universal' values that writers tend to project in their writings.

7) To help learners apply the literary-critical principles they study in the paper 'Literary Criticism and Theory' to the texts prescribed or to any other text they read.

8) To explain to the learners the canonical relevance of the texts prescribed for them.

9) To help them identify potential areas of research on which they can work independently for securing a degree or merely for the sake of obtaining knowledge.

10) To enhance their proficiency in English

2) COURSE CONTENT Most of the texts/excerpts listed below are available online. Some of the online resources/sites are given under the section titled 'References.' Teachers and students must also consult standard editions of the texts for authenticity and accuracy.

Semester-I

Allotment of Credits: One credit is equal to 15 clock hours and every semester is allotted four credits (60 clock hours). This also includes the completion of the background to each period/age. The allotment is as follows:

1) Unit I: Philip Sidney, Edmund Spenser, Walter Raleigh, Robert Herrick: **16 clock hours**

2) Unit II: John Donne, Andrew Marvell, George Herbert, Edmund Waller- **18 clock hours**

3) Unit III: Christopher Marlowe: *Edward II*- **13 clock hours**

4) Unit IV: William Shakespeare: *The Tempest*- **13 clock hours**

Unit-I:

Sir Philip Sidney: The following lyric from *Astrophel and Stella*: 'Come Sleep! O Sleep, the certain knot of peace'

Edmund Spenser: The following poem from *Amoretti*–"Ye tradefull Merchants that with weary toyle"

Sir Walter Raleigh: "The Lie"

Robert Herrick: "Delight in Disorder"

Unit-II

John Donne: i) "The Sunne Rising" ii) "Batter my heart, three-person'd God"

Andrew Marvell: "On Mr. Milton's Paradise Lost"

George Herbert: i)"Death" ii) "The Collar"

Edmund Waller: "Go, lovely Rose"

Unit-III

Christopher Marlowe: *Edward II*

Unit-IV

William Shakespeare: *The Tempest*

Paper – 2.1: English Literature from 1550 to 1798

Semester-II

Unit-I: John Milton: **12 clock hours**

Unit-II: John Dryden, Alexander Pope and William Blake **18 clock hours**

Unit-III: Richard Steele, Joseph Addison, Ben Jonson: **16 clock hours**

Unit-IV: Jonathan Swift: **14 clock hours**

COURSE CONTENT

Unit-1

Paper – 1.2: English Literature from 1798 to the Present

1) AIMS AND OBJECTIVES

1) To introduce students to the major movements and figures of English Literature through a study of selected literary texts/pieces published during the period prescribed for study.

2) To enhance learners' literary sensibility and their emotional response to literary texts and to help them understand the thematic and stylistic preoccupations of the writers prescribed for study.

3) To enable them to critically examine the writers' thematic concerns and to point out the (in)significance of such concerns in the postcolonial context.

4) To help them recognize the distinctive ways in which the writers differed, in their ideological positions, from their counterparts belonging to different ages.

5) To provide learners some basic information about England's political, social and cultural developments during the period prescribed for study.

6) To enable them to critically assess the 'universal' values that writers tend to project in their writings.

7) To help learners apply the literary-critical principles they study in the paper 'Literary Criticism and Theory' to the texts prescribed or to any other text they read.

8) To explain to the learners the canonical relevance of the texts prescribed for them.

9) To help them identify potential areas of research on which they can work independently for securing a degree or merely for the sake of obtaining knowledge.

10) To enhance their proficiency in English

2) COURSE CONTENT Most of the texts/excerpts listed below are available online. Some of the online resources/sites are given under the section titled 'References.' Teachers and students must also consult the print versions of the texts for authenticity and accuracy.

Allotment of Credits: One credit is equal to 15 clock hours and every semester is allotted four credits (60 clock hours). This also includes the completion of the background to each period/age. The allotment is as follows:

Semester-I

Unit-I: ST Coleridge, William Wordsworth: **14 clock hours**

Unit-II: PB Shelley, John Keats, Felicia Hemans: **16 clock hours**

Unit-III: Mary Shelley: **15 clock hours**

Unit-IV: Jane Austen: **15 clock hours**

Unit-I

S. T. Coleridge: i) "Frost at Midnight"; ii) "Dejection: An Ode"

William Wordsworth: "Resolution and Independence"

Unit-II

P. B Shelley: "England in 1819"

John Keats: i) "Ode on a Grecian Urn" ii) "On First Looking into Chapman's Homer"

Felicia Hemans: "The Bird's Release"

Unit-III

Mary Shelley: *Frankenstein*

Unit-IV

Jane Austen: *Persuasion*

Paper – 2.2: English Literature from 1798 to the Present

Semester-II

Unit I: Elizabeth Barrett Browning, Alfred Tennyson, Robert Browning: **12 clock hours**

Unit II: TS Eliot, WB Yeats, Siegfried Sassoon: **16 clock hours**

Unit III: Seamus Heaney, Anthony Thwaite, Kathryn Simmonds, Jean Rhys: **20 clock hours**

Unit IV: Tom Stoppard: **12 clock hours**

Unit-I

Elizabeth Barrett Browning: "The Cry of the Children"

Alfred Lord Tennyson: From *In Memoriam* "I envy not in any moods"

Robert Browning: "Among the Rocks"

Unit-II

T. S. Eliot: "Preludes"

Sales, Roger. *Tom Stoppard: Rosencrantz and Guildenstern Are Dead* [Penguin Critical Studies] London / New York: Penguin, 1988

Paper 1.3: Contemporary Studies in English Language

1) AIMS AND OBJECTIVES

1. To introduce students to the basic tools essential for a systematic study of language

2. To acquaint students with the basic concepts and issues in linguistics

3. To introduce them to various sub-disciplines of linguistics

4. To initiate them into some of the theoretical assumptions underlying language and to enable them to apply the acquired linguistic skills in real life situations

5) To introduce learners to the syntactic features of the English language

6) To help them shake off some of the regional features of English pronunciation

7) To enable them to use English with confidence and with a better understanding of its appropriate social applications.

2) COURSE CONTENT

[**Note:** Teachers are expected to discuss in class the background to major linguistic theories, linguists and their theoretical models. There will be a separate question on the linguistic background]

A note on the allotment of Credits: One credit is equal to 15 clock hours and every semester is allotted four credits (60 clock hours). The allotment is as follows:

Semester-I

Unit-I: Introduction to Linguistics and Contemporary Theories/Views of Language: **15 clock hours**

Unit-II: Phonology: **15 clock hours**

Unit-III: Morphology: **15 clock hours**

Unit-IV: Syntax: **15 clock hours**

Unit-1: Introduction to Linguistics and Contemporary Theories/Views of Language

A) Introduction: What is Linguistics? Major branches of Linguistics (Psycholinguistics, Sociolinguistics, Computational linguistics, Historical linguistics), Linguistics in the 20th century: A short history

B) Ferdinand de Saussure's Structuralist View of Grammar:

i) Synchronic and Diachronic Studies

प्रथम वर्ष कला (F.Y.B.A.) (सामान्य)
(द्वितीय अयन)

पाठ्यचर्या : वैकल्पिक हिंदी प्रश्नपत्र – 1 B

3 कर्मांक

उद्देश्य :

1. छात्रों को हिंदी काव्य साहित्य का परिचय देना।
2. हिंदी कहानी साहित्य से अवगत कराना।
3. निबंध लेखन कौशल को विकसित करना।
4. छात्रों को विज्ञापन लेखन से अवगत करना।

	द्वितीय सत्र / द्वितीय अयन
इकाई– **I**	काव्य साहित्य : आदमी को प्यास लगती है – ज्ञानेंद्रपति रोशनी के उस पार – ओमप्रकाश वाल्मीकि उतनी दूर मत ब्याहना बाबा – निर्मला पुत्तुल किताबें झाँकती हैं – गुलज़ार नींव की ईंट हो तुम दीदी – उद्यप्रकाश
इकाई –**II**	गद्य विधा : सरजू भैया – रामवृक्ष बेनीपुरी (रेखाचित्र) भय – आ. रामचंद्र शुक्ल (निबंध) एक बूंद सहसा उछली – अज्ञेय (यात्रा वर्णन) अकबरी लौटा – अन्नपूर्णानंद वर्मा (व्यंग्य) प्रतिशोध – डॉ. रामकुमार वर्मा (एकांकी)
इकाई –**III**	साहित्येतर पाठ्यक्रम : लेखन कौशल : स्ववृत्त लेखन निबंध लेखन विज्ञापन लेखन : (दैनिक पत्र–पत्रिकाओं के लिए) वाक्य शुद्धिकरण (संज्ञा, सर्वनाम, विशेषण क्रिया के संबंध में)

अंक विभाजन – पूर्णांक : 100

आंतरिक मूल्यांकन – 30 (लघुत्तरी परीक्षा – 20, शोध परियोजना / समूह परियोजना / मौखिक प्रस्तुति / क्षेत्रीय अध्ययन– 10)

सत्रांत परीक्षा – 70

प्रथम वर्ष वाणिज्य (F.Y.B.com) (सामान्य)

(प्रथम अयन)

पाठ्यचर्या : वैकल्पिक हिंदी प्रश्नपत्र – 1 A

3 कर्मांक

उद्देश्य :

1. छात्रों को हिंदी काव्य साहित्य का परिचय देना।
2. हिंदी कहानी साहित्य से अवगत कराना।
3. हिंदी भाषा द्वारा संवाद कौशल विकसित करना।
4. मौलिक लेखन की ओर रूझान बढ़ाना।
5. विज्ञापन लेखन कौशल विकसित करना।
6. हिंदी कंप्यूटिंग का परिचय देना।

	प्रथम सत्र/प्रथम अयन
इकाई – I	काव्य साहित्य : स्वदेश के प्रति – सुभद्राकुमारी चौहान हो गई पीर – दुष्यंत कुमार पिता के जूते – अशोक वाजपेयी पेड़ की पुकार – शंभुनाथ सिंह उदास तुम – धर्मवीर भारती
इकाई – II	कहानी साहित्य : भोलराम का जीव – हरिशंकर परसाई उसने कहा था – चंद्रधर शर्मा गुलेरी व्यथा का सरगम् – अमृतराय जंगल दाह – स्वयंप्रकाश सबसे कठिन काम – मधु कांकरिया
इकाई – III	साहित्येतर पाठ्यक्रम : अंक तथा गणितीय चिह्नों का देवनागरी में लेखन हिंदी कंप्यूटिंग : यूनिकोड (Unicode) की जानकारी। इंटरनेट की सामान्य जानकारी हिंदी सॉफ्टवेयर की जानकारी।

अंक विभाजन – पूर्णांक : 100

आंतरिक मूल्यांकन – 30 (लघुत्तरी परीक्षा – 20, शोध परियोजना/समूह परियोजना/मौखिक प्रस्तुति/क्षेत्रीय अध्ययन– 10)

सत्रांत परीक्षा – 70

प्रथम वर्ष वाणिज्य (F.Y.B.com) (सामान्य)
(द्वितीय अयन)

पाठ्यचर्या : वैकल्पिक हिंदी प्रश्नपत्र – 1 B

3 कर्माक

1. छात्रों को हिंदी काव्य साहित्य का परिचय देना।
2. हिंदी कहानी साहित्य से अवगत कराना।
3. हिंदी भाषा द्वारा संवाद कौशल विकसित करना।
4. विज्ञापन लेखन के प्रकारों को अवगत करना।
5. अनुवाद का स्वरूप से अवगत करना।
6. पारिभाषिक शब्दावली से अवगत कराना।

	द्वितीय सत्र / द्वितीय अयन
इकाई – I	काव्य साहित्य : अब की लौटा तो – कुंवरनारायण कलगी बाजरे की – अज्ञेयए माँझी का पूल – केदारनाथ सिंह बापू के प्रति –सुमित्रानंदन पंत माँ के लिए एक कविता – कात्यायनी
इकाई – II	कहानी साहित्य : पहलवान की ढोलक – फणीश्वरनाथ रेणु सलाम – ओमप्रकाश वाल्मीकि बच्चे का सपना – शेखर जोशी बोलनेवाली औरत – ममता कालिया चिट्ठी – अखिलेश
इकाई – III	साहित्येतर पाठ्यक्रम : संवाद कौशल अनुवादः स्वरूप, परिभाषा, व्यावहारिक पक्ष पारिभाषिक (कार्यालयीन) 100 शब्दावली।

अंक विभाजन – पूर्णांक : 100

आंतरिक मूल्यांकन – 30 (लघुत्तरी परीक्षा – 20, शोध परियोजना / समूह परियोजना / मौखिक प्रस्तुति / क्षेत्रीय अध्ययन– 10)

सत्रांत परीक्षा – 70

एम. ए. हिंदी साहित्य

प्रथम अयन :

पाठ्यचर्या : 1 मध्ययुगीन काव्य

4 : क्रमांक

उद्देश्य :

1. हिंदी की मध्ययुगीन काव्य प्रवृत्तियों का परिचय देना।
2. मध्ययुगीन काव्य प्रवृत्तियों की पृष्ठभूमि पर कवि विशेष की रचनाओं का परिचय कराना।
3. तत्कालीन काव्यभाषा की प्रवृत्तियों का परिचय देना।
4. पाठ्यकृतियों के आधार पर काव्य मूल्यांकन की क्षमता का विकास करना।
5. सर्जनात्मक कौशल विकसित करना।

पाठ्यविषय :	
इकाई– **I**	पूर्वमध्यकालीन काव्य (कबीर/जायसी) कबीर – सं. हजारीप्रसाद द्विवेदी – (पदसंख्या 160 से 170) कबीर की काव्यकला, भाषा, समन्वय, मानवता, लोकमंगल जायसी – पद्मावत नागमती वियोग खण्ड (आरंभ के 10 पद) जायसी की काव्यकला, भाषा, समन्वय, विरह वर्णन, लोकतत्व
इकाई– **II**	पूर्वमध्यकालीन काव्य (सूरदास/तुलसीदास) सूरदास – भ्रमरगीत सार – सं. रामचंद्र शुक्ल (पद – 21 से 30) सूरदास की काव्यकला, भाषा, समन्वय, लोकमंगल, विरह वर्णन तुलसीदास – रामचरितमानस – उत्तरकाण्ड (आरंभ के 25 दोहे) तुलसीदास की काव्यकला, भाषा, लोकमंगल, समन्वय, भक्ति, आदर्श कल्पना।
इकाई – **III**	पूर्वमध्यकालीन काव्य (मीरा/रहीम) मीरा – सं. विश्वनाथ त्रिपाठी – (आरंभ के 10 पद) मीरा की काव्यकला, भाषा, प्रेमतत्व, प्रगतिशीलता, विरह वर्णन, रहीम की काव्यकला, भाषा, नीतितत्व, समन्वय, प्रेमतत्व रहीम (दोहे : 01 से 25)
इकाई– **IV**	उत्तरमध्यकालीन काव्य (बिहारी/घनानंद) बिहारी – बिहारी सतसई – सं. जगन्नाथदास रत्नाकर (दोहा संख्या 01 से 25) बिहारी की काव्यकला, भाषा, प्रेमतत्व, बहुज्ञता घनानंद – कवित्त सं. विश्वनाथ मिश्र, (कवित्त संख्या 01 से 15) घनानंद की काव्यकला, भाषा, प्रेमतत्व।

अंक विभाजन – पूर्णांक : 100

आंतरिक मूल्यांकन– 50 (लघुत्तरी परीक्षा – 20, शोध परियोजना – 20, प्रस्तुतिकरण – 10)

सत्रांत परीक्षा – 50

प्रथम अयन :

पाठ्यचर्या : 2 कथा साहित्य

4 कर्मांक

उद्देश्य :

1. उपन्यास विधा से अवगत कराना।
2. कहानी विधा से अवगत कराना।
3. पाठ्य रचनाओं में अभिव्यक्त मूल्यों का संप्रेषण करना।
4. आलोचनात्मक दृष्टि का विकास करना।
5. सर्जनात्मक कौशल का विकास करना।

पाठ्यविषय	
इकाई–I	प्रेमचंदोत्तर के परवर्ती उपन्यास का विकासक्रम (2000 तक) बीसवीं सदी की हिंदी कहानी का विकासक्रम (2000 तक)
इकाई –II	उपन्यास साहित्य : आपका बंटी – मन्नू भंडारी तात्विक विवेचन, संवेदना एवं शिल्पगत अध्ययन।
इकाई –III	कहानी साहित्य : उसने कहा था – चंद्रधर शर्मा गुलेरी आकशदीप – जयशंकर प्रसाद गैंग्रीन – अज्ञेय दुनिया का अनमोल रत्न – प्रेमचंद सिक्का बदल गया – कृष्णा सोबती संवेदना एवं शिल्पगत अध्ययन।
इकाई –IV	कहानी साहित्य : साजिश – सूरपाल चौहान जंगल गाने लगा – अंकुश्री पक्षी और दीमक – ग. मा. मुक्तिबोध दूसरा ताजमहल – नासिरा शर्मा दुख – यशपाल संवेदना एवं शिल्पगत अध्ययन।

अंक विभाजन – पूर्णांक : 100

आंतरिक मूल्यांकन – 50 (लघुत्तरी परीक्षा – 20, शोध परियोजना – 20, प्रस्तुतिकरण – 10)

सत्रांत परीक्षा – 50

एम. ए. हिंदी साहित्य

प्रथम अयन : वैकल्पिक

पाठ्यचर्या : 4 (ख) नाटककार मोहन राकेश

4 कर्मांक

उद्देश्य :

1. नाटक के स्वरूप एवं संरचना से परिचय कराना।
2. नाटक के रचनाविधान और रंगमंच से परिचय कराना।
3. हिंदी नाटक और रंगमंच के विकास का परिचय देना।
4. मोहन राकेश के नाटकों के द्वारा नाट्यास्वादन और मूल्यांकन की दृष्टि विकसित करना।
5. नाट्याभिनय कौशल को विकसित करना।

पाठ्यविषय	
इकाई–I	नाटक और रंगमंच, स्वरूप एवं संरचना हिंदी रंगमंच का विकासक्रम रंगमंच की विभिन्न शैलियाँ नाटक की पाश्चात्य परंपरा पारसी थिएटर, रंगभाषा
इकाई–II	निर्धारित नाटक आषाढ़ का एक दिन कथ्यगत अध्ययन, रंगमंचीय अध्ययन, तात्विक मूल्यांकन।
इकाई –III	निर्धारित नाटक लहरों के राजहंस कथ्यगत अध्ययन, रंगमंचीय अध्ययन, तात्विक मूल्यांकन।
इकाई –IV	निर्धारित नाटक आधे अधूरे कथ्यगत अध्ययन रंगमंचीय अध्यन तात्विक मूल्यांकन।

अंक विभाजन – पूर्णांक : 100

आंतरिक मूल्यांकन – 50 (लघुत्तरी परीक्षा – 20, शोध परियोजना – 20, प्रस्तुतिकरण – 10)

सत्रांत परीक्षा – 50

द्वितीय अयन :

पाठ्यचर्या : 5 कथेतर गद्य साहित्य

4 : कर्मांक

उद्देश्य :

1. व्यंग्य, निबंध, रेखाचित्र और संस्मरण विधा से अवगत करना।
2. पाठ्य विधाओं का भाषिक अध्ययन करवाना।
3. मौलिक लेखन कौशल विकसित करना।

पाठ्यविषय	
इकाई –I	आत्मकथा साहित्य : मुर्दहिया – तुलसीराम आलोचनात्मक अध्ययन, अंर्तवस्तु / भाषागत अध्ययन।
इकाई –II	निबंध साहित्य : कविता क्या है ? – रामचंद्र शुक्ल लेखक और जनता – डॉ. रामविलास शर्मा मेरे राम का मुकुट भीग रहा है – विद्यानिवास मिश्र संस्कृति और सौंदर्य – नामवर सिंह कुटज – हजारीप्रसाद द्विवेदी पानी है अनमोल – श्रीराम परिहार विशेषताएँ, आलोचनात्मक अध्ययन, अंर्तवस्तु, भाषागत अध्ययन।
इकाई –III	रेखाचित्र साहित्य : माटी की मूरतें – रामवृक्ष बेनीपुरी स्वरूपगत अध्ययन आलोचनात्मक अध्ययन अंर्तवस्तु, भाषागत अध्ययन।
इकाई –IV	व्यंग्य साहित्य : भोलाराम का जीव – हरिशंकर परसाई स्वरूपगत अध्ययन, आलोचनात्मक अध्ययन, अंतर्वस्तु, भाषागत अध्ययन संस्मरण साहित्य : याद हो की न हो – काशीनाथ सिंह। स्वरूपगत अध्ययन, आलोचनात्मक अध्ययन, अंर्तवस्तु, भाषागत अध्ययन।

अंक विभाजन – पूर्णांक : 100

आंतरिक मूल्यांकन – 50 (लघुत्तरी परीक्षा – 20, शोध परियोजना – 20, प्रस्तुतिकरण – 10)

सत्रांत परीक्षा – 50

द्वितीय अयन :

पाठ्यचर्या : 6 शोध प्रविधि

4 : क्रमांक

उद्देश्य :

1. छात्रों को शोध प्रविधि से अवगत कराना।
2. शोध दृष्टि का विकास करना।
3. नये शोध–प्रावाहों से परिचय कराना।
4. शोध प्रक्रिया एवं शोधप्रबंध लेखन कौशल विकसित करना।

पाठ्यविषय	
इकाई – I	**शोध का स्वरूप :** शोध के लिए प्रयुक्त विभिन्न शब्द एवं उनका औचित्य शोध की विभिन्न परिभाषाएँ और उनका विश्लेषण शोध के उद्देश्य, शोध की विवेचन पद्धति वस्तुनिष्ठ, तर्कसंगति, प्रमाणबद्धता।
इकाई – II	शोध के मूलतत्व : शोध और आलोचना शोध के भेद : साहित्यिक,साहित्येत्तर साहित्यिक शोध के भेद : वर्णनात्मक, ऐतिहासिक, तुलनात्मक, अंतर्विद्याशाखीय।
इकाई – III	शोध प्रक्रिया : विषय चयन,सामग्री संकलन के स्रोत मूल, सहायक, हस्तलेख संकलन एवं उपयोगिता, तर्क पद्धति : निगमनात्मक पद्धति (Deductive Method) और आगमनात्मक पद्धति (Inductive Method)। विवेचन, निष्कर्ष, स्थापना।
इकाई – IV	**शोध–प्रबंध लेखन प्रणाली :** शोध प्रबंध, शीर्षक निर्धारण, रूपरेखा, भूमिका लेखन, अध्याय विभाजन, संदर्भ, संदर्भ सूची, MLAपद्धति (Modern language Association), सहायक ग्रंथ सूची, परिशिष्ट, वर्तनी सुधार, टंकण, यूनिकोड परिचय।

अंक विभाजन – पूर्णांक : 100

आंतरिक मूल्यांकन – 50 (लघुत्तरी परीक्षा – 20, शोध परियोजना – 20, प्रस्तुतिकरण – 10)

सत्रांत परीक्षा – 50

द्वितीय अयन : वैकल्पिक

पाठ्यचर्या : 8 (घ) हिंदी उपन्यास साहित्य

4 : क्रमांक

उद्देश्य :

1. हिंदी उपन्यास साहित्य के विकासक्रम एवं प्रवृत्तियों से परिचित कराना।
2. उपन्यासों के आस्वादन, अध्ययन की क्षमता विकसित करना।
3. पाठ्य रचनाओं में प्रस्तुत साहित्यिक मूल्यों का संप्रेषण करना।
4. मूल्यांकन की दृष्टि का विकास करना।

पाठ्यविषय	
इकाई –I	तमस – भीष्म साहनी संवेदना एवं शिल्पगत अध्ययन।
इकाई –II	छप्पर – जयप्रकाश कर्दम संवेदना एवं शिल्पगत अध्ययन।
इकाई –III	गिलीगडू – चित्रामुद्गल संवेदना एवं शिल्पगत अध्ययन।
इकाई –IV	ग्लोबल गांव के देवता – रनेंद्र संवेदना एवं शिल्पगत अध्ययन।

अंक विभाजन – पूर्णांक : 100

आंतरिकमूल्यांकन – 50 (लघुत्तरी परीक्षा–20, शोध परियोजना–20, प्रस्तुतिकरण–10)

सत्रांत परीक्षा – 50

सत्रांत परीक्षा – प्रश्नपत्र का प्रारूप :

(शैक्षिक वर्ष 2019–20 से आगे)

समय 3 घंटे — अंक 50

प्रश्न : 1	इकाई एक पर दीर्घोत्तरी प्रश्न (दो में से एक)	अंक 10
प्रश्न : 2	इकाई दो पर दीर्घोत्तरी प्रश्न (दो में से एक)	अंक 10
प्रश्न : 3	इकाई तीन पर दीर्घोत्तरी प्रश्न (दो में से एक)	अंक 10
प्रश्न : 4	इकाई चार पर दीर्घोत्तरी प्रश्न (दो में से एक)	अंक 10
प्रश्न : 5	बहुविकल्पीय प्रश्न – 12 में से 10 (चार में से एक सही विकल्प का चयन कीजिए।)	

Kopargaon Taluka Education Society's
K. J. Somaiya College of Arts, Commerce & Science, Kopargaon Dist. A. Nagar
Dept of Political Science

List of Courses addresses crosscutting issues as per new syllabus (CBCS- 2019 Pattern)

Sr. No.	Programme Name	Course code	Name of Course	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	FYBA (Sem.I)	11161	Introduction to Constitution	Human Values
2	FYBA (Sem.II)	12161	Introduction to Constitution	Professional Ethics
3	SYBA (Sem.III)	CC1-1C	An Introduction to Political Ideology	Professional Ethics
4	SYBA (Sem.IV)	CC1-1D	An Introduction to Political Ideology	Human Values
5	SYBA (Sem.III)	DSE-1A	Western Political Thought	Professional Ethics
6	SYBA (Sem.IV)	DSE-1B	Western Political Thought	Human Values
7	SYBA (Sem.III)	DSE-2A	Political Journalism	Professional Ethics
8	SYBA (Sem.IV)	DSE-2B	Political Journalism	Professional Ethics
9	SYBA (Sem.III)	SEC-2A	Basic of Indian Constitution	Human Values
10	SYBA (Sem.IV	SEC-2B	Basic of Indian Constitution	Human Values
11	TYBA (Sem.V)	CC-1E	Local Self Government in Maharashtra	Professional Ethics
12	TYBA(Sem.VI)	CC-2E	Local Self Government in Maharashtra	Professional Ethics
13	TYBA (Sem.V)	DSE-1C	Public Administration	Professional Ethics
14	TYBA (Sem.VI)	DSE-1D	Public Administration	Professional Ethics
15	TYBA (Sem.V)	DSE-2C	International Relations	Professional Ethics
16	TYBA (Sem.VI)	DSE-2D	International Relations	Professional Ethics
17	TYBA (Sem.V)	SEC-2C	Samyukt Maharashtra Movement	Human Values
18	TYBA (Sem.VI)	SEC-2D	Samyukt Maharashtra	Human Values

			Movement	
19	MA –I (Sem.I)	PO-C1	Tradition of Political Thought	Human Values
20	MA –I (Sem.I)	PO-C2	Administrative Theory	Professional Ethics
21	MA –I (Sem.I)	PO-C3	Political Institution in India	Professional Ethics
22	MA –I (Sem.I)	PO-O4	Party System in India	Professional Ethics
23	MA –I (Sem.II)	PO-C4	Comparative Political Analysis	Professional Ethics
24	MA –I (Sem.II)	PO-C5	Theory of International Politics	Professional Ethics
25	MA –I (Sem.II)	PO-C6	Public Policy	Professional Ethics
26	MA –I (Sem.II)	PO-O5	Politics and the Media	Professional Ethics
27	MA – II (Sem.III)	PO-C7	Modern Political Thought	Human Values
28	MA – II (Sem.III)	PO-C8	Political Sociology	Human Values
29	MA – II (Sem.III)	PO-C9	World Politics New Developments	Professional Ethics
30	MA – II (Sem.III)	PO-O9	Indian Administration Structure and Organization	Professional Ethics
31	MA – II (Sem.IV)	PO-C10	Fundamentals of Political Theory	Human Values
32	MA – II (Sem.IV)	PO-C11	Political Process in India	Professional Ethics
33	MA – II (Sem.IV)	PO-C12	Politics and Society	Human Values
34	MA – II (Sem.IV)	PO-O15	Election Studies	Professional Ethics

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K. J. Somaiya College
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List of Certificate Courses

Sr. No.	Department	Name of Certificate Course	Course Code	Year of Offering	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	Political Science	Human Rights	CC.014	2017-18	Human Values

List of Add-on/Value Added Courses

Sr. No.	Department	Name of Certificate Course	Course Code	Year of Offering	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	All PG (I Sem.)	Human Rights	10091	2019-20	Human Values
	All PG (II Sem.)	Human Rights	20091	2019-20	
2	All PG (Sem. III)	Introduction to Constitution	30095	2019-20	Human Values
3	All PG (Sem. III)	Skill Development	30094	2019-20	Professional Ethics
4	All PG (Sem. IV)	Skill Development	40094	2019-20	Professional Ethics
5	All PG (I Sem.)	Cyber Security	10092	2019-20	Professional Ethics
6	All PG (II Sem.)	Cyber Security	20092	2019-20	Professional Ethics
7	All PG (III Sem.)	Cyber Security	30092	2019-20	Professional Ethics
8	All PG (IV Sem.)	Cyber Security	40092	2019-20	Professional Ethics

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Kopargaon



SAVITRIBAI PHULE PUNE UNIVERSITY

(formerly University of Pune)

F. Y. B. A. Political Science

Syllabus

(Semester & Choice Based Credit System)

(To be implement ted from the Academic Year, 2019-20)

Savitribai Phule Pune University

F. Y. B. A. Political Science (CBCS pattern to be implemented from 2019-2020)

G-1 General Paper INTRODUCTION TO INDIAN CONSTITUTION

Total Credits : 03

Objectives

The contents of this course are designed with the following objectives: .

1. To acquaint students with the important features of the Constitution of India andwith The basic framework of Indian government.
2. To familiarize students with the working of the Constitutionof India.

Semester-I Period

Unit 1: Making of the Indian Constitution 12

- a) Historical Background
- b) Constituent Assembly
- c) Preamble
- d) Salient Features

Unit 2: Fundamental Rights, Duties and DirectivePrinciples 12

- a) Fundamental Rights
- b) Fundamental Duties
- c) Directive Principles of State Policy

Unit 3: Federalism 12

- a) Salient Features of Indian Federalism
- b) Centre –State Relations
- c) Issues of Conflict (Water and Border Issues)

Unit 4: Constitutional Amendments: Scope and Limitations 12

- a) Constitutional Provisions
- b) Major Constitutional Amendments (42, 44 & 86)
- c) Basic Structure of the Indian Constitution

Semester- II

Unit5: Legislature 12

- a) Union Legislature – Structure, Powers and Role
- b) State Legislature – Structure, Powers and Role

Unit6: Executive 12

- a) Union Executive – i) President and Vice President– Powers, Functions and Role
- ii) Prime Minister - Powers, Functions and Role
- iii) Council of Minister – Powers and Functions and Role
- b) State Executive- i) Governor - Powers, Functions and Role
- ii) Chief Minister – Powers, Functions and Role
- iii) Council of Minister – Powers and Functions and Role

Unit7: Judiciary 12

- a) Supreme Court : Powers and Functions
- b) High Court : Powers and Functions
- c) Judicial Review and Judicial Activism

Unit8: Electoral System 12

- a) Election Commission:Composition, Functions and Role
- b) Chief Election Commissioner
- c) Electoral reforms

References:

1) Austin Granville, 1999, The Indian Constitution: Cornerstone of a Nation, Oxford, Oxford University Press.

Savitribai Phule Pune University
Political Science
Syllabus for M.A. - I

Semester I

List of Compulsory Courses **(C= compulsory)**

PO-C1: Traditions of Political Thought
PO-C2: Administrative Theory
PO-C3: Political Institutions in India

List of Optional Courses **(O = optional)**

PO-O1-Modern Political Ideologies
PO-O2- Political Process in Maharashtra
PO-O3- India's Foreign Policy
PO-O4- Party System in India

Semester II

List of Compulsory Courses **(C= compulsory)**

PO-C4: Comparative Political Analysis
PO-C5: Theory of International Politics
PO-C6: Public Policy

List of Optional Courses **(O = optional)**

PO-O5- Politics and the Media
PO-O6- Human Rights
PO-O7- Social Movements in India
PO-O8- Political Thought in Modern Maharashtra

SAVITRIBAI PHULE PUNE UNIVERSITY
(formerly University of Pune)
M. A. Political Science Syllabus
(CREDIT & SEMESTER SYSTEM)
Revised syllabus will be implemented with effect from the academic year 2019-2020 at College Centers

M.A. - I
Political Science
Semester I

PO-C1: Traditions of Political Thought

Objectives:
This course is meant to serve as a window on the major traditions of thought that have shaped political discourse in different parts of the world over the last three millennia. It stresses the great diversity of social contexts and philosophical visions that have informed the ideas of key political thinkers across epochs. The chief objective is to project the history of political thought as a series of critical, interconnected and open-ended conversations about the ends and means of the good life.

1. ANCIENT ERA
1. Confucius
a. Life and Works b. Ruling through Virtue c. Rituals and Filial Piety

2. Plato
a. Life and Works b. Plato's concept of Ideal State c. Platonic Theory of Justice
2. MODERN ERA
1. Niccolo Machiavelli
a. Life and Works b. Suggestions to the "Prince" c. Relationship between Ethics and Politics
2. Jean-Jacques Rousseau
a. Life and Works b. Social Contract Theory c. General Will

3. INDUSTRIAL ERA
1. John Stuart Mill
a. Life and Works
b. Liberty
c. Representative Government
2. Karl Marx
a. Life and Works
b. State and Class
c. Historical Materialism

4. COLONIAL ERA
1. M. K. Gandhi
a. Life and Career
b. Views on the State
c. Critique of Western Civilization
2. Frantz Fanon
a. Life and Career
b. Africana Phenomenology
c. Theory of Decolonization

PO-C2: Administrative Theory

Objectives:
Public Administration is an essential part of a society. In last few years the profession of Public Administration is going through changes. Present paper aims to make aware the students about Evolution & Importance of the Public Administration. Paper introduces changing trends in the field of Public Administration.

1. Public Administration
a. Evolution of the Discipline
b. Changing Nature of Public Administration
c. Changing Role of Public Administration in Developing Societies

2. Major Approaches to Public Administration
a. Bureaucratic Approach
b. Decision Making Approach
c. Ecological Approach

3. Theories of Public Administration
a. Rational Choice Theory
b. Comparative Public Administration
c. Development Administration

4. Principles of Organization
a. Hierarchy, Unity of Command,
b. Span of Control – Centralization and Decentralization
c. Line- Staff Agencies

5. New Trends in Public Administration
a. New Public Management
b. Challenges of Liberalization, Privatization

6. Governance
a. Problems of Administrative Corruption
b. Ombudsman
c. Lok Pal, Lok Ayukta

PO-C3: Political Institutions in India

Objectives:
The course introduces the student to the leading institutions of India's political system and to the changing nature of these institutions. Apart from explaining the structure and functions of the main institutions the course will try to acquaint students with the idea of institutional balance of power as discussed in the Indian constitution and as developed during the functioning of Indian democracy over the past seven decades.

1. Nationalist legacies
a. Unity and Integrity
b. Democracy
c. Development and Social Transformation

2. Federal institutions
a. Strong Centre' framework
b. Autonomy and devolution
c. Multilevel federalism

3. Executive
a. President and prime minister
b. Principle of collective responsibility and accountability to the legislature
c. Role of governor

4. Legislature
a. Composition and powers
b. Norms of representation
c. Legislative supremacy

5. Judiciary
a. Composition
b. Judicial review and judicial activism
c. Judicial interpretations of Fundamental Rights and Directive Principles, basic structure doctrine

6. Welfare, Regulation and Security
a. UIDAI
b. TRAI
c. AFSPA

PO-O4- Party System in India

Objectives:
This course provides a much fuller treatment, otherwise not available, on political parties and on the electoral process and on the factors that shape and influence both in the specifically Indian context. As parties constitute an important part of the political process, this course would expect students to understand the evolution of different parties and the different configurations of competition both at all-India level and in different states of India. Students will also study the ideological variations across parties, their relationship with social movements and the social bases of parties.

1. Party System in India
a. One Party Dominance
b. Multi Party System and Coalition Politics
c. Reemergence of one party Dominance

2. Indian National Congress
a. Ideology and Leadership
b. Social Base and Support Structure
c. Electoral Performance

3. Bhartiya Janata Party
a. Ideology and Leadership
b. Social Base and Support Structure
c. Electoral Performance

4. Communist Party of India and Marxist Communist Party
a. Origin and Development
b. Social Base and Leadership Patterns
c. Electoral Performance

5. Bahujan Samaj Party
a. Origin and Development
b. Social Base and Leadership Patterns
c. Electoral Performance

6. People's Movement and Political Parties
a. Peasant Movements
b. Dalits and Tribal's Movement
c. Women and Environment Movements

M.A. - I
Political Science
Semester II

PO-C4: Comparative Political Analysis

Objectives:

The purpose of this course is to acquaint the student with the sub-discipline of comparative politics. It expects the students to understand the comparative methodology and dynamics of domestic politics across countries.

1. Nature of Comparative Analysis

a. Old and New Comparative Politics

b. Nature and Scope

2. Approaches to the study of Comparative Politics

a. New Institutional

b. Structure-Functional

3. Theories of Development

a. Modernization b. World System Theory

4. Security Apparatus and Concerns

a. Military b. Violence

5. Parties and Pressure Groups

a. Parties and Party System

b. Pressure Groups in Politics

6. Non State Political Actors

a. Social Movements

b. Non-Governmental Organizations

PO-C5: Theory of International Politics

Objectives:

Students need a brief history of international politics to understand why we study the subject and how current scholarship is informed by what preceded it. Theories provide interpretative frameworks for understanding what is happening in the world and the levels of analysis. Competing theories are presented.

1. Introduction to International Politics

a. Meaning b. Nature c. Scope

2. Changing International Political Order since World War II

a. Rise of super powers; cold war & Détente

b. Non-aligned movement: aims and achievements, relevance

c. Collapse of the Soviet Union; Rise of American hegemony

3. Approaches to International Politics

a. Idealism b. Realism c. Liberalism d. Marxism

4. Geopolitical Issues

a. Theories of Geopolitics, Alfred Mahan, Harry Mackinder and Robert Kohen

b. Contemporary Geopolitics

5. Positivist and Post Positivist Framework

a. Positivism b. Critical Theory c. Constructivism

6. Contemporary concerns

a. Terrorism b. Environment c. Gender d. Human Rights

PO-C6: Public Policy

Objectives:
The purpose of this course is to provide students an understanding of the basic concepts, theories and process of public policy. The course also seeks to help students understand public policy processes and actors involved in it by studying specific policies. It attempts to help students understand and analyze policy making in practical context.

1. Public Policy
a. Nature and Scope b. Evolution of Discipline
2. **Major Approaches**
a. Group b. Incremental c. Policy Network
3. **Public Policy in Action**
a. Implementation b. Evolution c. Bureaucracy
4. **Shaping of Public Policy**
a. Agenda b. Public formulation and adoption c. Role of legislature
5. Public Policy Development
a. Health b. Agriculture c. Environment
6. **Globalization and Public Policy**
a. Global Policy Process b. Role of Transnational Actors
c. Impact of Globalization on Public Policy making.

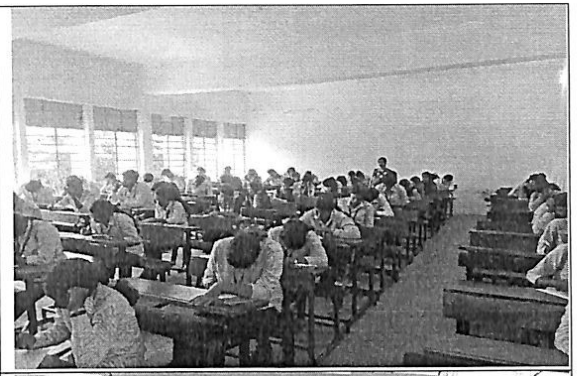
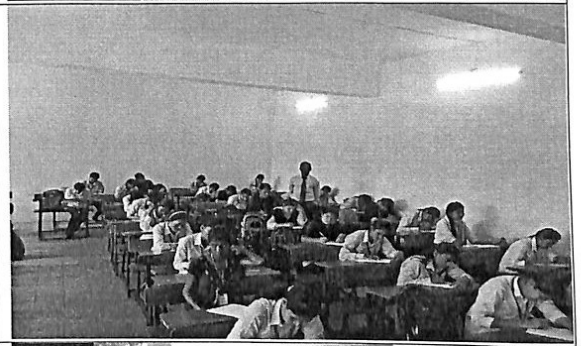
Optional Papers

PO-O5- Politics and the Media

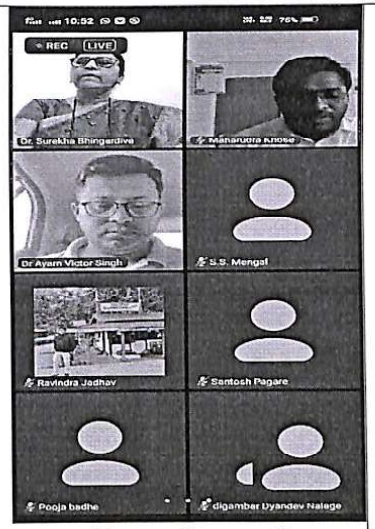
Objectives:
The news media are sometimes called the fourth branch of government-and for good reason. Much of our exposure to politics comes not from direct experience but from mediated stories. This course is designed to help you think about this relationship between the news media and politics. We will explore how news organizations decide what is news, how they report it, how those reports have an impact on viewers or readers, and ultimately, the political system.

1. Media, Politics and Democracy
a. Nature of Media- Folk Media, Print Media, Broadcast Media and New Media
b. Media as fourth Pillar of Democracy c. Role of Media in Power Politics
2. Media and Political Socialization
a. Role of Media in Socializing the Public towards Politics and Political Processes
b. Role of Media in creating Political Attitudes of Public
c. Influence of Media in deciding levels of Political Participation of the Public
3. Effects of Media on Public Opinion and Political Processes
a. Role of Media in the Formation of Public Opinion about Political Issues
b. Role of Media in Setting Political Agendas
c. The Level of Media influence on Public Opinion
4. Election Campaigns, Awareness and Propaganda
a. Campaign and Propaganda b. The Techniques of Media Election Campaigns
c. Political Coverage and Paid News
5. Governing through the Media
a. Assessing Partisan Bias in Political News b. Media Favoritism and Political Nominations
c. Role of Media in Policy Making Process
6. New Media, Social Movements and Collective Action
a. Role of New Media in Collective Action, Social Movements and Popular Mobilization
b. Media Impact on Voters and Political Outcome c. Media and Image Building

List Showing Curricular and Extra Curricular activities to address Crosscutting Issues (Similar/repeated activities are not listed)

Sr. No.	Name of Activity and Date of Implementation	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)	Representative Photograph
1	**Bank Visit – State Bank of India, Kopargaon Branch** 18/09/2018 Time: 10:00 am	Professional Ethics	
2	Field Visit at Dahegaon Bolka, Tel. Kopargaon, 24/12/2018 Time: 10:00 am	Professional Ethics	
3	Subject **Based Competitive Exam** 30/08/2018 Time: 10:00 am	Professional Ethics,	
4	**Bank Visit – Bank of Baroda, Kopargaon Branch** 17/01/2020 Time: 10:30 am	Professional Ethics	
5	**Based Competitive Exam** 22/08/2019 Time: 10:00 am	Professional Ethics	
6	**Bank Visit – IDFC, Kopargaon Branch** 25/11/2022 Time: 10:00 am	Professional Ethics	

7	**Subject Based Competitive Exam** 27/09/2022	Professional Ethics	

Sr.No.	Title of the Activity	Period		Representative Photograph	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
		From	To		
1	One Day National Webinar on New Farm Act 2020 :	29 Oct 2021			Professional Ethics
2	One Day webinar on Indian Budget	2022-23			Professional Ethics
3	One Day National Virtual Conference	27 Sep 2022			Professional Ethics
4	Guest lecture of Hon. Abasaheb Kalyankar, Chief Editor,Arthak altan on on the topic " Arthakalyan	17Jan 2019			Professional Ethics
5	Guest lecture of Hon. Prof Dr. Sambhaji Kale Economics BOS Member (SPPU, Pune) on the topic "Indian Economy & Agricultural"	2018-19			Professional Ethics

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	i) Direct Methods 1) Consumer Survey 2) Expert opinion 3) Simulating market situation 4) Controlled Market Experiments ii) Indirect Methods 1) Simple correlation 2) Trend Projections	
3.	**PRODUCTION AND COST ANALYSIS** 3.1 Production Function – Meaning 3.2 Law of Variable Proportions - The Three Stages 3.3 Law of Returns to Scale - The Three Stages 3.4 Economies and Diseconomies of Scale – Internal and External 3.5 Cost Analysis – Types of Costs a) Types of Costs 1) Total cost 2) Average Cost 3) Marginal Cost 4) Opportunity cost b) Behaviour of Cost Curves 1) In the Short Run 2) In the Long Run	16
	Total	**48**

Unit No.	Term II Topic	No. of Lectures
4.	**REVENUE BEHAVIOUR** 4.1 Meaning and Importance of Revenue Concepts 4.2 Total Revenue (TR), Average Revenue (AR) Marginal Revenue (MR). 4.3 Relationship between Total Revenue, Average Revenue and Marginal Revenue	8
5.	**PRICING UNDER VARIOUS MARKET CONDITIONS** 5.1 Perfect Competition – Features and equilibrium 5.2 Monopoly – Features and equilibrium, Price Discrimination 5.3 Monopolistic competition - Features and equilibrium 5.4 Oligopoly – Features	20
6.	**FACTOR PRICING** 6.1 Marginal Productivity theory of Distribution. 6.2 Rent a) Theories of Rent i) Ricardian Theory of Rent ii) Modern Theory of Rent	20

University of Pune
S.Y.B.A. Economics Revised Syllabus
G-2, Modern Banking
From : June – 2014

PREAMBLE

To create the awareness among the students of Modern Banking System. Banking constitutes important components towards understanding of economics. Clear understanding of the operations of banking their interaction with the rest of the economy is essential to realize how monetary forces operate through a multitude of channels- market, non-market, institutions and among others, the state.

First Term

Chapter No.	Title of the Chapter	Lectures
1	**Evolution of Modern Banking** 1.1 Meaning & Definition of Bank. 1.2 Banking in Europe, USA & Asia. 1.3 Evolution of Banking in India. 1.4 Structure of Indian Banking System	12
2	**Functions of Commercial Banks** 2.1 Primary Functions-Accepting Deposits, Granting Loans & Advances. 2.2 Secondary Functions-Agency Functions, General Utility Functions 2.3 Methods of Remittances.	12
3	**Principles of Commercial Banks** 3.1 Liquidity, Profitability and Safety- Meaning & Concept. 3.2 Multiple Credit Creation-Process & Limitations. 3.3 Components of Balance Sheet of Commercial Banks	12

	i) Direct Methods 1) Consumer Survey 2) Expert opinion 3) Simulating market situation 4) Controlled Market Experiments ii) Indirect Methods 1) Simple correlation 2) Trend Projections	
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University of Pune
S.Y.B.A. Economics Revised Syllabus
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3	**Principles of Commercial Banks** 3.1 Liquidity, Profitability and Safety- Meaning & Concept. 3.2 Multiple Credit Creation-Process & Limitations. 3.3 Components of Balance Sheet of Commercial Banks	12

4	**Operation & Types of Accounts** 4.1 Opening and operating of Deposit Account. 4.2 Closure and Transfer of Accounts 4.3 Types of Account Holders - Individual & Institutional 4.4 No Frills Account, Escrow Account	12

Second Term

5	**Negotiable Instruments** 5.1 Promissory Note, Bill of Exchange and Cheque - meaning, Definition & Characteristics 5.2 Types of Cheque – Bearer, Order & Crossed 5.3 Types of Crossing- General & Special 5.4 Endorsement- Definition, Types & Effects	12
6	**New Technology in Banking** 6.1 E-Banking – Need and Importance 6.2 Meaning, concept and operation of - 6.2.1 Automated Teller machine- ATM 6.2.2 Credit Card 6.2.3 Debit Card 6.2.4 Tele Banking 6.2.5 Mobile Banking 6.2.6 Net Banking 6.2.7 Society for worldwide Interbank Financial Telecommunication 6.2.8 Core Banking 6.2.9 RTGS	12
7	**Reserve Bank of India** 7.1 Functions 7.2 Money Measures- M0, M1, M2, M3, M4 7.3 Monetary policy- Meaning & objectives	12

University of Pune
S.Y.B.A. Economics Revised Syllabus
S-1, Micro Economics
From : June – 2014

Preamble

As a foundation course, in this Paper, student is expected to understand the behavior of an economic agent, namely, a consumer, a producer, a factor owner and the price fluctuation in a market. The chapter incorporated in this Paper deal with the nature and scope of economics, the theory of consumer behavior, analysis of production function and equilibrium of a producer, the price formation in different markets structures and the equilibrium of a firm and industry. In addition, the principles of factor pricing and commodity pricing as also the problems of investment and welfare economics have been included.

First Term

Chapter No.	Title of the Chapter	Lectures
1	**Introduction** **1.1** Micro Economics – Meaning, Nature Scope, importance & limitations,. 1.2 Basic Economic Problems. 1.3 Tools of Economic Analysis – Functional relationships, Schedules, Graphs & Equations. 1.4 Variable – Dependent and Independent variable- Exogenous & Endogenous.	**10**
2	**Demand Analysis** 2.1 Utility – Meaning, Concept & Assumptions 2.2 Cardinal Utility- Law of Diminishing Marginal Utility. 2.3 Ordinal Utility – Indifference curve - Concept and Properties, Consumer Equilibrium 2.4 Demand- concept & law 2.5 Elasticity of Demand 2.5.1 Price Elasticity-Definition, Types, Determinants, Importance. 2.5.2 Income Elasticity - Types & Importance, 2.5.3 Cross Elasticity- concept	**18**

3	**Supply Analysis** 3.1 Meaning, Concept & Determinates. 3.2 Law of Supply. 3.3 Elasticity of Supply.	08
4	**Theory of Production** 4.1 Production function. 4.2 The law of Variable Proportions. 4.3 Law of returns to scale. 4.4 Revenue concept-Total, Average &Marginal Revenue. 4.5 Cost concepts: Fixed & Variable Cost, Opportunity cost, Average & Marginal cost, Total cost.	12

Second Term

5	**Market Structure** 5.1 Meaning & Classification 5.2 Perfect Competition: Concept- Characteristics, price determination in short run and long run, equilibrium of the firm and industry 5.3 Monopoly- Concept, Characteristics and short and long run Equilibrium. Price discrimination 5.4 Monopolistic Competition : Concept, Characteristics, short & long run Equilibrium, Selling cost- concept 5.5 Oligopoly – Concept, Characteristics 5.6 Duopoly – Concept, Characteristics	20
6	**Factor Pricing** 6.1 The Marginal Productivity Theory of Distribution. 6.2 Rent – Recardian Theory of Rent, Modern Theory of Rent, Quasi Rent 6.3 Wages –Modern Theory of Wages, Collective Bargaining , Supply curve of Labour	20

University of Pune
S.Y.B.A. Economics Revised Syllabus
S-2, Macro Economics
From : June 2014

PREAMBLE

On account of the growing influence and involvement of the State in economic fields, macroeconomics has become a major area of economic analysis in terms of theoretical, empirical as well as policy-making issues. Macroeconomics has an extensive, substantive as well as methodological content. It deals with the functioning of the economy as a whole, the objective of the course is to familiarize the students the basic concept of Macro Economics and application. Macro economics has an extensive, substantive as well as methodological content. It deals with the functioning of the economy as a whole, including how the economy's total output of goods and services and employment of resources is determined and what causes these totals to fluctuate. The Paper entitled Macroeconomics‖ is designed to make an undergraduate student aware of the basic theoretical framework underlying the field of macroeconomics.

First Term

Chapter No.	Title of the Chapter	Lectures
1	**Introduction** 1.1 Meaning, Nature, Scope, Importance and Limitation of Macroeconomics 1.2 Difference between Micro and Macro Economics	08
2	**National Income** 2.1 Concepts: National Income, Gross National Product, Net National Product, Per Capita Income, Disposable Income. 2.2 Importance of National Income. 2.3 Methods of National Income Measurement 2.4 Difficulties in Measurement of National Income 2.5 Circular Flow of National Income	14

3	**Supply Analysis** 3.1 Meaning, Concept & Determinates. 3.2 Law of Supply. 3.3 Elasticity of Supply.	08
4	**Theory of Production** 4.1 Production function. 4.2 The law of Variable Proportions. 4.3 Law of returns to scale. 4.4 Revenue concept-Total, Average &Marginal Revenue. 4.5 Cost concepts: Fixed & Variable Cost, Opportunity cost, Average & Marginal cost, Total cost.	12

Second Term

5	**Market Structure** 5.1 Meaning & Classification 5.2 Perfect Competition: Concept- Characteristics, price determination in short run and long run, equilibrium of the firm and industry 5.3 Monopoly- Concept, Characteristics and short and long run Equilibrium. Price discrimination 5.4 Monopolistic Competition : Concept, Characteristics, short & long run Equilibrium, Selling cost- concept 5.5 Oligopoly – Concept, Characteristics 5.6 Duopoly – Concept, Characteristics	20
6	**Factor Pricing** 6.1 The Marginal Productivity Theory of Distribution. 6.2 Rent – Recardian Theory of Rent, Modern Theory of Rent, Quasi Rent 6.3 Wages –Modern Theory of Wages, Collective Bargaining , Supply curve of Labour	20

University of Pune
S.Y.B.A. Economics Revised Syllabus
S-2, Macro Economics
From : June 2014

PREAMBLE

On account of the growing influence and involvement of the State in economic fields, macroeconomics has become a major area of economic analysis in terms of theoretical, empirical as well as policy-making issues. Macroeconomics has an extensive, substantive as well as methodological content. It deals with the functioning of the economy as a whole, the objective of the course is to familiarize the students the basic concept of Macro Economics and application. Macro economics has an extensive, substantive as well as methodological content. It deals with the functioning of the economy as a whole, including how the economy's total output of goods and services and employment of resources is determined and what causes these totals to fluctuate. The Paper entitled Macroeconomics‖ is designed to make an undergraduate student aware of the basic theoretical framework underlying the field of macroeconomics.

First Term

Chapter No.	Title of the Chapter	Lectures
1	**Introduction** 1.1 Meaning, Nature, Scope, Importance and Limitation of Macroeconomics 1.2 Difference between Micro and Macro Economics	08
2	**National Income** 2.1 Concepts: National Income, Gross National Product, Net National Product, Per Capita Income, Disposable Income. 2.2 Importance of National Income. 2.3 Methods of National Income Measurement 2.4 Difficulties in Measurement of National Income 2.5 Circular Flow of National Income	14

3	**Theory of Employment** 3.1 Say's Law of Market 3.2 Classical Theory of Employment 3.3 Criticism by Keynes on Classical Theory 3.4 Keynesian Theory of Employment	12
4	**Consumption and Investment** 4.1 Meaning of Consumption Function 4.2 Average and Marginal Propensity to Consume 4.3 Psychological Law of Consumption 4.4 Factors influencing Consumption Function 4.5 Saving- concept & Function 4.6 Investment- Meaning & Types 4.7 Investment Multiplier- Concept and Limitations 4.8 Principle of Acceleration - Concept	14
	Second Term	
5	**Value of Money** 5.1 Money- Definition and Functions 5.2 Quantity Theory of Money 5.3 Cash balance approach	12
6	**Inflation and Deflation:** 6.1 Inflation - Meaning and Causes 6.2 Demand Pull and Cost Push Inflation 6.3 Effects of Inflation 6.4 Measures to control Inflation 6.5 Deflation- Meaning, Causes and Consequences	12
7	**Business Cycles** 7.1 Meaning and Features of Business Cycle 7.2 Phases of Business Cycle 7.3 Causes and Effects of Business Cycle. 7.4 Control of Business Cycles- Monetary and Fiscal Controls	12

Savitribai Phule Pune University

T.Y. B.A. Economics
General Paper III

G.3 Economic Development & Planning

(From June 2015)

Revised Syllabus

PREAMBLE:

The Study of Economic Development has gained importance because of stained interest of the developing countries in uplifting their economic conditions by restructuring their economics to acquire greater diversity, efficiency and equity in Consonance with their priorities. While few success stories can be counted, many have grappled with chronic problems of narrow economic base, inefficiency and low standard of living. For this and other reasons, their have been many approaches to economic development. In recent times, besides hard core economic prescriptions to development, concern hitherto relegated to background, like education, health, sanitation and infrastructural development, have found place of pride in explaining the preference of various economies incorporated in this paper are devoted to the theories of economic development, approaches to economic development, social and institutional aspects of development, constraints on development process, macro economic policies, roll of foreign capital and economic planning etc. in developing countries.

Section I	Lectures
1. Economic Development and Growth 1.1 Meaning of Economic Development and Growth 1.2 Indicators of Economic Growth 1.3 Indicators of Economic Development 1.4 Differences between Economic Development & Growth	10
2. Developing Countries 2.1 Concept- Developed, Developing Countries 2.2 Characteristics of Developing Countries 2.2.1 Economic Characteristics 2.2.2 Demographic Characteristics 2.2.3 Technological Characteristics 2.2.4 Socio - Cultural Characteristics 2.2.5 Other Characteristics	14
3. Constraints on Development Process 3.1 Vicious Circle of Poverty 3.2 Population Explosion 3.3 Low Productivity of Agriculture	12

3.4 Scarcity of Capital
3.5 Inappropriate Technology
3.6 Socio- Cultural Constraints
3.7 Political and Administrative Constraints
3.8 External Bottleneck

4. Theories of Economic Development 12
4.1 Classical Theories- Adam Smith, Ricardo & Malthus
4.2 Karl Mark's Theory of Economic Development
4.3 Schumpeterian Theory of Economic Development

Section II

5. Approaches to Economic Development 10
5.1 Big Push Theory
5.2 Balanced Growth
5.3 Imbalanced Growth

6. Foreign Capital and Development 14
6.1 Meaning & Role of Foreign Capital in Economic Development
6.2 Problems of Foreign Capital
6.3 Private Foreign Investment- Types & Role
6.4 Public Foreign Investment-Types
6.5 Foreign Aid- Tide and Untied

7. Macro Economic Policy 12
7.1 Monetary Policy- Objectives, Instruments and Limitations
7.2 Fiscal Policy- Objectives, Instruments and Limitations
7.3 Fiscal Policy in Cyclical Fluctuations

8. Economic Planning
8.1 Meaning & Definition
8.2 Need of Planning
8.3 Objective of Economic Planning- Economic, Social and Political
8.4 Inclusive Growth Approach & 11th five year plan
8.5 National Institution for Transforming India Aayog (NITI AYOG)

Basic Reading List

- Adelmen, I. (1961) Theories of Economic Growth and Development, Stanford University Press,Stanford.
- Behrman, S. and T.N Srinivrsan,(1995) Handbook of Development Economic, Vol. 1 to 3, Elsevire, Amsterdam,

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T.Y. B.A. Economics
Special Paper III

S.3 International Economics

(From June 2015)

Revised Syllabus

PREAMBLE

This course provides the students a thorough understanding and deep knowledge about the basic principles that tend to govern the free flow of trade in goods and services at the global level. The contents of the Paper spread over various modules, lay stress both on theory and applied nature of the subject that have registered rapid changes during the last decade. Besides this, the contents prepare the students to know the impact of free trade and tariffs on the different sectors of the economy as well as at the macro level. The students would also be well trained about the rationale of recent changes in the export import policies of India. This paper has become relatively more relevant from the policy point of view under the present waves of globalization and liberalization both in the North and in the South.

Section I

No of Lectures

1. Introduction 12
1.1 International economics- meaning, Scope & Importance
1.2 Inter-regional and international trade
1.3 Importance of International Trade

2.Theories of International Trade 12
2.1 Theory of absolute cost advantage and comparative cost advantage
2.2 Heckscher-Ohlin theory
2.3 Leontief's paradox, Rybczynski theorm, Intra-Industry Trade

3. Gains from Trade 12
3.1 Measurement of gains, static and dynamic gains
3.2 Terms of trade – Importance, types and determinants
3.3 Causes of unfavorable terms of trade to developing countries.

4. Balance of Payments 12
4.1 Balance of trade and Balance of payments- Concepts and components
4.2 Equilibrium and disequilibrium in balance of payments; causes and consequences
4.3 Measures to correct deficit in the balance of payments

Section II

5. Trade policy & Exchange Rate 12
5.1 Free trade policy - case for and against
5.2 Protection Policy – case for and against
5.3 Types of tariffs and quotas
5.4 Exchange rates-Fixed and flexible

6. India's Foreign Trade and Policy 12

6.1 Growth of India's foreign trade
6.2 Changes in the composition and direction of foreign trade since 2000-2001
6.3 Foreign Trade policy 2015-2020.
6.4 India and WTO

7. Export Promotion measures 12

7.1 Export promotion - Contribution of SEZ
7.2 Role of multinational corporations in India.
7.3 FEMA-provisions and impact
7.4 Convertibility of Indian rupee

8. Regional and International Co-operation 12

Nature and Functions of-
8.1 South Asian Association for Regional Co-operation (SAARC)
8.2 Brazil, Russia, India, China and South Africa (BRICS)
8.3 European Economic Community (EEC)

BASIC READING LIST

1. Kenan, P.B. (1994), The International Economy, Cambridge University Press, London.
2. Kindlberger, C.P. (1973), International Economics, R.D. Irwin, Homewood.
3. Krugman, P.R. and M. Obstgeld (1994), International Economics : Theory and Policy, Glenview, Foresman.
4. Salvatore, D.L. (1997), International Economics, Prentice-Hall, Upper Saddle River, N.J.
5. Sodersten, Bo (1991), International Economics, Macmillan Press Ltd., London.
6. International Economics , M.L. Jhingan

ADDITIONAL READING LIST

1. Bhagwati, J. (Ed.) (1981), International Trade, Selected Readings, Cambridge University Press, Mass.
2. Greenaway, D. (1983), International Trade Policy, Macmillan Publishers Ltd., London.
3. Joshi V. and I.M.D. Little (1998), India's Economic Reforms, 1999-2001, Oxford University Press, Delhi.
4. Panchmukhi, V.R. (1978), Trade Policies of India : A Quantitative Analysis, Concept Publishing Company, New Delhi.
5. Patel, S.J. (1995), Indian Economy Towards the 21st Century, University Press Ltd., India.
6. Misra and Puri, Indian Economy, Himalaya Publishing House
7. Dangat Nilesh (2015), 'International Economics' Success Publication, Pune.
8. Gite T.G. (2015), 'International Economics' (Marathi Edition), Success Publication, Pune.

Savitribai Phule Pune University

T.Y. B.A. Economics
Special Paper IV

S 4. Public Finance

(From June 2015)

Revised Syllabus

PREAMBLE

Role and functions of the Government in an economy has been changing with the Passas of time. The term 'Public Finance' has traditionally been applied to the package of those policies and operations which involve the use of tax and expenditure measures while budgetary policy is an important part to understand the basic problems of use of resources, distribution of Income, etc. There are vast array of fiscal institutions -tax systems, expenditure programs budgetary procedures, stabilization instruments, debt issues, levels of government, etc., which Raise a spectrum of issues arising from the operation of these institutions. Further, the existence of externalities, concern for adjustment in the distribution of income and wealth, etc. require political processes for their solution in a manner which combines individual freedom and justice.

Section I **No of Lectures**

1 Public Finance 10

1.1The role of Government in an economy
1.2 Meaning, Nature, Scope and Importance of Public Finance
1.3 Private Finance and Public Finance
1.4 Principle of Maximum Social Advantage- Dr. Dalton

2. Public Expenditure 12

2.1 Meaning and Principle of Public Expenditure
2.2 Classification of Public Expenditure
2.3 Trends of Public Expenditure in India.
2.4 Causes of increase in Public Expenditure
2.5 Effects of Public Expenditure

3. Public Revenue 14

3.1 Sources of Public Revenue
3.2 Meaning and Objectives of Taxation
3.3 Principles of taxation- Benefit approach, Ability to pay
3.4 Concepts- Impact of Tax, incidence of Tax, Shifting of Tax and Taxable Capacity
3.5 Indian Tax Structure- Direct and Indirect tax, Progressive, proportional and Regressive

4. Public Debt 12

4.1 Meaning and types of Public Debt
4.2 Sources of internal and external Public Debt
4.3 Effects of Public Debt
4.4 Methods of repayment

	1.2 Challenges to Indian Service sector- Business-based & Knowledge-based Sector, Education sector, Health sector, Insurance, Tourism, Banking	06
	1.3 Recent Trends in Indian Service Sector- Digital Economy, E-Commerce, E- Finance	04
Unit 2	**Banking Environment**	**18**
	2.1 Banking- Definition, Functions, Changing Structure of Banking in India- New Private Banks, Small Banks, Payment Banks	08
	2.2 Bank Accounts- Types, Procedure and Operation of Accounts	05
	2.3 Recent Trends in Indian Banking Environment- E-Banking, E- Wallets, Bank Mergers and Amalgamations	05
Unit 3	**Overview of Indian economy**	**18**
	3.1 Challenges of Indian Economy- Poverty, Employment, Inequality, Informal Sector	09
	3.2 Policy Measures (Two-Three recent Programmes)- Poverty Alleviation Programmes; Employment Generation Programmes; Agriculture Development Programmes, Skill Development Programmes	09

11) Recommended books

Semester I: Basic Reading List

- Agrawal A.N., Problems of Development & Planning, (Latest Edition)
- Ashwani Mahajan, 'Indian Economy' S. Chand & Company Ltd., New Delhi.
- Cherunilam Francis, 'Business Environment-Text and Cases' Himalaya Publishing House(Latest Edition)
- Faisal Ahmed 'Business Environment: Indian and Global Perspective' PHL Learning Pvt. Ltd. (Latest Edition)
- Fernando A.C. (2014) 'Business Environment' Pearson Education,
- Misra & Puri, 'Business Environment', Himalaya Publication House, Mumbai. (Latest Edition)
- Misra & Puri, 'Indian Economy', Himalaya Publication House, Mumbai. (Latest Edition)

Recommended Reading

- Asian Development Bank (2009) 'Urban Poverty in India' BS Books

Revised syllabi (2019Pattern) for three years F.Y. B. Com. Degree course (CBCS)

Semester-I

Business Economics (Micro) - I

No. of Credits :- 03

Course Code - 113

Objectives of the course:-

1. To impart knowledge of business economics
2. To clarify micro economic concepts
3. To analyze and interpret charts and graphs
4. To understand basic theories, concepts of micro economics and their application

Unit No.	Unit Title	Contents	Purpose & skills to be developed
1	**Introduction and Basic Concepts**	1.1 Meaning, Nature, Scope and Importance of Business Economics 1.2 Concept of Micro and Macro Economics 1.3 Tools for Economic Analysis- Functional Relationship, Schedules, Graphs and Equations 1.4 Basic Concepts: Household, Consumer, Firm, Plant and Industry 1.5 Goals of Firms- Economic and Non-Economic	• To make the students aware of concepts in micro economics • To help the students understand the difference between micro and macro economics • To make the students understand economic and non-economic goals of firms. **Skills :** Analyze and think critically, develop writing skills
2	**Consumer Behavior**	Utility: Concept and Types 2.2 Cardinal Approach: Law of Diminishing Marginal Utility and Law of Equi Marginal Utility 2.3 Consumer Surplus: Concept and Measurement 2.4 Ordinal Approach: Indifference curve	• To help the students understand the concept of utility • To impart knowledge of cardinal and ordinal approach • To make them understand the concept of consumer surplus **Skills:** Understanding complex theories and concepts Geometrical skills, mathematical aptitude, writing skills

Revised syllabi (2019 Pattern) for Three Years B. Com. Degree course (CBCS)

First Year B. Com
Semester-II Course Code - 123

Business Economics (Micro) - II

Objectives:

1. To understand the basic concepts of micro economics.
2. To understand the tools and theories of economics for solving the problem of decision making by consumers and producers.
3. To understand the problem of scarcity and choices.

Depth of the program – Fundamental Knowledge

Objectives of the Program

1. To impart knowledge of business economics
2. To clarify micro economic concepts
3. To analyze and interpret charts and graphs
4. To understand basic theories, concepts of micro economics and their application

Unit No.	Unit Title	Contents	Purpose skills to be developed
1	**Cost and Revenue**	1.1 Concepts and Types of Cost- Economic Cost and Accounting Cost, Private Cost and Social Cost, Actual Cost and Opportunity Cost, Explicit Cost and Implicit Cost, Incremental Cost and Sunk Cost, Fixed Cost and Variable Cost 1.2 Relation between Total Cost, Average Cost and Marginal Cost 1.3 Cost Curves in Short run and Long run 1.4 Concept of Total Revenue, Average Revenue and Marginal Revenue	• To understand the concept and types of cost • To make the students know about short run and long run cost concepts • To impart knowledge about types of revenue Skills: Interpretation of cost curves, integrate cost and revenue concepts, draw inferences

Savitribai Phule Pune University, Pune
For All faculties

2 credit Compulsory course for all the First Year students in All Faculties

Democracy, Election and Governance

Objectives:

1. To introduce the students meaning of democracy and the role of the governance
2. To help them understand the various approaches to the study of democracy and governance

Module 1 Democracy- Foundation and Dimensions

a. Constitution of India
b. Evolution of Democracy- Different Models
c. Dimensions of Democracy- Social, Economic, and Political

Module 2 Decentralization

a. Indian tradition of decentralization
b. History of panchayat Raj institution in the lost independence period
c. 73rd and 74th amendments
d. Challenges of caste, gender, class, democracy and ethnicity

Module 3 Governance

a. Meaning and concepts
b. Government and governance
c. Inclusion and exclusion

References:

1. Banerjee-Dube, I. (2014). *A history of modern India*. Cambridge University Press.
2. Basu, D. D. (1982). *Introduction to the Constitution of India*. Prentice Hall of India.
3. Bhargava, R. (2008). *Political theory: An introduction*. Pearson Education India.

CORE COURSE-SEMESTER II
EC-1001 MICRO-ECONOMIC ANALYSIS–II
(This course will have *FOUR* credits)

PREAMBLE

The course makes an attempt to provide an introduction to the advanced theories in Microeconomics and at the same time provide an understanding of the analytical rigour of the subject. Micro Economics is a core course that covers Market Structure, Equilibrium, Competition, Price Determination, Price Discrimination, Price Leadership as well as Game Theory. Microeconomics brings to the fore the practical significance of microeconomic theories

Course Objectives:

- To provide a thorough understanding of the principles of economics
- To enable students to apply micro economic concepts in various contexts.
- To enable understanding the basic theories in microeconomics such as demand theory, production theory, market structures.
- To discuss the modern developments in micro economics such as Game Theory.

Programme Outcome:

- Ability to apply the concepts of micro economics such as demand, supply, revenue, cost, elasticity, etc.
- Ability to compare and contrast various market structures and understand concept of equilibrium, price determination
- At the end of the course, the student should be able to evaluate microeconomic concepts, models and its use in real life situations.

1. Market Structures

1.1 Perfect Competition - Short Run and Long Run Equilibrium **(6 Lectures)**
1.2 Equilibrium of a Firm and Industry

2. Monopoly

2.1 Short Run & Long Run Equilibrium of a Firm under Monopoly **(12 Lectures)**
2.2 Price Discrimination under Monopoly, Degrees of Price Discrimination.
2.3 Comparison of Monopoly and Perfectly Competitive Market outcomes.
2.4 Regulation of Monopoly Power.

3. Monopolistic Competition

3.1 Monopolistic Competition, Price and Non-price competition, Equilibrium. **(10 Lectures)**
3.2 Product Differentiation, Selling Costs and Excess Capacity.

4. Oligopoly

4.1 Oligopoly, Basic market structure, Kinky Demand Curve, Price and Output **(10 Lectures)**

CORE COURSE-SEMESTER I
EC-1002 PUBLIC ECONOMICS I
(This course will have *FOUR* credits)

PREAMBLE

There has been a considerable change in the role of the government in modern times. Traditionally, Public Finance was applied to the policies and operation of revenue, expenditure and debt, while the applications have extended to resource utilization, distribution, equality, stabilization, etc. An understanding is provided on how political processes are instrumental in the fiscal policy processes and decision-making, supported by theoretical concepts and practical applications.

Course Objectives:

- To develop an understanding of the changing role of the government and the fiscal functions of the modern governments.
- To discuss and deliberate on the concepts and theories in public economies like public policy, principles of taxation, theories of public expenditure, etc.
- To develop an understanding of various policies in public economics like fiscal policy, taxation policy, public debt policy, public expenditure policy etc.

Programme Outcome:

- Ability to recognize, apply and analyze concepts and theories in public economics.
- Ability to appraise and assess the theory of public economics in real life situations.

1. Introduction **(10 Lectures)**

1.1 Changing Role of Government – Fiscal Functions of Modern Governments - The Allocation Function, The Distribution Function, The Stabilization Function, (Case Study: The Great Depression- From Police to Welfare State)
1.2 Private Goods, Public Goods, Social Goods, Merit Goods, Club Goods

2. Rationale for Public Policy **(14 Lectures)**

2.1 Allocation of Resources- Provision of Public Goods.
2.2 Voluntary Exchange Models- Lindahl, Johansen and Samuelson
2.3 Impossibility of Decentralized Provision of Public Goods
2.4 Contributions of Paul Samuelson, Robert Musgrave, Hugh Dalton- Demand Revealing Schemes for Public goods
2.5 The Clarke Tax, The Tiebout Hypothesis **(12 Lectures)**

3. Taxation

3.1 Principles of Taxation- Benefit and Ability to Pay Approaches
3.2 Theory of Incidence; Alternative concepts of Incidence
3.3 Allocative and equity aspects of Individual Taxes;
3.4 Theory of Optimal Taxation; Excess Burden of Taxes;

CORE COURSE SEMESTER II
EC-2002 PUBLIC ECONOMICS II
(This course will have *FOUR* credits)

PREAMBLE

There is considerable change in the public economics in modern economies. Public Finance was applied to the policies and operation of public debt, budgets, deficits as well as fiscal federalism, with understanding of the fiscal policy in the management and responsibility context. An understanding is provided on the reforms and change in government finances, supported by theoretical concepts and practical applications.

Course Objectives:

- To develop an understanding of various policies in public economics like fiscal policy, public debt policy, fiscal finances, etc.
- To help the students to understand the normative policies and compare it with the policies framed and followed by Indian economy.
- To impart information to the students about the reforms like taxation reforms in India.

Programme Outcome:

- Ability to understand, apply and analyze concepts-public debt, budget, fiscal policy in public economics.
- Ability to interpret the theories relating to public economics in real life situations.
- Ability to discuss and debate on the public finance and policies w.r.t. India

1. Public Finance in India **(12 Lectures)**

1.1 Indian Tax System- Tax and Non-tax Revenue
1.2 Taxes in India - Direct and Indirect Taxes
1.3 Reforms in Direct and Indirect Taxes, Introduction of GST
1.4 Budget- Meaning and Components, Economic Classification of Budget, Balanced Budget Multiplier, Gender Budget- Concept, Objectives & Purpose
1.5 Budget Deficits and Their Implications.

2. Public Debt **(12 Lectures)**

2.1 Sources of Public Debt w.r.t India;
2.2 Burden of Public Debt on Indian Economy
2.3 Deficit financing, Public Borrowings and Level of Prices
2.4 Principles of Debt Management and Repayment

3. Fiscal Policy **(10 Lectures)**

3.1 Objectives of Fiscal Policy in Countries like India, Interdependence between Fiscal and Monetary Policies

CORE COURSE-SEMESTER I
EC 1003- INTERNATIONAL TRADE
(This course will have *FOUR* credits)

PREAMBLE

International Economics is subject that is ever dynamic and relevant in the current context. International Economics provides a framework on international trade and finance in the theoretical context, along with economic analysis as well as practical applications. The subject discusses Free Trade, Barriers to Trade, Trade Agreements and Trade Organizations. Various issues are discussed and analyzed arising out of international trade and finance.

Course Objectives:

- To develop an understanding of the theoretical concept in international trade.
- To analyze international economics with reference to terms of trade, trade policy, trade agreements etc.
- To provide knowledge to students regarding recent developments and changes in international banking, international banking agreements etc.
- To make the students understand role of international economic organization and global crisis development.

Programme Outcome:

- Ability to understand the concepts of international economics such as comparative cost, terms of trade, trade policies and trade agreements
- Ability to interpret and apply theory relating to understand international trade
- Ability to discuss and debate the effects of trade policy, trade agreements, exchange rate policies on the world economy/trade

1. Overview of Classical and Modern Trade Theories **(20 lectures)**

1.1 The Theory of Comparative Cost- David Ricardo
1.2 The Heckscher-Ohlin Theorem- The Opportunity Cost Approach
1.3 Verification of Physical Criterion and Price Criterion,
1.4 Leontief Paradox – Factor Price Equalization [Edgeworth Box Diagram]
1.5 New Theories of Trade, Product Life Cycle and Technology Gap Models,
1.6 Preference Similarity and Intra-Industry Trade,
1.7 Economies of Scale and Monopolistic Competition
1.8 Krugman- Theory of Economic Geography
1.9 Neo-Heckscher Ohlin Theorem

2. Terms of Trade **(4 lectures)**

2.1 Concepts of Terms of Trade, Factors affecting Terms of Trade
2.2 Gross & Net Barter Terms of Trade
2.3 Terms of Trade and Economic Development

CORE COURSE SEMESTER II
EC - 2003- INTERNATIONAL FINANCE
(This course will have *FOUR* credits)

PREAMBLE

International Economics is subject that is relevant in the current context. International Finance provides an understanding of the various aspects of International Finance in the analytical context along with a theoretical background. The subject discusses Balance of Payments, Foreign Exchange, Risk, Currency Management as well as International capital flows. Various topics are discussed and analyzed that relate to international finance, banking and markets.

Course Objectives:

- To develop an understanding of the theoretical concept in international finance- Balance of Payments, exchange rate policies, capital flows, etc.
- To compare and contrast the scenarios on international trade in India vis-à-vis the world economy.
- To provide knowledge to students regarding recent developments and changes in international banking, international banking agreements etc.
- To make the students understand role of international economic organization and global crisis development.

Programme Outcome:

- Ability to understand and interpret the concepts such as Balance of Payments, Exchange Rates, Foreign Exchange transactions, International capital flows, etc.
- Ability to critically analyze the effects of deficits, exchange risk, role of foreign capital on the world economy/trade
- Ability to discuss and debate on subjects related to international trade and finance w.r.t the Indian Economy

1. Balance of Payment

1.1 Balance of Trade- Concept, Structure & Components **(10 Lectures)**
1.2 Balance of Payments- Concept, Disequilibrium, Causes of Disequilibrium;
1.3 Correction of Disequilibrium-Automatic Correction, Deliberate Correction,
1.4 Foreign Trade Multiplier- Meaning, Working, Implications & Limitations
1.5 Policies for Internal and External Balance-Fiscal and Monetary Policy Under Fixed and Floating Exchange Rates
1.6 Devaluation of Indian Rupee- Effect on Balance of Payment in 1991.

2. Foreign Exchange

2.1 Components of Foreign Exchange Market- Transfer of Purchasing Power, Provision of Credit, Provision of Hedging Facilities **(12 lectures)**

ELECTIVE COURSE-SEMESTER I
EC.1004-AGRICULTURAL ECONOMICS
(This course will have *FOUR* credits)

PREAMBLE

Agricultural Economics is an applied field in economics; the subject provides an understanding of the production and distribution of food. Agricultural Economics provides an understanding of the various aspects of agriculture- productivity, labour, credit, markets for farm products, with appropriate economic analysis. The subject discusses agrarian structures w.r.t. growth, employment, efficiency and prices as well as incomes. It is important to analyze the challenges to agriculture in the context of emerging economies.

Course Objectives:

- To develop an understanding of agricultural economics in the theoretical as well as practical context.
- To discuss and debate the various issues and challenges faced by agrarian economies w.r.t. production, productivity, efficiency, employment, etc.

Programme Outcome:

- Ability to analyze and evaluate the subject with reference to various aspects of agrarian economies.
- Ability to develop an understanding of agriculture with its intricacies and imperfections and to be able to construct intellectual dialogue on the challenges of agriculture.

(8 Lectures)

1. Introduction

1.1 Role of Agriculture in Indian Economy
1.2 Agrarian Structure in India in a Liberalizing and Globalizing Economy,
1.3 Barriers to Agricultural Growth in India
1.4 Need for Policy Intervention – Productivity, Equity and Sustainability **(10 Lectures)**

2. Agriculture Productivity and Agricultural Labour

2.1 Trends in Agricultural Productivity in India since 1991
2.2 Challenges to Agricultural Productivity– Crop Insurance, Irrigation, Exports
2.3 Agricultural Labour- Trends in Agricultural Employment and Efficiency
2.3 Technology Inputs in Agriculture and Impact on Agriculture Labour
2.4 Review of the National Employment Guarantee Scheme **(10 Lectures)**

3. Agriculture and Credit

3.1 Financial Sector Reforms and Rural Credit
3.2 Role of NABARD, Commercial Banks and Cooperative Institutions
3.4 Micro Finance in Rural Finance – Emergence, Role and Challenges
3.5 Challenges to Rural and Agricultural Credit in India

ELECTIVE COURSE-SEMESTER II
EC- 2004 LABOUR ECONOMICS
(This course will have *FOUR* credits)

PREAMBLE

Labour Economics is a specialized area in economics; the subject covers the study of labour, the industrial structure and industrial relations. Labour Economics provides an understanding of the various aspects of labour markets on structure, division of labour, employment and wage determination with a relevant theoretical background. The subject discusses labour markets, wages and wage determination, labour dynamics and industrial relations. Various contemporary topics are discussed and analyzed such as migration, absenteeism, wage differentials and social security under labour economies.

Course Objectives:

- To develop an understanding of labour economics in the theoretical as well as practical context.
- To discuss and debate the various issues and challenges faced by labour with reference to division of labour, employment, wage determination, etc.
- To demonstrate on the various aspects of labour dynamics and labour relations w.r.t. India

Programme Outcome:

- Ability to analyze and evaluate the subject with reference to various aspects of Labour economics.
- Ability to develop an understanding of the labour with its intricacies and imperfections and to be able to construct intellectual dialogue on the challenges of labour w.r.t. the Indian Economy.

1 Introduction **(8 Lectures)**

1.1 Concept of Labour Force, Determinants of Labour Force Participation
1.2 Historical Emergence and Relevance of Labour Economics
1.3 Indian Labour Market- Changing Structure and Impact of Globalization
1.4 Unemployment in India and Policies for Employment Generation

2 Labour Markets and Wage Determination **(12 Lectures)**

2.1 Labour Markets- Rural & Urban, Formal and Informal, Organized and Unorganized, Contract Labour
2.2 Growth and Trends in Labour Market,- New Legislation, Unionization, Labour Dynamics, Labour Market Flexibility
2.3 Theories of Wages- Marginal Productivity Theory, Theory of Collective Bargaining, Modern Theory of Wages- Demand and Supply Theory
2.4 Wage Structure, Minimum Wage, Fair Wage, Wage Differentials- Inequality, Inter-sectoral Differences, Gender Differences

CORE COURSE
SEMESTER III
EC-3001
MACRO ECONOMICS ANALYSIS - I
(This course will have *FOUR* credits)

PREAMBLE

Macroeconomics or aggregative economics analysis establishes the functional relationship between various aggregates of the economy. Aggregative analysis assumed such a great significance in recent times that a prior understanding of macroeconomic theoretical structure is considered essential for proper comprehension of different issues and policies. Macroeconomics now is not only a scientific method of analysis but also a body of empirical economic knowledge. The course equips the students at the postgraduate level to understand systematic facts and theoretical developments for empirical analysis,

Course Objectives:

- To provide a thorough understanding of the principles of macroeconomics and the application of macroeconomic concepts in real-life situations.
- To discuss the modern developments in macroeconomics.

Programme Outcome:

- Ability to analyze and demonstrate knowledge of the basic theories/laws in macroeconomics.
- At the end of the course, the student should be able to evaluate macroeconomic concepts, models and its use in real life situations.

1. Traditional Approaches to Macroeconomics **12**

1.1 Classical Approach-Introduction and main features
1.2 Keynesian Approach-Introduction and main features
1.3 Neoclassical Approach-Introduction and main features

2. National Income and Social Accounting **12**

2.1 Circular Flow Income in two-three and four sector economy
2.2 Different forms of national income accounting-
2.2.1 Social accounting
2.2.2 Input-output accounting
2.2.3 Flow of funds Accounting
2.2.4 Balance of payments Accounting
2.2.5 Matrix presentation of Social Accounting

3. Demand and Supply of Money **12**

3.1 Definition of Money, Debates relating to definition of Money
3.2 The Liquidity Theory, Gurley and Shaw Hypothesis, Demand for Money-Classical and Keynesian
3.4 Cash Balance Approach- Post Keynesian Theories of Demand for Money, Tobins Approach, Baumol's Inventory Theoretic Approach, Friedman's Theory of Demand for Money.

CORE COURSE
SEMESTER IV
EC- 4001
MACRO ECONOMIC ANALYSIS II
(This course will have *FOUR* credits)

PREAMBLE

Macroeconomics or aggregative economics analysis establishes the functional relationship between various aggregates of the economy. Aggregative analysis assumed such a great significance in recent times that a prior understanding of macroeconomic theoretical structure is considered essential for proper comprehension of different issues and policies. Macroeconomics now is not only a scientific method of analysis but also a body of empirical economic knowledge. The course equips the students at the postgraduate level to understand systematic facts and theoretical developments for empirical analysis,

Course Objectives:

- To provide a thorough understanding of the principles of macroeconomics and the application of macroeconomic concepts in various contexts.
- To discuss the modern developments in macroeconomics.

Programme Outcome:

- Ability to analyze and demonstrate knowledge of the basic theories/laws in economics- general equilibrium psychological law of consumption, etc.
- At the end of the course, the student should be able to evaluate macroeconomic concepts, models and its use in real life situations.

1. Aggregate Demand and Aggregate Supply Analysis **12**

1.1 Aggregate Demand Curve (with price flexibility)-Derivation of aggregate demand curve-shift in aggregate demand curve and multiplier effect
1.2 Aggregate Supply curve (with variable prices)-shift in aggregate supply curve-long-run aggregate supply curve –Derivation of Aggregate supply curve-
1.3 Macroeconomic equilibrium: AS-AD Model-Friedman's Natural Rate Hypothesis-Economic Fluctuations
1.4 Three Models of the Upward Sloping SRAS (short-run aggregate supply curve) –The Sticky Wage Theory, The Sticky Price Theory and The Misperceptions (Fooling) Theory

2. The IS-LM Curves Model **12**

2.1 Introduction-The Structure of the Model
2.2 Derivation of IS Curve and LM Curve –Shifts in IS Curve and LM curve, causes in shifts in IS and LM Curve.
2.3 Simultaneous Equilibrium in Goods Market and Money Market-Extension IS-LM model with government sector Fiscal policies.
2.4 Extension of IS-LM model with Labor Market and flexible prices.

3. Inflation-Unemployment Trade-Off: Phillips Curve and Rational Expectations Theory **12**

3.1 Inflation and Unemployment-Phillips curve-Explanation of Phillips curve.
3.2 Causes of shifts in Phillips Curve- Long-run Phillips curve and adaptive expectations – Long-run Phillips curve: Rational expectations.
3.3 Relation between short-run Phillips curve and long-run Phillips curve.

CORE COURSE
SEMESTER III
EC- 3002
GROWTH AND DEVELOPMENT- I
(This course will have *FOUR* credits)

PREAMBLE

The course makes an attempt to provide an introduction to the economics of Growth and Development and at the same time provide an understanding of the analytical rigour of the subject. Growth and Development-I is a core course that covers meaning and concept of Economic Growth and Development, measuring the economic growth and development, theories of economic growth and development, poverty, inequality and unemployment and role human capital in economic development . Growth and development-I will try to clear the concepts regarding the economic growth and development and provides basic knowledge to the students to get engaged in the activities.

Course Objectives:

- To enable learning and understanding of the basic concepts and process to measure the growth and economic development etc.
- To analyze and evaluate the obstacles in the process of economic growth and development

Programme Outcome:

- Ability to apply the concepts of economic growth and compare international comparison of economic development, etc.
- Ability to analyze and demonstrate knowledge of the economic growth and development theories of economic growth and development

1 Principles and Concepts of Growth and Development **12**

1.1 Concepts of growth and Development
1.2 Measuring Economic Development: Income and Alternative Measures
1.3 International Comparison of Incomes: PPP and Exchange Rate Approaches
1.4 Developing / Emerging Economies – Concept
1.5 Barriers to Economic Development

2 Theories of Economic Development and Growth **12**

2.1 Classical Theory of Economic Development: Adam Smith
2.2 The Harrod-Domar Model
2.3 Solow model of economic growth
2.4 The Cobb-Douglas Production Function
2.5 The Big push theory
2.6 The New (Endogenous) Growth Theory

3 Poverty, Inequality and Unemployment **12**

3.1 Measurement of Poverty- Uni-dimensional & Multi-dimensional, Amartya Sen's Approach to Poverty measurement, Rural and Urban Poverty, Participatory Approach to Poverty, Women and Poverty
3.2 Measuring Inequality, Lorenz Curve, Gini Coefficient, Functional Distribution,
3.3 Challenge of Unemployment, Disguised Unemployment and Economic Development, Concept of Jobless Growth
3.4 Employment and Migration

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K. J. Somaiya College of Arts, Commerce & Science, Kopargaon

Crosscutting Issues in Syllabus of Geography

Crosscutting Issues in 2019 Pattern:

Sr. No.	Class	Course Code	Course Name	Addressed issues
1.	B. A. Geography	SEC-2B	(Value/skill based course) IV SEC 2 B Introduction to Remote Sensing	Professional Ethics
2.	B. A. Geography	SEC- 2C	(Value/skill based Course) SEC 2C Research Methodology – I	Professional Ethics
3.	B. A. Geography	SEC- 2D	Value/skill based course) SEC 2 D Research Methodology – II	Professional Ethics
4.	M.A./M.Sc. Geography	GGDT130	Geography of Tourism	Professional Ethics
5.	M.A./M.Sc. Geography	GGUT 251	Research Methodology	Professional Ethics
6.	B. A. Geography	Gg: 220(A)	Geography of Maharashtra – I	Gender, Environment & Sustainability
7.	B. A. Geography	Gg: 220(B)	Geography of Maharashtra – II	Gender, Environment & Sustainability
8.	M.A. /M.Sc. Geography	GGDT-114	Principles of Population and Settlement Geography	Gender
9	M.A /M.Sc. Geography	GGUT239	Urban Geography	Human Values & Professional Ethics
10.	B.A. Geography	Gg: 210(A)	Economic Geography I	Professional Ethics
11.	B.A. Geography	Gg: 210(B)	Economic Geography II	Professional Ethics
12.	B.A. Geography	SEC 2 A	(Value/skill based course) III Introduction to Geographical Information System	Professional Ethics
13.	B.A. Geography	Gg: 310(A)	Geography of Tourism-I	Environment and Sustainability Gender, Professional Ethics

14.	B.A. Geography	Gg: 310(B)	Geography of Tourism-I	Environment and Sustainability Gender, Professional Ethics
15.	M.A. /M.Sc. Geography	GGUT112	Principles of Climatology	Environment and Sustainability
16.	M.A. /M.Sc. Geography	GGUT 243	Watershed Management	Environment and Sustainability

Dr. G. K. Chavhan
Head, Dept. of Geography

Dr. V. C. Thange
IQAC, Coordinator

Dr. B. S. Yadav
Principal

Semester II

Course: GGDT-130: Geography of Tourism

Course Outcome:

1. Students will get introduced with the basic and recent concepts related to tourism.
2. The course will help the students to understand various factors which affect tourism.
3. Students will comprehend various roles of accommodation in tourism.
4. Students will be aware of Indian tourism through various case studies.
   Students will get overall knowledge about tourism section in India.

No. of Credits: 02No. of Periods: 30

Topic No.	Topic	Sub topics	No. of Periods
1	Introduction to Geography of tourism	i. Definition: tourist and tourism ii. Concept of recreation and leisure iii. Importance of tourism iv. Impact of tourism on economy of nation	02
2	Classification and Recent Concepts of Tourism	i. Classification on the basis of: nationalitytime of travel, number of tourist and purpose ii. Recent concepts: agro-tourism, eco-tourism, heritage tourism and adventure tourism	10
3	Factors of Tourism	i. Physical factors:relief, climate, vegetation, wild life and water bodies ii. Socio-cultural factors:religious, historical and cultural, economic, transportation and accommodation	08
4	Role of Accommodation in Tourism	i. Hotels, motels, inn, saraies, dharmashalas ii. Governmentaccommodation, tourist homes iii. Youth hostels, cottages, tents, caravans iv. Rail yatribhavan, house boats v. Private accommodations and unrecognizedaccommodations	06
5	Indian Tourism	Case studies i. Hill stations: Manali, Mahabaleshwar ii. Beaches: Kalangut (Goa), Ganpatipule iii. Historical centres: Agra, Pratapgad iv. Caves : Badami, Ajanta v. Religious Centres: Prayagraj (Allahabad), Shirdi vi. National Parks: Kaziranga, Tadoba vii. Dams: SardarSarovar, Koyna viii. Waterfalls: Nohkalikai Fall, Thoseghar	04

Semester I

Course: GGUT- 112:Principles of Climatology

Course Outcome:

1. Student gets acquainted with the basic concepts in Climatology
2. Understand the elements of weather and climate, different atmospheric phenomena and climate change
3. Gain the knowledge to associate climate with other environmental and human issues.
4. Understands the concepts of Insolation and temperature

Realize the way atmospheric moisture works.

No. of Credits: 04 **No. of Periods: 60**

Topic No.	Topic	Sub topics	No. of Periods
1	Introduction toClimatology	i. Meteorology and Climatology ii. Nature and Scope of Climatology iii. Development of Climatology iv. Tropical Climatology	06
2	Earth's Atmosphere	i. Evolution ii. Structure and composition of atmosphere iii. The ozone layer depletion iv. Aurora - types	08
3	Insolation	i. Solar and terrestrial radiation ii. Electromagnetic spectrum iii. Factors affecting insolation iv. Latitudinal and seasonal variation v. Effect of atmosphere vi. Greenhouse effect vii. Heat budget viii. Mechanisms of heat transfer	10
4	Temperature	i. Heat and temperature ii. Temperature measurements and controls iii. Lapse rate iv. Temperature inversion v. Types of inversion	06

K.J.Somaiya College of Arts, Commerce & Science Kopargaon

Faculty of Commerce & Management

Cross Cutting Issues in Core Subjects

F.Y.B.Com 2019 Pattern (CBCS) (Sem. –I)



Sr. No	Class	Subject	Course Syllabus	Cross Cutting Issue
1	F.Y.B.Com 2019 Pattern	Financial Accounting-I	Accounting Concepts, Conventions Of Emerging Trends In Accounting	Professional Ethics
			Piecemeal Distribution Of Cash	Professional Ethics
			Accounts From Incomplete Records	Professional Ethics
			Introduction To Goods And Services Tax Laws And Accounting	Professional Ethics
2	F.Y.B.Com 2019 Pattern	Business Economics - I	Introduction And Basic Concepts	Professional Ethics
			Consumer Behaviour	Human Values
			Demand And Supply Analysis	Professional Ethics
			Production Analysis	Professional Ethics
3	F.Y.B.Com 2019 Pattern	Business Mathematics & Statistics- I	Interest And Annuity	Professional Ethics
			Shares And Mutual Funds	Professional Ethics
			Population And Sample	Professional Ethics
			Measures Of Central Tendency And Measures Of Dispersion	Professional Ethics
4	F.Y.B.Com 2019 Pattern	Computer Concepts And Application - I	Introduction To Computer And Operating System	Professional Ethics Professional Ethics
			Office Automation Tools	Professional Ethics
			Introduction To Computer Network	Professional Ethics Professional Ethics
			Computer Applications In Commerce	Professional Ethics Professional Ethics
5	F.Y.B.Com 2019 Pattern	Organizational Skills Development- I	Concept Of Modern Office	Professional Ethics
			Office Organisation And Management	Professional Ethics Professional Ethics
			Office Records Management	Professional Ethics Professional Ethics
			Office Work	Professional Ethics
6	F.Y.B.Com	Marketing And	Introduction To Market And Marketing	Professional Ethics

	2019 Pattern	Salesmanship- I	Market Segmentation And Marketing Mix	Professional Ethics
			Product Mix And Price Mix	Professional Ethics Professional Ethics
			Place Mix And Promotion Mix	Professional Ethics Human Values
7.	F.Y.B.Com 2019 Pattern	Computerised Accounting	Computerised Accounting	Professional Ethics Sustainability
			Tally Software	Professional Ethics Sustainability
			Voucher Entry in Tally Software	Professional Ethics Sustainability
			Ledger and financial statements in Tally Software	Professional Ethics Sustainability
8.	F.Y.B.Com 2019 Pattern	Value Education	Concepts of Value Education	Human Values
			Ethics and Moral Values	Human Values
			Gender Equity	Gender
			Ethics, Moral Values and Culture	Human Values
			Human Rights	Human Values & Gender Sensitization
			Awareness of values and ethics in economic progress	Sustainability
			Concept of Morality and Moral Education	Human Values

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Financial Accounting- I

K. SOMAIYA COLLEGE Commerce KOPARGAON

Course Code - 112 **No. of Credits :- 03 and for practical - 01**

Objective of the Course:-

1. To impart knowledge of basic accounting concepts
2. To create awareness about application of these concepts in business world
3. To impart skills regarding Computerised Accounting
4. To impart knowledge regarding finalization of accounts of various establishments.

Unit No.	Unit Title	Contents	Purposed Skills to be developed
1	Accounting Concepts, Conventions and Principles and an overview of Emerging Trends in Accounting	**(A) Accounting Concepts, Conventions and Principles** 1. Money Measurement 2. Business Entity 3. Dual Aspect 4. Periodicity Concept 5. Realization Concept 6. Matching Concept 7. Accrual / Cash Concept 8. Consistency Concept 9. Conservatism Principle 10. Materiality Concept 11. Going Concern Concept 12. Historical Cost Concept **(B) Emerging Trends in Accounting** 1. Inflation Accounting 2. Creative Accounting	• Knowledge about various accounting Concepts, Conventions and Principles. • Understanding emerging trends in accounting and its effect on accounting Practices.

2	Fleeman Dissolution of Cash	1. Surplus Capital Method only, Asset taken over by a partner, 2. Treatment of past profits or past losses in the Balance sheet, 3. Contingent liabilities 4. Realization expenses/amount kept aside for expenses 5. adjustment of actual, Treatment of secured liabilities, 6. Treatment of preferential liabilities like Govt. dues/labour dues etc., Excluding: Insolvency of partner and Maximum Loss Method.	• Knowledge about process of dissolution of partnership firm.
3	Accounts from Incomplete Records (Single Entry System)	1. Meaning of single entry system 2. Features of Single Entry System 3. Conversion of Single Entry into Double Entry	• *Knowledge about single entry systems.* • *Purpose and advantages of double entry system* • *Process of conversion of single entry into double entry system.*
4	Introduction to Goods and Services Tax laws and Accounting	1. Constitutional Background of GST, Concepts and definition of GST. 2. IGST, CGST and SGST 3. Input and Output Tax credit 4. Procedure for registration under GST	• *Knowledge about conceptual framework of the GST* • *Knowledge about various components of GST.* • *Types of taxes under GST* • *Registration process under GST for business establishments.*

Business Economics (Micro) - I

Course Code - 113 **No. of Credits : 03**

Objectives of the course:-

1. To impart knowledge of business economics
2. To clarify micro economic concepts
3. To analyze and interpret charts and graphs
4. To understand basic theories, concepts of micro economics and their application

Unit No.	Unit Title	Contents	Purpose & skills to be developed
1	**Introduction and Basic Concepts**	1.1 Meaning, Nature, Scope and Importance of Business Economics 1.2 Concept of Micro and Macro Economics 1.3 Tools for Economic Analysis- Functional Relationship, Schedules, Graphs and Equations 1.4 Basic Concepts: Household, Consumer, Firm, Plant and Industry 1.5 Goals of Firms- Economic and Non-Economic	• To make the students aware of concepts in micro economics • To help the students understand the difference between micro and macro economics • To make the students understand economic and non-economic goals of firms. **Skills :** Analyze and think critically, develop writing skills
2	**Consumer Behavior**	Utility: Concept and Types 2.2 Cardinal Approach: Law of Diminishing Marginal Utility and Law of Equi Marginal Utility 2.3 Consumer Surplus: Concept and Measurement 2.4 Ordinal Approach: Indifference curve Analysis- Concept, Characteristics, Consumer Equilibrium	• To help the students understand the concept of utility • To impart knowledge of cardinal and ordinal approach • To make them understand the concept of consumer surplus **Skills:** Understanding complex theories and concepts Geometrical skills, mathematical aptitude, writing skills

			3.4 Elasticity of Demand 3.4.1 Price Elasticity of Demand - Meaning, Types, Measurement, Uses and Significance 3.4.2 Income Elasticity of Demand-Meaning and Types 3.4.3 Cross Elasticity of Demand-Meaning and Types 3.5 Supply : Concept, Determinants and Law of Supply 3.6 Equilibrium of Demand and Supply for Price Determination	of law of supply • To help the students understand price determination in varie demand and supply condition **Skills imparted:** *Applying mathematical and statistical analysis methods extracting information, drawing conclusions*
		4.	**Production Analysis**	4.1 Concept of Production Function 4.2 Total, Average and Marginal Production 4.3 Law of Variable Proportions 4.4 Law of Returns to Scale 4.5 Economies and Diseconomies of Scale-Internal and External	• *To help the students understand the relation between revenue concepts* • *To understand theories of production function* • *To make students know about economies and diseconomies of scale* **Skills:** *Interpret economic theories, writing skills, understand charts and graphs.*

K. J. SOMAIYA COLLEGE OF ARTS & COMMERCE KOPARGAON

Course Code – 114 (A) **Semester: I** **Business Mathematics & Statistics- I**

Objective of the Program

1. To introduce the basic concepts in Finance and Business Mathematicsand Statistics
2. To familiar the students with applications of Statistics and Mathematics in Business
3. To acquaint students with some basic concepts in Statistics.
4. To learn some elementary statistical methods for analysis of data.
5. The main outcome of this course is that the students are able to analyze the data by using some elementary statistical methods

Unit No.	Unit Title	Contents	Purpose/Skills to be developed
1	**Interest and Annuity**	**Interest:** Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest, Examples and Problems **Annuity:** Ordinary Annuity, Sinking Fund, Annuity due, Present Value and Future Value of Annuity, Equated Monthly Installments (EMI) by Interest of Reducing Balance and Flat Interest methods, Examples and Problems.	1. To understand the concept of Simple interest, compound interest, effect of compounding. 2. To understand the concept of Annuity and its applications for EMIs and Amortization Schedule.
2	**Shares and Mutual Funds**	**Shares:** Concept of share, face value, market value, dividend, brokerage, equity shares, preferential shares, bonus shares. Examples and Problems **Mutual Funds:** Concept of Mutual Funds, Problems on calculation of Net Income after considering entry load, Dividend, Change in Net Asset Value (NAV) and exit load. Averaging of price under the Systematic Investment Plan (S.I.P.). Examples and Problems	1. To understand the concept of shares and mutual funds. 2. To understand contribution of shares and mutual funds in systematic investment plans 3. To solve problems related to shares and mutual funds
3	**Population and Sample**	Definition of Statistics, Scope of Statistics in Economics, Management Science and Industry. Concept of population and sample, methods of data collection: Census and sampling with illustration. Methods of random sampling – SRSWR, SRSWOR, Stratified, Systematic (Description of sampling procedures only).	1. Collection of data 2. Analyzing and interpreting data. 3. Knowing different method of sampling

Topic No.	Total Lectures	Innovative methods to be used	Expected Outcome
1	16	ICT	Students will be able to apply concepts of interests and annuities to calculate EMI, prepare amortization schedule, calculate insurance premiums etc
2	8	ICT	Students will be able calculate dividend, brokerage on shares and mutual funds. Also students will be able to identify the contribution of shares and mutual funds in systematic investment plans and to select best investment options
3	8	ICT	Students will be able to recognize and classify different types of data. Students will be able to take a sample of appropriate size using suitable method of sampling.
4	16	ICT	Students will be able to calculate measures of central tendency and measures of dispersion. Students will be able to use appropriate measure of central tendency or measure of dispersion for given data to given problems from business or economics.

Teaching methodology

Semester: I

Computer Concepts and Application - I

Course Code – 114 (B) **No. of Credits :- 03**

Objective:

1. To make the students familiar with Computer environment.
2. To make the students familiar with the basics of Operating System and business communication tools.
3. To make the students familiar with basics of Network, Internet and related concepts.
4. To make awareness among students about applications of Internet in Commerce.
5. To enable make awareness among students about e-commerce and M commerce.

Unit 1 Introduction to Computer and Operating system **[12]**

Introduction to Computer
Definition, Block Diagram, Computer Hierarchy, (Classification), Characteristics of Computer

Computer System Hardware
Computer Memory
Input and Output Devices

Definition – Software
Software Types - System Software, Application Software

Definition of Operating System

Types of Operating Systems,
Functions of Operating Systems

Working with Windows Operating System:

Introduction to Free and Open Source Software

Definition of Computer Virus, Types of Viruses, Use of Antivirus software.

Unit 2 Office automation tools [12]

Definition of Information Technology (IT)
Benefits of Information Technology (IT)
Applications of Information Technology (IT)

Office automation tools

MS-Word: *Introduction, Starting MS-Word, MS-Word Screen and its Components, Elementary Working with MS-Word*

MS-Excel: *Introduction, Starting MS-Excel, Basics of Spread sheet, MS-Excel Screen and Its Components, Elementary Working with MS-Excel*

MS-PowerPoint: *Introduction, Starting MS-PowerPoint, Basics of PowerPoint, MS-PowerPoint Screen and Its Components, Elementary Working with MS PowerPoint*

Data Processing: Files and Records, File Organization (Sequential, Direct/Random, Index)

Unit 3 Introduction to Computer Network [12]

Introduction
Importance of Networking
Computer Network (LAN, WAN, MAN)

Network Components (Hub, Switch, Bridge, Gateway, Router, Modem)

Unit 4 Computer applications in Commerce [12]

Computer Applications in Business – Need and Scope

Computer Applications in various fields of Commerce:
Personnel Administration, Accounting, Cost and Budgetary Management, Purchasing, Banking, Insurance and Stock-broking, e-governance

E-Commerce

Defining e-Commerce, Main Activities of Electronic Commerce, Benefits of E-Commerce; Broad Goals of Electronic Commerce; Main Components of E-Commerce; Functions of Electronic Commerce – Communication, Process Management, Service Management, Transaction Capabilities;

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Semester: I

Organizational Skills Development- I

Course Code – 115 - A

No. of Credits :- 03



Objectives of the course

1. To introduce the students to the emerging changes in the modern office environment
2. To develop the conceptual , analytical , technical and managerial skills of students efficient office organization and records management
3. To develop the organizational skills of students
4. To develop Technical skills among the students for designing and developing effective means to manage records , consistency and efficiency of work flow in the administrative section of an organsation
5. To develop employability skills among the students

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Concept of Modern Office	a. Modem Office :- Definition, Characteristics, importance and functions b. Office environment:- Meaning and Importance c. Office Location :-Meaning, Principles and factors affecting Office location d. Office Layout :- Meaning, Principles and factors affecting Office Layout	1. Conceptual Clarity on the meaning of a modern office 2. Developing understanding on the internal and external factors of an office environment 3. Developing analytical and technical skills to contribute towards planning office location and layout
2	Office Organisation and Management	a. Office Organisation : Definition, Importance, Principles and Types of Organisation b. Office Management:- Definition, Functions c. Scientific Office Management :- Meaning, Aims, Techniques of Scientific Office Management and Steps for installation of Scientific Office Management	1. Conceptual clarity on the meaning of Scientific office management 2. Development of understanding in various techniques for scientific management

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Power Point Presentation	Online Videos	Making a model of office layout in groups	Conceptual Clarity on meaning of Modern Office, internal and external factors of an office environment
2	12	Power Point Presentation			Conceptual clarity on the meaning of Scientific office management and understanding various techniques for scientific management
					documents for effective records creation and maintenance
					1. Analytical skills for process improvement in office work.

Teaching Methodology

Course Code – 116 - C

Semester - I

Marketing and Salesmanship-I

(Fundamentals of Marketing)

Objectives of the Course

1. To introduce the basic concepts in Marketing.
2. To give the insight of the basic knowledge of Market Segmentation and Marketing Mix
3. To impart knowledge on Product and Price Mix.
4. To establish link between commerce, business and marketing.
5. To understand the segmentation of markets and Marketing Mix.
6. To enable students to apply this knowledge in practicality by enhancing their skills in the field ofMarketing.

Unit No.	Unit Title	Contents	Purposed Skills To Be Developed
1	Introduction to Market and Marketing	1.1 Meaning and Definition of Market 1.2 Classification of Markets 1.3 Marketing Concept: Traditional and Modern 1.4 Importance of Marketing 1.5 Functions of Marketing: Buying, Selling, Assembling, Storage, Transportation, Standardization, Grading, Branding, Advertising, Packaging, Risk Bearing, Insurance, Marketing Finance, Market Research and Marketing Information. 1.6 Selling vs. Marketing	The basic knowledge of Market and Marketing will be developed amongst students.
		b. Digitalization of records:- Advantages and Problems of Digitalization c. Form Design:- Objectives, types of forms, Significance, Principles of form designing d. Office Manual – Definition, Contents Types , benefits and limitations	
4	Office work	Office work :-Meaning and Characteristics, Flow of work :- Significance, Features of Ideal flow of work ,benefits of flow of work ,problems in smooth flow of work , suggestions for even flow of work	

K. J. SOMAIYA COLLEGE Dept. of Commerce VIDYAVIHAR

		ii. Importance iii. Types of Distribution Channels – consumer goods and Industrial Goods iv. Factors Influencing selection of Channels		
		4.2 Promotion Mix 4.2.1 Meaning of Promotion Mix 4.2.2 Elements of Promotion Mix- Personal Selling, Public Relation and Sales Promotion 4.2.3 Factors Affecting Market Promotion Mix 4.2.4 Promotion Techniques or Methods		

K. J. SOMAIYA COLLEGE
Dept. of Commerce
KOPARGAON

Course No. 5 – Value Education

Objectives of the course:

The course is designed to inculcate the values which are an utmost need of the hour to overcome various challenges. The students will learn to adopt and implement the suitable values at appropriate time, understand various challenges in value adoption in this contemporary world, use the 'Reflection method' to explore values from inside out.

The course is expected to aquatint students with the core values such as physical, mental and spiritual aspects of personality, developing respect for the dignity of individual and the society, inculcation of spirit of patriotism and national integrity and developing tolerance towards understanding of different religious faiths as well. The course will help students to be a better human being and a strong pillar of society.

Course Contents ;-

1. **Values for excellence in life :**
   Developing Values, Personal Values, Family Values, Professional Values.

2. **Life Skills :**
   Motivational Skills, Communication Skills, Life style modification, Accessibility and Addiction, Environmental Awareness.

3. **Spiritual Education :**
   Different schools of meditation, exploring the self, universal concept of the supreme, changing the belief system, Self Esteem, Stress free living.

Methods of Instruction

- Lecture
- Class discussion
- Role plays
- Guest speakers
- Written assignments
- Videos

Certification :

The college needs to provide 'Course Completion Certificate' to every student who completes the course successfully. The certificate must contain the grade obtained by the student in the examination.

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K.J.Somaiya College of Arts, Commerce & Science Kopargaon

Faculty of Commerce & Management

Cross Cutting Issues in Core Subjects

F.Y.B.Com 2019 Pattern (CBCS) (Sem. –II)



Sr.No	Class	Subject	Course Syllabus	Cross Cutting Issue
1	F.Y.B.Com 2019 Pattern	Financial Accounting	Software Used In Accounting	Professional Ethics
			Final Accounts Of Charitable Trust (Clubs, Hospitals, Libraries Etc.)	Professional Ethics
			Valuation Of Intangibles	Professional Ethics Professional Ethics
			Accounting For Leases	Professional Ethics
2	F.Y.B.Com 2019 Pattern	Business Economics	Cost And Revenue	Professional Ethics
			Pricing Under Perfect Market Conditions	Professional Ethics
			Pricing Under Imperfect Market Conditions	Professional Ethics
			Factor Pricing	Professional Ethics Professional Ethics
3	F.Y.B.Com 2019 Pattern	Business Mathematics & Statistics	Matrices And Determinants (Up To Order 3 Only)	Professional Ethics
			Linear Programming Problems (LPP) (For Two Variables Only)	Professional Ethics
			Correlation And Regression	Organisational Behaviour
			Index Numbers	Human Values
4	F.Y.B.Com 2019 Pattern	Computer Concepts And Application	Introduction To E-Commerce Tools	Professional Ethics
			Introductions To E-Marketing	Professional Ethics Professional Ethics
			Electronic Payment System	Professional Ethics
			Introduction To M-Commerce	Professional Ethics Professional Ethics
5	F.Y.B.Com	Organizational	Office Manager	Professional Ethics

	2019 Pattern	Skills Development	Management Reporting (Office Reports)	Professional Ethics
			Work Measurement And Standardization Of Office Work	Professional Ethics
			Office Automation	Professional Ethics
6	F.Y.B.Com 2019 Pattern	Marketing And Salesmanship	Salesmanship	Professional Ethics
			Process Of Selling	Professional Ethics
			Rural Marketing	Human Values
			Recent Trends In Marketing	Professional Ethics

K. J. SOMAIYA COLLEGE KOPARGAON Dept. of Commerce

Head
Department of Commerce
K. J. Somaiya College, Kopargaon

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Kopargaon, Dist. A.Nagar

Principal
K. J. Somaiya College of Arts
Commerce & Science, Kopargaon

Syllabus for F.Y.B.Com

Semester-II, Paper-II

Subject Name: - Financial Accounting- II

Course Code - 122

K.J. SOMAIYA COLLEGE OF ARTS & COMMERCE (AUTO.) Dept. of Commerce

Objectives of the course

This course is intended to introduce the basic theory, concepts and practice of financial accounting and to enable students to understand information contained in the published financial statements of companies and other organizations. It includes the preparation of accounting statements, but their uses and limitations will also be emphasized.

Depth of the program – fundamental Knowledge

Objective of the Program

1. To impart knowledge of various software used in accounting
2. To impart knowledge about final accounts of charitable trusts
3. To impart knowledge about valuation of intangible assets
4. To impart knowledge about accounting for leases

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	**Software used in Accounting**	1. Types of Accounting Software 2. Use of Accounting Software 3. Installation of Accounting Software 4. Advantages and disadvantages of Accounting Software Voucher entry and Report Generation including GST transactions	• Students are expected to acquaint themselves with Computerised accounting, its application and utility.

2	**Final Accounts of Charitable Trust (Clubs, Hospitals, Libraries etc.)**	1. Meaning and Characteristics 2. Accounting Records 3. Income and Expenditure Account 4. Receipt and Payment Account 5. Balance Sheet and Adjustments	• Understanding the accounting process of accounting of charitable trusts • Recording basic accounting transactions and prepare annual financial statements; and • Analyzing , interpreting and communicating the information contained in basic financial statements and explain the limitations of such statements
3	**Valuation of Intangibles**	1. Valuation of Goodwill (Problem) 2. Valuation of Brands 3. Valuation of Patents, Copyright and Trademark etc.	• Learning the concept of intangible assets and the methods of their valuation.
4	**Accounting for Leases**	1. Types of Lease (Finance Lease and Operating Lease) 2. Finance Lease (Hire Purchase and installment) (Theory) 3. Operating Lease 4. Royalty, 5. Minimum Rent, 6. Short Workings, 7. Recoupment Of Short Working. 8. Lapse of Short Working Journal Entries and Ledger Accounts in the Books of Landlord and Lessee	• Understanding the process and methods of leasing.

Revised syllabi (2019 Pattern) for Three Years B. Com. Degree course (CBCS)

First Year B. Com

Semester-II Course Code - 123

Business Economics (Micro) - II

Objectives:

1. To understand the basic concepts of micro economics.
2. To understand the tools and theories of economics for solving the problem of decision making by consumers and producers.
3. To understand the problem of scarcity and choices.

Depth of the program – Fundamental Knowledge

Objectives of the Program

1. To impart knowledge of business economics
2. To clarify micro economic concepts
3. To analyze and interpret charts and graphs
4. To understand basic theories, concepts of micro economics and their application

Unit No.	Unit Title	Contents	Purpose skills to be developed
1	**Cost and Revenue**	1.1 Concepts and Types of Cost- Economic Cost and Accounting Cost, Private Cost and Social Cost, Actual Cost and Opportunity Cost, Explicit Cost and Implicit Cost, Incremental Cost and Sunk Cost, Fixed Cost and Variable Cost 1.2 Relation between Total Cost, Average Cost and Marginal Cost 1.3 Cost Curves in Short run and Long run 1.4 Concept of Total Revenue, Average Revenue and Marginal Revenue	• To understand the concept and types of cost • To make the students know about short run and long run cost concepts • To impart knowledge about types of revenue Skills: Interpretation of cost curves, integrate cost and revenue concepts, draw inferences

2	**Pricing Under Perfect Market Conditions**	2.1Pure Competition: Meaning and Features 2.2 Features of Perfect Competition 2.3 Price Determination in Perfect Competition 2.4 Equilibrium of Firm and Industry in Short Run and Long Run	• To help the students understand the concept of pure and perfect competition • To impart knowledge about equilibrium of firm and industry in short and long run. Skills: Understanding, writing skills, critical thinking			
3.	**Pricing Under Imperfect Market Conditions**	1.1 Meaning of Imperfect Competition 1.2 Monopoly: Features and Equilibrium, Price Discrimination 3.3 Monopolistic Competition- Features and Equilibrium. 3.4 Oligopoly: Concept and Features 3.5 Duopoly: Concept and Features 3.6 Comparison of Perfect and Imperfect Competition	• To develop ability to understand the market structures under imperfect competition • Ability to compare perfect and imperfect competition *Skills: Understand complex relations, problem solving skill, analytical skill*			
4	**Factor Pricing**	4.1 Marginal Productivity Theory of Distribution 4.2 Rent- Meaning, Ricardian Theory of Rent, Modern Theory of Rent, Concept of Quasi Rent 4.3 Wages- 4.3.1 Meaning and Types of Wages- a) Minimum Wages b) Money Wages c) Real Wages d) Subsistence Wages e) Fair Wages 4.3.2 Backward Bending Supply Curve of Labour	• *To understand the theory of marginal productivity* • *To understand the concept and theories in factor pricing* *Skills: Critical thinking, logical thinking, apply information processing skills*			
		4.3.3 Role of Collective Bargaining in Wage Determination 4.4 Interest-Meaning, Loanable Fund Theory, Liquidity Preference Theory 4.5 Profit- Meaning, Risk and Uncertainty Theory of Profit, Dynamic Theory of Profit, Innovation Theory of Profit				

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	8	• Open book discussion, • Case studies	• You tube lectures • Online PPTs	Types of cost in industries Comparison of cost and revenues in industries Trends of cost and revenue in industries	• Will understand the concept and types of cost • Students will know about short run and long run cost concepts • Students will have knowledge about types of revenue
2	8	Digital lectures Interactive lectures	• You tube lectures • Online PPTs	Application of perfect competition markets in the markets like that of agricultural products, dairy products etc	• Students will understand the concept of pure and perfect competition • Students will know about the equilibrium of firm and industry in short and long run.

Dept of Commerce
YOPARGAON COLLEGE

Syllabus for B. Com. Semester: - II

Subject Name: - Business Mathematics and Statistics - II

Course code: - 124 (A)

K.J. Dept. of Commerce KOPARGAON

Depth of the program – Basic Knowledge of Mathematics and Statistics

Objective of the Program

1. To introduce the basic concepts in Finance and Business Mathematics and Statistics
2. To familiar the students with applications of Statistics and Mathematics in Business
3. To acquaint students with some basic concepts in Statistics.
4. To learn some elementary statistical methods for analysis of data.
5. The main outcome of this course is that the students are able to analyze the data by using some elementary statistical methods

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	**Matrices and Determinants (up to order 3 only)**	Definition of a Matrix, Types of Matrices, Algebra of Matrices, Determinants, Adjoint of a Matrix, Inverse of a Matrix via Adjoint Matrix, Homogeneous System of Linear equations, Condition for Consistency of homogeneous system, Solution of Non-homogeneous System of Linear equations (not more than three variables), Applications in Business and Economics, Examples and Problems.	1. To understand the concept of matrices and determinants. 2. To understand the application of determinant in solving linear equations 3. To understand applications of matrices and determinants in business and economics.
2	**Linear Programming Problems (LPP) (for two variables only)**	Definition and terms in a LPP, formulation of LPP, Solution by Graphical method, Examples and Problems	1. To understand the concept of LPP and its application in business and decision making. 2. To understand graphical method to solve business optimization problems with two variables.
3	**Correlation and Regression**	Concept and types of correlation, Scatter diagram, Interpretation with respect to magnitude and direction of relationship. Karl Pearson's coefficient of correlation for ungrouped data. Spearman's rank correlation coefficient. (with tie and without tie) Concept of regression, Lines of regression for ungrouped data, predictions using lines of regression. Regression coefficients and their properties (without proof). Examples and problems.	1. To use correlation for knowing the relationship between two variables. 2. To use regression for prediction

K. J. SOMAIYA COLLEGE
Dept. of Commerce
KOPARGAON

Course No. 1 – Computerised Accounting

Objectives of the course:

The course has been designed to acquaint students with the computerized accounting practices used in the industry. Practical knowledge about accounting software will be provided to the students' along with hands on experience in the computer laboratories. The course aims at enhancing skills and employability of students. This course is an extension of the existing curriculum of Financial Accounting.

Course Contents:

- Tally Fundamentals
- Accounts Masters – Groups, Ledgers, Voucher Types – Create, Display, Alter
- Accounting Voucher Types – Contra, Payment, Receipt, Journal, Sale, Purchase, Debit Note, Credit Note
- Data Export / Import,
- Finalization Adjustment entries
- Inventory Masters – Stock Groups, Unit of Measure, Godowns, Stock Items – Create, Display, Alter
- Invoicing – Enter Purchases / Sales / Debit Note / Credit Note in Invoice Mode – Accounting Invoice, Item Invoice, Additional expenses, Tax ledgers in Invoices
- Bank Reconciliation,
- Data Backup/Restore

Methods of Instruction

- Lecture
- Guest speakers
- Written assignments
- Laboratory practical

Certification :

The college needs to provide 'Course Completion Certificate' to every student who completes the course successfully. The certificate must contain the grade obtained by the student in the examination.

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		1.8 Salesmanship – a Profession **1.9** Qualities of Salesman	
2	**Process of Selling**	**2.1** Psychology of Salesmanship – Attracting Attention, Awakening Interest, Creating Desire and Action **2.2** Stages in Process of Selling – (i) *Pre-Sale Preparations* (ii) *Prospecting* (iii) *Pre-Approach* (iv) *Approach* (v) *Sales Presentation* (vi) *Handling of Objections* (vii) *Close* (viii) *After Sales Follow-up*	*Techniques of salesma* *skills will be develope*
3	**Rural Marketing**	**3.1** *Rural Marketing* 3.1.1 *Introduction* 3.1.2 *Definition of Rural Marketing* 3.1.3 *Features of Rural Marketing* 3.1.4 *Importance of Rural Marketing* 3.1.5 *Present Scenario of Rural Market* 3.1.6 *Challenges and Opportunities in Rural Marketing*	*Awareness and importance o* *Rural Marketing amongst* *students.*
4	**Recent Trends in Marketing**	**4.1** Digital Marketing **4.2** Green Marketing **4.3** Niche Marketing **4.4** E-marketing **4.5** Social Media Marketing- Challenges and Opportunities	Skills of Modern Marketing will be developed.

K.J.Somaiya College of Arts, Commerce & Science Kopargaon

Faculty of Commerce & Management

Cross Cutting Issues in Core Subjects

S.Y.B.Com 2013 Pattern



Sr. No	Class	Subject	Course Syllabus	Cross Cutting Issue
1	S.Y. B.Com. 2013 Pattern	Business Communication	Introduction Of Business Communication	Professional Ethics
			Methods And Channels Of Communication	Professional Ethics
			Soft Skills:	Skill Enhancement
			Business Letters	Professional Ethics
			Types And Drafting Of Business Letters	Professional Ethics & Skill enhancement
			Job Application Letters	Professional Ethics
			Internal And Other Correspondence	Professional Ethics
			New Technologies In Business Communication	Professional Ethics
2	S.Y. B.Com. 2013 Pattern	Corporate Accounting	Accounting Standards	Professional Ethics
			Company Final Accounts	Professional Ethics
			Company Liquidation Accounts	Professional Ethics
			Computerized Accounting Practices	Professional Ethics
			Accounting For Amalgamation, Absorption And External Reconstruction Of Companies	Professional Ethics
			Accounting For Internal Reconstruction	Professional Ethics Professional Ethics
			Holding Company Account	Professional Ethics
			Valuations Of Shares	Professional Ethics
3	S.Y. B.Com. 2013 Pattern	Business Economics (Macro)	Basic Concepts Of Macro Economic	Professional Ethics Professional Ethics
			National Income	Professional Ethics Professional Ethics
			Money	Professional Ethics
			Value Of Money	Professional Ethics
			Inflation And Deflation	Professional Ethics Professional Ethics
			Trade Cycle	Professional Ethics

				Professional Ethics
			Theories Of Output And Employment	Professional Ethics
			Public Finance	Professional Ethics
4	S.Y. B.Com. 2013 Pattern	Business Management	Overview Of Management	Professional Ethics
			Planning & Decision Making	Professional Ethics
			Organization & Staffing	Professional Ethics
			Direction & Communication	Professional Ethics
			Motivation	Professional Ethics Professional Ethics
			Leadership	Professional Ethics
			Co-Ordination And Control	Professional Ethics Professional Ethics
			Recent Trends In Business Management	Professional Ethics
5	S.Y. B.Com. 2013 Pattern	Elements Of Company Law	Introduction To The New Act & Concept Of Companies	Professional Ethics Professional Ethics
			Formation And Incorporation Of A Company	Professional Ethics
			Documents Relating To Incorporation And Raising Of Capital	Professional Ethics
			Capital Of The Company	Professional Ethics
			Forfeiture, Surrender & Transfer Of Shares	Professional Ethics
			E-Governance And E-Filing	Professional Ethics
			Management Of Company	Professional Ethics
			Key Managerial Personnel (Kmp)	Professional Ethics
			Company Meetings	Professional Ethics
			Revival And Re-Facilitation Of Sick Companies	Professional Ethics
6	S.Y. B.Com. 2013 Pattern	Marketing And Salesmanship	Basics Of Cost Accounting	Professional Ethics
			Elements Of Cost	Professional Ethics
			Material Control	Professional Ethics
			Material Accounting	Professional Ethics
			Inventory Control	Professional Ethics
			Labour Cost, Remuneration And Incentives	Professional Ethics Professional Ethics
			Other Aspects Of Labour	Professional Ethics
			Direct Cost	Professional Ethics

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K.J. SOMAIYA COLLEGE ★ KOPARGAON ★ Dept. of Commerce

S.Y. B.Com.

Compulsory Paper

Subject Name -: Business Communication.

Course Code -: 201.

Objectives of the Course:

1. To understand the concept, process and importance of communication.
2. To develop awareness regarding new trends in business communication.
3. To provide knowledge of various media of communication.
4. To develop business communication skills through the application and exercises.

Medium of Instruction : English

Unit No.	TERM: I	Periods
1	**Introduction of Business Communication:** Introduction, Meaning, Definition, Features, Process of Communication, Principles, Importance, Barriers to Communication & Remedies.	12
2	**Methods and Channels of Communication:** Methods of Communication-Merits and Demerits&Channels of Communication in the Organisation and their Types, Merits & Demerits	10
3	**Soft Skills:** Meaning, Definition, Importance of Soft Skills **Elements of Soft Skills:** 1) Grooming Manners and Etiquettes 2) Effective Speaking 3) Interview Skills 4) Listening 5) Group Discussion 6) Oral Presentation	16
4	**Business Letters:** Meaning, Importance, Qualities or Essentials, Physical Appearance, and Layout of Business Letter	10
	Total Periods	48
	TERM: II	
5	**Types and Drafting of Business Letters:** 1) Enquiry Letters 2) Replies to Enquiry Letters 3) Order Letters 4) Credit and Status Enquiries 5) Sales Letters 6) Complaint Letters 7) Collection Letters 8) Circular Letters	16
6	**Job Application Letters:** Meaning, Types & Drafting of Job Application Letters, Bio-Data/Resume	08

	/Curriculum Vitae	
7	**Internal and other Correspondence:** 1) Office Memo (Memorandums) 2) Office Orders 3) Office Circulars 4) Form Memos or Letters 5) Press Releases	12
8	**New Technologies in Business Communication:** Internet: Email, Websites, Electronic Clearance System, Writing a Blog Social Media Network: Twitter, Facebook, LinkedIn, YouTube, Cellular Phone, WhatsApp Voice Mail Short Messaging Services Video Conferencing Mobile	12
	Total Periods	48

Recommended Books:

1. Asha Kaul (1999), "Business Communication", Prentice Hall of India, New Delhi.
2. Chaturvedi P. D. & Chaturvedi Mukesh (2012), "Managerial Communication", Pearson, Delhi.
3. Madhukar R. K. (2005), "Business Communication", Vikas Publishing House Pvt. Ltd., New Delhi.
4. Mamoria C. B. & Gankar S. V. (2008), "Personnel Management", Himalaya Publishing House, Mumbai.
5. Nawal Mallika (2012), "Business Communication", Cengage Learning, Delhi.
6. Rajendra Pal & Korlahalli (2007), "Essentials of Business Communication", Sultan Chand & Sons, New Delhi.
7. Sharma R. C. & Krishan Mohan, "Business Correspondence & Report Writing", Tata McGraw Hill Publishing Co. Ltd.
8. Sinha K. K. (2003), "Business Communication", Galgotia Publishing Company, New Delhi.
9. Sinha K. K. (2008), "Business Communication", Galgotia Publishing Company, New Delhi.
10. Vasishth Neeru& Rajput Namita (2006), "Business Communication", Kitab Mahal, Allahabad.

Assessment Pattern

Internal Assessment (Term End Examination) : 20 Marks
Practical Examination : 20 Marks
Annual Examination : 60 Marks
Total Marks : **100 Marks**

K. J. SOMAIYA COLLEGE Dept. of Commerce KOPARGAON

S.Y. B.Com.

Compulsory Paper

Subject Name -: Corporate Accounting

Course Code -: 202

Objectives:-

To enable the students to develop awareness about Corporate Accounting in conformity with the provisions of Companies Act and Accounting as per Indian Accounting Standards.

1. To make aware the students about the conceptual aspect of corporate accounting
2. To enable the students to develop skills for Computerized Accounting
3. To enable the students to develop skills about accounting standards

Term – I

Unit	Topic and Contents	No. of Lectures
1.	**Accounting Standards:-** Detailed Study of Accounting Standards 5, 6, 10, 14, 21 with Practical Examples numerical case studies, Application nature.	08
2.	**Company Final Accounts:-** Preparation of Final Accounts- Forms and contents as per Provisions of Companies Act (As Amendment upto the beginning of the relevant academic year) As per Revised Schedule- VI	14
3.	**Company Liquidation Accounts:-** Meaning of Liquidation- Modes of winding up – (a) Preparation of Liquidator final statement of Account (b) Preparation of Statement of Affairs and Deficiency Account.	12
4.	**Computerized Accounting Practices:-** Conceptual background - (a) Inventory Accounting (b) Payroll Accounting (c) MIS Reports including Demonstration and Hands Experience.	14
	Total	48

Term – II

Unit	Topic and Contents	No. of Lectures
5.	**Accounting for Amalgamation, Absorption and External Reconstruction of Companies:-** Meaning- Vendor and Purchasing Companies- Purchase Consideration- Accounting entries- and Preparation of Balance Sheet after Amalgamation, Absorption and External Reconstruction.	14
6.	**Accounting for Internal Reconstruction:-** Meaning- Alteration of Share Capital, Reduction of Share Capital-Accounting Entries and preparation of Balance Sheet After Internal Reconstruction	10
7.	**Holding Company Account:-**	14

	Preparation of consolidated Balance sheet of Holding Company with one subsidiary only. Adjustment of inter company transactions, unrealized profit of stock.	
8.	**Valuations of Shares:-** Concept of Valuation, Need for Valuation, Special Factors affecting Valuation of Shares, Methods of Valuation - (a) Net Assets Method, (b) Yield Basis Method, (c) Fair Value Method.	10
	Total	48

Notes:-

1. Question Paper for Termend and Annual Examination should consist of :
   Theory Questions : - 30%
   Problems :- 70%
2. In the Question Paper of Annual Examination, the weightage to the syllabus should be as follows:
   i) 40% on the total syllabus of the First Term.
   ii) 60% on the total syllabus of the Second Term.
3. Colleges are required to use only licensed copy of software.

Recommended Books:-

1. Advanced Accounts: By M.C. Shukla & S.P. Grewal (S.Chand & Co. Ltd.)
2. Advanced Accountancy: By S.P. Jain & K.N. Narang (Kalyani Publishers)
3. Advanced Accountancy: By R.L.Gupta & M. Radhaswamy (Sultan Chand & Sons)
4 Company Accounts: By S.P. Jain & K.L. Narang
5 Advanced Accounts: By Paul Sr.
6 Corporate Accounting: By Dr. S. N. Maheshwari & S.K. Maheshwari
7 Corporate Accounting: By Mukharji & Hanif
8. Corporate Accounting: By Dr. K. N. Jagtap, Dr. S. D. Zagade, Dr. H. M. Jare
9. Accounting Standard: By D. S. Rawat.
10. Accounting Standards –as issued by Institute of Chartered Accountants of India.

Journals:-

1. The Chartered Accountant : Journal of the Institute of Chartered Accountants of India.
2. The Accounting World : ICFAI Hyderabad
3. Journal of Accounting & Finance : Accounting Research Association of Jaipur.

K. J. SOMAIYA COLLEGE ★ Dept. of Commerce ★ KOPARGAON

S.Y. B.Com.

Compulsory Paper

Subject Name -: Business Economics (Macro)

Course Code -: 203

Objectives:

1. The objective of the course is to familiarize the students the basic concept of Macro Economics and application.
2. To Study the behavior of the economy as a whole.
3. To Study the relationship among broad aggregates.
4. To apply economic reasoning to problems of the economy.

Term – I

Sr. No	Topic	No. of Lectures
UNIT- 1	**Basic Concepts of macro Economics** 1.1 Meaning of Macro Economics 1.2 Nature and Scope of Macro Economics 1.3 Significance and limitations of Macro Economics 1.4 Difference between Micro and Macro Economics	08
UNIT- 2	**National Income** 2.1 Meaning & Importance of National Income 2.2 Concept - a) Gross National Product (GNP) b) Net National Product (NNP) c) Income at Factor cost or National Income at Factor Prices d) Per Capita Income e) Personal Income (PI) f) Disposable Income(DI) 2.3 Measurement of National Income – Circular Flow of Income-Two sector model 2.4 Difficulties in Measurement of National Income	14
UNIT- 3	**Money** 3.1 Meaning and functions of Money 3.2 Demand for Money – Classical and Keynesian Approach 3.3 Supply of Money a) Role of Central Bank – Credit Control- Quantitative and Qualitative b) Reserve Bank of India's New Money Measures 3.4 Role of Commercial Banks – Process of Multiple Credit Creation and its limitations	12
UNIT- 4	**Value of Money** 4.1 Meaning & Concept of Value of Money 4.2 Quantity Theory of Money 4.3 Cash Balance approach – Cambridge Equation - Pigou, Marshall, Keynes 4.4 Milton Friedman's Approach 4.5 Difference between Quantity Theory and Cash Balance Approach	14

	Theory	
	Term - II	
UNIT- 5	**Inflation and Deflation** 5.1 Inflation and Deflation – Meaning, Causes and effects 5.2 Demand Pull and cost Push inflation 5.3 Inflationary Gap 5.4 Philips Curve – Supply side Economics 5.5 Stagflation	10
UNIT- 6	**Trade Cycle -** 6.1 Meaning, Definition and features of Trade Cycle 6.2 Phases of Trade Cycle 6.3 Policy for control of Trade Cycle – Monetary and Fiscal Measures	12
UNIT- 7	**Theories of Output and Employment** 7.1 Classical Theories of Employment – Says , Pigoue , Fisher 7.2 Keynesian Criticism on Classical Theories of Employment 7.3 Keynesian Theory of Employment	12
UNIT-8	**Public Finance** 8.1 Meaning, Nature and Scope of Public Finance 8.2 Principle of Maximum Social advantage-Dr. Dalton's Approach 8.3 Public Revenue and Expenditure 8.4 Types of Taxation 8.5 Principles of Taxation 8.6 Effects of Taxation 8.7 Causes of increasing Public Expenditure	14

Basic Reading List

1. Ackey, G (1976) Macro Economics Theory and Policy, Macmillan Publishing Company, New York
2. Ahuja H. L. (2002) Macroeconomics Theory and Policy, Chand and Co. Ltd New Delhi.
3. D'souza Errol (2008) Macroeconomics : Person Publication, New Delhi.
4. Gupta S.B. (1994) Monetary Economics, S. Chand and Co. Delhi
5. Jingan M.L. (2002) Macro Economic Theory, Vrinda Publication,Delhi
6. Vaish M. C. (2002) Macro Economic Theory, Vikas Publishing House, N. Delhi
7. Shapiro E (1996) Macro Economic Analysis; Galgotia Publication, New Delhi

ADDITIONAL READING LIST

1. Dillard, D. (1960), The Economics of John Maynard Keynes, Crossby Lockwood and Sons,London.
2. Day A.C.L. (1960) Outline of Monetary Economics, Oxford University Press, Oxford
3. Higgins, B. (1963), Economic Development: Principles, Problems and Policies, Central Book Depot, Allahbad.
4. Keynes, J.M. (1936), The General Theory of Employment, Interest and Money, Macmillan, London.
5. Kindleberger, C.P. (1958), Economic Development, McGraw-Hill Book Company, New York.
6. Lucas, R. (1981), Studies in Business Cycle Theory, MIT Press, Cambridge, Massachusetts.

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K. J. SOMAIYA COLLEGE Dept. of Commerce KOPARGAON

S.Y. B.Com.

Compulsory Paper

Subject Name -: Business Management

Course Code -: 204

Objective:

1. To provide basic knowledge & understanding about business management concept.
2. To provide an understanding about various functions of management.

UNIT NO	CHAPTER	PERIODS
	TERM-I	
Unit –I	**OVERVIEW OF MANAGEMENT** Meaning, Definition, Management: Is it Science, Art or profession? Characteristics of Professional Management. The need of Management Study. Process of Management, Level Of Management, Managerial Skills, Challenges before management , Brief Review of Management Thought with reference to FW Taylor & Henry Fayol	12
Unit –II	**PLANNING & DECISION MAKING.** Planning-Meaning, Definition, Nature, Importance, Forms, Types Of Planning, Steps in Planning, Limitations Of Planning. Forecasting-Meaning & Techniques. Decision Making- Meaning, Types Of Decisions & Steps In Decision Making.	12
Unit III	**ORGANIZATION & STAFFING** Meaning, Process & Principles, Departmentalization, Organization Structure, Authority and Responsibility, Delegation of authority, Difficulties in delegation of Authority, Centralization verses Decentralization, Team Work. Staffing-Meaning, Need & Importance of Staffing, Recruitment-Sources and Methods of Recruitment.	12
Unit IV	**DIRECTION & COMMUNICATION** Direction- Meaning, Elements, Principles, Techniques & importance.. Communication-Meaning, Types, Process of Communication & importance of effective Communication. Barriers to Communication.	12
	Total	**48**
	TERM-II	
UNIT-V	**MOTIVATION** Meaning, importance, Theories of motivation, Maslow's Need Hierarchy Theory, Herzberg's Two factors Theory, Douglas Mc Gregor's Theory of X & Y & Ouchi'Theory Z. McClelland's Theory.	12
UNIT-VI	**LEADERSHIP** Meaning, Importance, Qualities & Functions of a Leader, Leadership Styles for Effective Management .Contribution of Mahatma Gandhi, Dr. Babasaheb Ambedkar & Pandit Jawaharlal Neharu	12

Unit- VII	**CO-ORDINATION AND CONTROL** Meaning and Need , Techniques of establishing Co-ordination, difficulties in establishing co-ordination, Control-Need, steps in the process of control & Techniques.	12
Unit-VIII	**RECENT TRENDS IN BUSINESS MANAGEMENT** Business Ethics, Corporate Social Responsibilty, Corporate Governance, Disaster Management, Management of Change	12
	Total	48

Recommended Books:

1. Principles of Management - Koontz & O'Donnel
2. The Management Process - R S Davar
3. Essentials of Management - Koontz & O' Donnel Tralei McGrow Hill Publishing House
4. Business Administration - Mritunjoy Banerjee
5. Principles & Practice - T N Chhabra, Dhanapat Rai & Co.of Management.
6. Management – LM .Prasad.
7. Super Highway: Bill Gates Foundation
8. Makers of Modern India - NBT Publishers
9. Indian Business leaders

K.J. SOMA ... KOPARGAON

S.Y. B.Com.
Compulsory Paper

Subject Name -: Elements of Company Law.
Course Code -: 205

Objectives:

1) To impart students with the knowledge of fundamentals of Company Law.
2) To update the knowledge of provisions of the Companies Act of 2013.
3) To apprise the students of new concepts involving in company law regime.
4) To acquaint the students with the duties and responsibilities of Key Managerial Personnel.
5) To impart students the provisions and procedures under company law.

Sr. No.	Term – I Topic	Lectures
Unit 1	**Introduction to the New Act & Concept of Companies:** 1.1. Background and Salient Features of the Act of 2013, Overview of the changes introduced by the Act of 2013; 1.2. Nature and types of Companies, Definitions and important features of a Company- Distinction between a company and a partnership - Lifting or Piercing the Corporate Veil 1.3. Types of Companies based on various criteria including one man company, dormant company, sick and small company, associate company. 1.4. Distinction between private and public company (Advantages, Disadvantages and privileges of both the companies) - Conversion of a private company into a public company - Conversion of a public company into a private company.	13
Unit 2	**Formation and Incorporation of a Company:** 2.1. Stages in the Formation and Incorporation. 2.1.1. Promotion: Meaning of the term 'Promoter' / Promoter Group - Legal Position of Promoters, Pre-incorporation contracts. 2.1.2. Registration/ Incorporation of a company : - Procedure, Documents to be filed with ROC. Certificate of Incorporation- Effects of Certificate of Registration. 2.1.3. Floatation/ Raising of capital. 2.1.4. Commencement of business.	8
Unit 3	**Documents relating to Incorporation and Raising of Capital:** 3.1 **Memorandum of Association**: Meaning and importance- Form and contents- Alteration of memorandum. 3.2 **Articles of Association:** Meaning- Relationship of and distinction between Memorandum of association and Articles of association- Contents and form of Articles- Alteration of articles- Doctrine of constructive notice- Doctrine of Indoor Management. 3.3 **Prospectus:** Meaning and Definition- Contents- Abridged form of	07

	prospectus- Statutory requirements in relation to prospectus- Deemed prospectus- Shelf prospectus - Statement in lieu of prospectus- Mis-statement in a prospectus and Liabilities for Mis-statement.	
Unit 4	**Capital of the Company** 4.1 Various Modes for Raising of Share Capital including private placement, public issue, rights issue, bonus shares. 4.2 ESOS, Sweat Equity Shares, Buy-back of shares. 4.3 Allotment of Shares: Meaning- - Statutory provisions for allotment, improper and irregular allotment- Consequences of irregular allotment. 4.4 Calls On Shares: Meaning- Requisites of a valid call, Calls in advance 4.5 Share Certificates: Meaning, Provisions regarding issue of share certificates - Duplicate Share Certificate. 4.6 Share Capital – Meaning, Structure (Kinds) – Concept of Securities – Definition, Nature and Kinds of Shares.	**14**
Unit 5	**Forfeiture, Surrender & Transfer of Shares** 5.1 Forfeiture and Surrender of Shares: Meaning of forfeiture of shares: - Conditions/Rules of valid forfeiture- Effect of forfeiture- Re-issue of forfeited shares- Annulment of forfeiture- 5.2 Surrender of shares 5.3Transfer and transmission of shares - meaning and procedure distinction between transfer and transmission 5.4 Nomination of shares	**6**
	Term – II	
Sr. No.	**TOPIC**	**Lectures**
Unit 6	**E-Governance and E-Filing:** 6.1 Introduction- Meaning of E-Governance 6.2 Advantages of E-Governance, 6.3 Basic understanding of MCA Portal 6.4 E-filing (Ss. 397 to 402), DIN-Directors Identification Number (Ss. 153-159)	**06**
Unit 7	**Management of Company:** 7.1 Board of Directors: Definition, Powers, Restrictions, Prohibition on Board. (Ss. 179 to 183) 7.2 Director: Meaning and Legal position of directors. 7.3 Types of Directors – Types including Executive, Non-Executive, Independent, Additional, Alternate, Interested, Nominee Director, Related Party Transactions (Ss. 188) 7.4 Appointment of Directors, Qualifications and Disqualifications. 7.5 Powers, Duties, Liabilities of Directors, Remedies for Breach of Duties. 7.6 Loans to Directors (S. 185), Remuneration of Directors	**10**
Unit 8	**Key Managerial Personnel (KMP)** 8.1 Meaning, Definition and Appointments of Managing Director,	**10**



	Whole Time Director, Manager, Company Secretary Term of office/ Tenure of appointment, Remuneration – 8.2 Distinction between Managing Director, Manager and Whole Time Director - Role (Powers, Functions of above KMP) 8.3 Corporate Social Responsibility (CSR) [U/S 135] – Concept who is Accountable, CSR Committee, Activities under CSR, 8.4 Role of Board of Directors. 8.5 Prevention of Oppression and Mismanagement (Ss. 241 to 246)	
Unit 9	**Company Meetings:** 9.1 Board Meeting – Meaning and Kinds 9.2 Conduct of Meetings - Formalities of valid meeting [Provisions regarding agenda, notice, quorum, proxies, voting, resolutions (procedure and kinds) minutes, filing of resolutions, Virtual Meeting] 9.3 Meeting of Share Holders General Body Meetings, Types of Meetings A. Annual General Meeting (AGM), Ss. 96 to 99 B. Extraordinary General Meeting (EOGM) – S. 100 9.4 Provisions regarding convening, constitution, conducting of General Meetings contained in Ss. 101 to 114	**12**
Unit 10	**10.1 Revival and Re-habilitation of Sick Companies (S. 253-269)** **10.2 Compromises, Arrangements and Amalgamation:** Concept and Purposes of Compromises, Arrangements, Amalgamation, Reconstruction – Fine distinction between these terms.: **10.3 Winding –up**: Meaning of winding-up, Dissolution of company, Conceptual understanding of winding-up by the Tribunal, Compulsory winding-up, Members' voluntary winding-up, Creditors' voluntary winding-up	**10**

Recommended Books

1) Bharat's – Companies Act, 2013 with comments, Edited by: Ravi Puliani, Advocate Mahesh Puliani, Bharat Law House Pvt. Ltd., New Delhi, 19th Edition, 2013.
2) Introduction to Company Law, Karn Gupta, Publication: LexisNexis, 2013, Gurgaon, Haryana, India.
3) The Companies Act, 2013. With notes to Legislative Clauses. 2014 Edition. Corporate Professionals – where excellence is Law, CCH – a Wolters Kluwer business. Wolters Kluwer (India) Pvt. Ltd., DLF – Cyber City, Gurgaon, Haryana (India)
4) Insights into the New Company Law – PrachiManekar LexisNexis, Gurgaon, Haryana, India, 2013.
5) Taxman's, Company Law Ready Reckoner, V.S. Datey, Printed at – Tan Prints (India) Pvt. Ltd. Jhajjar, Haryana, India., 13th September, 2013.
6) Analysis of Companies Act, 2013, Corporate Professionals – where excellence is Law., CCH – a Wolterskluwer business., Corporate Professionals India Pvt. Ltd., New Delhi, India., Published by – Wolters Kluwer (India) Pvt. Ltd., 2013.

K. J. SOMAIYA ★ KOPARGAON ★

S.Y. B.Com.

Cost and Works Accounting Special Paper I

Subject Name -: Cost and Works Accounting.

Course Code -: 206 – E.

Objectives:

To Impart The Knowledge Of:

1. Basic Cost concepts.
2. Elements of cost.
3. Ascertainment of Material and Labour Cost.

SR. NO.	TOPIC	LECTURES
Unit 1	**Basics Of Cost Accounting**	16
1.1	Concept of Cost, Costing, Cost Accounting and Cost Accountancy.	
1.2	Limitations of Financial Accounting.	
1.3	Origin of Costing.	
1.4	Objectives of Costing.	
1.5	Advantages & Limitations of Costing.	
1.6	Difference Between Financial Accounting and Cost Accounting.	
1.7	Cost Units and Cost Center.	
Unit 2	**Elements Of Cost**	16
2.1	Material, Labour and other Expenses.	
2.2	Classification of Costs.	
2.3	Preparation of Cost Sheet, Quotation, Tenders.	
Unit 3	**Material Control**	16
3.1	Need and Essentials of Material Control.	
3.2	Functions of Purchase Department.	
3.3	Purchase Procedure.	
3.4	Purchase Documentation.	
3.5	Stock Levels.	
3.6	Economic Order Quantity. (EOQ)	

Term – II

SR.NO.	TOPIC	LECTURES
Unit 4	**Material Accounting**	16
4.1	Stores Location and Layout.	
4.2	Types of Stores Organization.	
4.3	Classification and Codification of Material.	
4.4	Stores and Material Records – Bin Card, & Store Ledger etc.	
4.5	Issue of Material and Pricing Methods of Issue of Material:- (a) FIFO. (b) LIFO. (c) Simple Average Methods. (d)Weighted Average Methods.	
4.6	Stock valuation, Use of computer in store Accounting.	

Unit 5	**Inventory Control**	
5.1 5.2 5.3	Stock Taking, Periodic and Perpetual Method. ABC Analysis. Inventory Ratios.	08
Unit 6	**Labour Cost, Remuneration And Incentives**	
6.1 6.2 6.3 6.4	Records &Methods Of Time Keeping and Time Booking Study of New Methods. **Methods Of Remuneration-** ❖ Time Rate System, ❖ Piece Rate system, ❖ Taylor's Differential Piece rate System. **Incentive Plan-** Halsay Premium Plan, ❖ Rowan Premium Plan. ❖ Group Bonus Schemes.	12
Unit 7	**Other Aspects Of Labour**	
7.1 7.2 7.3	Labour Turnover. Job Analysis & Job Evaluation Key. Merit Rating.	10
Unit8	**Direct Cost**	
8.1	Concept and Illustrations.	02
		Total 48

Note-

Allocation of Marks

50% for Theory

50% for Practical Problem.

❖ ***Teaching Methodology***

1. Class Room Lectures.
2. Guest Lectures.
3. Visit to Industries.
4. Group Discussion.
5. Collection of Records & Documents.

❖ ***Recommended Books :***

1. S.P. Lyengar - Cost Accounting Principles and Practice, Sultan Chand , & Sons Accounting Taxman's, New Delhi.
2. M.N. Arora - Cost Accounting Principles and Practice Vikas Publishing House Pvt.Ltd. New Delhi.
3. S.N. Maheshwari and S.N.Mittal- Cost Accounting, Theory and Problems, Mahavir book Depot, New Delhi.

K.J.Somaiya College of Arts, Commerce & Science Kopargaon

Faculty of Commerce & Management

Cross Cutting Issues in Core Subjects

S.Y.B.Com 2019 Pattern (CBCS) (Sem. –III)

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Sr. No	Class	Subject	Course Syllabus	Cross Cutting Issue
1	S.Y.B.Com 2019 Pattern	Business Communication-I	Introduction Of Business Communication	Professional Ethics
			Business Letters	Professional Ethics Professional Ethics
			Soft Skills	Professional Ethics
			Resume Writing & Job Application Letters	Professional Ethics
2	S.Y.B.Com 2019 Pattern	Corporate Accounting –I	Accounting Standards	Professional Ethics Professional Ethics
			Profit Prior To Incorporation	Professional Ethics
			Company Final Accounts	Professional Ethics & Skill Enhancement
			Valuation Of Shares	Professional Ethics
3	S.Y.B.Com 2019 Pattern	Business Economics (Macro)	Introduction To Macro Economics	Skill Enrichment Professional Ethics
			National Income	Sustainability
			Theories Of Output And Employment	Professional Ethics
			Consumption, Saving And Investment:	Human Values
4	S.Y.B.Com 2019 Pattern	Business Management-I	Management 1.1 Meaning Def	Professional Ethics
			Understanding Management :Planning And Decision Making	Professional Ethics
			Management At Work : The Process Of Organizing And Staffing	Professional Ethics
			Result Orientation: Direction And Team Work	Professional Ethics Human Values
5	S.Y.B.Com 2019 Pattern	Elements Of Company Law	The Companies Act, 2 013	Professional Ethics
			Formation And Incorporation Of A	Professional Ethics

			Company	
			Principal Documents	Skill Enhancement
			Capital Of The Company	Professional Ethics
6	S.Y.B.Com 2019 Pattern	Cost And Works Accounting -I	Basics Of Cost Accounting	Professional Ethics
			Elements Of Cost And Cost Sheet	Professional Ethics
			Purchase Procedure	Skill Enhancement
			Inventory Control	Professional Ethics Professional Ethics

J. SOMAIYA COLLEGE Dept. of Commerce KOPARGAON

Head
Department of Commerce
K. J. Somaiya College, Kopargaon

Co ordinator
IQAC, K. J. Somaiya College
Kopargaon, Dist. A.Nagar

Principal
K. J. Somaiya College of Arts
Commerce & Science, Kopargaon

			Modern West	
22	M.A History	CC-12	World after World War II (1945-2000)	Human Values
23	M.A History	OC-19	Maharashtra in the 20th Century	Human Values

List of Courses addresses crosscutting issues as per new syllabus (CBCS- 2019 Pattern)

Sr. No.	Programme Name	Course code	Name of Course	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	B.A History	G-1	Early India: From Prehistory to the Age of the Mauryas	Human Values
2	B.A History	G-1	Early India: Post Mauryan Age to the Rashtrakutas	Human Values
3	B.A History	CC-1(3)	History of the Marathas: (1630-1707)	Human Values
4	B.A History	DSE-1A (3)	Medieval India - Sultanate Period	Human Values
5	B.A History	DSE-2A (3)	Glimpses of the Modern World - Part I	Human Values
6	B.A History	SEC -2 A (2)	Tourism Management	Human Values
7	B.A History	CC-2	History of Marathas (1707-1818)	Human Values
8	B.A History	DSE-1B(3)	Medieval India – Mughal Period	Human Values
9	B.A History	DSE-2B (3)	Glimpses Of the Modern World Part-2	Human Values
10	B.A History	SEC-2B (2)	Travel Agency and Tour business	Human Values
11	B.A History	CC- 3(3)	Indian National Movement (1885-1947)	Human Values
12	B.A History	DSE-3 C (3)	Introduction to Historiography	Human Values
13	B.A History	DSE-4 D (3)	8.Maharashtra in the 19th Century	Human Values
14	B.A History	SEC 2 C (2)	Museology Fourier Series	Human Values
15	B.A History	CC- 4(3)	India After Independence-(1947-1991)	Human Values
16	B.A History	DSE-3 C (3)	Applied History	Human Values

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17	B.A History	DSE-4 D (3)	Maharashtra in the 20th Century	Human Values
18	B.A History	SEC 2 D (2)	Archaeology	Human Values
19	M.A History	CC-01	History: Theory and Method	Human Values
20	M.A History	CC-02	Evolution of Ideas and Institutions in Early India	Human Values
21	M.A History	CC-03	Maratha Polity	Human Values
22	M.A History	EC-01	History of the Deccan: Pre-History to Chalukya	Human Values
23	M.A History	CC-04	Approaches to History	Human Values
24	M.A History	CC-05	Ideas and Institutions in Medieval India	Human Values
25	M.A History	CC-06	Socio-Economic History of the Marathas	Human Values
26	M.A History	EC-09	Marathas in 17th and 18th century: Power Politics	Human Values
27	M.A History	CC-07	Cultural History of Maharashtra	Human Values
28	M.A History	CC-08	Intellectual History of the Modern World	Human Values
29	M.A History	CC-09	Economic History of Modern India	Human Values
30	M.A History	EC-18	East Asia: Japan (1853-2000)	Human Values
31	M.A History	CC-10	Modern Maharashtra: History of Ideas	Human Values
32	M.A History	CC-11	Debates in Indian Historiography	Human Values
33	M.A History	CC-12	World after World War II (1945-2000)	Human Values
34	M.A History	EC- 28	Modern India	Human Values
35	M.A History	10091	HUMAN RIGHTS - I	Human Values
36	M.A History	10092	INTRODUCTION TO CYBER SECURITY - I	Professional Ethics
37	M.A History	20091	HUMAN RIGHTS - II	Human Values
38	M.A History	20092	INTRODUCTION TO CYBER SECURITY - II	Professional Ethics
39	M.A History	30092	INTRODUCTION TO CYBER SECURITY - III	Professional Ethics
40	M.A History	30094	SKILL DEVELOPMENT - I	Human Values
41	M.A History	40092	INTRODUCTION TO CYBER SECURITY - IV	Professional Ethics
42	M.A History	40094	SKILL DEVELOPMENT - II	Human Values

K. J. SOMAIYA COLLEGE Dept. of History KOPARGAON

17	B.A History	DSE-4 D (3)	Maharashtra in the 20th Century	Human Values
18	B.A History	SEC 2 D (2)	Archaeology	Human Values
19	M.A History	CC-01	History: Theory and Method	Human Values
20	M.A History	CC-02	Evolution of Ideas and Institutions in Early India	Human Values
21	M.A History	CC-03	Maratha Polity	Human Values
22	M.A History	EC-01	History of the Deccan: Pre-History to Chalukya	Human Values
23	M.A History	CC-04	Approaches to History	Human Values
24	M.A History	CC-05	Ideas and Institutions in Medieval India	Human Values
25	M.A History	CC-06	Socio-Economic History of the Marathas	Human Values
26	M.A History	EC-09	Marathas in 17th and 18th century: Power Politics	Human Values
27	M.A History	CC-07	Cultural History of Maharashtra	Human Values
28	M.A History	CC-08	Intellectual History of the Modern World	Human Values
29	M.A History	CC-09	Economic History of Modern India	Human Values
30	M.A History	EC-18	East Asia: Japan (1853-2000)	Human Values
31	M.A History	CC-10	Modern Maharashtra: History of Ideas	Human Values
32	M.A History	CC-11	Debates in Indian Historiography	Human Values
33	M.A History	CC-12	World after World War II (1945-2000)	Human Values
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36	M.A History	10092	INTRODUCTION TO CYBER SECURITY - I	Professional Ethics
37	M.A History	20091	HUMAN RIGHTS - II	Human Values
38	M.A History	20092	INTRODUCTION TO CYBER SECURITY - II	Professional Ethics
39	M.A History	30092	INTRODUCTION TO CYBER SECURITY - III	Professional Ethics
40	M.A History	30094	SKILL DEVELOPMENT - I	Human Values
41	M.A History	40092	INTRODUCTION TO CYBER SECURITY - IV	Professional Ethics
42	M.A History	40094	SKILL DEVELOPMENT - II	Human Values



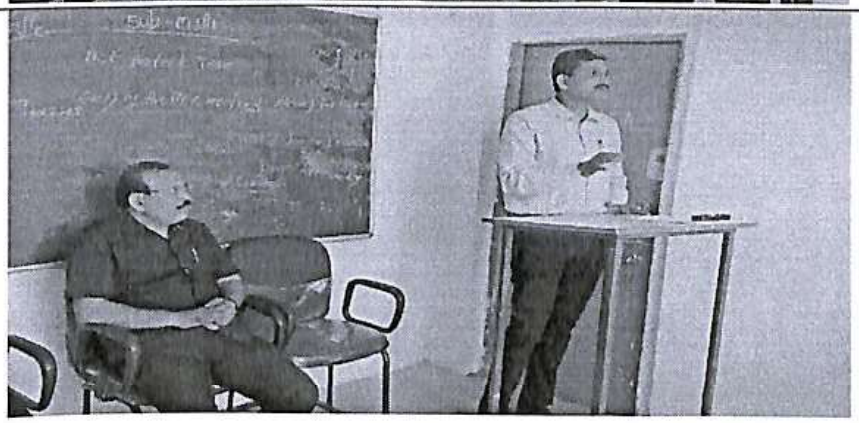
List of Add-on/Value Added/ Certificate Courses

Sr. No.	Department	Name of Certificate Course	Course Code	Year of Offering	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	History	Travel and Tourism Management	CC. 012	2008-09	Human Values
2	History	Modi Script	CC. 017	2013-14	Human Values

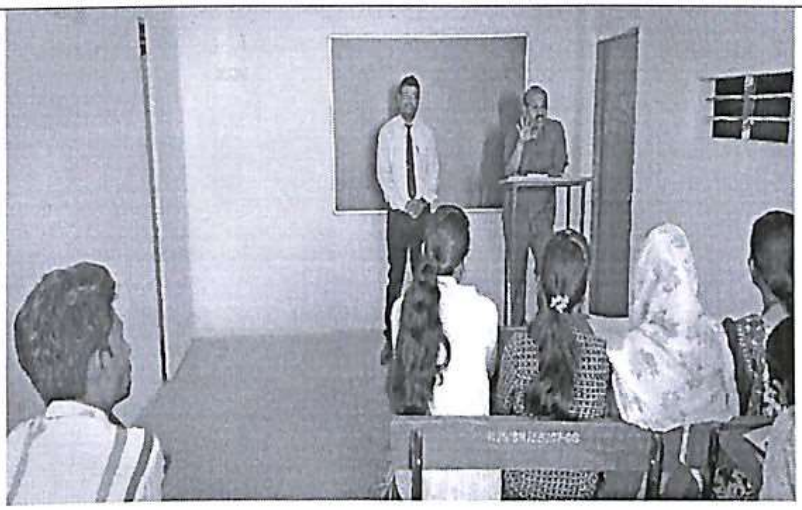
List Showing Curricular and Extra Curricular activities to address Crosscutting Issues (Similar/repeated activities are not listed).

Sr. No.	Name of Activity and Date of Implementation	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)	Representative Photograph
1	National Conference topic National Integrity and Sardar Vallabhbhai Patel ' on 7th and 8th January 2019	Professional Ethics, Human Values	

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2	National Conference topic National Integrity and Sardar Vallabhbhai Patel ' on 7th and 8th January 2019	Professional Ethics, Human Values	
3	department of History organized a certificate course 'Modi Script 18th January 2019	Professional Ethics, Human Values	
4	Guest lecture of Dr. J.C. Sonawane , Department of History, Arts Commerce and Science College Sonai on 15 March 2019	Professional Ethics, Gender, Human Values,	

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5	department of History organized a certificate course 'Travel and Tourism Management' 1 march to 30 march 2019	Professional Ethics	
6	department of History organized a certificate course 'Modi Script 16 Sep 2019	Professional Ethics	
7	Guest lecture on the topic 'History of Mathematics' on20th December 2019	Professional Ethics, Human Values	
8	One day College level Seminar on Value Education 30 January 2020	Professional Ethics, Human Values	

K. J. SOMAIYA COLLEGE
Dept. of History
KOPARGAON

University of Pune

Revised Syllabus (S.Y.B.A. History)
From 2014-15
Special Paper - I, Ancient India (3000 B.C. to 1206 AD)

First Term

Objectives:

To Survey the sources of History of Ancient India. The Course intends to provide an Understanding of the social, economic, religious and institutional bases of Ancient India. The course will study such as agriculture, Industry, trade. To study the development of the concept of Nation- State background of political history. To study ancient Indian Art & Architecture.

Unit - 1) Sources for the study of Ancient Indian History. **10**

a) Archaeological

b) Literary

c) Foreign Accounts

d) Epigraphical

e) Numismatics

Unit - 2) Conceptual study of Ancient Indian History **10**

1) Pre-history 2) Proto-history 3) Age of History 4) Stone Age

5) Bharatvarsh 6) Sabha- Samiti 7) Varnashram 8) Samakaras 9) Dandniti

10) Stupa-chaitya & Vihar 11) Alvars-Nayanars 12) Agraharas

13) Vishti 14) Hero-Stone (Memorial Stones) 15) Saptang theory

16) Mahajanapadas

Unit - 3) The Harappan Civilization **8**

a) Scope and features

b) Socio - Economic & Religious Life

c) Decline

Unit - 4) Vedic Culture **10**

a) Political, Social, Economic & Religious Life

b) Vedic literature

Unit - 5) Economic and religious Transformation **10**

a) Agriculture, Iron Technology, Urbanisation

b) New Religion, sects and its philosophy: Jainism, Buddhism and Charvak: Lokayats

Second Term

Unit - 6) The Mauryan Empire **10**

a) Rise & Expansion

b) Administration

c) Socio- Economic and Religious Life

d) Decline

Unit - 7) Satvahans **10**

a) Socio- economic condition

b) Religious

c) Cultural

Unit - 8) The Age of Imperial Guptas **10**

a) Political backgrounds

b) Administration

c) Socio- Economic and Religious Life

d) Science

Unit - 9) Harshavardhana and his Achievements **8**

Unit - 10) South Indian Dnyansties and their socio-cultural life **12**

a) Sangam Age : Brief Survey

b) Chalukyas

c) Pallavas

d) Rashtrakutas

e) Cholas

UNIVERSITY OF PUNE

(Revised Syllabus From 2014-15)

Modern- India (1857-1950)

S.Y.B.A. (History)

General Paper 2

Objectives:-

The course is designed to help the student to know- History of freedom movement of India, aims, objectives problems and progress of Independent India. It aims at enabling the student to understand the processes of rise of modern India. The Course attempts to acquaint student with fundamental aspects of Modern Indian History. To explain the basic concepts/ concerns/ frame work of Indian History.

First- Term

Unit I - Conceptual Study **8**

1. Modernity
2. Rule of Law
3. Drain of wealth
4. Nationalism
5. Home- Rule
6. Satyagraha
7. Communalism
8. Dyarchy

Unit II - Uprising of 1857 **10**

1. Causes, course and effects
2. Various Views
3. Causes of failure

Unit III - Social and Religious Movement (Special reference to institutional work) **10**

1. Brahmo Samaj
2. Arya Samaj
3. Prarthna Samaj

4. Theosophical Society

5. Satyashodhak Samaj

Unit IV - Indian Nationalism 10

1. Rise and Growth

2. Foundation of Indian National Congress.

3. The Moderates and Extremists.

4. Revolutionary Nationalism

Spl. Ref. (Abhinav Bharat, Gadar, Anushilan Samitee, Yugantar, Hindustan Socialist Republican Army)

Unit V - Administrative Policy of the British 10

1. Education

2. Press

3. Famine

4. Local self government

5. Land Revenue systems

Second Term

Chapter VI - Mahatma Gandhi and Indian National movement 10

1. Philosophy

2. Non - Co operation

3. Civil Disobedience

4. Quit India

Chapter VII - Rise and Growth of communalism 10

1. Muslim League

2. Khilafat movement

3. Two Nation Theory

4. Partition

Chapter VIII - Constitutional Development 10

1. Morley Minto Act - 1909

2. Montegue - Chelmsford Act - 1919

3. Provincial Autonomy - 1935

4. Various Constitutional Plans 1942 to 1946 (Crips mission, Wavell plan, Cabinate mission)

5. The last phase - Transfer of power (Mountbatten plan and India's Independence Act - 1947)

Chapter IX - Subaltern Movement 10

1. Dalit Movement

2. Women's Movement

3. Peasant Movement

4. Tribal Movement

5. Workers Movement

Chapter X - India after Independence 8

1. Consequences of partition

2. Integration of princely state: Hyderabad, Junagad & Kashmir.

Books for Study: English

1. Bipinchanda - India's struggle for freedom
2. Bearce, George D - British attitude towards India
3. Bipinchanda - The Rise and Growth of Economic Nationalism
4. Desai A.R. - Social background of India Nationalism
5. Dodwell H.H. - Cambridge History of India Vol V,VI
6. Dutt R.C. - Economic History of India Vol 1,2
7. Gopal S. - British policy in India 1858-1905
8. Majumdar R.C. - British paramountcy and Indian Renaissance Vol IX
9. Menon V.P. - The transfer of power in India
10. Natrajan S. - A century of social Reform In India
11. Overstreet G.D. & Windmiller M. - Communism In India

University of Pune

Revised Syllabus S.Y.B.A. (History, special Paper -II)
From 2014-2015
History of Modern Maharashtra (1818 to 1960)

First Term

Objectives:

The purpose of the course is to enable the students to study the history of modern Maharashtra .To highlight the ideas, institutions, forces and movements that contributes to the modern Maharashtra. To acquaint the students with various interpretative perspectives. To introduce the student to the regional history within a broad national framework.

Unit - 1) Conceptual Study of Modern Maharashtra **15**

1) Modernity 2) Renaissance 3) Nationalism 4) Drain of wealth 5) Moderates 6) Extremist 7) Revolutionary 8) Four Points programme of Lokmanya Tilak 9) Statyagraha 10) Democracy 11) Capitalism 12) Industrialization 13) Urbanization 14) Utilitarianism.

Unit - 2) Maharashtra in Early 19th Century **9**

a) Socio- Political & Economic background.(transition period)

b) British Administration & its Impacts.

Unit -3) Socio-Economic & Religious Reformism **12**

a) Balshastree Jambhekar

b) Jagannath Shankarsheth

c) Bhau Daji Lad

d) Gopal Hari Deshmukh (Lokhiwadi)

e) Mahatma Phule

Unit - 4) Institutional Experiments in Socio- Religious Reformism **12**

a) Paramahamsa Mandai

b) Prarthana Samaj

c) Satyashodhak Samaj

d) Arya Samaj

e) Depressed Classes Mission

Semester I: Core Paper No. 1

Credits: 4

Course Title: History and its Theory

Objectives

The paper is designed to provide adequate conceptual base, bring better understanding of history and its forces, help interrogate existing paradigms and challenge the outdated, help in developing critique, help research in terms of formulating hypotheses and develop broad frames of interaction with other social sciences and attain certain level of interdisciplinary approach.

Course Content

1. History:
    a) Definition, nature, functions, concepts
    b) Modes of interaction with Humanities and Social Sciences

2. History and its theories
    a) Greco-Roman
    b) Church
    c) Arab

3. Emergence of Modern theories of history
    a) Rationalist, Romanticist, Idealist
    b) School of Scientific History
    c) Materialist Theory of history
    d) Positivism

4. Structuralism, Post-structuralism, Post modernism

5. Subaltern Studies

Select Readings

English

Barry, Peter, *Beginning Theory: An introduction to literary and cultural theory*, Manchester University Press, New York, 1995.
Carr, E.H., *What is History*, Penguin Books, Harmondsworth, 1971.
Childs, Peter, *Modernism*, Routledge, London, 2000.
Collingwood, R.G., The *Idea Of History*, Oxford University Press, New York, 1976.
Eagleton, Terry, *Ideology*, Verso, 1991.
Encyclopaedia of Social Sciences
Foucault, Michel, *The Archeology of Knowledge*, translated by Sheridan Smith, Tavistock Publications, London 1982.
Hamilton,Paul, *Historicism*, London, Routledge, First Indian Edition, 2007.

Semester I: Core Paper No. 2

Credits: 4

Course Title: Evolution of Ideas and Institutions in Ancient India

Objectives

The course intends to provide an understanding of the social, economic and institutional bases of Ancient India. It is based on the premise that an understanding of Ancient Indian history is crucial to understand Indian history as a whole.

Course content

1. Defining Ancient India
   a) Historiography (colonial, nationalist)
   b) Terminology ('Hindu', 'Ancient', 'Early')

2. Sources: Perceptions, Limitations, Range
   a) Archaeological
   b) Literary sources (Sanskrit, Prakrit, Pali; Religious, non-religious)
   c) Inscriptions
   d) Foreign accounts

3. Political Ideas and Institutions
   a) Lineage Polities (Rig Vedic)
   b) Pre-State formations (Janapadas, Mahajanapadas)
   c) Early State Formations (From Mahajanapadas to Maurya)
   d) Administrative Institutions (Kingship: Rajanya-Samrat, Sabha and Samiti to Council of ministers
   e) Saptanga Theory

4. Social ideas and institutions
   a) Kin and Lineage society
   b) The emergence of caste based societies, marginalization and subordination
   c) Social protest and the emergence of new social and religious forms
   d) Concept of Kaliyuga and post-Mauryan social formations

5. Economy
   a) Pre-historic to Chalcolithic developments
   b) Development of Agriculture and Trade (Iron Age, Magadha, Gupta)
   c) Expanding Trade Economy
   d) The Mauryan State

6. Deccan and South India
   a) Sangam Age
   b) The emergence of states in the Deccan – the Satavahanas
   c) Urban economy

Semester I: Core Paper No.3.

Credits: 4

Course Title: Maratha Polity

Objectives

The purpose of the course is to study the administrative system of the Marathas in an analytical way, to acquaint the student with the nature of Maratha Polity, to understand basic components of the Maratha administrative structure, to enable the student to understand the basic concepts of the Maratha polity.

Course content

1. Defining the term 'Maratha Polity'

2. Nature of Sources: Perceptions, Limitations, Range
   a) Literary
   b) Foreign
   c) Archival
   d) Miscellaneous

3. Maratha State
   a) Formation of the Maratha State
   b) Nature

4. Administrative Structure
   a) Administrative Structure of the Deccani Kingdoms: a brief survey
   b) Principles underlying Maratha Administration
   c) Central: the institution of kingship, theory, problem of legitimacy, Ashta Pradhan Mandal
   d) Provincial and Village: administrative units
   e) Fiscal administration: Public income and expendture

5. Socio-Political Power Structure
   a) Religion
   b) Caste
   c) Gota
   d) Watan

6. Administration of Justice
   a) Sources of law
   b) Judicial structure – central, provincial
   c) Judicial institutions – political, traditional
   d) Crime and punishment – police

8. Military system
   a) Infantry
   b) Cavalry
   c) Navy

Semester I: Optional Paper No. 1

Credits: 4

Course Title: Cultural History of Maharashtra

Objectives:

To introduce the student to regional history within a broad framework of Indian culture; to enable the student to understand the internal dynamics of Marathi culture.

Course content

1. Defining the term 'culture'

2. Maharashtra as a cultural region
   a) Physical and geographical features
   b) Origin of Marathi people
   c) Nomenclature of Maharashtra
   d) Origin of Marathi language

3. Maharashtra Dharma
   a) Meaning
   b) Different views

4. Movements and cults: philosophy and teaching
   a) Nath
   b) Mahanubhav
   c) Varkari
   d) Ramdasi
   e) Datta
   f) Sufi
   g) Shakti

5. Literature
   a) Bhakti
   b) Bakhar
   c) Panditi
   d) Shahiri
   e) Folk

6. Interaction with Islamic Culture
   a) Language
   b) Literary forms
   c) Socio-cultural practices

7. Art and Architecture
   a) Art: Visual and Performing Art
   b) Architecture: Religious, Secular, Military

Semester II: Core Paper No. 5

Credits: 4

Course Title: Evolution of Ideas and Institutions in Medieval India

Objectives

The course examines the nature of medieval Indian society, economy, state formations, and the main religious currents of the time. It is seen as a continuation of the course on ancient India. It is also seen to be crucial to an understanding of the nature of society, and the problems of the challenge to that society, through colonialism, at a later stage.

Course content

1. Defining medieval India
   a) The Transition to the Medieval
   b) Historiography of the study of Medieval India

2. Sources: Perceptions, Limitations, Range
   a) Persian sources
   b) Regional language sources
   c) Foreign sources: Travellers' accounts, European records

3. The state in medieval India: perceptions and practice
   a) Modern theories of the medieval state: Theocracy, Autocracy, Feudal, Segmentary, Patrimonial-Bureaucratic
   b) Medieval Theories of the State: Farabi, Ghazzali, Shukracharya, Barani, Abul Fazl, Ramachandrapant Amatya
   c) State formation in peninsular India – Chola, Bahamani, Vijayanagar

4. Administrative Systems
   a) Central and Provincial
   b) Mansabdari

5. Medieval Indian society
   a) Social Mobility and Stratification in medieval India
   b) The emergence of new classes: Administrative, agrarian and mercantile classes in medieval India
   c) Bhakti and social change
   d) Sufism
   e) Towards a composite culture

6. Economic institutions
   a) Agrarian systems, north and south India
   b) Trade, internal and external
   c) Financial Institutions: Banking, Bills of Exchange

Select Readings

SEMESTER II

Semester II: Core Paper No. 4

Credits: 4

Course Title: History and its Practice

Objectives

The paper is designed to provide adequate conceptual base, bring better understanding of history and its forces, help interrogate existing paradigms and challenge the outdated, help in developing critique, help research in terms of formulating hypotheses and develop broad frames of interaction with other social sciences and attain certain level of Interdisciplinary approach.

Course content

1.Defining Historical Research Methodology

2. Operations in Research Methodology
   a) Preliminary Operations: Choice of subject, preparation of outline
   b) Analytical Operations: Heuristics and Hermeneutics
   c) Synthetic Operations: Determining and grouping of facts, constructive reasoning
   d) Concluding Operations: Valid generalisations, footnotes and bibliography

3. Schools of History Writing
   1. Indian:
   a) Colonial
   b) Nationalist
   c) Marxist
   d) Subaltern

   2. Non-Indian:
   a) Cambridge
   b) Annales
   c) Dakar

4. Recent developments in methodology
   a) Myth, legend, folklore, oral history: their methodologies
   b) The linguistic turn in history: methodologies of Deconstruction, Post-structuralism, Post-modernism

Select Readings

English

Carr, E.H., *What is History*, Penguin Books, Harmondsworth, 1971.

Semester II: Core Paper No. 6

Credits: 4

Course Title: Socio-Economic History of the Marathas

Objectives

The purpose of the course is to study socio-economic history of the Marathas in an analytical way, to acquaint the student with the components of social structure and their functions, to understand the relationship between religion, caste, customs, traditions, class in 17th and 18th century Maratha Society, to enable the student to understand aspects of economic life, to trace the determinants of changes in social and economic life.

Course Content

1. Defining socio-economic history
   a) Historiography of Socio-economic History.

2. Sources: Perceptions, Limitations, Range
   a) Literary
   b) Foreign
   c) Archival
   d) Miscellaneous

3. Village community
   a) Land Tenures
   b) Residents of the village
   c) Balutedari system

4. Social institutions
   a) Varna and caste
   b) Communities
   c) Marriage'
   d) Family

5. Social Stratification and mobility

6. Fairs and Festivals

7. Education
   a) Educational institutions
   b) Primary education
   c) Higher education

8. Agrarian System
   a) Types of land
   b) Assessment of land
   c) Methods of land revenue collection

Semester IV: Optional Paper No. 19.

Credits :4

Course Title: History of Maharashtra in the 20th Century

Objectives

The purpose of the course is to enable the student to study the history of modern Maharashtra with an analytical perspective and to highlight the ideas, institutions, forces and movements in 20th century Maharashtra. It aims to introduce the student to the regional history within a broad national framework.

Course content

1. Nature of Freedom Movement in 20th Century Maharashtra
2. Social Reform Movement — 04
   a) Non- Brahmin Movement
   b) Dalit Movement — 08
3. Industrial and Economic development of Maharashtra
   a) Industrialization and Urbanization
   b) Cotton and Sugar Industry — 10
   c) Co-operative Movement
4. Movements
   a) Peasants Movements
   b) Workers Movements — 06
   e) Tribal Movement
5. Integration and Reorganization
   a) Hyderabad Mukti Sangram
   b) Sanyukta Maharashtra Movement — 08
6. Towards emancipation of Women
   Beginnings of Feminist Movement — 04

Select Readings

Bhagwat Vidyut, Stree Prashnachi Vatchal

Dixit Raja, Itihas, Samajvichar ani Keshavsut, Lokavangmaya Gruha, Mumbai, 2nd edn., 2005. (in Marathi)

Javdekar, S. D. Adhunik Bharat

F.Y.B.A. HISTORY

Under the Faculty of Humanities

Total Credits: 03

Semester-I Early India: From Prehistory to the Age of the Mauryas

Objectives:

The history of Early India is a crucial part of Indian history. It is a base for understanding the entire Indian history. The course is aimed at helping the student to understand the history of early India from the prehistoric times to the age of the Mauryas. It attempts to highlight the factors and forces behind the rise, growth and spread of civilization and culture of India along with the dynastic history. It also attempts to help the students to understand the contribution of Early Indians to polity, art, literature, philosophy, religion and science and technology. It also aims to foster the spirit of enquiry among the students by studying the major developments in early Indian history.

Unit I: Early India: Sources and Prehistory **[12]**

(a) Importance of Early History
(b) Sources and Tools of historical reconstruction – Archaeology (Material remains), Epigraphy (Inscriptions), Numismatics (Coins), Literary Sources, Foreign Accounts
(c) Palaeolithic, Mesolithic, Neolithic and Chalcolithic Cultures: A Brief Review

Unit II: Harappan Culture: Bronze Age Civilization **[12]**

(a) Geographical Extent, Town Planning, Trade, Religious Practices
(b) Art, Crafts and Technology: Pottery, Seals, Beads, Images, Terracotta Figurines Metallurgy, Script and Decline

Unit III: Vedic Culture, Religious Protest: Jainism and Buddhism **[12]**

(a) Vedic and Later Vedic Culture: Original home, Tribal Polity, Social Divisions, Rituals and Philosophy
(b) Jainism and Buddhism: Causes of Origin, Doctrines, Contributions and Importance

Semester I: Core Paper No. 2

Credits: 4

Course Title: HS: CC - 2: Evolution of Ideas and Institutions in Early India

Objectives

The course intends to provide an understanding of the social, economic and institutional bases of early India. It is based on the premise that an understanding of early Indian history is crucial to understand Indian history as a whole.

Course content

1. Defining Early India
   - i. Historiography (colonial, nationalist)
   - ii. Terminology ('Hindu', 'Ancient', 'Early')
2. Sources: Perceptions, Limitations, Range
   - i. Archaeological
   - ii. Literary sources: Sanskrit, Prakrit, Pali; Religious, non-religious; Tamil Inscriptions
   - iii. Foreign accounts: Chinese, Roman
3. Political Ideas and Institutions: North and South India
   - i. Lineage Polities
   - ii. Pre-State formations in north and south India
   - iii. Early State Formations: Mahajanapadas, Maurya, Deccan and South India
   - iv. Administrative Institutions: Kingship, Administrative structures
4. Social ideas and institutions
   - i. Kin and Lineage society
   - ii. The emergence of caste based societies, marginalization and subordination
   - iii. Social protest and the emergence of new social and religious forms
   - iv. Social systems in the far south
5. Economy
   - i. Pre-historic to Chalcolithic developments
   - ii. Development of Agriculture and Trade
   - iii. Expanding Trade Economy - guilds, crafts, coinage
   - iv. Urbanisation

Select Readings

English

1. Altekar, A.S., State and Government in Ancient India, Motilal Banarasidas, Delhi. 2016.
2. Gurukkal, R., *Social Formations in Early South India*, Oxford University Press, 2010.
3. Jha, D.N., *Early India: A Concise History*, Manohar, 2004.
4. Jha, D.N., *Ancient India in a Historical Outline*, Manohar, 3rd enlarged edition, 2015.

Semester I: Core Paper No.3.

Credits: 4

Course Title: HS: CC 3: Maratha Polity

Objectives

The purpose of the course is to study the administrative system of the Marathas in an analytical way, to acquaint the student with the nature of Maratha Polity, to understand basic components of the Maratha administrative structure, to enable the student to understand the basic concepts of the Maratha polity.

Course content

1. Defining the term 'Maratha Polity'
2. Nature of Sources: Perceptions, Limitations, Range
   - i. Literary
   - ii. Foreign
   - iii. Archival
   - iv. Miscellaneous
3. Maratha State
   - i. Formation of the Maratha State
   - ii. Nature
4. Administrative Structure
   - i. Administrative Structure of the Deccani Kingdoms: a brief survey
   - ii. Principles underlying Maratha Administration
   - iii. Central: the institution of kingship, theory, problem of legitimacy, Ashta-PradhanMandal
   - iv. Provincial and Village: administrative units
   - v. Fiscal administration: Public income and expenditure
   - vi. Military System: forts, infantry, cavalry, navy
5. Socio-Political Power Structur
   - i. Religion
   - ii. Caste
   - iii. Gota
   - iv. Watan
6. Administration of Justice
   - i. Sources of law
   - ii. Judicial structure - central, provincial
   - iii. Judicial institutions - political, traditional
   - iv. Crime and punishment - police

Semester 2: Elective Course No. 2

Credits.4

Course Title: HS: EC-2: Social Background of Dalit Movement in Maharashtra

Objectives:
This paper is designed to emphasise the background of the Dalit movement which flourished in the twentieth century. It highlights the earlier forms of protest from the ancient till the medieval period, which laid the foundations for social protest and dissent in the pre- Ambedkar period.

Course Content

1. Historical Development of caste system

2. Defining the term 'Dalit' and 'Dalit consciousness'

3. Historical Background of Protest
   i. Early Manifestations- Lokayat, Buddhism,Jainism
   ii. Medieval Manifestations- Janabai, Chokhamela, Soyarabai, Karmamela, Banka and Bahinabai

4. Non-Dalit Contribution to the Dalit Movement
   i. Mahatma Phule, Savitribai Phule, Vitthal Ramji Shinde
   ii. Sayaji Maharaj, RajarshiShahu Maharaj

5. Pre-Ambedkar reformers and protest
   i. Gopal Baba Walangkar
   ii. Mukta Salve
   iii. Shivaram JanbaKamble
   iv. KisanFagujiBansode

Select Readings:

English:

1. Ambedkar B. R., *'Castes in India', Dr. Babasaheb Ambedkar Writings and Speeches*, Vol. I, Govt. of Maharashtra, Mumbai, 1987.
2. Ambedkar B. R., *'Who were the Shudras', Dr. Babasaheb Ambedkar Writings and Speeches*, Vol. VII, Govt. of Maharashtra, Mumbai, 1987.
3. Ambedkar B. R., *'Revolution and Counter Revolution in Ancient India', Dr. Babasaheb Ambedkar Writings and Speeches*, Vol. III, Govt. of Maharashtra, Mumbai, 1987.
4. Ambedkar B. R., *'The Untouchables', Dr. Babasaheb Ambedkar Writings and Speeches*, Vol. VII, Govt. of Maharashtra, Mumbai, 1987.

Semester 2: Core Paper No. 4

Credits: 4

Course Title: HS: CC - 4: Approaches to History

Objectives
The paper is designed to make the student aware about the various approaches to the discipline of History. With its roots in Indian history, the paper provides a historical review of the salient approaches that have developed over the last few centuries. It is hoped that the student will become aware of the idea that the same set of historical source materials can be interpreted in different ways depending upon the approach one takes in studying them.

Course content

1. Many Worlds of Indian History
   i. Political, Economic, Social, Cultural Histories
   ii. Food History, Micro-History, Family History, History and Memory

2. Early Approaches to Historical Sciences-
   i. Colonial
   ii. Nationalist
   iii. Cambridge
   iv. Marxist

3. Later Approaches to Historical Sciences
   i. Annales
   ii. Subaltern
   iii. Dakar
   iv. Feminist

4. Recent Developments
   i. Myths, Folklore, Oral History
   ii. Textual Criticism
   iii. Cognitive and Cultural Turn
   iv. Dalit and Non-Brahminical
   v. Environmental
   vi. Digital Turn

Select Readings:

1. Abrams, Lawrence, and Knoblauch, Kaleb, ed., *Historians without Borders: New Studies in Multidisciplinary History*, Routledge, 2018.
2. Elton, Geoffrey, *The Practice of History*, Methuen, 1967.
3. Ferro, Marc, *The Use and Abuse of History*, Routledge, 2003.
4. Sreedharan, E., *A Textbook of Historiography*, Orient Blackswan, 2004.
5. Tamm, Marek, and Burke, Peter, ed., *Debating New Approaches to History*, Bloomsbury, 2014.
6. Woolf, D.R., ed., *A Global Encyclopedia of Historical Writing*, Routledge, 2014.

Semester 2: Core Course No. 5

Credits: 4

Course Title: HS: CC - 5: Ideas and Institutions in Medieval India

Objectives

The course examines the nature of medieval Indian society, economy, state formations, and the main religious currents of the time. It is seen as a continuation of the course on ancient India. It is also seen to be crucial to an understanding of the nature of society, and the problems of the challenge to that society, through colonialism, at a later stage.

Course content

1. Defining medieval India

2. Sources: Perceptions, Limitations, Range
   i. Persian sources
   ii. Regional language sources
   iii. Foreign sources: Travellers' accounts, European records

3. The state in medieval India: perceptions and practice
   i. Modern theories of the medieval state: Theocracy, Feudal, Segmentary, Patrimonial-Bureaucratic
   ii. Medieval Theories of the State: Farabi, Ghazzali, Shukracharya, Barani, Abul Fazl, RamachandrapantAmatya
   iii. State formation in peninsular India - Chola, Bahamani, Vijayanagar

4. Administrative Systems
   i. Central and Provincial
   ii. Mansabdari
   iii. Agrarian systems

5. Society and Economy in Medieval India
   i. Social mobility and Stratification; the emergence of new classes: Administration, agrarian, mercantile
   ii. Religion and social change - Bhakti and Sufi
   iii. Trade - internal and external
   iv. Impact of the arrival of the Europeans

Semester 2: Elective Course No. 10

Credits: 4

Course Title: HS: EC - 10: Nature of Dalit Movement in Maharashtra

Objectives

The paper is developed to analyze the ideology and organization of the Dalit Movement in Maharashtra. Dr. Babasaheb Ambedkar led the Dalit Movement and achieved many kindsof justices to Dalits. He had to fight against inequality and atrocities imposed due to socio-economic and political structure of Hindu society. He had to fight on various fields at the same time such as political, social, economic, religious etc. The attempt here is to help students to understand the details of the most important and neglected socio-religious reform movement in Maharashtra with its root causes. The paper attempts to help students to understand the ideology of Dr. Babasaheb Ambedkar who was the unchallenged leader of the Dalit Movement.

Course Content

1. Ambedkarism: The Theory of Dalit Liberation- Dr. Babasaheb Ambedkar's Ideology
   i. Educational Thoughts of Dr. Babasaheb Ambedkar
   ii. Socio-religious Thoughts of Dr. Babasaheb Ambedkar
   iii. Political Thoughts of Dr. Babasaheb Ambedkar
   iv. Economic Thoughts of Dr. Babasaheb Ambedkar

2. Dalit Movement under the leadership of Dr. Babasaheb Ambedkar
   i. Newspapers: Mooknayak, Bahishkrut Bharat, Janata, Prabuddha Bharat
   ii. BahishkrutHitkarini Sabha, SamajSamta Sangh and People's Education Society
   iii. Mahad Satyagraha and Burning of Manusmruti
   iv. Kalaram Temple Entry Satyagraha

3. The Dalit Movement and Politics
   i. Southborough Committee on Franchise
   ii. Simon Commission
   iii. Round Table Conferences
   iv. Poona Pact
   v. Gandhi-Ambedkar Debate

4. Political Development of Dalit Movement
   i. Independent Labour Party
   ii. Scheduled Caste federation
   iii. Republican Party of India

Introduction to Cyber Security / Information Security

Syllabus for 'Introduction to Cyber Security / Information Security' program* for students of University of Pune is given below.

The program will be of 4 credits and it will be delivered in 60 clock hours**.

*: Course material for this program will be developed by CINS

**: These clock hours also includes practical sessions and demonstrations wherever required.

SR. NO.	TOPIC	HOURS	MARKS
1	**Module 1: Pre-requisites in Information and Network Security**	**14**	**25**
	Chapter 1: Overview of Networking Concepts	3	
	Chapter 2: Information Security Concepts	3	
	Chapter 3: Security Threats and Vulnerabilities	5	
	Chapter 4: Cryptography / Encryption	3	
2	**Module 2: Security Management**	**13**	**25**
	Chapter I: Security Management Practices	7	
	Chapter 2: Security Laws and Standards	6	
3	**Module 3: Information and Network Security**	**13**	**25**
	Chapter 1: Access Control and Intrusion Detection	3	
	Chapter 2: Server Management and Firewalls	4	
	Chapter 3: Security for VPN and Next Generation Technologies	6	
4	**Module 4: System and Application Security**	**20**	**25**
	Chapter 1: Security Architectures and Models	5	
	Chapter 2: System Security	5	
	Chapter 3: OS Security	5	
	Chapter 4: Wireless Network and Security	5	

The syllabus

Course I

Introduction to Human Rights and Duties

Credit: 1

I) Basic Concept

a) Human Values- Dignity , Liberty, Equality , Justice, Unity in Diversity, Ethics and Morals

b) Meaning and significance of Human Rights Education

II) Perspectives of Rights and Duties

a) Rights: Inherent-Inalienable-Universal- Individual and Groups

b) Nature and concept of Duties

c) Interrelationship of Rights and Duties

III) Introduction to Terminology of Various Legal Instruments

a) Meaning of Legal Instrument- Binding Nature

b) Types of Instruments: Covenant-Charter-Declaration-Treaty-Convention-Protocol-Executive Orders and Statutes

IV) United Nations And Human Rights

a) Brief History of Human Rights- International and National Perspectives

b) Provision of the charters of United Nations

c) Universal Declaration of Human Rights- Significance-Preamble

d) Civil and Political Rights-(Art. 1-21)

e) Economic, Social and Cultural Rights-(Art.22-28)

f) Duties and Limitations-(Art. 29)

g) Final Provision (Art. 30)

K.J. Somaiya College of Arts, Commerce & Science
Estd. 1964
Kopargaon

Department of Chemistry

List of Courses addresses Crosscutting Issues as per New Syllabus (CBCS-2019 Pattern)

Sr. No.	Programme Name	Course Code	Name of Course	Addressed Issue (Professional Ethics, Gender, Human Values, Environment and Sustainability
1	B.Sc. Chemistry	CH-101	Physical Chemistry	Professional Ethics
2	B.Sc. Chemistry	CH-201	Inorganic Chemistry	Professional Ethics
3	B.Sc. Chemistry	CH-102	Organic Chemistry	Professional Ethics
4	B.Sc. Chemistry	CH-202	Organic Chemistry	Professional Ethics
5	B.Sc. Chemistry	CH-103	Chemistry Practical-I	Professional Ethics
6	B.Sc. Chemistry	CH-203	Chemistry Practical–II	Professional Ethics
7	B.Sc. Chemistry	CH-301	Physical and analytical Chemistry	Professional Ethics
8	B.Sc. Chemistry	CH-302	Inorganic and Organic Chemistry	Professional Ethics
9	B.Sc. Chemistry	CH-303	Chemistry Practical –III	Professional Ethics
10	B.Sc. Chemistry	CH-401	Physical and analytical Chemistry	Professional Ethics
11	B.Sc. Chemistry	CH-402	Inorganic and Organic Chemistry	Professional Ethics
12	B.Sc. Chemistry	CH-403	Chemistry Practical-IV	Professional Ethics
13	B.Sc. Chemistry	CH-501	Physical Chemistry-I	Professional Ethics
14	B.Sc. Chemistry	CH-502	Analytical Chemistry-I	Professional Ethics
15	B.Sc. Chemistry	CH-503	Physical Chemistry Practical-I	Professional Ethics
16	B.Sc. Chemistry	CH-504	Inorganic Chemistry-I	Professional Ethics
17	B.Sc. Chemistry	CH-505	Industrial Chemistry	Professional Ethics
18	B.Sc. Chemistry	CH-506	Inorganic Chemistry Practical-I	Professional Ethics
19	B.Sc. Chemistry	CH-507	Organic Chemistry-I	Professional Ethics
20	B.Sc. Chemistry	CH-508	Chemistry of Biomolecules	Professional Ethics
21	B.Sc. Chemistry	CH-509	Organic Chemistry Practical-I	Professional Ethics

22	B.Sc. Chemistry	CH-510	(A) Introduction of Medicinal Chemistry OR (B) Polymer Chemistry	Professional Ethics
23	B.Sc. Chemistry	CH-511	(A) Environmental Chemistry OR Chemoinformatics	Professional Ethics
24	B.Sc. Chemistry	CH-601	Physical Chemistry-II	Professional Ethics
25	B.Sc. Chemistry	CH-602	Physical Chemistry-III	Professional Ethics
26	B.Sc. Chemistry	CH-603	Physical Chemistry Practical-II	Professional Ethics
27	B.Sc. Chemistry	CH-604	Inorganic Chemistry-II	Professional Ethics
28	B.Sc. Chemistry	CH-605	Inorganic Chemistry -III	Professional Ethics
29	B.Sc. Chemistry	CH-606	Inorganic Chemistry Practical- II	Professional Ethics
30	B.Sc. Chemistry	CH-607	Organic Chemistry-II	Professional Ethics
31	B.Sc. Chemistry	CH-608	Organic Chemistry-III	Professional Ethics
32	B.Sc. Chemistry	CH-609	Organic Chemistry Practical-II	Professional Ethics
23	B.Sc. Chemistry	CH-610	(A) Chemistry of Soil and Agrochemicals OR (B) Introduction of Forensic Chemistry	Professional Ethics
24	B.Sc. Chemistry	CH-611	(A) Analytical Chemistry-II OR (B) Chemistry of Cosmetics and Perfumes	Professional Ethics
25	(M.Sc-I).Organic Chemistry	CHP-110	Physical Chemistry	Professional Ethics
26	M.Sc. Organic Chemistry	CHI-130	Inorganic Chemistry -I	Professional Ethics
27	M.Sc. Organic Chemistry	CHO-150	Organic Chemistry -I	Professional Ethics
28	M.Sc. Organic Chemistry	CHG-190	Section –I General Chemistry –I Section- II General Chemistry	Professional Ethics
29	M.Sc. Organic Chemistry	CHP-107	Basic Practical Chemistry -I	Professional Ethics
30	M.Sc. Organic Chemistry	CHP-210	Physical Chemistry -II	Professional Ethics
31	M.Sc. Organic Chemistry	CHI-230	Inorganic Chemistry -II	Professional Ethics
32	M.Sc. Organic Chemistry	CHO-250	Organic Chemistry -I	Professional Ethics
33	M.Sc. Organic Chemistry	CHG-290	Section –I General Chemistry –I Section- II General Chemistry	Professional Ethics
34	M.Sc. Organic Chemistry	CHP-227	Basic Practical Chemistry –I	Professional Ethics
35	(M.Sc-II).Organic Chemistry	CHO-450	Chemistry of Natural Products	Professional Ethics
36	M.Sc. Organic Chemistry	CHO-451	Advanced Synthetic Organic Chemistry	Professional Ethics
37	M.Sc. Organic Chemistry	CHO-452	Carbohydreates and Chiraon Approach / Chiral Drugs and Medicinal Chemistry	Professional Ethics
38	M.Sc. Organic Chemistry	CHO-453	Designing Organic Synthesis and Asymmetric Synthesis	Professional Ethics
39	M.Sc. Organic Chemistry	CHO-347	Single Stage Preparation	Professional Ethics
40	M.Sc. Organic Chemistry	CHO-350	Organic Reaction Mechanism	Professional Ethics
41	M.Sc. Organic Chemistry	CHO-351	Spectroscopic Methods in structure Determination	Professional Ethics
42	M.Sc. Organic Chemistry	CHO-352	Organic Stereochemistry	Professional Ethics
43	M.Sc. Organic Chemistry	CHO-353	Pericyclic Reactions, Photochemistry and Heterocyclic Chemistry	Professional Ethics

44	M.Sc. Organic Chemistry	CHO-447	Double Stage Preparations	Professional Ethics
45	M.Sc. Organic Chemistry	CHO-448	Project/Industrial Training / Green chemistry and Chemical Biology	Professional Ethics
46	All PG Programmes		Democracy, Election and Governance	Human Values
47	All PG Programmes		Human Rights - I	Human Values
48	All PG Programmes		Cyber Security -I	Human Values
49	All PG Programmes		Cyber security -II	Human Values
50	All PG Programmes		Cyber security -III	Human Values
51	All PG Programmes		Cyber security -IV	Human Values
52	All PG Programmes		Skill Development –I	Human Values
53	All PG Programmes		Skill Development –II	Human Values
54	All PG Programmes		Introduction to Constitution	Human Values
55	All PG Programmes		Introduction to Indian Constitution	Human Values
	All UG Programmes		EVS 231 – Environmental Awareness	Environment and Sustainability

Representative Example

Crosscutting issue: Professional Ethics

Programme Name – M Sc-I (Organic Chemistry)

Course Name – Fundamental of Physical Chemistry

Course Code – CCTP-1: CHP – 110

Unit No.	Contents	Lectures
1.	**Section -I** **Thermodynamics** -State function, path function, exact differential and inexact differential, internal energy and enthalpy, temperature dependent internal energy and enthalpy, reversible and irreversible adiabatic expansion. The entropy of irreversible changes, the Helmholtz and Gibbs function, Entropy and entropy change in an ideal gas with temperature and pressure, Clausius inequality, chemical potential, chemical potential of a substance in a mixture.	**05**
2.	**Change of State** -Partial molar quantities, methods for determination of molar quantities, ideal solutions. Raoult's and Henery's law, Thermodynamics of Gibbs function of mixing, colligative properties: Elevation in boiling point, depression in freezing point and osmosis.	**04**
3.	**Quantum Chemistry** -Applications of quantum chemistry-blackbody radiation, photoelectric effect, de Broglie hypothesis and uncertainty principle and its experimental evidence. Schrödinger wave equation, particle in one dimensional box. Normalization and orthogonality of wave function, particle in three dimensional box, hydrogen like atoms (no derivation). Operators: algebra of operators, commutative property, linear operators, commutator operator, the operator V and V	**08**
4.	**Chemical Bonding**-Valence bond theory, hybrid orbitals, geometry and hybridization, molecular orbital theory for di and tri atomic molecule, linear variation method, approximations underlying Huckel theory, applications to simple x-systems.	**07**
1.	**Section -II** **Chemical Kinetics and Reaction Dynamics** **Rate Laws**-Recapitulations of basic concept, the temperature dependent reaction rates, reaction moving towards equilibrium, consecutive reaction, parallel reactions, pre-equilibria, unimolecular reactions.	**06**
2.	**Kinetics of Complex Reactions**-Fast reactions: flash photolysis, flow technique, stopped flow technique, relaxation method, the steady state approximation, chain reactions free radical polymerization reaction between H, and Br, explosive reaction.	**03**

3.	**Molecular Reaction Dynamics**-Collision theory of bimolecular gas phase reactions, diffusion controlled and activation controlled reaction in solution, activated complex theory of reaction rate, Eyrings equation,	**05**
4.	**Enzyme Catalysis** -Michaelis mechanism, effect of pH and temperature on enzyme catalyzed reactions, limiting rate, Lineweaverburk and Eadie equation and plots, inhibition of enzyme action, competitive inhibition and non- competitive inhibition.	**04**
5.	**Molecular Thermodynamics** - Molecular energy levels, Boltzmann distribution law, partition functions and ensembles, translational, rotational and vibrational partition function of diatomic molecule, obtaining energy, heat capacity, entropy and equilibrium constants from partition functions, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics.	**06**

References:

1. Physical Chemistry by P.W.Atkin and De Paul
2. Physical Chemistry by T.Engel and P. Reid
3. Physical Chemistry and molecular approach by D. Mcquarie and J. Siman 4. Physical Chemistry for biological sciences by Raymond Chang (Universal books, 2000)
4. Physical Chemistry by Merron and C.F. Prouton
5. Physical Chemistry by G.M. Barrow 7. Quantum Chemistry by L. Levine 8. Quantum Chemistry by R.K. Prasad

Representative Example

Crosscutting issue: Professional Ethics

Programmer Name – M Sc-I (Organic Chemistry)

Course Name – Organomettallic Chemistry and Molecular Reaction Mechanism

Course Code – CCTP-1: CHG – 290

Unit No.	Contents	Lectures
1.	**Organometallic Chemistry** Organic ligands and nomenclature, 18 electron rule: counting electrons, ligands having extended pi system, bonding between Metal Atoms and organic pi systems: linear pi system, cyclic pi system, spectral analysis and characterization of organometallic complexes: IR and NMR, examples.	**08**
2.	**Organometallic Reactions and Catalysis Reactions involving gain and loss of ligands** Ligand dissociation and substitution, oxidative addition, reductive elimination, nucleophilic displacement, reactions involving modification of ligands: insertion, carbonyl insertion, 1-2 insertion, hydride elimination, abstraction, organometallic catalysis. Hydroformylation, Monsanto acetic acid process, Wacker Process, Hydrogenation by Willkinsons catalyst, Olefin metathesis, heterogeneous catalysis: Ziegler Natta Polymerization, Water gas reduction.	**08**
3.	**Coordination Compounds:** Reactions and Mechanism History and principles. Substitution reactions: Inert and labile complexes, mechanism of substitution, Kinetics Consequences of reaction pathway; dissociation, interchange. Association. Experimental evidences in Octahedral Substitution: dissociation, linear free energy relationship, associative mechanism, the conjugate base mechanism, the kinetic chelate effect. Stereochemistry of reactions: substitution in trans complexes, substitution in cis complexes, isomerisation of chelate rings, substitution reactions in Sq. Pl. Complexes.	**08**

Reference

1. Inorganic Chemistry: Gary Miessler and Donald A. Tarr, Third Ed., Pearson (Chapter-12, 13 and 14 pages: 422 to 561)
2. IUPAC Nomenclature of Organometallic Compounds of Transition Metals by Salzer http://publications.org/p/1999/71 08 pdf:7108salzer 1557.pdf

15)To standardize $KMnO_4$ soln. & hence find strength of the given solution

D Any One of the following:

16) Estimation of % purity of a given sample of sodium chloride.

17) Analysis of brass

Organic Chemistry (Minimum 7 experiments)

18. Techniques (**any two**) - To be carried out on micro-scale
    i. Thin layer chromatography
    ii. Crystallization with M.P. and % yield of purified compound
    iii. Distillation with B.P. and % yield of purified compound
    iv. Sublimation with M.P. and % yield of purified compound
19. Estimations (**any one**)
    i. To determine amount of acetic acid in commercial vinegar
    ii. To determine amount of aspirin in APC tablets
20. Organic qualitative analysis of single organic compound at least one belonging from each type (**any four**)

    Type, Preliminary tests, elements, functional group, physical constants

    a. Benzoic acid, Salicylic acid, Cinnamic acid, Phthalic acid, oxalic acid
    b. β-Naphthol, α-naphthol
    c. Aniline, N,N-Dimethyl aniline
    d. Napthalene, Thiourea, Urea, m-Dinitrobenzene, chloroform, ethyl methyl ketone, ethyl acetate, chlorobenzene

2013 - PA

S.Y.B.Sc.

Practical Course in Chemistry CH – 223

A) Physical Chemistry practicals (Any Five)

i. To determine critical solution temperature of phenol water system
ii. To determine molecular weight of given organic liquid by steam distillation
iii. Determination of solubility of benzoic acid at different temperature and to determine ΔH of dissociation process.
iv. To study neutralization of acid (HCl) base (NaOH) and CH_3COOH by NaOH and H_2SO_4 by NaOH.
v. To determine the rate constant (or to study kinetics) of acid catalyzed ester hydrolysis.
vi. To determine the rate constant of base catalyzed ester hydrolysis.
vii. Partition coefficient of iodine between water and carbon tetrachloride.

Aim: To equip students to correlate theoretical and experimental knowledge

Objectives: After completion of practical course student should be able to

i. Verify theoretical principles experimentally
ii. Interpret the experimental data
iii. Improve analytical skills
iv. Correlate the theory and experiments and understand their importance

B) Inorganic Qualitative Analysis (Minimum Five mixtures)

i. One simple mixture (without phosphate or borate)
ii. Two Mixtures containing PO_4^{3-} (With PO_4^{3-} removal)
iii. Two Mixtures containing BO_3^{3-} (With BO_3^{3-} removal)

Inorganic Qualitative Analysis of Binary Mixtures (including phosphate and borate removal).

Sodium carbonate extract is to be used wherever necessary for detecting acidic radicals.

C) Organic Chemistry Practical

a. Organic qualitative analysis of Binary Mixtures without ether separation (**Four only**)

Two: solid-solid, one: solid-liquid, one: liquid-liquid

b. Organic Preparation: (**Any two including Crystallization, MP, TLC**)

i) Pthalic anhydride to pthalamide

ii) Glucose to osazone

CHO-453: Designing Organic Synthesis and Asymmetric Synthesis

[4 credits, 48 Lectures]

1. Designing of organic synthesis: Protection and de-protection of hydroxyl, amino, carboxyl, ketone and aldehyde functions as illustrated in the synthesis of polypeptide and polynucleotide, enamines, Umpolung in organic synthesis, Reterosynthesis. (24L)

2. Principles and applications of asymmetric synthesis: (24L)
stereoselectivity in cyclic compounds, enantio-selectivity, diastereo-selectivity, enatiomeric and diastereomeric excess, stereoselective aldol reactions. Cram's rule, Felkin Anh rule, Cram's chelate model, Asymmetric synthesis, use of chiral auxiliaries, chiral reagents and catalysts, asymmetric hydrogenation, asymmetric epoxidation and asymmetric dihydroxylation. Ref. 3 chapters 33, 34, 35

1. Designing of organic synthesis – S. Warren (Wiley)
2. Some modern methods of organic synthesis – W. Carruthers (Cambridge)
3. Organic chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford Press)
4. Organic synthesis – Michael B. Smith
5. Advanced organic chemistry, Part B – F. A Carey and R. J. Sundberg, 5th edition (2007)
6. Guidebook to organic synthesis-R K Meckie, D M Smith and R A Atken
7. Organic synthesis- Robert E Ireland
8. Strategic Applications of named reactions in organic synthesis-Laszlo Kurti and Barbara Czako

M.Sc. II 2013 - PAT

M.Sc. II: Organic Chemistry Practical

CHO-347: (A) Single stage preparations

[6 Credits]

At least Fourteen single stage and three Isolation of Natural products should carried out. The preparation should be carried out on micro scale.

1. 2-Phenyl indole (Fischer indolc synthesis),
2. 7-Hydroxy -3-methyl flavone (Baker-Venkatraman reaction),
3. Benzyl alcohol and benzoic acid from benzaldehyde (Cannizzaro reaction)
4. 4-Chlorotoluene from p-toluidine (Sandmeyer reaction)
5. Benzilic acid from benzoin (Benzilic acid rearrangement)
6. Benzopinacol (Photochemical reaction),
7. 7-Hydroxy-4-methyl coumarin (Pechmann Reaction)
8. 4-Methyl benzophenone (Friedal Craft reaction)

9. Benzanilide (Beckmann rearrangement)
10. Vanillyl alcohol from vanillin ($NaBH_4$ reduction)
11. 2- and 4-nitrophenols (nitration and separation by steam distillation)
12. Stilbene from benzyl chloride (Wittig reaction)
13. Ethyl cinnamate from benzaldehyde (Wittig reaction)
14. Triphenyl or diphenyl methyl carbinol (Grignard reaction)
15. Benzotriazole
16. 1-Phenyl-3-methyl pyrazol-5-one
17. Glucose pentaacetate
18. 2,4-diethoxycarbonyl-3,4-dimethyl pyrrole from ethyl acetoacetate
19. Quinoline from aniline Skraup synthesis)
20. Benzimidazole from benzyl
21. Cyclohexanol from cyclohexanone (LAH reduction)

B) Isolation of Natural products (Any three)

1. Caffeine from tea leaves (Soxhlet extraction)
2. Piperine from pepper (Soxhlet extraction)
3. Eucalyptus oil from leaves (Steam distillation)
4. Lycopene from tomatoes
5. Trimyristin from nutmeg
6. Cinnamaldehyde from cinnamom
7. Eugenol from clove

References:

1. Practical organic chemistry by Mann & Saunders
2. Text book of practical organic chemistry –by Vogel
3. The synthesis, identification of organic compounds –Ralph L. Shriner, Christine K.F. Hermann, Terence C. Morrill and David Y. Curtin

CHO-447 : Two stage preparations (any Ten) [6 Credits]

1. Benzaldehyde → Benzalacetophenone → Epoxide
2. 4-Nitro toluene → 4-Nitro benzoic acid → 4-Amino benzoic acid
3. Resorcinol → 4-methyl-7-hydroxy coumarin → 4-Methyl-7-acetoxy coumarin
4. Cyclohexanone → Phenyl hydrazone → 1,2,3,4-Tetrahydrocarbazole
5. Hydroquinone → Hydroquinone diacetate → 1,2,4-Triacetoxy benzene
6. Acetanilide → p-Acetamidobenzene sulphonyl chloride → P. Acetamidobenzene sulphonamide
7. p-Amino phenol → p-Acetyl amino phenol → p-Ethoxy acetanilide
8. Hippuric acid → Azalactone → 4-Benzylidene 2-phenyl oxazol-5-one
9. p-Cresol → p-Cresyl benzoate → 2-Hydroxy-5-methyl benzophenone
10. Phthalimide → N-Benzylphthalimide → Benzylamine

11. o-Nitroaniline → o-Phenylene diamine → Benzimidazole
12. Phthalic acid → Phthalimide → Anthranilic acid
13. Benzyl cyanide→ p-Nitrobenzyl cyanide→p-Nitro phenyl acetic acid
14. Hydroquinone → Hydroquinone diacetate → 2,5-Dihydroxy acetopheneone
15. Cyclohexanone→ Enamine→2-Acetyl cyclohexanone
16. α-Pinene→ Disiamyl borane→Pinanol

CHO-448: Project/Industrial training/Green Chemistry and Chemical biology experiments (any Twelve) [6 Credits]

1. Preparation of acetanilide from aniline and acetic acid using Zn dust
2. Base catalyzed aldol condensation using $LiOH.H_2O$ as a Catalyst.
3. Bromination of *trans*-stilbene using sodium bromide and sodium bromate
4. [4+2] cycloaddition reaction in aqueous medium at room temperature
5. Benzil Benzilic acid rearrangement under solvent free condition
6. Thiamine hydrochloride catalyzed synthesis of benzoin from benzaldehyde
7. Clay catalyzed solid state synthesis of 7-hydroxy-4-methylcoumarin
8. Ecofriendly nitration of phenols and its derivatives using Calcium nitrate
9. Bromination of acetanilide using ceric ammonium nitrate in aqueous medium
10. Green approach for preparation of benzopinacolone from bezopinacol using iodine catalyst
11. Preparation of 1, 1-bis-2-naphthol under grinding at room temperature.
12. Solvent free aldol condensation between 3,4-dimethoxybenzaldehyde and 1-indanone
13. Solvent free quantitative solid phase synthesis of azomethines from substituted anilines and substituted benzaldehydes.
14. Sucrose to ethyl alcohol (Baker's yeast)
15. Asymmetric reduction of EAA by using Baker's yeast

Note: i) Project/Industrial training students have to perform 6 practical from the above experiments.

ii) 20% students should be given project or industrial training.

Reference:

1. Comprehensive Practical Organic Chemistry by V.K. Ahluwalia and Renu Aggarwal
2. Monograph on Green Chemistry Laboratory Experiments by Green Chemistry Task Force Committee, DST

SEMESTER-I

CH- 101: Physical Chemistry (2 Credits, 36 Lectures of 50 min.)

1. Chemical Energetics

Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances, problems [11]

2. Chemical Equilibrium:

Introduction: Free Energy and equilibrium - Concept, Definition and significance
The reaction Gibbs Energy, Exergonic and endergonic reaction. The perfect gas equilibrium, the general case of equilibrium, the relation between equilibrium constants, Molecular interpretation of equilibrium constant. The response of equilibria to conditions- response to pressure , response to temperature, Van't Haff equation, Value of K at different temperature, Problems [11]

3. Ionic Equilibria

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts– applications of solubility product principle. [14]

Learning Outcome

1. Chemical Energetics

1. Students will be able to apply thermodynamic principles to physical and chemical process
2. Calculations of enthalpy , Bond energy, Bond dissociation energy , resonance energy
3. Variation of enthalpy with temperature –Kirchoff's equation
4. Third law of thermodynamic and its applications

2. Chemical Equilibrium

Knowledge of Chemical equilibrium will make students to understand

1. Relation between Free energy and equilibrium and factors affecting on equilibrium constant.
2. Exergonic and endergonic reaction
3. Gas equilibrium, equilibrium constant and molecular interpretation of equilibrium constant
4. Van't Haff equation and its application

3. Ionic equilibria

methods, Atomic absorption spectrophotometers, Experimental preliminaries (calibration curve methods, standard addition method) Preparation of sample (wet ashing, fusion, Dry ashing, microwave dissolution, concentration procedures), Detection limits, Estimation of Ca and Mg in water.

Key Ref-2: 612 – 643

6. Flame Emission Spectroscopy **(4 L)**

Introduction, emission spectra, flame emission spectroscopy, flame photometers. Evaluation methods, calibration curve procedure, the standard addition technique, Applications: determination of alkali metals by flame photometry, determination of tracc elements in contaminated soil by AAS. Numerical,

Key Reference-2: 645-649, 655-656

References:

Ref-1: Vogel's textbook of Inorganic Quantitative Analysis, Jeffery, Basset, Mendham Deney, 5th Ed, Longman Scientific Technical, USA (copublished with John Wiley Sons)

Ref-2: Vogel's textbook of Inorganic Quantitative Analysis, Mendham, Deney Barnes, 6th Ed, Pearson education

Ref-3: Analytical Chemistry by G. D. Christian, et al , Wiley, 6th Ed.

Ref-4: Principles of Instrumental Analysis: Holler, Skoog, Crouch 6th Ed. Thomson Publication

Ref-5: Modern Analytical Chemistry, David Harvey, Mc-Graw Hill Higher education

Ref-6: High performance Liquid Chromatography, (Analytical Chemistry through open learning series) Second Ed, Sandie Lindsay, Wiley

Ref-7: Gas Chromatography, (Analytical Chemistry through open learning series) 2nd Ed, Ian A. Fowlis, Wiley

Course outcome: After completion of the course student should able to

1. Define basic terms in solvent extraction, basics of chromatography, HPLC, GC, and AAS and AES. Some important terms are: solvent extraction, aqueous and organic phase, distribution ratio and coefficient, solute remain unextracted, percent extraction, ion association complex, theoretical plate, HETP, retention time, selectivity, resolution, stationary phase, normal and reverse phase, ion exchange, column efficiency, carrier gas, split and spitless injection, packed column, tubular column, atomic absorption and emission spectroscopy, electronic excitation in atoms, nebulization, atomization, reduction of metal ions in flame, absorbance by atoms in flame, flame atomizers, furnace atomizers, interference in AES and FES, HCL, hydride generator, etc.

M. Sc. [I]

Detailed Syllabus:

Semester-I

CCTP-1: CHP-110, Physical Chemistry-I, Semester - I

(Fundamentals of Physical Chemistry) (4 Credits)

SECTION - I (2 Credits, 24 L, 6T)

1.Thermodynamics **(05 L)**

State function, path function, exact differential and inexact differential, internal energy and enthalpy, temperature dependent internal energy and enthalpy, reversible and irreversible adiabatic expansion. The entropy of irreversible changes, the Helmholtz and Gibbs function, Entropy and entropy change in an ideal gas with temperature and pressure, Clausius inequality, chemical potential, chemical potential of a substance in a mixture.

2. Change of State **(04 L)**

Partial molar quantities, methods for determination of molar quantities, ideal solutions, Raoult's and Henery's law, Thermodynamics of Gibbs function of mixing, colligative properties: Elevation in boiling point, depression in freezing point and osmosis.

3. Quantum Chemistry **(08 L)**

Applications of quantum chemistry- blackbody radiation, photoelectric effect, de Broglie hypothesis and uncertainty principle and its experimental evidence. Schrödinger wave equation, particle in one dimensional box, Normalization and orthogonality of wave function, particle in three dimensional box, hydrogen like atoms (no derivation).Operators: algebra of operators, commutative property, linear operators, commutator operator, the operator ∇ and ∇^2. **(07 L)**

4. Chemical Bonding

Valence bond theory, hybrid orbitals, geometry and hybridization, molecular orbital theory for di and tri atomic molecule, linear variation method, approximations underlying Huckel theory, applications to simple π-systems.

SECTION – II (2 Credits, 24 L, 6 T)

Chemical Kinetics and Reaction Dynamics

1.Rate Laws **(06 L)**

Recapitulations of basic concept, the temperature dependent reaction rates, reaction moving towards equilibrium, consecutive reaction, parallel reactions, pre-equilibria, unimolecular reactions. 2.

2. Kinetics of Complex Reactions **(03 L)**

Fast reactions: flash photolysis, flow technique, stopped flow technique, relaxation method, the steady state approximation, chain reactions - free radical polymerization reaction between H_2 and Br_2, explosive reaction.

3. Molecular Reaction Dynamics **(05 L)**

Collision theory of bimolecular gas phase reactions, diffusion controlled and activation controlled reaction in solution, activated complex theory of reaction rate, Eyrings equation.

4. Enzyme Catalysis **(04 L)**

Michaelis mechanism, effect of pH and temperature on enzyme catalyzed reactions, limiting rate, Lineweaverburk and Eadie equation and plots, inhibition of enzyme action, competitive inhibition and non- competitive inhibition.

5. Molecular Thermodynamics **(06 L)**

Molecular energy levels, Boltzmann distribution law, partition functions and ensembles, translational, rotational and vibrational partition function of diatomic molecule, obtaining energy, heat capacity, entropy and equilibrium constants from partition functions, Maxwell- Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

References:

1. Physical Chemistry by P.W.Atkin and De Paul
2. Physical Chemistry by T.Engel and P. Reid
3. Physical Chemistry and molecular approach by D. Mequarie and J. Siman
4. Physical Chemistry for biological sciences by Raymond Chang (Universal books, 2000)
5. Physical Chemistry by Merron and C.F. Prouton
6. Physical Chemistry by G.M. Barrow
7. Quantum Chemistry by I. Levine 8. Quantum Chemistry by R.K. Prasad

Semester-I

CCTP-4: CHP-210, Physical Chemistry-II, Semester - II (Molecular Spectroscopy and Nuclear Chemistry) (4 Credits)

SECTION - I Molecular Spectroscopy (2 Credits, 24 L, 6T)

1) Microwave Spectroscopy **(03 L)**

Types of molecule on the basis of moment of inertia and rotational spectra of di- and poly-atomic molecules.

2) Infra-red Spectroscopy **(05 L)**

The vibrating diatomic molecule, harmonic and Anharmonic oscillator, The diatomic vibrating rotator, breakdown of the Born-Oppenheimer approximation, The vibrations of polyatomic molecule, Fourier transform spectroscopy and its advantages, The carbon dioxide laser, Applications.

3) Raman Spectroscopy **(05 L)**

Quantum and classical theory of Raman effect, pure rotational Raman spectra, vibrational Raman spectra, polarization of light and Raman effect, structure determination from Raman and Infra-red spectroscopy, applications.

4) Electronic Spectroscopy of molecules **(07 L)**

Electronic spectra of diatomic molecules - The Born- Oppenheimer approximation, Vibrational coarse structure, Frank- Condon principle, dissociation energy and dissociation product, Rotational fine structure of electronic-vibration transition, The fortrat diagram, Pre-dissociation, molecular photoelectron spectroscopy.

5) Mossbauer Spectroscopy **(04 L)**

Principle, Instrumentation and Applications of Mossbauer Spectroscopy.

SECTION – II Nuclear and Radiation Chemistry (2 Credits, 24 L, 6T)

1) Radioactivity **(04 L)**

Types of radioactive decay, general characteristics of radioactive decay, decay kinetics, general expression for the activity of a daughter nuclide, Geiger- Nuttalis law, α-decay: A problem in classical physics, Internal conversion and the Auger effect.

2) Elements of Radiation **(06 L)**

Chemistry: Interaction of radiation with matter, interaction of γ radiation with matter, units for measuring radiation absorption, Radiation dosimetry, Radiolysis of water, free radicals in water radiolysis, Radiolysis of some aqueous solutions.

3) Nuclear Fission: **(06 L)**

The discovery of nuclear fission, the process of nuclear fission, fission fragments and their mass distribution, charge distribution, Ionic charge of fission fragments, fission energy, fission cross-section and threshold, fission neutrons, theory of nuclear fission, Neutron evaporation and spallation.

4) Applications of Radioactivity **(08 L)**

Typical reaction involved in the preparation of radioisotopes, The Szillard- Chalmers reaction, Radiochemical principles in the use of tracers, Isotopes in elucidating reaction mechanism and structure determination, physic-chemical research - The solubility of a sparingly soluble substances, surface area of a powder or precipitate rates of diffusion, Analytical applications- Isotope dilution analysis, Neutron activation analysis, Radiometric titrations, Medical applications-Thyroiditis, Assessing the volume of blood in a patient, Industrial applications thickness measurements and control, friction and wear out, gamma radiography.

References:

1) Elements of Nuclear Chemistry by H.J.Arnikar
2) Source book of Atomic energy by S. Glasstone and D. Van
3) Chemical applications of radioisotopes by H.J.M. Brown
4)Fundamentals of molecular spectroscopy by C.N.Banwell and E.M.McCash

Semester-I

CCTP-2: CHI-130, Inorganic Chemistry-I, Semester - I

(Molecular Symmetry and Chemistry of Main Group Elements) (4 credits)

SECTION-I (2Credits, 24 L, 6 T)

Molecular Symmetry and its Applications

1) Molecular Symmetry and Symmetry Groups **(10L)**

Symmetry elements and operations, Symmetry planes and reflections, the inversion centre, proper axes and proper rotations, improper axes and improper rotation, products of symmetry operations, equivalent symmetry elements and equivalent atoms, general relations among symmetry elements and symmetry operations, classes of symmetry operations, symmetry elements and optical isomerism, symmetry point groups, classification of molecular point groups. Defining properties of a group, group multiplication table, some examples of group, subgroups andclasses.

2) Representations of Groups **(06 L)**

Matrix representation and matrix notation for geometric transformation, The Great Orthogonality Theorem and its consequence, character tables (No mathematical part),wave function as basis for irreducible representations.

3)Symmetry Adapted Linear Combinations **(04L)**

Projection operators and their use of construct SALC (Construction of SALC for sigma bonding for molecules belonging point groups: D_{2h}, D_{3h} D_{4h}, C_{4v}, Td., Oh., normalization of SALC, transformation properties of atomic orbital, MO's for sigma bonding,ABn molecules, tetrahedral AB_4 and Oh AB_6 cases.

4) Application of Group theory to Infrared Spectroscopy **(04L)**

Introduction, selection rules, polyatomic molecules, possible vibrations in a linear molecule, bending modes, symmetry of vibrations and their IR activity, Group vibration concept and its limitations, IR spectra related to symmetry of some compounds, IR spectra of complex compounds.

References:

1) Chemical Applications of Group Theoryby F. A. Cotton
2) Symmetry and spectroscopy of molecules by K. VeeraReddy
3) Group Theory and its Chemical Application, P.K. Bhattarchrya
4) Inorganic Chemistry by Shriver and Atkins
5) Concise Inorganic Chemistry by J. D. Lee
6) Inorganic chemistry: principle of structures and reactivity by Huheey, Keiter, Medhi

Learning outcomes:

1. Student should visualize/ imagine molecules in 3 dimensions.
2. To understand the concept of symmetry and able to pass various symmetry elements through the molecule.
3. Understand the concept and point group and apply it to molecules.
4. To understand product of symmetry operations.

5. To apply the concept of point group for determining optical activity and dipole moment.
6. Student should understand the importance of Orthogonality Theorem.
7. They should able to learn the rules for constructing character table.
8. Using reduction formulae should be able to find out the possible type of hybridization.
9. Student should know the concept of SALC.
10. Student able to find out character for reducible representation.
11. To know about projection operator.
12. Apply projection operator to find out the normalized wave function for atomic orbital.
13. Student should correlate the application of symmetry to spectroscopy.
14. Students able to find out the possible modes of vibration.
15. From the previous knowledge of symmetry student must able to find out which mode are IR active.

Section-II (2 Credits, 24 L, 6 T)

Chemistry of Main Group Elements

1. Hydrogen and its compounds: **(02L)**

Classification of Hydrides, electron deficient, electron precise and electron rich hydrides.; PH_3, SbH_3 , AsH_3 , Selenides, Tellurides.

2. Alkali and Alkaline Earth Metals **(02L)**

Solutions innon - aqueous media, application of crown ether in extraction of alkali and alkaline earth metal **(04L)**

3. Boron Group

Boron Hydrides, preparation, structure and Bonding with reference to LUMO, HOMO, interconversion of lower and higher boranes, metalloboranes, carboranes, reactions of organoboranes, STYX rules and structure of higher boranes. **(03L)**

4. Carbon Group

Allotropes of carbon, Diamond, Graphite, Graphene, fullerenes ,carbon nanotube with synthesis, properties , Structure- single walled and multi walled and its application ,Intercalation compounds of graphite, Silicates, including Zeolites.

5. Nitrogen Group

(03L) Nitrogen activation, Boron nitride, Oxidation states of nitrogen and their interconversion, PN and SN Compounds, Applications of PN and SN compounds. **(03L)**

6. Oxygen Group

Metal Selenides and Tellurides, oxyacid's, and oxoanions of Sulphurand nitrogen. Ring, Cage and Cluster compounds of p-block elements. **(02L)**

7. Halogen Group:

Interhalogens, pseudohalagen, Synthesis, Properties and Applications, Structure, Oxyacid's andOxyanions of Halogens. **(02L)**

8.Noble gases:

Occurrence, Compounds ofXenon-with fluorine andOxygen and its uses

9.Organometallic Compounds **(03L)**

Organometallic Compounds of Li, Mg, Si, Pb, As, with Classification, Nomenclature, Synthesis, Structure Properties and Usesof Li, Mg, Si, Pb, As, with Classification, Synthesis, Structure Properties and Uses

References:

1) Inorganic Chemistry by Shriver and Atkins
2) Concise Inorganic Chemistry by J. D. Lee
3) Inorganic chemistry byPrinciple of Structures and Reactivity by Huheey, Keiter, Medhi
4) Inorganic Chemistry by Catherine Housecraft
5) Inorganic Chemistry by MeisslerandTarr
6) Organometallics by Christoph Elschenbroich
7) Organometallics by A Concise Introduction by Christoph Elschenbroich and Albrecht Salzer
8) Basic Organometallic Chemistry by B. D. Gupta and A. J. Elias

Learning outcomes:

1.Student should understand the detail chemistry of S and P block elements w.r.t. their compounds, their reactions and applications.
2. To learn the advance chemistry of boranes, fullerene, zeolites, polymers etc.
3. Organometallic chemistry of some important elements from the main groups and their applications

Semester-I

CCTP-5: CHI-230,Inorganic Chemistry, Semester – II (Coordination and Bioinorganic Chemistry) (4 Credits)

(2 Credits, 24 L, 6T)

SECTION-I

Coordination Chemistry

1)Concept and Scope of Ligand Fields: **(05 L)**

Quantum numbers, Free ion Configuration, Terms and States, Energy levels of transition metal ions, free ion terms, microstates, term wave functions, spin-orbits coupling.

2)Ligand Field Theory of Coordination Complexes **(07L)**

Effect of ligand field on energy levels of transition metal ions, weak cubic ligand field effect on Russell- Saunders terms, Orgel diagrams, strong field effect, correlation diagrams, Tanabe-Sugano Diagrams, Spin-Pairing energies.

3)Electronic spectra of Transition Metal Complexes **(06 L)**

Introduction, band intensities, band energies, band width and shapes, transition metalspectra of 1st, 2nd and 3rd row ions and complexes, electronic spectra of Lanthanide and Actinide, spectrochemical andnephelauxetic series, charge transfer and luminescence spectra, calculations of Dq, B, β parameters, percentage of covalent character for metal complexes.

4)Magnetic Properties of Coordination Complexes **(06 L)**

Origin magnetism, types of magnetism, Curie law, Curie-Weiss Law, Magnetic properties of complexes-Para magnetism, 1stand 2nd Ordered Zeeman effect ,quenching of orbital angular momentum by Ligand fields, Magnetic properties of A, E and T ground terms in complexes, spin freeand spin paired equilibria, temperature dependence of magnetism.

References:

1. Ligand field theory and its applications by B.N. Figgis and M.A. Hitachman
2. Symmetry and spectroscopy of moleculesby K. Veera Reddy
3. Elements of Magnetochemistry by R. L. Datta and A. Syamal

Learning outcomes:

1. Student should able to find out the no of microstates and meaningful term symbols, construction of microstate table for various configuration
2. Hund's rules for arranging the terms according to energy.
3. Student should understand interelectronic repulsion.
4. Student should know the concept of weak and strong ligand field.
5. Student able to find out splitting of the free ion terms in weak ligand field and strong ligand field.
6. To draw correlations diagram for various configurations in Td an Oh ligand field.
7. Student should know basic instrumentation and selection rules and relaxation in rules.
8. Student should know basic d-d transition, d-p mixing, charge transfer spectra.

9. Interpretation of electronic spectra for spin allowed oh and td complexes using Orgel diagram.
10. Understand the concept of spectro chemical series and Nephelauxetic series.
11. Should able to solve numerical based on crystal field parameters.
12. Understand the various terms involved in magnetochemistry.
13. Various phenomenons of magnetism and their temperature dependence.
14. Various experimental methods to find out magnetic moment.
15. Understand the various Quenching of orbital angular momentum.

Section-II:
Bioinorganic Chemistry (2Credits, 24 L, 6 T)

1) Overview of Bioinorganic Chemistry (04 L)
Historical Background and current relevance, role of Cu, Fe, Mn and Mo in metalloprotein, and metalloenzymes.

2) Concepts of Inorganic Chemistry in Bioinorganic Chemistry (08L)
Thermodynamic aspects - HSAB concept, chelate effect and Irving-William series, pK_a values of coordinated ligands, Tuning of redox potential, Biopolymer effects. Kinetic aspects- Electron transfer reaction, Electronic substitution reaction. reactions of coordinated ligands and Template effect, concept of spontaneous self-assembly model compounds.

3) Functions and Transport of Alkali and Alkaline Earth Metal Ions (04L)
Importance of alkali and alkaline earth metals, Distribution of cationic and anionic electrolytes in blood plasma and intracellular fluid, Ionophores: Natural and Synthetic, Application of ionophores, Different mechanism involved in exchange of ions across cell wall,Na+/K+-ATPase ion pump for active transport of Na^+ and K^+.

4) Biochemistry of following Elements: (08L)
(a) Ca in Blood coagulation.
(b) Magnesium in Photosystem I
(c) Manganese in Photosystem II
(d) Iron in Ferritin, Transferrin, Fe-S clusters, Porphyrin based system.

References:
1. Principle of Bioinorganic Chemistry by S.J. Lippard and J. M. Berg
2.Bioinorganic Chemistry: Inorganic Elements in Chemistry of Life by W.Kaim and B. Schwederski

Learning outcomes:
1) Importance of bioinorganic chemistry.
2) Role of metals in Metalloprotein and metalloenzymes.
3) Similarities in coordination theory for metal complexes and metal ions complexed with biological ligands.
4) Importance and transport of metal ions.
5) Passive transport metal ions by ionophores and gramicidin.
6) Mechanism for active transport of $Na^+$and K^+
7) Nerve impulse generation in rod cell of retina.
8) Importance and function of Ca, Fe and Mg in metalloprotein
9) Catalytic role of Mn in photosynthesis.

Semester-I

CCTP-3:CHO-150, Organic Chemistry-I, Semester – I (4 Credits)
(2 Credits, 24 L, 6T)
SECTION-I
Basic Organic Chemistry

1. Structure and Reactivity: (04 L)
Aromaticity: Benzenoid and non-benzenoid compounds, Huckel's rule, antiaromaticity, Application to carbocyclic and heterocyclic systems, annulenes, azulenes, current concepts of aromaticity.

2. Heterocyclic Chemistry (08 L)
Five and six membered heterocycles with one and two hetero atoms: Synthesis, reactivity, aromatic character and importance of following heterocyclic compounds, Furan, Pyrrole, Thiophene, Pyrazole, Imidazole, Pyridine, Pyrimidine

3. Stereochemistry: (12 L)
a) Sterochemical principles, enantiomeric relationship, distereomeric relationship, R and S, E and Z nomenclature in C, N, S, P containing compounds, Prochiral relationship, stereospecific andstereoselective reactions, optical activity in biphenyls, spiranes, allenes, Topicity.
b) Conformational analysis of di, tri, tetra-substituted 5 -6 membered rings and decalins.

(2 Credits, 24 L, 6T)
SECTION-II

1. Structure, Stability and Reactions of Reactive Intermediates (06 L)
a) Carbocation, Carbanion, Free Radical, Carbenes and nitrenes
b) NGP : Neighbouring group participation

2. Rearrangements: (06 L)
Beckmann, Hofmann, Curtius, Schmidt, Wolff, Lossen, Bayer-villiger, Sommelet, Favorskii, Pinacol-pinacolone, Benzil-benzilic acid, Fries, Tiffeneau Demjanov.

3. Ylides: (04 L)
Phosphorus, Nitrogen and Sulphur ylides

4. Oxidation and Reduction Reactions: (08 L)
Oxidisingagents: CrO_3, PDC, PCC, $KMnO_4$, MnO_2, Swern, SeO_2, $Pb(OAc)_4$, Pd-C, RuO_4, OsO_4, m-CPBA, O_3,$NaIO_4$, HIO_4, TEMPO, IBX, CAN, Dess-Martin, DDQ, Ag_2O
Reducing agents: Boranes and hydroboration reactions,MPV reduction and reduction with H_2/Pd-C, Raney-Ni, $NaBH_3CN$, Willkinsons catalyst, DIBAL and Wolff-Kishner reduction, Birch, Clemenson, Dissolving metal

References:
1. Organic Chemistry–by J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford)
2. Advanced Organic Chemistry –by J. March 6th Edition
3. Advanced Organic Chemistry (Part A) –by A. Carey and R.J. Sundberg
4. A guidebook to mechanism in organic chemistry – Peter Sykes 6th Ed.
5. Stereochemistry of carbon compound-by E.L. Eliel
6. Stereochemistry of organic compound-by Nasipuri
7. Stereochemistry conformations and mechanism by P.S. Kalsi

Semester-I

CCTP-6:CHO – 250, Organic Chemistry-II, Semester–II

(4 Credits)

SECTION-I

(2 Credits, 24 L, 6T)

Photochemistry and Pericyclic Reactions

1) Photochemistry [12 L]

Principles of Photochemistry, photochemistry of carbonyl compounds, alkenes,dienes, and aromatic compounds, photo rearrangements, Barton reaction

2) Pericyclic Reactions [12 L]

Cycloaddition reactions, Analysis by correlation diagrams, FMO approach, Electrocyclic, sigmatropic and ene reactions. 1,3-dipolar additions,

References:

1. Advanced Organic Chemistry, Part A by F. A. Carey and R. J. Sundberg
2. Excited states in Organic Chemistry by J.A. Barltrop and J.D.Coyle
3. Organic photochemistry: A visual approach by Jan Kopecky
4. Conservation of orbital symmetry by R. B. Woodward and R. Hoffmann
5. Orbital Symmetry : A problem solving approach- R. E. Lehr and A. P. Marchand
6. Pericyclic Reactions By A. P. Marchand, Roland E. Lehr
7. Organic reactions and orbital symmetry, 2nd Ed. T. L. Gilchrist and R. C. Storr
8. Molecular Orbitals and Organic Chemical Reactions by Ian Fleming
9. Pericyclic Reactions by Ian Fleming
10. Pericyclic Reactions by A Mechanistic and Problem-Solving Approachby Sunil Kumar Vinod Kumar S.P. Singh
11. Essentials of Pericyclic and Photochemical Reactions by Dinda and Biswanath Sankararaman, Roald Hoffmann (Foreword by)
12. Pericyclic Reactions - A Textbook: Reactions, Applications and Theory by S.

SECTION-II

(2 Credits, 24 L, 6T)

Spectroscopic Methods in Structure Determination of Organic Compounds

1. UV and IR Spectroscopy [04L]

UV: Recapitulation of UV spectroscopy, calculations of ∃max of aromatic compounds IR spectra of important functional groups 1. With and without conjugation, 2. Ring size effect 3. Effect of H-bonding, 4. Resonance effect,5. Inductive effect.

2. ^{1}H-NMR [12L]

Understanding of basic principle, chemical and magnetic nonequivalence, Homotopism, Enantiotopism, diastereotopism, chemical shifts and factors influencing chemical shift: electronegativity, NMR solvent polarity, temperature, anisotropic effect, chemical shifts of acidic protons. D_2O exchange, Multiplicity patterns and Coupling Constants: Pascal's triangle, understanding of tree diagram, complex splitting patterns in aromatic, vinylic, saturated monocyclic compounds, bicyclic compounds (fused and bridged rings), Integration: NMR of racemic mixture, relationship between integration and ee% in diasterotomers.

Problems: complex problems based on multiple coupling constants should be discussed and drawing of expected ^{1}H-NMR spectrum along with complex multiplicity patterns and coupling constants. Drawing of multiplicity patterns and determination of coupling constants of complex multiplets should be discussed.

3. ^{13}C-NMR [04L]

Basic of ^{13}C-NMR: Chemical shift and factors affecting chemical shifts in ^{13}C NMR, off resoanance and proton decoupled spectra. Simpleproblems on ^{13}C-NMR.

4. Mass spectrometry (MS) [04L]

Basic principle of MS, significance of M^+ (m/z) in determination of molecular formula, Rule of 13. Genesis of m/z fragments: alkanes (cyclic and acyclic), alcohols, amines

Problems: Based on 2-3 fragments of above mentioned functional groups should be discussed.

Combined problems: Problems based on UV, IR, MS, ^{1}H-NMR, ^{13}C-NMR should be solved.

Learning outcomes:

1. Students should able to understand free radicals' formation, stability and reactivity and should also be able to use the basic understanding in writing probable reaction mechanisms.
2. Students should able to write MO diagram for various olefinic compounds and should able to predict the products, the stereochemistry as well as should able to understand the preferred reaction pathways.
3. Students should able to calculate λmax of organic compounds containing more than one and less than four conjugated systems. Students should able to correlate IR bands with functional groups using numerical data as well as spectral data.
4. Students should able to solve 1H-NMR problems and should also able to draw the 1H-NMR spectrum for simple organic compounds mentioning multiplicity pattern and coupling constant with the help of "Tree Diagram" Should able to predict and analyze the multiplicity patterns with more than one coupling constants.
5. Students should able to use ^{13}C-NMR data to interpret the structure NMR problems and should also able to draw the ^{1}H-NMR spectrum for simple organic compounds mentioning multiplicity pattern and coupling constant with the help of "Tree Diagram" Should be able to predict and analyze the multiplicity patterns with more than one coupling constants.
6. Students should know various key factors responsible for the spectroscopic data acquisition and should able to solve Problems based on UV, IR, MS, ^{1}H-NMR,^{13}C-NMR. .

Course outcomes:

Students will be able to understand -

1. MOT and will be able to extend this in predicting reaction mechanism and stereochemistry of electrocyclic reactions.
2. The concepts in free radical reactions, mechanism and the stereo chemical outcomes.
3. The basic principle of spectroscopic methods and their applications in structure elucidation of organic compounds using given spectroscopic data or spectra.

Semester-I

CBOP-1: CHG – 190, General Chemistry-I, Semester-I (4 Credits)

SECTION-I: Theory Course (2 Credits, 24 L, 6T)
(Any one option is to be selected by candidate)

Elective Option-A : Introduction to Solid State of Matter

1. Bonding in Solids and Electronic Properties (Ref-1, 4) **(05 L)**

Recollect the concepts: Crystalline solids, unit cell, and types of unit cells

Introduction, Bondingin Solids—Free Electron Theory, Electronic Conductivity, Bonding In Solids—Molecular Orbital Theory, Simple Metals, Semiconductors—Si And Ge, Photoconductivity, The *P-N* Junction—Field-Effect Transistors, Bands In Compounds—Gallium Arsenide, Bands In D-Block Compounds—Transition Metal Monoxides.

2. Defects and Non-Stoichiometry (Ref-1, 4) **(07 L)**

Introduction, point defects—an introduction, defects and their concentration, intrinsic defects, extrinsic defects the concentration of defects, ionic conductivity in solids, solid electrolytes, fast-ion conductors: oxygen ion conductors, fast-ion conductors: sodium ion conductors, Applications: 1) fuel cells, 2) sensors, 3) electrochromic devices, non-stoichiometric compounds, introduction, non-stoichiometry in wustite, the titanium monoxide structure.

3. Superconductivity (Ref-1, 4) **(04 L)**

Introduction, Discovery, The Magnetic Properties Of Superconductors, Josephson Effects, The Bcs Theory Of Superconductivity, High Temperature Superconductors, Theory Of High Tc Superconductors, Uses Of High Temperature Superconductors

4. Synthesis of Solids (Ref-2 and 3) **(08L)**

Introduction, Common Reactions Employed in Synthesis, Soft-Chemistry Routes, Ceramic Methods, Decomposition of Precursor Compounds, Combustion Synthesis, Mechano-chemical and Sono-chemical methods, Soft Chemistry Routes(Ion Exchange Reactions, Use of Fluxes, Sol–Gel Synthesis, Electrochemical Methods, Hydrothermal, Solvothermal and Ionothermal Synthesis), Chemical Vapour Deposition and Atomic Layer Deposition, Procedures of synthesis of some nano-materials- Gold and Silver nanoparticles, CdS nanoparticles, ZnO, TiO2 and Fe_2O_3 nanoparticles and Porous Silica

References

Ref.-1: Elaine A. Moore, Lesley E. Smart - Solid State Chemistry - an Introduction. Third Ed. / Fourth Ed. CRC Press (2012)
Ref-2: C. N. R. Rao, Kanishka Biswas, Essentials of inorganic materials synthesis, Wiley, 2015
Ref-3: Nanotechnology: Principles and Practices, S. K. Kulkarni, Third Ed. Springer
Ref-4: Anthony R. West, Solid State Chemistry and its Applications Second Edition (Student Edition), Wiley.

Learning outcomes

At the end of course student will understand
1. Bonding in solids – band theory
2. Electronic conductivity
3. Semiconductors, photoconductivity
4. Non-stoichiometry, defects and types of defects in solids

2. Harper's Biochemistry by R.K. Murray, D. I. Granner, P. A. Mayes, (Prentice Hall International Inc.)
3. Biochemistry by U. Satynarayana
4. Biochemistry by J. L. Jain
5. Biophysical Techniques by Upadhyaya Nath

Course Outcomes:

The goal of this course is to introduce students to fundamental concepts in Chemical Biology and methods of chemistry used to solve problems in molecular and cell biology. After completion of this course, successful students will:

1) Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
2) Students will be able to function as a member of an interdisciplinary problem solving team.
3) To impart the students thorough idea in the chemistry of carbohydrates, amino acids, proteins and nucleic acids etc.
4) Be able to describe the chemical basis for replication, transcription, translation and how each of these central processes can be expanded to include new chemical matter.
5) Develop skills to critically read the literature and effectively communicate research in a peer setting.

Semester-I

SECTION-II: Practical Course (2 Credits,48 L 12T)
(Any one option to be selected by candidate)

Elective Option-A: Inorganic Material Analysis, Synthesis and Applications

Time allotted: One practical session of 4 hours per week for one semester

Part-I: Analysis (at least two of the following) (Ref. -1)

1. Determination of Silica and Manganese from pyrolusite ore.
2. Determination of Aluminum and Silica from Bauxite ore.
3. Determination of silica and iron from hematite ore.
4. Determination of copper and Sulphide from Chalcopyrite ore.

Part-II: Alloy Analysis (at least two of the following) (Ref. -1)

5. Determination of tin and lead from solder alloy.
6. Determination of iron and chromium from stainless steel alloy.
7. Determination of copper and nickel from cupranickel alloy.

Part-III: Synthesis of solid state materials / nano-materials (any three) (Ref- 2 and 3)

8. Synthesis of ZnO from zinc oxalate - precursor method and determine band gap by absorption spectroscopy
9. Synthesis of TiO_2 $TiCl_4$ or Ti-Isopropoxide by Sol-gel method and determine band gap by absorption spectroscopy
10. Synthesis of Colloidal silver nanoparticles and determine band gap by absorption spectroscopy
11. Synthesis of Fe_2O_3 nanoparticles sol-gel/coprecipitation/hydrothermal (any one method)

12. ZnO, TiO_2, Fe_2O_3 nanoparticles powder XRD, SEM, TEM (at least one spectral analysis should be done)

Part-IV: Applications of Solid State Materials

12. Removal and kinetics of photocatalytic dyes, degradation (methylene blue) by ZnO TiO_2 photocatalysis (Ref-2)
13. Study of adsorption of phosphate ion on alfa-Fe_2O_3 (Ref-2)

References:

1. Text book of Quantitative Analysis by A.I. Vogel 3rded^{n} (1963).
2. Experimental Inorganic Chemistry by Mounir A. Malati, Horwood
3. Nanotechnology by S. K.Kulkarni

Examination Scheme:

1. **The examination structure will be given before the commencement of examination.**
2. **50% students will be assigned experiment on part-I or II while remaining – (analysis of any one component) 50% students will assigned experiment on part-III and IV.**
3. **Use of only university supplied procedure will be allowed at the time of examination.**

Elective Option - B: Chemical Biology-I Practical

Time allotted: One practical Session of 4 hours per week for one semester

1. Statistical treatment of experimental data (calculation of mean and standard deviation for given data and least square method for calibration curve method) - Compulsory

Perform at least 10 Practical from the following

1. Preparation of biological buffers.
2. Qualitative analysis of carbohydrates
3. Qualitative analysis of Lipids
4. Qualitative analysis of amino acids
5. Paper chromatographic / TLC separation of mixture of amino acids and their detection
6. Paper chromatographic separation of mixture carbohydrates and their detection
7. Quantitative estimation of Glucose by dinitro salicylic acid by using calorimetric method
8. Quantitative estimation of proteins by Loawry's method
9. Kjeldahl method of Protein Determination
10. Saponification number of fats
11. Iodine value of oil
12. Isolation Quantitative estimation of DNA by Diphenyl amine method
13. Determination of Inorganic Phosphate in Biological Samples

References:

1. A reference book of biochemistry practicals by Sadashivam
2. Practical approach to biochemistry by Plummer
3. Martin Holtzhauer, Basic Methods for the Biochemical Lab, First Edition, Springer

Examination Scheme:

1. **The examination structure will be given before the commencement of examination.**
2. **Use of only university supplied procedure will be allowed at the time of examination.**

Semester-II

CBOP-2: CHG – 290, General Chemistry -II, (4 Credits)

SECTION-I: Theory Course (2 Credits, 24 L, 6T)

(Any one option is to be selected by candidate)

Elective Option-A: Material Characterization Technique

1. X-Ray Diffraction Methods (Ref-1) (6 L)

Miller and Weiss indices, X-Ray Radiation, Generation of X-Rays, X-Ray Absorption, Theoretical Background of Diffraction, Diffraction Geometry, Bragg's Law, Reciprocal Lattice, Diffraction Intensity, Structure Extinction, X-Ray Diffractometry, Instrumentation, System Aberrations, Samples and Data Acquisition, Sample Preparation, Acquisition and Treatment of Diffraction Data, Distortions of Diffraction Spectra, Crystallite Size, Applications, Crystal-Phase Identification, Quantitative Measurement , Wide-Angle X-Ray Diffraction and Scattering, Wide-Angle Diffraction, Wide-Angle Scattering. Problem on XRD (Calculation of d values, assigning planes, calculation of crystal parameters)

2. Transmission Electron Microscopy (Ref-1) (4 L)

Instrumentation, Electron Sources, Thermionic Emission Gun, Field Emission Gun, Electromagnetic Lenses , Specimen Stage, Specimen Preparation, Prethinning, Final Thinning, Electrolytic Thinning, Ultramicrotomy, Image Modes (Mass–Density Contrast, Diffraction Contrast, Phase Contrast), Selected-Area Diffraction (SAD), Selected-Area Diffraction Characteristics.

3. Scanning Electron Microscopy (Ref-1) **(4 L)**

Instrumentation, Optical Arrangement , Signal Detection, Detector, Probe Size and Current Contrast Formation, Electron–Specimen Interactions, Topographic Contrast, Compositional Contrast, Operational Variables, Working Distance and Aperture Size, Acceleration Voltage and Probe Current, Astigmatism, Specimen Preparation, Preparation for Topographic examination.

4. X-Ray Spectroscopy for Elemental Analysis (Ref-1) **(10 L)**

Features of Characteristic X-Rays, Types of Characteristic X-Rays, Selection Rules, Comparison of K, L, and M Series, X-Ray Fluorescence Spectrometry, Wavelength Dispersive Spectroscopy, Analyzing Crystal, Wavelength Dispersive Spectra, Energy Dispersive Spectroscopy, Detector, Energy Dispersive Spectra, Advances in Energy, Dispersive Spectroscopy, XRF Working Atmosphere and Sample Preparation, Energy Dispersive Spectroscopy in Electron Microscopes, Special Features, Scanning Modes, Qualitative and Quantitative Analysis, Qualitative Analysis, Quantitative Analysis, Quantitative Analysis by X-Ray Fluorescence, Fundamental Parameter Method, Quantitative Analysis in Electron Microscopy, Numerical.

References:

1:Yang Leng, Materials Characterization -Introduction to Microscopic and Spectroscopic Methods, Second Ed. Wiley-VCH,
2:R. D. Braun, Introduction to Instrumental Analysis, Second Ed.
3:Elaine A. Moore, Lesley E. Smart - Solid State Chemistry - an Introduction. Fourth Ed. CRC Press (2012)

SECTION-II: Practical Course **(2 Credits, 48 L, 12T)**
(Any one option to be selected by candidate)

Elective Option-A: Electrochemical Methods of Analysis

Time allotted: One practical Session of 4 hours per week for one semester
Total 11 practical to be conducted

Part-I: Conductometry: (Any three)
1. Hydrolysis of NH_4Cl or CH_3COONa or aniline hydrochloride.
2. Determination of λ_0 or $\lambda\alpha$ and dissociation constant of acetic acid.
3. Hydrolysis of ethyl acetate by NaOH.
4. Determination of ΔG, ΔH, and ΔS of silver benzoate by conductometry.
5. Determination of critical micellar concentration (CMC) and ΔG of micellization of sodium Lauryl Sulphate / Detergent

Part-II: Polarography (any one)
6. Determination of half wave potential E 1/2 and unknown concentration of Cu or Pb or Zn ion.
7. Amperometric titration of $Pb(NO_3)_2$ with $K_2Cr_2O_7$.

Part-III: Potentiomerty: (Any three)
8. Stability Constant of a complex ion.
9. Solubility of a sparingly soluble salt.
10. To determine the ionic product of H_2O
11. Estimation of halide in mixture.

Part-IV: pH metry (any two)
12. Determination of the acid and base dissociation constant of an amino acid and hence the isoelectric point of the acid.
13. Determination of dissociation constants of tribasic acid (phospheric acid)
14. Construct pH curve for titration of strong base – strong acid, strong base - weak acid and predict the best indicator in these titrations (methyl orange, methyl orange, brocresol green, phenolphthalein, etc.)

Part-V: Table Work (any two)
15. Analysis of powder XRD of $SrTiO_3$ and Ag metal or any two compounds (Calculation d, lattice constant, crystal volume and density, and assigning planes to peaks using JCPDS data)
16. Cyclic voltamogram of $K_3Fe(CN)_6$ in KCl/H_2O / Ferrocene in TEAP//MeCN
17. Detailed interpretation of Raman spectra of diatomic molecules

References:

1. Practical physical chemistry, A. Findlay, T.A. Kitchner (Longmans, Green and Co.)
2. Experiments in Physical Chemistry, J.M. Wilson, K.J. Newcombe, A.r. Denko. R.M.W. Richett(Pergamon Press)
3. Senior Practical Physical Chemistry, B.D. Khosla and V.S. Garg (R. Chand and Co., Delhi.).
4. Experimental Physical Chemistry by D. P. Shoemaker, Mc. Growhill, 7th Edition, 2003.
5. Physical chemistry by Wien (2001)

Semester-II

CCPP-1: CHP-107: Practical Course – I: Semester -I

Basic Practical Chemistry (Compulsory) **(4 Credits, 96 L, 24T)**

Time allotted: Two practical sessions of 4 hours per week for one semester (one practical session for Section-I and one practical session for Section-II per week is compulsory)

Sec-I: Physical Chemistry Practical (11 Experiments)

1. Statistical treatment of experimental data (calculation of mean and standard deviation for given data and least square method for calibration curve method) (compulsory)

Part-I: Chemical Kinetics: (Any three)
2. Kinetic decomposition of diacetone alcohol by dilatometry.
3. Determination of an order of a reaction.
4. Brönsted primary salt effect.
5. Kinetics of oxidation of ethanol by $K_2Cr_2O_7$

Part-II: Non-Instrumental: (Any Three)
6. Determination of surface excess of amyl alcohol or TX-100 surfactant by Capillary rise method.
7. Determination of molecular weight by steam distillation.
8. Glycerol radius by viscosity.
9. Partial Molar Volume (Polynometry) Determination of the densities of a series of solutions and to calculate the molar volumes of the components.

Part-III: Colorimetry and spectrophotometry (Any four experiments)
10. Simultaneous determination of Ni and Co by spectrophotometry (Ref-1)
11. Simulations determination of $KMnO_4$ and $K_2Cr_2O_7$ by spectrophotometry.(Ref-7)
12. To study the adsorption of certain dyes such as methyl violet, picric acid or malachite green on charcoal. (Ref-2)
13. To determine the indicator constant of bromocresolpuple by half height method (Ref-8)
14. Estimation of Cu(II) by titration with Na_2 EDTA by colorimetry
15. a. Determination of energy of n to Π^* transition in acetone and study of effect of solvent on energy of this transition by recording absorbance spectra in n-hexane and water. b. To study the effect of the extended conjugation on the λ_{max} of p-nitro phenol by recording spectrum in acidic and alkaline medium (Ref-8).

Part -IV: Radioactivity: (Any one)
10. Estimation of Mn in tea leaves by NAA.
11. Half-life of a radioactive nuclide and counting errors.
12. Determination of E-max of β radiation and absorption coefficients in Al.

References:

1. Practical physical chemistry, A. Findlay, T.A. Kitchner (Longmans, Green and Co.)
2. Experiments in Physical Chemistry, J.M. Wilson, K.J. Newcombe, A.r. Denko. R.M.W. Richett(Pergamon Press)
3. Senior Practical Physical Chemistry, B.D. Khosla and V.S. Garg (R. Chand and Co., Delhi.).

4. Experimental Physical Chemistry by D. P. Shoemaker, Mc. Growhill, 7th Edition, 2003.
5. Physical chemistry by Wien (2001)
6. Advance Physical Chemistry Experiment, Gurtu and Gurtu, Pragati Publication (Meerut),
7. Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House
8. Practical physical Chemistry, B. Vishwanathan and P. S. Raghwan, Viva Books

Sec-II: Organic Chemistry (11 Experiments)

Introduction to Laboratory Safety: Meaning of safety signs on container of chemicals, safety handling of chemicals, MSDS sheets: Detailed explanation at least for 4 different types of substances (e.g. nitric acid, benzene, potassium dichromate, bromine, etc.), Handling of glassware's and care to be taken, handling of organic flammable as well as toxic solvents in laboratory, use of safety goggles, shoes and gloves, fire extinguisher and its use, action to be taken in accidental cases e.g. cleaning of acid spill over, use eye wash station and bath station in emergency, etc. (compulsory)

Part-I: Purification Techniques (Compulsory) (8 Experiments)

a) Purification of **two** organic solids by recrystallization using solvents other than water
b) Purification of **two** organic liquids by upward/downward/traditional distillation technique
c) Column Chromatography technique should be performed for any one of the following preparation
d) Sublimation by Cold Thumb Method
e) Thin Layer Chromatography technique **two mixtures**

Part-II: Introduction to Green Chemistry (Compulsory 1 Practical)

Concept of green chemistry, twelve principals of green chemistry, applications of green chemistry for sustainable development, Atom economy, Monitoring of reaction using TLC.

Green Chemistry Experiments (any two)

1. Preparation of Schiff's bases in aqueous medium.
2. Preparation of dihydropyrimidinone under solvent free conditions
3. Preparation of acetanilide from aniline and acetic acid using Zn dust

1. Examination Scheme:

1. **The examination structure will be given before the commencement of examination.**
2. **Use of only university supplied procedure will be allowed at the time of examination.**
3. **One experiment from Physical chemistry and any one experiment from organic section will be assigned.**

Semester-II

CCPP-2: CHP-227: Practical Course-II: Semester -II

Basic Practical Chemistry (Compulsory) **(4 Credits, 96 L, 24T)**

Time allotted: Two practical sessions of 4 hours per week for one semester (one practical session for Section-I and one practical session for Section-II per week is compulsory)

Section-I: Inorganic Chemistry (11 Experiments)

Part-I: Synthesis of coordination complexes (any three) (Ref. 2)

1. Synthesis and Purity of $[Mn(acac)_3]$
2. Synthesis and Purity Chloropentaamminecobalt(III) chloride.
3. Synthesis and Purity Nitro pentaamminecobalt(III) chloride.
4. Synthesis and Purity Bis[TrisCu(I)thiourea]

Part-II: Inorganic Conductometry (any two)

4. Structural determination of metal complexes by conductometric measurement. (Ref-3)
5. To study complex formation between Fe(III) with sulfosalicylic acid by conductometry (Ref-3).
6. To verify the Debye Huckel theory of ionic conductance for strong electrolytes KCl, $BaCl_2$, K_2SO_4 and $[K_3Fe(CN)_6]$ (Ref-3)
7. Determination of Pb(II) in solution with Na_2SO_4 solution and determination of solubility product of $PbSO_4$ (Ref-4)

Part-III: Inorganic characterization techniques (any two of the following)

8. Determination of equilibrium constant of M – L systems Fe(III)–Sulphosalicylic acid or Fe(III)–β–resorcilic acid by Job's continuous variation method. (Ref.-3, 5)
9. Solution state preparation of $[Ni(en)_3]S_2O_3$, $[Ni(H_2O)_6]Cl_2$, $[Ni(NH_3)_6]Cl_2$. Record absorption spectra in solution of all three complexes and calculate 10 Dq. Arrange three ligands according to their increasing strength depending on your observations. (Ref. -5)
10. Determination of magnetic susceptibility (χg and χm) of mercury tetracyanato cobalt or $Fe(acac)_3$ or Ferrous ammonium sulfate by Faraday or Gouy method. (Ref. -3, 5)

Part-IV: Inorganic Kinetics Experiment (any two)

11. Synthesis and photochemistry of $K_3[Fe(C_2O_4)_3].3H_2O$. (Ref-4)
12. Kinetics of substitution reaction of $[Fe(Phen)_3]^{2+}$ (Ref-3)
13. Kinetics of formation of Cr(III)-EDTA complex (Ref-3)

Part-V: Ion – Exchange Chromatography (Ref. -1 and 3)

1. Separation of mixture of Zn(II) and Mg(II) using Amberlite IRA 400 anion exchanger and quantitative estimation of separated ions Zn(II) and Mg(II)

Part-VI: Solvent Extraction and colorimetric (any one experiment) (Ref. -1 and 3)

2. Determination of Cu(II) by solvent extraction as Dithiocarbamate complex (Ref-1)
3. Determination of iron by solvent extraction techniques in a mixture of Fe(III) +Al(III) or Fe(III) + Ni(III) using 8–hydroxyquinoline reagent. (Ref. -1)

References:

1. Vogel's Textbook of Inorganic quantitative analysis

List of Courses addresses crosscutting issues as per new syllabus (CBCS- 2019 Pattern)

Sr. No.	Programme Name	Course code	Name of Course	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	B. Sc. Mathematics	MT-113	Mathematics Practical	Professional Ethics
2	B. Sc. Mathematics	MT-123	Mathematics Practical	Professional Ethics
3	B. Sc. Mathematics	MT232(A)	Numerical Methods and Its Applications	Professional Ethics
4	B. Sc. Mathematics	MT-232(B)	Graph Theory	Professional Ethics
5	B. Sc. Mathematics	MT-233	Mathematics Practical based	Professional Ethics
6			on MT - 231 and MT - 232	
7	B. Sc. Mathematics	MT-242(B)	Dynamical Systems	Professional Ethics
8	B. Sc. Mathematics	MT-243	Mathematics Practical based	Professional Ethics
9			on MT - 241 and MT-242	
10	B. Sc. Mathematics	MT 355(A)	Operations Research	Professional Ethics
11	B. Sc. Mathematics	MT 355(C)	C- Programming	Professional Ethics
12	B. Sc. Mathematics	MT356(A)	Machine Learning-I	Professional Ethics
13	B. Sc. Mathematics	MT 356(B)	Number Theory	Professional Ethics
14	B. Sc. Mathematics	MT 356(C)	Laplace Transform and Fourier Series	Professional Ethics
15	B. Sc. Mathematics	MT 357	Practical Course Lab-1(on Metric Space and Real Analysis-I)	Professional Ethics
16	B. Sc. Mathematics	MT 358	Practical Course Lab-II(on Differential equations)	Professional Ethics
17	B. Sc. Mathematics	MT 359	Practical Course Lab-III (on DSE-3A and DSE-3B)	Professional Ethics

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18	B. Sc. Mathematics	MT -3510	Programming in Python-I	Professional Ethics
19	B. Sc. Mathematics	MT-3511	LaTeX for Scientific Writing	Professional Ethics
20	B. Sc. Mathematics	MT 365(A)	Optimization Techniques	Professional Ethics
21	B. Sc. Mathematics	MT 365(B)	Calculus of Variation and Classical Mechanics	Professional Ethics
22	B. Sc. Mathematics	MT 365(C)	Financial Mathematics	Professional Ethics
23	B. Sc. Mathematics	MT366(A)	Machine Learning-II	Professional Ethics
24	B. Sc. Mathematics	MT 366(B)	Computational Geometry	Professional Ethics
25	B. Sc. Mathematics	MT366(C)	Lebesgue Integration	Professional Ethics
26	B. Sc. Mathematics	DSE-4MT367	Practical Course Lab-1(on Complex Analysis and Real Analysis-II)	Professional Ethics
27	B. Sc. Mathematics	MT 368	Practical Course Lab-II(on Ring Theory and Partial Differential Equations)	Professional Ethics
28	B. Sc. Mathematics	MT 369	Practical Course Lab-III (on DSE-6A and DSE-6B)	Professional Ethics
29	B. Sc. Mathematics	SEC-III MT 3610	Programming in Python-II	Professional Ethics
30	B. Sc. Mathematics	SEC-IVMT3611	Mathematics into LaTeX	Professional Ethics
31	M.Sc. Mathematics	MTUT 114	Advance Calculus	Professional Ethics
32	M.Sc. Mathematics	MTUT 124	Advance Numerical Analysis	Professional Ethics
33	M.Sc. Mathematics	MTUT 133	Programming with Python	Professional Ethics
34	M.Sc. Mathematics	MTUTO134	Discrete Mathematics	Professional Ethics

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35	M.Sc. Mathematics	MTUTO 135	Mechanics	Professional Ethics
36	M.Sc. Mathematics	MTUTO136	Advanced Complex Analysis	Professional Ethics
37	M.Sc. Mathematics	MTUTO137	Integral Equations	Professional Ethics
38	M.Sc. Mathematics	MTUTO 138	Differential Manifolds	Professional Ethics
39	M.Sc. Mathematics	MTUT 141	Fourier Series and Boundary Value Problems	Professional Ethics
40	M.Sc. Mathematics	MTUT 142	Differential Geometry	Professional Ethics
41	M.Sc. Mathematics	MTUT 143	Introduction to Data Science	Professional Ethics
42	M.Sc. Mathematics	MTUTO144	Number Theory	Professional Ethics
43	M.Sc. Mathematics	MTUTO147	Coding Theory	Professional Ethics
44	M.Sc. Mathematics	MTUTO148	Probability and Statistics	Professional Ethics

List of Add-on/Value Added/ Certificate Courses

Sr. No.	Department	Name of Certificate Course	Course Code	Year of Offering	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	Mathematics	Principles of Programming Language	CC.004	2019-20	Professional Ethics

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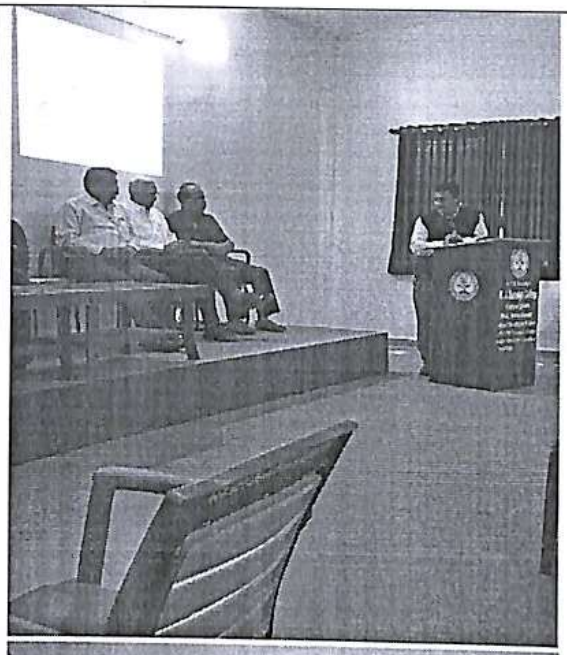
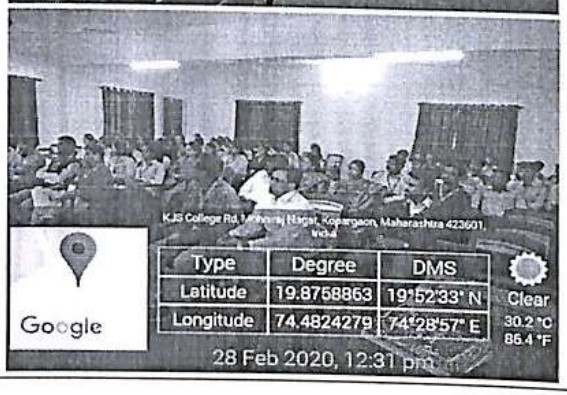
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List Showing Curricular and Extra Curricular activities to address Crosscutting Issues (Similar/repeated activities are not listed).

Sr. No.	Name of Activity and Date of Implementation	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)	Representative Photograph
1	Guest lecture on the topic 'History of Mathematics' on 20th December 2019	Professional Ethics, Human Values	
2	Covid -19 Vaccination camp 28/10/2021	Human Values, Environment and Sustainability	 

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3	Department of Mathematics celebrated the 'National Science Day' on 28th February 2020. On this occasion Dr. B. D. Gavhane delivered a lecture for science stream students on the topic 'Current innovations in science and technology'	Professional Ethics, Human Values	 
4	Dr.B.D.Gavhane worked as a examiner in a state level science exhibition held on 24-27th Feb. 2020 organized by National education research and training organization, Government of Maharashtra	Professional Ethics, Gender, Human Values, Environment and Sustainability	

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5	guest lecture of Dr. K. C. Takale, Department of Mathematics, Bytco College, Nashik on 15th Sep.2019 on the topic 'Maxima Software'	Professional Ethics	
6	guest lecture of Dr. K. C. Takale, Department of Mathematics, Bytco College, Nashik on 29th Jan. 2020 on the topic 'Computational Mathematics using Maxima software'	Professional Ethics	

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Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Mathematics

(Faculty of Science & Technology)

F.Y.B.Sc. (Mathematics)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: B. Sc (Mathematics)

Preamble:

SavitribaiPhule Pune University has decided to change the syllabi of various faculties from June,2019. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects board of studies in mathematics with concern of teachers of mathematics from different colleges affiliated to SavitribaiPhule Pune University has prepared the syllabus of F. Y. B.Sc. Mathematics. To develop the syllabus the U.G.C. Model curriculum is followed.

Aims:

(i) Give the students a sufficient knowledge of fundamental principles,methods and a clearperception of innumerous power of mathematical ideas and tools and know how to usethem by modeling ,solving and interpreting.
(ii) Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science and technology.
(iii) Enhancing students' overall development and to equip them with mathematical modeling abilities, problem solving skills , creative talent and power of communication necessary for various kinds of employment .
(iv) Enabling students to develop a positive attitude towards mathematics as an interestingand valuable subject of study.

Objectives:

(i) A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology and recognize basic geometrical figures and graphical displays , state important facts resulting from their studies.
(ii) A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.
(iii) A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.
(iv) A student be able to apply their skills and knowledge ,that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
(v) A student should be made aware of history of mathematics and hence of its past, present and future role as part of our culture.

Course Outcome:

Upon successful completion of this course, the student will be able to:
i) The mathematical maturity of students in their current and future courses shall develop.
ii) The student develops theoretical, applied and computational skills.
iii) The student gains confidence in proving theorems and solving problems.

Structure of the course:

	Semester - I		Semester -II		Credit
Paper I	MT-111	Algebra	MT-121	Analytical Geometry	2
Paper II	MT-112	Calculus - I	MT-122	Calculus - II	2
Paper III	MT-113	Mathematics Practical	MT-123	Mathematics Practical	1.5

Proposed Structure of S. Y. B. Sc. Mathematics Courses:

	Semester - III		Semester -IV		
Paper I	MT-231	Calculus of Several Variables	MT-241	Linear Algebra-I	2
Paper II	MT-232 (A)	Laplace Transform and Fourier Series	MT-242(A)	Vector Calculus	2
	MT-232 (B)	Computational Geometry	MT-242(B)	Numerical Analysis	2
Paper III	MT-233	Mathematics Practical	MT-243	Mathematics Practical	2

Proposed Structure of T. Y. B. Sc. Mathematics Courses:

Semester- V		Semester- VI		Credit
MT 351	Matric Spaces	MT 361	Complex Analysis	2
MT 352	Real Analysis-I	MT 362	Real Analysis-II	2
MT 353	Problem Course on MT 351 and MT 352	MT 363	Problem Course on MT 361 and MT 362	2
MT 354	Group Theory-I	MT 364	Ring Theory-I	2
MT 355	OrdinaryDifferential Equations–I	MT 365	Partial Differential Equations-I	2
MT 356	Problem Course on MT 354 and MT 355	MT 366	Problem Course on MT 364 and MT 365	2

Select Any Two out of six courses				
MT357:A	Operations Research	MT367: A	Optimization Techniques	2
MT357:B	Number Theory	MT367: B	Graph theory	2
MT357:C	C- Programming	MT367: C	Lebesgue Integration	2
MT357:D	Lattice Theory	MT367: D	Financial Mathematics	2
MT357:E	Python Course -I	MT367: E	Python Course-II	2
MT357:F	Machine Learning Course- I	MT367: F	Machine Learning Course- II	2
MT 338	Practical based on papers selected from 357 A to 357 F	MT 348	Practical based on papers selected from 367 A to 367 F	2
MT-3510	Skill Enhancement course in maths	MT-3511	Skill Enhancement course in maths	2
MT-3610	Skill Enhancement course in maths	MT-3611	Skill Enhancement course in maths	2

All three above courses are compulsory.

1. Equivalence of Previous syllabus along with new syllabus:

	Old course	New Course
Paper I	MT-101 : Algebra and Geometry	MT-111: Algebra and MT-121 : Analytical Geometry
Paper II	MT-102 : Calculus and Differential Equations	MT-112 : Calculus - I and MT-122 : Calculus – II
Paper III	MT-103 : Mathematics Practical	MT – 113 : Mathematics Practical and MT – 113 : Mathematics Practical

Details of Syllabus:

Semester – I

MT 111- Algebra

Unit 1: Sets Relations and Functions (8 Lectures)

1.1 Sets, Relations, Equivalence relations, Equivalence classes and partitions of a set

1.2 Functions, Basic terminology, Types of Functions, Inverse of a Function, Composition of Functions (Excluding theorems only examples).

Unit2: Divisibility Theory in the Integers(10 Lectures)

2.1 Mathematical Induction:Well-Ordering Principle.

2.2 The Division Algorithm, The Greatest Common Divisor, Euclid's Lemma, The Least Common Multiple, The Euclidean Algorithm.

Unit 3: Primes and the theory of Congruence (8 Lectures)

3.1 The Fundamental Number of Arithmetic: Prime Numbers, Euclid's Lemma.

3.2 The theory of Congruence: Basic Properties of congruence.

3.3 Fermat's Theorem

Unit 4: Complex Numbers (10 Lectures)

4.1 Sums and Products, Basic Algebraic Properties, Moduli, Complex Conjugates, Exponential form, Products and Quotients, De-Moivre's theorem.

4.2 Roots of Complex Numbers: The n^{th} roots of unity.

4.3 Regions in Complex Plane.

Text Books:

1. **A Foundation Course in Mathematics, Ajit Kumar, S. Kumeresan and Bhaba Kumar Sarma, Narosa Publication House.**
Unit 1: Chapter 2: Sec. 2.1 to 2.5, Chapter 3: Sec. 3.1 to 3.6, Chapter 4: Sec. 4.1 to 4.4.
2. **Elementary Number Theory, David M. Burton, Tata McGraw Hill, Sixth Edition.**
Unit 2: Textbook 2: Chapter 1: Sec. 1.1, Chapter 2: Sec. 2.2 to 2.4
Unit 3: Textbook 2: Chapter 3: Sec. 3.1, Chapter 4: Sec. 4.1, 4.2, Chapter 5: Sec. 5.2.
3. **Complex Variables and Applications, James Ward Brown and Ruel V. Churchill, Mc-Graw Hill, Seventh Edition.**

Unit 4: Textbook 3: Chapter 1: Sec 1 to 10.

Reference Books:

1. Textbook of Algebra, S. K. Shah and S. C. Garg, Vikas Publishing House Pvt. Ltd. Edition 2017.
2. Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert,John Wiley and Sons Inc, Fourth Edition.

MT 112: CALCULUS - I

Unit 1: Real Numbers (06 Lectures)

1.1 The Algebriac and Order Properties of R:
Algebraic properties of R, Order properties of R, Well-Ordering Property of N. Arithmetic mean-Geometric mean inequality, Bernoulli's inequality.
(Revision: essential properties should be revised with illustrative examples)

1.2 Absolute Value and the Real Line:
Absolute value function and its properties, triangle inequality and its consequences, neighborhood of a point on real line.

1.3 The Completeness Property of R:
Definitions of Upper bound, Lower bound, supremum, infimum of subsets of R, completeness property of R.

1.4 Applications of the Supremum Property:
Archimedean property and its consequences, The density theorem (without proof).

Unit 2. Sequences (10 Lectures)

2.1 Sequences and Their Limits:
Definition and examples of sequences of real numbers, Definition of limit of sequence and uniqueness of limit, Examples on limit of sequence.

2.2 Limits Theorems:
Definition of bounded sequence, Every convergent sequence is bounded, Algebra of limits.

2.3 Monotone Sequences:
Definition and examples of monotone sequences, Monotone convergence theorem and examples.

2.4 Subsequences and Bolzano -Wierstrass Theorem:
Definition of subsequence and examples, Divergence criteria, Monotone Subsequence theorem (without proof), Bolzano -Wierstrass theorem (first proof).

Unit 3. Limits (08 lectures)

3.1 Functions and their Graphs:

Functions, domain and range, graphs of functions, representing a function numerically, Vertical line test, Piecewise defined functions, increasing and decreasing functions, even and odd functions symmetry, common functions

3.2 Limits of Functions:
Definition of cluster point and examples, definition of limit of a function, sequential criterion for limits, divergence criteria.

3.3 Limit Theorems:
Algebra of limits (proofs using sequential criterion) ,Squeeze theoerem.

3.4 Some extension of limit concepts:
one-sided limits, infinite limits (without proof) .

Unit 4: Continuity (12 lectures)

4.1 Continuous Functions:
Definition of continuous function at a point , sequential criterion for continuity, Divergence criterion, combination of continuous functions.

4.2 Continuous Functions on Intervals:
Properties of continuous functions on an interval, Boundedness theorem (without proof), The minimum -maximum theorem(without proof), Location of root theorem (Without proof), Bolzano's intermediate value theorem. Continuous function maps closed bounded interval to closed bounded interval, Preservation of interval theorem.

Textbook Books:

1. **Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert, John Wiley and Sons Inc, Fourth Edition.**
Unit 1: Chapter 2: Sec 2.1 (2.1.1 to 2.1.13), Sec. 2.2(2.2.1 to 2.2.9), 2.3, 2.4(2.4.1, 2.4.3 to 2.4.6, 2.4.8, 2.4.9).
Unit 2: Chapter 3: Sec. 3.1(3.1.1 to 3.1.7, 3.1.10, 3.1.11), Sec. 3.2(3.2.1 to 3.2.11), Sec. 3.3(3.3.1, 3.3.4), Sec. 3.4 (3.4.1 to 3.4.3, 3.4.5 to 3.4.8).
Unit 3: Chapter 4: Sec. 4.1(4.1.1, 4.1.3 to 4.1.9), Sec. 4.2(4.2.1 to 4.2.8), Sec. 4.3 (4.3.1 to 4.3.9).
Unit 4: Chapter 5: Sec. 5.1, Sec. 5.2, Sec 5.3 (5.3.1 to 5.3.5, 5.3.7 to 5.3.10).

2. **Thomas Calculus, Thirteenth edition, Pearson Publication.**
Unit 3: Text book-2: Chapter 1: Sec. 1.1.

Reference books:

1 Introduction to Real analysis, William F.Trench, Free edition, 2010.
2 Calculus of a single variable Ron Larson , Bruce Edwards, tenth edition.
3 Elementary Analysis, The Theory of Calculus, Kenneth A. Ross, Springer Publication, second edition.
4 Calculus and its Applications, Marvin L. Bittinger, David J. Ellenbogen and Scott A. Surgent, Addison Wesley, tenth edition.

MT 113: Mathematics Practical

(Practicals based on the applications of articles in MT 111 and MT 112)
In Semester-I, we should conduct 3 written practical and 3 practical on maxima software for each paper MT-111 and MT-112.

List of Practical

Practical 1 : Problems on Unit 1 and Unit 2(Written) from MT-111.
Practical 2 : Problems on Unit 3 (Written) from MT-111.
Practical 3 : Problems on Unit 4(Written) from MT-111.
Practical 4 :Introduction to *maxima software* forMT-111.
Practical 5 : Problems on unit 1 and unit 2 from MT-111using maxima software.
Practical 6 : Problems on Unit 3 and Unit 4 from MT-111using maxima software.
Practical 7: Problems on Unit 1 and Unit 2(Written) from MT-112.
Practical 8 : Problems on Unit 3 (Written) from MT-112.
Practical 9 : Problems on Unit 4(Written) from MT-112.
Practical 10 :Introduction to maxima software for MT-112.
Practical 11 : Problems on unit 1 and unit 2 from MT-112using maxima software.
Practical 12 : Problems on Unit 3 and Unit 4 from MT-112 using maxima software.

Note:

1 The soft copy of practicals on maxima software will be prepared and provided by the Board of Studies in mathematics.

2. Practicals on maxima software can be performed on computer and android mobiles.

3. Android mobiles are allowed for practical examination on maxima software .

4.Practical examination of 25 marks on written problems, 10 marks for problems on maxima software (5 marks for writing syntax and 5 marks to perform the same on android mobile or computer).

Semester - II

MT 121-Analytical Geometry

Unit 1: Analytical Geometry of Two Dimension **(10 Lectures)**

1.1. Change of axes: translation and rotation.
1.2. Conic Sections: General equation of second degree in two variables
1.3. Reductionto standard form, center of conic, nature of conic.

Unit 2: Planes **(10 Lectures)**

2.1. Direction cosines and direction ratios,Equation of plane, Normal form, Transform to the normal form, Plane passing through three non-collinear points, Intercept form, Angle between two planes.
2.2. Distance of a point from a plane, Distance between parallel planes, Systems of planes, two sides of planes, Bisector planes.

Unit 3: Lines in three dimension **(8 lectures)**

3.1. Equations of a line in Symmetric and unsymmetrical forms, Line passing through two points, Angle between a line and a plane.
3.2. Perpendicular distance of a point from a plane, Condition for two lines to be coplanar (without proof).

Unit 4: Sphere **(8 Lectures)**

4.1. Equation of a sphere in different forms, plane section of a sphere.
4.2. Equation of a circle, sphere through a given circle
4.3. Intersection of a sphere and a line, Equation of tangent plane to sphere.

Text Books:

1. **Analytic Geometry in Two and Three Dimensions : Von Steuben**
Unit1: Sec, 8.4
2. **Analytical Solid Geometry: Shantinarayan; S. Chand and Company Ltd, New Delhi, 1998.**
Unit2: Sec. 1.6,1.7, Sec. 2.1 to 2.7
Unit3: Sec. 3.1 to 3.4, 3.7
Unit4: Sec. 6.1 to 6.6.

Reference Book:

1. P.K.Jain and Khalil Ahmad,A Text Book of Analytical Geometry of Three Dimensions, Wiley Estern Ltd. 1999.

MT 122: Calculus-II

Unit 1: Differentiation **(10 lectures)**

1.1. The Derivatives:
Definition of the derivative of a function at a point, every differentiable function is continuous, Rules of differentiation, Caratheodary'stheorem(without proof), The chain rule, Derivative of inverse function (without proof , only examples).

1.2 The Mean Value Theorems:
Interior extremum theorem, Mean Value theorems and their Consequences, Intervals of increasing and decreasing of a function,first derivative test for extrema.

Unit 2: L' Hospital Ruleand Successive Differentiation(10 lectures)

2.1 L'Hospital Rule:
Indeterminate forms, L'Hospital Rules(without proof)

2.2 Taylor's theorem: Taylor's theorem and Maclaurin'stheorem with Lagrange's form of remainder(Without proof).

2.3 Successive Differentiation: The nth derivative and Leibnitz theorem for successive differentiation.

Unit 3: Ordinary Differential Equations **(08 lectures)**

3.1 Linear first order equations.
3.2 Separable equations.
3.3 Existence and Uniqueness of solutions of nonlinear equations.

Unit 4: Exact Differential Equations **(08 lectures)**

4.1 Transformation of nonlinear equations to separable equations.
4.2 Exact differential equations.
4.3 Integrating factors.

Textbooks:

1. **Introduction to Real Analysis by R.G. Bartle and D.R. Sherbert, John Wiley and Sons, Inc., Fourth Edition.**
   Unit 1: Chapter 6: Sec. 6.1(6.1.1 to 6.1.8), Sec 6.2(6.2.1 to 6.2.8).
   Unit 2: Chapter 6: Sec 6.3(6.3.1 to 6.3.7), Sec 6.4(6.4.1 to 6.4.3).
2. **Differential Calculus by Shanti Narayan, Tenth Revised Edition.**
   Units 2: Chapter 5: Sec. 5.1 to 5.6.
3. **Elementary Differential equations, William F. Trench, E-book (Free download)**
   Unit 3: Chapter 2: Sec 2.1 to 2.3.
   Unit 4: Chapter 2: Sec 2.4 to 2.6.

Reference books:

1. Introduction to Real analysis, William F.Trench, Free edition, 2010.
2. Calculus of a single variable Ron Larson , Bruce Edwards, tenth edition.
3. Elementary Analysis, The Theory of Calculus, Kenneth A. Ross, Springer Publication, second edition.
4. Calculus and its Applications, Marvin L. Bittinger, David J. Ellenbogen and Scott A. Surgent, Addison Wesley, tenth edition.
5. Ordinary and partial Differential equations,M.D. Raisingania, S. Chand andCompany,2009.

MT 123: Mathematics Practical

(Practical based on the applications of articles in MT 121 and MT 122)

In Semester-II, we should conduct 4 written practical and 2 practical on maxima software for each paper MT-121 and MT-122.

List of Practical

Practical 1 : Problems on Unit 1 (Written) from MT-121.
Practical 2 : Problems on Unit 2 (Written) from MT-121.
Practical 3 : Problems on Unit 3(Written) from MT-121.
Practical 4 :Problems on Unit 4(Written) from MT-121.
Practical 5 : Problems on unit 1 and unit 2 from MT-121using maxima software.
Practical 6 : Problems on Unit 3 and Unit 4 from MT-121using maxima software.
Practical 7: Problems on Unit 1 (Written) from MT-122.
Practical 8 : Problems on Unit 2 (Written) from MT-122.
Practical 9 : Problems on Unit 3(Written) from MT-122.
Practical 10 :Problems on Unit 4(Written) from MT-122.
Practical 11 : Problems on unit 1 and Unit 2 from MT-122using maxima software.
Practical 12: Problems on Unit 3 and Unit 4from MT-122 using maxima software.

Note:

1 The soft copy of practical on maxima software will be prepared and provided by the Board of Studies in mathematics.
2. Practicals on maxima software can be performed on computer and android mobiles.
3. Android mobiles are allowed for practical examination on maxima software .
4.Practical examination 25 marks on written problems, 10 marks for problems on maxima software (5 marks for writing syntax and 5 marks to perform the same on android mobile or computer).

5. The ICARE Company has three plants located throughout a state with production capacity 50, 75 and 25 gallons. Each day the firm must furnish its four retail shops R1, R2, R3, and R4 with at least 20, 20 , 50, and 60 gallons respectively. The transportation costs (in Rs.) are given below.

Company	R1	R2	R3	R4	Supply
A	3	5	7	6	50
B	2	5	8	2	75
C	3	6	9	2	25
Demand	20	20	50	60	

Savitribai Phule Pune University, Pune

(Formerly University of Pune)

Two Year Degree Program in Mathematics

(Faculty of Science & Technology)

Revised Syllabi for

M.Sc. - Mathematics

Part-I

(For Colleges Affiliated to Savitribai Phule Pune University, Pune)

Choice Based Credit System Syllabus

To be implemented from the Academic Year 2019-2020

Title of the Course: M.Sc./M.A. (Mathematics)

Preamble :

Savitribai Phule Pune University has decided to change the syllabi of various faculties from June,2019. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects, Board of studies in Mathematics after a thorough discussion with the teachers of Mathematics from different colleges affiliated to University of Pune has prepared the syllabus of M.Sc./M. A. Semester - I and Semester- II (w.e.f. 2019-20) Mathematics course under the Choice Based Credit System (CBCS).
The model curriculum as developed by U. G. C. is used as a guideline for the present syllabus.

Aims and Objectives of the new curriculum :

i) To maintain updated curriculum.
ii) To take care of fast development in the knowledge of mathematics.
iii) To enhance the quality and standards of Mathematics Education.
iv) To provide a broad common frame work, for exchange, mobility and free dialogue across the Indian Mathematical and associated community.
v) To create and aptitude for Mathematics in those students who show a promise for higher studies and creative work in Mathematics.
vi) To create confidence in others, for equipping themselves with that part of Mathematics which is needed for various branches of Sciences or Humanities in which they have aptitude for higher studies and original work.

Sr. No.	Courses		% of Assessment		Total Marks	Credit
	Semester-I	Semester-II	I A	U E		
1	MTUT111: Linear Algebra	MTUT 121: Complex Analysis	30	70	100	4
2	MTUT112: Real Analysis	MTUT 122: General Topology	30	70	100	4
3	MTUT113. Group Theory	MTUT 123: Ring Theory	30	70	100	4
4	MTUT114. Advance Calculus	MTUT 124: Advance Numerical Analysis	30	70	100	4
5	MTUT115: Ordinary Differential Equations	MTUT 125: Partial Differential Equations	30	70	100	4

The study tour is important to learn, network and collaborate with academics, students and industry professionals in Science and Technology, Engineering and Mathematics recruiters . It is also important to know and understand different cultures, easily adapt to new environments, skillfully negotiate business deals. **Therefore department of Mathematics should arrange a student's study tour in each academic year .**

Equivalence of previous syllabus with new syllabus:

Semester I and Semester II Old Courses Equivalent New Courses

Old Courses	New Courses
MT 501: Real Analysis	MTUT112: Real Analysis
MT 502: Advanced Calculus	MTUT114: Advanced Calculus
MT 503: Group Theory	MTUT113: Group Theory
MT 504: Numerical Analysis	MTUT124: Advanced Numerical Analysis
MT 505: Ordinary Differential Equations	MTUT115: Ordinary Differential Equations
MT 601: Complex Analysis	MTUT121: Complex Analysis
MT 602:General Topology	MTUT122: General Topology
MT 603: Rings and Modules	MTUT123: Rings and Modules
MT 604: Linear Algebra	MTUT111: Linear Algebra
MT 605:Partial Differential Equations	MTUT125: Partial Differential Equations

Details of Syllabus:

Semester I

MTUT-111: LINEAR ALGEBRA

[06 Hours]

Unit I. Vector Spaces.

1.1 Vector Spaces,
1.2 Subspaces and linear dependence,
1.3 The concepts of basis and dimension **[06 Hours]**
1.4 Some general theorems about finitely generated vector spaces..

Unit II. Linear Transformation and Matrices.

2.1 Linear Transformations
2.2 Addition and multiplication of matrices. **[10 Hours]**
2.3 Linear Transformations and matrices.

Unit III. Vector Spaces with an Inner product.

3.1 The concept of symmetry **[10 Hours]**
3.2 Inner Product.

Unit IV. The Theory of a single Linear Transformation.

4.1 Basic Concepts
4.2 Invariant Subspaces **[14 Hours]**
4.3 The Triangular form theorem
4.4 The rational and Jorden canonical forms.

Unit V. Dual Vector Spaces and Multilinear Algebra.

5.1 Quotient spaces and dual vector spaces
5.2 Bilinear forms and duality **[14Hours]**
5.3 Direct sums and tensor products
5.3 A proof of the elementary divisor theorem.

Unit VI. Orthogonal and Unitary Transformations

6.1 The structure of orthogonal transformations
6.2 The principal axis theorem
6.3 Unitary transformation and the spectral theorem.

Recommended Book:

Charles W. Curtis: Linear Algebra An Introductory Approach, Springer.
Chapter 2: Sect- 3, 4, 5, 7. Chapter 3: Sect-11 (except Theorem 11.7, Definition

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4	MTUT114. Advance Calculus	MTUT 124: Advance Numerical Analysis	30	70	100	4
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MT 602:General Topology	MTUT122: General Topology
MT 603: Rings and Modules	MTUT123: Rings and Modules
MT 604: Linear Algebra	MTUT111: Linear Algebra
MT 605:Partial Differential Equations	MTUT125: Partial Differential Equations

Details of Syllabus:

Semester I

MTUT-111: LINEAR ALGEBRA

[06 Hours]

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1.1 Vector Spaces,
1.2 Subspaces and linear dependence,
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2.2 Addition and multiplication of matrices.
2.3 Linear Transformations and matrices.

[10 Hours]

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3.1 The concept of symmetry
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[14Hours]

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6.1 The structure of orthogonal transformations
6.2 The principal axis theorem
6.3 Unitary transformation and the spectral theorem.

Recommended Book:
Charles W. Curtis: Linear Algebra An Introductory Approach, Springer.
Chapter 2: Sect- 3, 4, 5, 7. Chapter 3: Sect-11 (except Theorem 11.7, Definition

11.8, Theorem 11.7′, Definition 11.10, Theorem 11.11, Theorem 11.12), 13.
Chapter 4: Section 15. Chapter 7: Sections 22, 23, 24, 25. Chapter 8: Sections 26, 27, 28, 29.
Chapter 9: Sections 30, 31,32

Reference Books:

1) Vivek Sahai, Vikas Bist, Linear Algebra, Narosa Publication.
2) K. Hoffman, Ray Kunze, Linear Algebra, Prentice Hall of India Private Ltd.
3) P. B. Bhattacharya, S. R. Nagpaul, S. K. Jain, First Course in Linear Algebra, 2 nd Edition, New Age International Publishers.
4) S. Kumaresan, Linear Algebra A Geometric Approach, PHI Learning Private Ltd

MTUT-112 : REAL ANALYSIS

Unit-I. Lebesgue Measure: **[20 Hours]**

1.1 Lebesgue Outer Measure
1.2 σ- algebra of Lebesgue Measurable Sets
1.3 Outer and Inner Approximation of Lebesgue Measurable Sets
1.4 Countable Additivity
1.5 Contiuity
1.6 Borel-Cantelli Lemma
1.7 Non-measurable Set, Cantor Set, Cantor-Lebesgue Function.

Unit-II. Lebesgue Measurable Functions: **[18 Hours]**

2.1 Definition and algebra of Lebesgue Measurable Functions
2.2 Sequential Point wise Limits and Approximations by Simple Functions
2.3 Littlewood's Three Principles
2.4 Egoroff's Theorem
2.5 Lusin's Theorem.

Unit-III. Differentiation and Integration: **[22 Hours]**

3.1 Continuity of Monotone Functions
3.2 Lebesgue's Differentiation Theorem
3.3 Functions of Bounded Variation
3.4 Jordan's Theorem, Absolutely Continuous Functions
3.5 Integration of Derivatives
3.6 Differentiation of Indefnite Integral
3.7 Fundamental Theorem of Calculus.

Recommended Book:

Real Analysis-Fourth Edition, Authors: H. L. Royden, P. M. Fitzpatrick.
Sections: Chapter 2 - sections 2.1 to 2.7, Chapter 3 - sections 3.1 to 3.3, Chapter 6 - sections 6.1 to 6.5.

Reference Books:

1. Real Analysis: Authors: Elias M. Stein, Rami Shakarchi.
2. Basic Real Analysis: Author: Anthony W. Knapp.
3. Beginning Functional Analysis: Authors: Karen Saxe (Springer International Edition)

MTUT- 113: GROUP THEORY

UNIT-I: Groups, Subgroups and Cyclic Groups **[12 HOURS]**

1.1 Definition and Examples of Groups; Properties of Groups; Order of a finite group; Order of an element in group; Subgroups; Subgroup Tests.
1.2 Cyclic Groups; Properties of Cyclic Groups; Classification of Subgroups of Cyclic Groups.

UNIT-II: Permutation Groups- Isomorphism **[12 HOURS]**

2.1 Permutations Groups; Definition and notation; Cycles; Properties of Permutations; Even and odd permutations; Alternating Group of degree n.
2.2 Isomorphism of Group; Properties of Isomorphisms; Cayley's Theorem; Automorphisms.

UNIT-III: Cosets, Lagrange's Theorem, External Direct Product **[12 HOURS]**

3.1 Cosets; Lagrange's Theorem and consequences; Stabilizer and orbit; Orbit stabilizer theorem.
3.2 External Direct Products; Properties of External Direct Products; Group of units modulo n as an external direct product.

UNIT-IV: Normal Subgroups, Homomorphisms **[8 HOURS]**

4.1 Normal Subgroups; Factor Groups; Application of Factor Groups; Internal Direct Products.
4.2 Group Homomorphisms; Definition and examples; Properties of Homomorphisms; First Isomorphism Theorem.

UNIT-V: Sylow Theorems **[4 HOURS]**

5.1 Fundamental Theorem of Finite Abelian Groups; Isomorphism Classes of Abelian Groups; Proof of the Fundamental Theorem.
5.2 Conjugacy Classes; Class Equation; The Sylow Theorems; Applications of Sylow's Theorems.

UNIT-VI: Group Actions

6.1 Group Actions; Definition and examples; Permutation representation associated to a given action; Faithful action; Kernel; Left regular action.

Recommended Books:

1) **Joseph Gallian, Contemporary Abstract Algebra**, 9 th Edition, Cengage Learning India Pvt. Ltd. ISBN-10 9353502527
Chapters 2, 3, 4, 5 (except last article: A check Digit Scheme based on D5).
Chapters 6, 7 (except: Rotations of a cube and Soccer Ball and subsequent Article). Chapter 8 (except: Applications). Chapters 9, 10, 11, 24.
2) **David S. Dummit, Richard M. Foote**, Abstract Algebra, 2 nd Edition, John Wiley and Sons (Indian Edition)
In chapter 1 only Article 1.7.

Reference Books:

1) I. S. Luthar, I. B. S. Passi, Algebra (Vol 1), Groups; Narosa Publication House.
2) I. N. Herstein, Topics in Algebra, Wiley Eastern Ltd.
3) M. Artin, Algebra, Prentice Hall.
4) N. S. Gopalkrishnan, University Algebra, Wiley Eastern Ltd.
5) J. B. Fraleigh, A First Course in Abstract Algebra, 7 th Edition, Pearson Edition Ltd.

MTUT 114: ADVANCED CALCULUS

UNIT-I: Differential Calculus of Scalar and Vector Fields **[20 Hours]**

1.1 Functions from R^n to R^m. Scalar and vector fields; Limits and continuity.
1.2 The derivative of a scalar field with respect to a vector; Directional derivatives and partial derivatives; Partial derivatives of higher order; Inverse function theorem and Implicit Function theorem . (without proof)
1.3 Directional derivatives and continuity; The total derivatives; The gradient of a scalar field; A sufficient condition for differentiability.

1.4 A chain rule for derivatives of scalar fields; Applications to geometry. Level sets.Tangent planes; Derivatives of vector fields; Differentiability implies continuity; The chain rule for derivatives of vector fields; Matrix form of the chain rule.

UNIT-II: Line Integrals **[10 Hours]**

2.1 Paths and line integrals; Other notations for line integrals; Basic properties of line integrals.

2.2 The concept of work as a line integral; Line integrals with respect to arc length; Further applications of line integrals.

2.3 Open connected sets. Independence of the path; The first and second fundamental theorem of calculus for line integrals; Necessary and sufficient conditions for a vector field to be a gradient; Necessary conditions for a vector field to be a gradient.

UNIT-III: Multiple Integrals **[15 Hours]**

3.1 Partitions of rectangles. Step functions; The double integral of a step function; The definition of the double integral of a function defined and bounded on a rectangle ; Upper and lower double integrals; Evaluation of double integral by repeated one- dimensional integration; Geometric interpretation of the double integral as a volume; Worked examples.

3.2 Integrability of continuous functions; Integrability of bounded functions with discontinuities ; Double integrals extended over more general regions; Applications to area and volume; Worked examples.

3.3 Green's theorem in the plane; Some applications of Green's theorem; A necessary and sufficient condition for a two dimensional vector field to be a gradient.

3.4 Change of variables in a double integral; Special cases of the transformation formula with proof; General case of the transformation formula with proof; Extensions to higher dimensions; Change of variables in an n-fold integral; Worked examples.

UNIT-IV: Surface Integrals **[15 Hours]**

4.1 Parametric representation of a surface; The fundamental vector product; The fundamental vector product as a normal to the surface; Area of a parametric surface.

4.2 Surface integrals; Change of parametric representation ; Other notations for surface integrals

4.3 The theorem of Stokes; Curl and divergence of a vector field; Properties of curl and divergence; the divergence theorem (Gauss' theorem) and applications of divergence theorem.

Recommended Book:

1) **Tom M. Apostol**, Calculus Volume II (Second Edition) Indian Reprint 2016 (John Wiley & Sons, Inc) ISBN:978-81-265-1520-2.
Unit 1: Chapt 8 : 8.1 to 8.22. ;Unit 2: Chapt 10 : 10.1 to 10.11, 10.14 to 10.16.
Unit 3: Chapt 11 : 11.1 to 11.15; 11.19 to 11.22, 11.26 to 11.34.;
Unit 4: Chapt 12: 12.1 to 12.15, 12.19 and 12.21.
2) For " Inverse Function Theorem" and "Implicit Function Theorem", use Tom M. Apostol, Mathematical Analysis 2nd Edition Narosa Publication 20th Reprint 2002. ISBN 978-81-85015-66-8. Unit-I: Chapter 13: Sections 13.3 and 13.4.

Reference Books:

1) Gerald B. Folland, Advanced Calculus , Pearson Edn 2012. 2) A Devinatz, Advanced Calculus (Holt , Reinhart & Winston) 1968.

MTUT 115: ORDINARY DIFFERENTIAL EQUATIONS

Unit I: Linear equations of the first order **[04 hours]**

1.1 Linear equations of the first order
1.2 The equation y'+ay=0
1.3 The equation y'+ay=b(x)
1.4 The general linear equations of first order

Unit II: Linear equations with constant coefficients **[14 hours]**

2.1 Second order homogeneous equations
2.2 Initial value problems for second order equations
2.3 Linear dependence and independence
2.4 Formula for the Wronskian
2.5 Non homogeneous equations of order two
2.6 Homogeneous equations of order n
2.7 Non homogeneous equations of order n
2.8 Algebra of constant coefficients equations

Unit III: Linear equations with variable coefficients **[14 hours]**

3.1 Initial value problems for the homogeneous equation
3.2 Solutions of the homogeneous equation
3.3 Wronskian and linear independence
3.4 Reduction of order of the homogeneous equation
3.5 Non homogeneous equations with analytic coefficients
3.6 Homogeneous equations
3.7 Legendre equation

Unit IV: Linear Equations with regular singular points **[14 hours]**

4.1 Euler equation
4.2 Second order equation with regular singular points
4.3 Exceptional cases
4.4 Bessel's equation
4.5 Regular singular point at infinity

Unit V: Existence and uniqueness of solutions to first order equations **[14 hours]**

5.1 Equations with variables separated
5.2 Exact equations
5.3 Method of successive approximations
5.4 Lipschitz condition
5.5 Approximation to, and uniqueness of, solutions

Recommended Book:

E. A. Coddington, An Introduction to Ordinary Differential Equations (Prentice-Hall).
Chapter- 1.4 -1.7; 2.1-2.12; 3.1-3.8; 4.1- 4 .4, 4.6- 4.8; 5.1 -5.8.

Reference Books :

G. F. Simmons and S. G. Krantz, Dfferential Equatins (Tata McGraw-Hill).

SEMESTER-II

MTUT 121: COMPLEX ANALYSIS

Unit I: Basic Properties of Complex Numbers: [04 hours]
- 1.1 Arithmetic of Complex Numbers
- 1.2 The Fundamental Theorem of Algebra

Unit II Complex Differentiability and Conformality: [10 hours]
- 2.1 Definition and Basic Properties
- 2.2 Polynomials and Rational Functions
- 2.3 Analytical Functions: Power Series
- 2.4 Cauchy- Riemann Equations
- 2.5 Review of Calculus of Two Real Variables

Unit III: Contour Integration: [14 hours]
- 3.1 Definition and Basic Properties
- 3.2 Existence of Primitives
- 3.3 Cauchy-Goursat Theorem
- 3.4 Cauchy's Theorem via Green's Theorem
- 3.5 Cauchy's Integral Formulae
- 3.6 Analyticity of Complex Differentiable Functions
- 3.7 A Global Implication: Liouville
- 3.8 Mean Value and Maximum Modulus

Unit IV: Zeros and Poles: [14 hours]
- 4.1 Zeros of Holomorphic Functions
- 4.2 Open Mapping Theorem
- 4.3 Singularities
- 4.4 Laurent Series
- 4.5 Residues

Unit V: Application to Evaluation of Definite Real Integrals: [12 hours]
- 5.1 Trigonometric Integrals
- 5.2 Improper Integrals
- 5.3 Jordan's Inequality

Unit VI: Local And Global Properties: [06 hours]
- 6.1 Schwarz's Lemma
- 6.2 Local mapping

Recommended Book:

1. **Anant R. Shastri, Basic Complex Analysis of One Variable**, Macmillan Publishers India, 2010 .
   Ch. 1: 1.1 , 1.8.1 , Ch. 2: 2.1,2.2, 2.3(only 2.3.1); Ch. 3: 3.1, 3.2,
   Ch. 4: 4.1 to 4.5, 4.7,4.8 , Ch. 5: 5.1 to 5.5, Ch. 6: 6.1 to 6.3; Ch. 7: 7.1, 7.2

Reference Books:

1. J. W. Brown and R.V. Churchill, Complex Variables and Applications, Indian Edition. (Eighth Edition)
2. John. B. Conway, Functions of One Complex Variable, Springer International Student Edition. (Second Edition)
3. S. Ponnusamy, Foundation of Complex Analysis, Narosa Publications. (Second Edition)
4. L.V. Alfors, Complex Analysis, McGraw Hill, 1979.

MTUT- 122 : GENERAL TOPOLOGY

Unit 1. Prerequisites [10 hours]
- 1.1 : Cartesian Products
- 1.2 : Finite Sets
- 1.3 : Countable and Uncountable Sets
- 1.4 : Infinite Sets and Axiom of Choice
- 1.5 : Well Ordered Sets

Unit 2. Topological Spaces and Continuous Functions [20 hours]
- 2.1 : Topological Spaces
- 2.2 : Basis for a Topology
- 2.3 : Order Topology
- 2.4 : Product Topology on X× Y
- 2.5 : Subspace Topology
- 2.6 : Closed Sets and Limit Points
- 2.7 : Continuous Functions
- 2.8 : The Product Topology, Metric Topology
- 2.9 : Quotient Topology

Unit 3. Connected and Compact Spaces [15 hours]
- 3.1 : Connected spaces
- 3.2 : Connected Subspaces of Real Line
- 3.3 : Components and Local Connectedness
- 3.4 : Compact spaces
- 3.5 : Compact Subspaces of the Real Line
- 3.6 : Limit point compactness
- 3.7 : Local Compactness

Unit 4. Countablity and Separation Axioms [15 hours]
- 4.1 : The Countability Axioms
- 4.2 : The Separation axioms and Normal Spaces
- 4.3 : Urysohn Lemma (State Only)
- 4.4 : The Urysohn Metrization Theorem (State Only)
- 4.5 : Tietze Extension Theorem
- 4.6 : Tychonoff's Theorem.

Text Book:
J. R. Munkres, Topology: A First Course, (Prentice Hall, Second Edition), 2000.
Chapter 1 : Sec. 5 to 7, Sec. 9 to 10. ;Chapter 2: Sec.12 to 22.
Chapter 3 : Sec. 23 to 29. ; Chapter 4 : Sec. 30 to 35 ; Chapter 5 : Sec. 37.

Reference Books:
1. K J¨anich. Topology. Springer, 1984.
2. M A Armstrong. Basic Topology. Springer, 1983.
3. O Viro, O Ivanov, V Kharlamov, and N Netsvetaev. Elementary Topology: Problem Textbook, AMS Publication, 2008.
4. K. D. Joshi, Introduction to General Topology, John Wiley & Sons .

MTUT123: RING THEORY [16 hours]

Unit I : Rings
- 1.1 Basic Terminologies
- 1.2 Rings of Continuous functions

1.3 Matrix Rings, Polynomial Rings, Power Series Rings, Laurent Rings, Boolean Rings, Some Special Rings,
1.4 Direct Products
1.5 Several Variables
1.6 Opposite Rings
1.7 Characteristic of a Ring.

Unit II : Ideals **[12 hours]**

2.1 Definitions
2.2 Maximal Ideals
2.3 Generators
2.4 Basic Properties of Ideals
2.5 Algebra of Ideals
2.6 Quotient Rings
2.7 Ideals in Quotient Rings
2.8 Local Rings.

Unit III : Homomorphisms of Rings **[10 hours]**

3.1 Definitions and Basic Properties
3.2 Fundamental theorems
3.3 Endomorphism Rings
3.3 Field of Fractions, Prime fields.

Unit IV : Factorisation Domains **[12 hours]**

4.1 Division in Domains
4.2 Euclidean Domains
4.3 Principal Ideal Domains
4.4 Factorisation Domains
4.5 Unique Factorisation Domains
4.6 Eisenstein's Crieterion.

Unit V : Modules **[10 hours]**

5.1Definitions and Examples
5.2 Direct Sums
5.3 Free Modules
5.4 Quotient Modules
5.5 Homomorphism
5.6 Simple Modules
5.7 Modules over PID.

Recommended Book:

C. Musili, Rings and Modules, 2nd Revised Edition, Narosa Publishing House. (Chapters 1, 2, 3, 4, 5)

Reference Books :

1. Dummit and Foote, Abstract Algebra, second edition (Wiley India).
2. Luther and Passi, Algebra II, Narosa Publishing House.
3. Jain and Bhattacharya, Basic Abstract Algebra, 2nd Edition, Cambridge University Press.
4. Joseph Gallian, Contemporary Algebra, 7th Edition, Narosa Publishing House.

MTUT 124: ADVANCED NUMERICAL ANALYSIS

UNIT-I: Root Finding Methods [10 HOURS]

1.1 Convergence; Floating Point Number Systems; Floating Point Arithmetic.
1.2 Fixed Point Interaction Schemes; Newton's Method; Secant Method; Accelerating Convergence.

UNIT-II: System of Equations [14 HOURS]

2.1 Gaussian Elimination; Pivoting Strategies.
2.2 Error Estimates and Condition Number; LU decomposition; Direct Factorization.
2.3 Iterative Techniques for Linear Systems: Basic Concepts and Methods.
2.4 Nonlinear Systems of Equations.

UNIT-III: Eigenvalues and Eigenvectors [10 HOURS]

3.1 The Power Method.
3.2 The Inverse Power Method.
3.3 Reduction to Symmetric Tridiagonal Form.
3.4 Eigenvalues of Symmetric Tridiagonal Matrices.

UNIT-IV: Differentiation and Integration [14 HOURS]

4.1 Numerical Differentiation, Part II.
4.2 Numerical Integration – The Basics and Newton-Cotes Quadrature; Composite Newton-Cotes Quadrature.

UNIT-V: Initial Value Problems of Ordinary Differential Equations [12 HOURS]

5.1 Euler's Method; Higher-Order One-Step Methods: Taylor Methods.
5.2 Runge-Kutta Methods.
5.3 Multistep Methods.
5.4 Convergence and Stability Analysis.

RECOMMEDNDED BOOK:

1) **Brian Bradie**, A Friendly Introduction to Numerical Analysis, Pearson Prentice Hall 2007, ISBN 978-81-317-0942-9.
Sections: 1.2 – 1.4, 2.3 – 2.6, 3.1, 3.2, 3.4 -3.6, 3.8, 3.10, 4.1, 4.2, 4.4, 4.5, 6.2, 6.4, 6.5, 7.2-7.6
2) **John H. Mathews, Kurtis D. Fink**, Numerical Methods Using Matlab, 4th Edition, Pearson Education (Singapore) Pte. Ltd., Indian Branch, Delhi 2005. (SciLab commands similar to MatLab commands can be used for problems)

REFERENCE BOOKS:

1) **K .E. Atkinson**, An Introduction to Numerical Analysis, Second Edition, John Wiley & Sons.
2) **J. L. Buchaman, P. R. Turner**, Numerical Methods and Analysis, McGraw Hill, 1992 cop.
3) **M.K. Jain, S.R.K. Iyengar, R.K. Jain**, Numerical Methods for Scientific &

MTUT 125: PARTIAL DIFFERENTIAL EQUATIONS

[12 Hours]

1. INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS OF FIRST ORDER **[16 Hours]**

1.1 Genesis of first order P.D.E.
1.2 Compatible systems
1.3 Charpit's method
1.4 Jacobi's method
1.5 Non Linear first order P.D.E

2. FUNDAMENTAL CONCEPTS

2.1 First order partial differential equations
2.2 Classification of Second Order PDE

2.3 Canonical Forms, Canonical Form for Hyperbolic Equation , Canonical Form for Parabolic Equation , Canonical Form for Elliptic Equation

2.4 Linear Partial Differential Equations with Constant Coefficients, General Method for Finding CF of Reducible Non-homogeneous Linear PDE ,General Method to Find CF of Irreducible Non-homogeneous Linear PDE

3. ELLIPTIC AND PARABOLIC DIFFERENTIAL EQUATIONS **[20 Hours]**

3.1 Occurrence of the Laplace and Poisson Equations , Derivation of Laplace Equation , Derivation of Poisson Equation

3.2 Boundary Value Problems (BVPs)

3.3 Green's first and second identities

3.4 Dirichlet Problem for a Rectangle

3.5 Occurrence of the Diffusion Equation

3.6 Boundary Conditions

3.7 Elementary Solutions of the Diffusion Equation

3.8 Dirac Delta Function

3.9 Separation of Variables Method (with examples)

4. HYPERBOLIC DIFFERENTIAL EQUATIONS

4.1 Occurrence of the Wave Equation **[12 Hours]**

4.2 Derivation of One-dimensional Wave Equation

4.3 Solution of One-dimensional Wave Equation by Canonical Reduction

4.4 Vibrating string- Variable separable solution(examples)

Recommended Books

1. An Elementary Course in Partial Differential Equations, T Amarnath ,Narosa Publication (Chapter 1)
2. Intoduction to Partial Differential Equations, K.Sankara Rao (Third Edition) PHI Learning Private Limited

Reference Books

1. Elements of Partial Differential Equations, Ian Sneddon, Dover Publication
2. An Introduction to Partial Differential Equations, Yehud Pinchor & Jaco Rubinstein, Cambridge University Press

Savitribai Phule Pune University, Pune

(Formerly University of Pune)

Two Year Degree Program in Mathematics

(Faculty of Science & Technology)

Revised Syllabi for

M.Sc. - Mathematics

Part-II

(For Colleges Affiliated to Savitribai Phule Pune University, Pune)

Choice Based Credit System Syllabus

To be implemented from the Academic Year 2020-2021

Kopargaon Taluka Education Society's

K.J. Somaiya College of Arts, Commerce & Science, Kopargaon

Department of BBA_CA

List of Courses addresses crosscutting issues as per new syllabus (CBCS- 2019 Pattern)

Sr. No.	Programme Name	Course code	Name of Course	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	BBA_CA	CA_101	Business Communication Skills	Professional Ethics
2	BBA_CA	CA_102	Principles of Management	Professional Ethics
	BBA_CA	CA_103	C Language	Professional Ethics
	BBA_CA	CA_104	Database Management System	Professional Ethics
	BBA_CA	CA_105	Statistics	Professional Ethics
	BBA_CA	CA_106	Computer Laboratory Based on 103 &104	Professional Ethics
	BBA_CA	CA_107	Add-On (PPA)	Professional Ethics
	BBA_CA	CA_201	Organization Behavior & Human Resource Management	Professional Ethics
	BBA_CA	CA_202	Financial Accounting	Professional Ethics
0	BBA_CA	CA_203	Business Mathematics	Professional Ethics
	BBA_CA	CA_204	Relational database	Professional Ethics
2	BBA_CA	CA_205	Web Technology HTML-JS-CSS	Professional Ethics
	BBA_CA	CA_206	Computer Laboratory Based on 204 & 205	Professional Ethics
	BBA_CA	CA_207	Add-On (Advance C)	Professional Ethics
	BBA_CA	CA_301	Digital Marketing	Professional Ethics
	BBA_CA	CA_302	Data Structure	Professional Ethics
	BBA_CA	CA_303	Software Engineering	Professional Ethics
18	BBA_CA	CA_304	PHP	Professional Ethics
19	BBA_CA	CA_305	Big data	Professional Ethics
20	BBA_CA	CA_306	Computer Laboratory Based on 302 , 304 and 305	Professional Ethics
21	BBA_CA	CA_307	Environment Awareness	Professional Ethics
22	BBA_CA	CA_401	Networking	Professional Ethics
23	BBA_CA	CA_402	Object Oriented Concepts Through CPP	Professional Ethics
24	BBA_CA	CA_403	Operating System	Professional Ethics
25	BBA_CA	CA_404	Advance PHP	Professional Ethics
26	BBA_CA	CA_405	Project	Professional Ethics
27	BBA_CA	CA_406	Computer Laboratory Based on 402,404	Professional Ethics
28	BBA_CA	CA_407	ADD-On	Professional Ethics

29	BBA_CA	CA_501	Cyber Security	Professional Ethics
30	BBA_CA	CA_502	OOSE	Professional Ethics
31	BBA_CA	CA_503	Core Java	Professional Ethics
32	BBA_CA	CA_504	Python	Professional Ethics
33	BBA_CA	CA_505	Project	Professional Ethics
34	BBA_CA	CA_506	Computer Laboratory Based on 503 and 504	Professional Ethics
35	BBA_CA	CA_507	Add on Course-IOT	Professional Ethics
36	BBA_CA	CA_601	Recent Trends in Information Technology(Tutorial/Assignment)	Professional Ethics
37	BBA_CA	CA_602	Software Testing	Professional Ethics
38	BBA_CA	CA_603	Advanced Java	Professional Ethics
39	BBA_CA	CA_604	Android Programming	Professional Ethics
40	BBA_CA	CA_605	Project	Professional Ethics
41	BBA_CA	CA_606	Computer Laboratory Based on 603 and 604	Professional Ethics
42	BBA_CA	CA_607	Add on Course-Soft Skills Training	Professional Ethics

List of Add-on/Value Added/ Certificate Courses

Sr. No.	Department	Name of Certificate Course	Course Code	Year of Offering	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
	BBA_CA	Cyber Security	CC.006	2018-19	Professional Ethics

H.O.D

HOD
Dept.of BBA_CA
omaiya College,Kopargaon

IQAC coordinator

Principal

Principal
K.J.Somaiya College of Arts
Commerce & Science,Kopargaon

13. Titles of Papers and Scheme of Study for B.B.A. (C.A.) Programme

CC-Core Course, EC-Elective Course, PR-Practical, PJ-Project, AECC-Ability Enhancement Compulsory Courses, SEC-Skill Enhancement Courses.

SEMESTER- I

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-101	Business Communication	CC	3	
CA-102	Principles of Management	CC	3	
CA-103	C Language	CC	3	
CA-104	Database Management System	CC	3	
CA-105	Statistics	CC	3	
CA-106	Computer Laboratory Based on 103 &104 (2 credits each)	PR		4
107	Add-On (PPA) (30 Hours)	SEC	2	

SEMESTER- II

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-201	Organization Behavior & Human Resource Management	CC	3	
CA-202	Financial Accounting	CC	3	
CA-203	Business Mathematics	CC	3	
CA-204	Relational database	CC	3	
CA-205	Web Technology HTML-JS-CSS	CC	3	
CA-206	Computer Laboratory Based on 204 & 205(2 credits each)	PR		4
207	Add-On (Advance C) (30 Hours)	SEC	2	

SEMESTER- III

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-301	Digital Marketing	CC	3	
CA-302	Data Structure	CC	3	
CA-303	Software Engineering	CC	3	
CA-304	Angular JS	EC	3	
OR				
CA-304	PHP	EC	3	
CA-305	Big data	EC	3	
OR				
CA-305	Block chain	EC	3	
CA-306	Computer Laboratory Based on 302 , 304 and 305 (2 credits each)	PR		2+2+2 = 6
307 AECC	Environment Awareness	AECC	2	

SEMESTER- IV

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-401	Networking	CC	3	
CA-402	Object Oriented Concepts Through CPP	CC	3	
CA-403	Operating System	CC	3	
CA-404	**NODE JS**	**EC**	**3**	
OR				
CA-404	**Advance PHP**	**EC**	**3**	
CA-405	Project	EC		4
CA-406	Computer Laboratory Based on 402,404 (2 credits each)	PR		4
4	ADD-On (30 Hours)	SEC	2	

SEMESTER- V

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-501	Cyber Security	CC	3	
CA-502	OOSE	CC	3	
CA-503	Core Java	CC	3	
CA-504	Mongo DB	EC	3	
OR				
CA-504	Python	EC	3	
CA-505	Project	PJ		4
CA-506	Computer Laboratory Based on 503 and 504(2 credits each)	PR		4
5	Add on Course-IOT(30 Hours)		2	

SEMESTER- VI

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-601	Recent Trends in Information Technology(Tutorial/Assignment)	CCT	3+1	
CA-602	Software Testing	CC	3	
CA-603	Advanced Java	CC	3	
CA-604	Android Programming	EC	3	
OR				
CA-604	Dot Net framework	EC	3	
CA-605	Project	PJ		4
CA-606	Computer Laboratory Based on 603 and 604(2 credits each)	PR		4
6	Add on Course-Soft Skills Training		2	

14. Acknowledgement: The focus of BBA CA Programme (CBCS-2019 Pattern) has always been raising the academic standards, excellence and holistic development of students. Hon. Prof.

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-301	Digital Marketing	CC	3	
CA-302	Data Structure	CC	3	
CA-303	Software Engineering	CC	3	
CA-304	Angular JS	EC	3	
OR				
CA-304	PHP	EC	3	
CA-305	Big data	EC	3	
OR				
CA-305	Block chain	EC	3	
CA-306	Computer Laboratory Based on 302 , 304 and 305 (2 credits each)	PR		2+2+2 = 6
307 AECC	Environment Awareness	AECC	2	

SEMESTER- IV

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-401	Networking	CC	3	
CA-402	Object Oriented Concepts Through CPP	CC	3	
CA-403	Operating System	CC	3	
CA-404	**NODE JS**	**EC**	**3**	
OR				
CA-404	**Advance PHP**	**EC**	**3**	
CA-405	Project	EC		4
CA-406	Computer Laboratory Based on 402,404 (2 credits each)	PR		4
4	ADD-On (30 Hours)	SEC	2	

SEMESTER- V

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-501	Cyber Security	CC	3	
CA-502	OOSE	CC	3	
CA-503	Core Java	CC	3	
CA-504	Mongo DB	EC	3	
OR				
CA-504	Python	EC	3	
CA-505	Project	PJ		4
CA-506	Computer Laboratory Based on 503 and 504(2 credits each)	PR		4
5	Add on Course-IOT(30 Hours)		2	

SEMESTER- VI

Subject Code	Subject Name	Course	Credits	
			Th	Pr
CA-601	Recent Trends in Information Technology(Tutorial/Assignment)	CCT	3+1	
CA-602	Software Testing	CC	3	
CA-603	Advanced Java	CC	3	
CA-604	Android Programming	EC	3	
OR				
CA-604	Dot Net framework	EC	3	
CA-605	Project	PJ		4
CA-606	Computer Laboratory Based on 603 and 604(2 credits each)	PR		4
6	Add on Course-Soft Skills Training		2	

14. Acknowledgement: The focus of BBA CA Programme (CBCS-2019 Pattern) has always been raising the academic standards, excellence and holistic development of students. Hon. Prof.

Savitribai Phule Pune University, Pune

B.B.A. (Computer Application)

(Under faculty of Commerce & Management)

(To be implemented from Academic year 2019-20)

Business Communication Skills
Course Code: -- 101
Credit 3

Depth of the syllabus - Reasonable knowledge of the communication

Program objectives

1 To understand what is the role of communication in personal and business world
2. To understand system and communication and their utility
3. To develop proficiency in how to write business letters and other communications in required b

Unit No.	Contents	Lectures
1	**1.Concept of Communication and Introduction to Communication** 1.1 Role of Communication in social and economic system 1.2Need for effective communication 1.3 Meaning and definition 1.4Principles of effective communication 1.5Barriers to communication and over comings	12
2	**Methods and types of Communication** 2.1 Written communication, 2.2 Forms of written communication. 2.3 Qualities ,difficulties in written communication , 2.4 Constraints in developing effective written communication 2.5 Merits and Limitations of written communication 2.6 Listening Written communication, 2.7 Forms of written communication. 2.8 Qualities, difficulties in written communication , 2.9 Constraints in developing effective written communication	12
3.	**Business Correspondence** 3.1 Concept , 3.2 Need and functions of Business .Correspondence , 3.3 Types of Business letters , 3.4 Layout Drafting of business , 3.5 Sales Letter , 3.6 Orders sales circulars and business promotion letters 3.7 written methods& types of communication	12
4.	**Analysis of different Media of Communication** 4.1 Fax communication ,	12

	4.2 Voice mail , 4.3 e-mails , 4.4 Tele conferencing , 4.5 Communication through social media	

References

Sr. No.	Title of the Book	Author/s	Publication
1	Business Communication	Meenakshi Raman , Prakash Singh	Oxford
2	Business Communication	HomaiPradhan , N.S. Pradhan	Himalaya Publishing House
3	Business Communication	R.K. Madhukar	Vikas Publishing House
4	Business Communication and personality Development	BiswajitDas .ipswwtaSatpathy	Excel Books
5	Business Communication – Concepts , Cases and applications	P.D Chaturvedi , MukeshChaturvedi	Dorling Kindersley
6	Business Communication – Connecting at work	HorySankarMukerjee	Oxford
7	Business Communication Today	Courtland L. Bovee , John V. Thill , AbhaChatterjee	Pearson
8	Hand Book of internal Communication	Eileen Scholes	Infinity Books

Principles of Management
Course Code 102
Credit -3

Depth of the course- Reasonable working knowledge

Program Objectives

- To understand basic concept regarding org. Business Administration
- To examining how various management principles
- To develop managerial skills among the students

Unit No.	Contents	Lectures
1	**Nature of management** Meaning , importance , functions ,types Management as an art ,science and social system Universality of concept of management and organization	**12**
2	**Evolution of management thoughts** Concept of managerial thoughts Contribution of Taylor, Mayo and Fayol and Drucker and Indian Management Ethos	**12**
3.	**Major managerial Functions** Planning , need types ,methods , advantages ,merits Forecasting. need types ,methods , advantages ,merits Decision making types process and techniques Directions nature and principles and Motivation –nature, principles and theories Organizing –concept delegation of authorities decentralization concepts and importance	**12**
4.	**Recent trends in Management** Management of change , Mgt of crises ,TQM ,stress management (Principles ,concepts merits)	**12**

References

Sr. No.	Title of the Book	Author/s	Publication
1	Management Concepts and Strategies	J.S. Chandan	Vikas Publishing House Pvt. Ltd.
2	Principles of Management	Harold Koontz , Heinz Weihrich , A. RamachandraArysri	McGraw hill companies
3	Management A Global and Entrepreneurial Perspective	Heinz Weihrich , Mark V. Cannice , Harold Koontz	McGraw hill companies
4	Management – 2008 Edition	Robert Kreitner , MamataMohapatra	Biztantra – Management For Flat World
5	Introduction to Management	John R. Schermerhorn	Wiley India Pvt. Ltd.
6	Principles of Management	P.C. Tripathi , P.N. reddy	McGraw hill companies
7	Management Text and Cases	R. SatyaRaju , A. Parthasarthy	PHI learning Pvt. Ltd
7	Management (Multi-Dimensional Approach)	H. R. Appannaiah , G. Dinakar , H.A. Bhaskara	Himalaya Publishing House

Subject : C-Programming
Course Code-103
Credit-3

Unit No.	Topics	No. of Lectures
1	**Introduction to C language** 1.1 History 1.2 Basic structure of C Programming 1.3 Language fundamentals 1.3.1 Character set, tokens 1.3.2 Keywords and identifiers 1.3.3 Variables and data types 1.4 Operators 1.4.1 Types of operators 1.4.2 Precedence and associativity 1.4.3 Expression	3
2	**Managing I/O operations** 2.1 Console based I/O and related built-in I/O functions 2.1.1 printf(), scanf() 2.1.2 getch(), getchar() 2.2 Formatted input and formatted output	2
3	**Decision Making and looping** 3.1 Introduction 3.2 Decision making structure 3.2.1 If statement 3.2.2 If-else statement 3.2.3 Nested if-else statement 3.2.4 Conditional operator 3.2.5 Switch statement 3.3 Loop control structures 3.3.1 while loop 3.3.2 Do-while loop 3.3.3 For loop 3.3.4 Nested for loop 3.4 Jump statements 3.4.1 break 3.4.2 continue 3.4.3 goto 3.4.4 exit	9
4	**Programs through conditional and looping statements** Addition / Multiplication of integers Determining if a number is +ve / -ve / even / odd Maximum of 2 numbers, 3 numbers Sum of first n numbers, given n numbers Integer division, Digit reversing, Table generation for n, ab Factorial, sine series, cosine series, nCr , Pascal Triangle Prime number, Factors of a number	5

	Other problems such as Perfect number, GCD of 2 numbers etc (Write algorithms and draw flowcharts)	
5	**Arrays and Strings** 5.1 Introduction to one-dimensional Array 5.1.1 Definition 5.1.2 Declaration 5.1.3 Initialization 5.2 Accessing and displaying array elements 5.3 Finding smallest and largest number from array 5.4 Reversing array 5.5 Finding odd/even/prime number from array 5.4 Introduction to two-dimensional Array 5.4.1 Definition 5.4.2 Declaration 5.4.3 Initialization 5.5 Accessing and displaying array elements 5.6 Matrices: Addition, Multiplication, Transpose, Symmetry, upper/lower triangular 5.7 Introductions to Strings 5.7.1 Definition 5.7.2 Declaration 5.7.3 Initialization 5.8 Standard library functions 5.9 Implementations without standard library functions.	12
6	**Functions** 6.1 Introduction 6.1.1 Purpose of function 6.1.2 Function definition 6.1.3 Function declaration 6.1.4 Function call 6.2 Types of functions 6.3 Call by value and call by reference 6.4 Storage classes	9
7	**7 Introduction to pointer** 7.1 Definition 7.2 Declaration 7.3 Initialization 7.4 Indirection operator and address of operator 7.5 Pointer arithmetic 7.6 Dynamic memory allocation 7.7 Functions and pointers	4
8	8 Structures 8.1 Introduction to structure 8.2 Definition 8.3 Declaration 8.4 Accessing members 8.5 structure operations 8.6 nested structure	4

Reference Book :-

1) Let us C –YashwantKanetkar, BPB publication.
2) Ansi C- Balagurusamy
3) The complete Reference- HerbeltSchildt

Subject Name -: Database Management Systems
Course Code: 104
Credit-3

Sr. No.	Chapter No.	Name of Chapter and Contents	No. of Lect.
1	1	File Structure and Organization 1.1 Introduction 1.2 Logical and Physical Files 1.2.1 File 1.2.2 File Structure 1.2.3 Logical and Physical Files Definitions 1.3 Basic File Operations 1.3.1 Opening Files 1.3.2 Closing Files 1.3.3 Reading and Writing 1.3.4 Seeking 1.4 File Organization 1.4.1 Field and Record structure in file 1.4.2 Record Types 1.4.3 Types of file organization 1.4.3.1 Sequential 1.4.3.2 Indexed 1.4.3.3 Hashed 1.5 Indexing 1.5.1 What is an Index? 1.5.2 When to use Indexes? 1.5.3 Types of Index 1.5.3.1 Dense Index 1.5.3.2 Sparse Index	6

2	2	Database Management System 2.1 Introduction 2.2 Basic Concept and Definitions 2.2.1 Data and Information 2.2.2 Data Vs Information 2.2.3 Data Dictionary 2.2.4 Data Item or Field 2.2.5 Record 2.3 Definition of DBMS 2.4 Applications of DBMS 2.5 File processing system Vs DBMS 2.6 Advantages and Disadvantages of DBMS 2.7 Users of DBMS 2.7.1 Database Designers 2.7.2 Application programmer 2.7.3 Sophisticated Users 2.7.4 End Users 2.8 Views of Data 2.9 Data Models	14
		2.9.1 Object Based Logical Model a. Object Oriented Data Model b. Entity Relationship Data Model 2.9.2 Record Base Logical Model a. Relational Model b. Network Model c. Hierarchical Model 2.10 Entity Relationship Diagram(ERD) 2.11 Extended features of ERD 2.12 Overall System structure	

3	3	**Relational Model** 3.1 Introduction 3.2 Terms a. Relation b. Tuple c. Attribute d. Cordinality e. Degree of relationship set f. Domain 3.3 Keys 3.3.1 Super Key 3.3.2 Candidate Key 3.3.3 Primary Key 3.3.4 Foreign Key 3.4 Relational Algebra Operations a. Select b. Project c. Union d. Difference e. Intersection f. Cartesian Product g. Natural Join	8
4	4	**SQL (Structured Query Language)** 4.1 Introduction 4.2 History Of SQL 4.3 Basic Structure 4.4 DDL Commands 4.5 DML Commands 4.6 Simple Queries 4.7 Nested Queries 4.8 Aggregate Functions	12
5	5	**Relational Database Design** 5.1 Introduction 5.2 Anomalies of un normalized database 5.3 Normalization 5.4 Normal Form 5.4.1 1 NF 5.4.2 2 NF 5.4.3 3 NF 5.4.3.4 BCNF	8

Business Statistics
Course code 105
Credit 3

Depth Reasonable working knowledge
Objective of the program
1. To understand role and importance of statistics in various business situations
2. To develop skills related with basic statistical technique
3. Develop right understanding regarding regression, correlation and data interpretation

Unit No.	Contents	Lectures
1	**Concept of statistics.** Role of statistics. In informatics business science Tabulation, Data condensations and tabulation, Data Condensation and graphical Methods :Raw data , attributes and variables , classification , frequency distribution ,cumulative frequency distributions. Graphs - Histogram, Frequency polygon. Diagrams - Multiple bar , Pie ,Subdivided bar.	12
2	**Measures of central tendency and dispersion** Criteria for good measures of central tendency, Arithmetic mean, Median and Mode for grouped and ungrouped data, combined mean.	12
3.	**Measures of Dispersion :** Concept of dispersion , Absolute and relative measure of dispersion, Range, Variance, Standard deviation, Coefficient of variation, Quartile Deviation , Coefficient of Quartile deviation.	12
4	**Correlation and Regression(for ungrouped data)** Concept of correlation, positive & negative correlation, Karl Pearson's Coefficient of correlation, meaning of regression, Two regression equations, Regression coefficients and properties.	12

Savitribai Phule Pune University
FY BBA- CA Semester II (CBCS) Pattern 2019
Organizational Behavior & Human Resource Management
Course code 201
Credit 3

Depth of the course- Basic working knowledge

Program Objectives:

i) To understand basic concept of HRM & OB
ii) To make aware students about traditional & modern methods of procurement & development in organization.
iii) To know the major trends in HRM & OB

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	**Introduction to Organizational Behavior**	Definition, concept, scope, Models of OB, Major trends in OB:-Total Quality management, Cultural diversity, Organizational change, Stress Management: Sources of Stress, Effects of Stress & Stress Management, Work life Balance and Quality of Work Life	To understand the basic concept of OB & To develop knowledge about major trends & ability to handle cultural diversity Stress, change and to maintain work life balance.
2	**Introduction to HRM**	**Introduction to HRM**- Definition, Concepts, scope, importance Functions ,Objectives & limitations, , Role of HR Manager , Areas in which Human Resource Manager can be of assistance	To understand the basic concept of HRM & developing knowledge & ability of the student about HRM.
3	**Procurement**	**HRP**-Concept, Definition, Merits & Demerits, process , influencing factors of HRP **Recruitment**-Concept, Definition, sources of recruitment and their utility in identifying vacancies, methods, E-recruitment, **Selection-** Concepts, definition, process, Types of interviews and frequently asked interview questions from the candidate at each step and how to answer them, E- selection	To understand process & importance of HR procurement and to develop the skills among students regarding awareness of new trends of Recruitment Selection and interview preparation
4	**Training & Development**	**Training & Development-** Concept, definition, importance, Methods, E-Training, Recent trends in Training	To know the training & performance appraisal methods & To develop evaluation skill.

Savitribai Phule Pune University
FY BBA- CA Semester II (CBCS) Pattern 2019
Financial Accounting
Course code 202
Credit 3

Depth of the syllabus: Reasonable working knowledge

Program objectives

i) To develop right understanding regarding role and importance of monetary and financial transactions in business
ii) To cultivate right approach towards classifications of different transactions and their implications
Iii) To develop proficiency preparation of basic financial as to how to write basis accounting statement - Trading and P&L

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	**Financial Accounting-**	definition and Scope, objectives, Accounting concepts, principles and conventions	To understand role and importance of accounting in Business and how accounting concept can be implemented in business Computation ability in business ability to distinguished between various accounting concepts and practices
2	**Accounting Transactions and Final Accounts**	Voucher system; Accounting Process, Journals, Ledger, Cash Book , subsidiary books ,Trial Balance preparation of Final Accounts of Sole Proprietorship(Trading and Profit & Loss Account and Balance Sheet	To understand how to record different financial transactions and their financial implications Ability to write different accounting tractions and prepare basic financial tractions
3.	**Bank Reconciliation Statements**	Meaning, importance and preparation of Bank Reconciliation Statement	To understand the kind of accounting relationship between customer and bank Ability to write necessary set of entries in books of accounts and in cash book and compare them with bank statement to understand their implications and effect

Evaluation Method

Internal Evaluation	External Evaluation
-	-
One project Report : 5 Marks **One assignment : 5 marks** **One Case Study Solution Report : 5 marks** **Internal Examination : 15 marks**	**25% MCQ** **Short notes 35%** **Long answers 40%**
30	**70**

Teaching Methodology

Teaching Hours	Innovative methods to be used	Project	Expected Outcome
10	Lecture ,Interactive teaching & Ice breaking session	Role play on HR Manager	To develop group cohesiveness.
10	Lab activity of Searching links about E-recruitment and E- selection.	Project report	Up gradation of knowledge of new trends in Recruitment and Selection.
12	Guest lecture	Assignment	Up gradation of skill.
13	Case Study , Video clips on Cultural Diversity and Stress management	Case study report	To develop decision making skill.

Savitribai Phule Pune University
FY BBA- CA Semester II (CBCS) Pattern 2019
Financial Accounting
Course code 202
Credit 3

Depth of the syllabus: Reasonable working knowledge

Program objectives

i) To develop right understanding regarding role and importance of monetary and financial transactions in business
ii) To cultivate right approach towards classifications of different transactions and their implications
Iii) To develop proficiency preparation of basic financial as to how to write basis accounting statement - Trading and P&L

Unit No.	Unit Title	Contents	Purpose and Skills to be developed
1	**Financial Accounting-**	definition and Scope, objectives, Accounting concepts, principles and conventions	To understand role and importance of accounting in Business and how accounting concept can be implemented in business Computation ability in business ability to distinguished between various accounting concepts and practices
2	**Accounting Transactions and Final Accounts**	Voucher system; Accounting Process, Journals, Ledger, Cash Book , subsidiary books ,Trial Balance preparation of Final Accounts of Sole Proprietorship(Trading and Profit & Loss Account and Balance Sheet	To understand how to record different financial transactions and their financial implications Ability to write different accounting tractions and prepare basic financial tractions
3.	**Bank Reconciliation Statements**	Meaning, importance and preparation of Bank Reconciliation Statement	To understand the kind of accounting relationship between customer and bank Ability to write necessary set of entries in books of accounts and in cash book and compare them with bank statement to understand their implications and effect

	Computerized Accounting	Role of computers and Financial application, Accounting Software packages	Ability to understand growing importance of software and to know how to use software and to write books of accounts Ability to use software like tally for writing of accounts

Teaching Methodology

Teaching Hours	Innovative methods to be used	AV Applications	Project	Expected Outcome
10	Appling accounting concepts in real life business Ability to distinguish between accounting tractions and real life business	Role of accounting in business	Importance of accounting of business and nonprofit organizations	To learn about importance of acc. In business
15	Using practical situations for writing Transactions And applying accounting concepts different situations	Writing ledger and cash book	Developing model of Journals and model books of accounts Preparing flow chart of accordance of different tractions	Ability to distinguish between different tractions and its nature
11	Interpretation of bank passbook and its statement Comparative analysis-of bank pass book and statement and their interpretation	Lesson on How to write bank reconciliations. Statement from YouTube	Preparing BR. With imaginary data	Ability to prepare and interpret bank reconciliation statement
12	NIL	To Understand how various tractions are recorded while using software and what cautions are need to be taken while recording transactions.	Film on silent features of tally accounting As business software	Appling software basic financial statement and converting row financial data into well written financial data

7

Savitribai Phule Pune University
FY BBA- CA Semester II (CBCS) Pattern 2019
Business Mathematics
Course code 203
Credit 3

Course Depth: Fundamental Knowledge

Objectives:
i) To understand role and importance of Mathematics in various business situations and while developing softwares.
ii) To develop skills related with basic mathematical technique

Unit No.	Topic	No. of Lecture
1	**1. Ratio, Proportion and Percentage:** Ratio – Definition, Continued Ratio, Inverse Ration, Proportion, Continued Proportion, Direct Proportion, Inverse Proportion, Variation, Inverse Variation, Joint Variation, Percentage, computation of Percentage.	8
2	**2. Profit and Loss: -** Terms and Formulae, Trade discount, Cash discount, Problems involving cost price, selling price, Trade discount and cash discount. Introduction to Commission and brokerage, Problems on commission and brokerage	6

3	**3.Interest and Annuity: -** interest, Compound interest, Equated monthly Installments (EMI) by interest of reducing balance and flat interest methods and problems. Ordinary annuity, sinker fund, annuity due, present value and future value of annuity. **Shares and Mutual Funds:-** Shares, face value, market value, dividend, brokerage, equity shares, preferential shares, bonus shares, examples and problems, Concept of Mutual Funds, Change in Net Asset Value (NAV), Systematic Investment Plan (SIP), Examples and Problems.	Simple Concepts of	7 7	
4	**4.Matrices and Determinant: -** Matrices, Types of Matrices, Algebra of Matrices, Determinant, Adjoint of Matrix, Inverse of Matrix, System of Linear equations, Solution of System of Linear Equation by adjoint method (upto 3 variables only).	Definition of	10	
5	**5. Linear Programming Problem (LPP)** LPP, Formulation of LPP and solution of LPP by graphical method. **Transportation Problem (T.P.):-** Concept of Transportation Problem, Initial Basic Feasible Solution, North-West Corner Method (NWCM), Least Cost Method (LCM), Vogal's Approximation Method (VAM).	Concept of	5 5	-
	Total		**48**	

Savitribai Phule Pune University
FY BBA- CA Semester II (CBCS) Pattern 2019
Relational Data Base
Course code 204
Credit 3

Course Depth: Fundamental Knowledge

Objectives:

i) Enables students to understand relational database concepts and transaction management concepts in database system.
ii) Enables student to write PL/SQL- programs that use: procedure, function, package, cursor and trigger.

Unit No.	Unit Title	Contents	Purpose	Expected Outcome
1.	**Introduction To RDBMS**	Introduction to popular RDBMS product and their features	To understand concept of RDBMS & use in business	Understanding of various RDBMS products()
		Difference Between DBMS and RDBMS	To understand advantages of RDBMS over DBMS	Use of relational database
		Relationship among application programs and RDBMS	To understand interface between application programs and data	To get knowledge of Front End and Backend
2.	**PL-SQL**	Overview of PLSQL Data Types ,PLSQL Block	To understand various data types , operators , functions and control statements	Understanding of various programming aspects
		Exception Handling	To understand predefined and user defined exceptions	Learning of different exceptions
		Functions, Procedures	To understand concept of compact program writing by making use of functions and procedure	Writing of compact code (Small program writing)
		Cursor	To understand types of cursors and selective data retrieval	Understanding of exact data retrieval
		Trigger Package	To understand concept of stored	Writing of triggers and

Savitribai Phule Pune University
FY BBA- CA Semester II (CBCS) Pattern 2019
Web Technology (HTML-JSS-CSS)
Course code 205
Credit 3

Course Depth: Fundamental Knowledge

Objectives:

i) To know & understand concepts of internet programming.
ii) To understand how to develop web based applications using JavaScript.

Unit No	Topic	No. of Lecture
1	**1. Introduction** 1.1 Clients- Servers and Communication 1.2 Internet-Basic, Internet Protocols (HTTP, FTP, IP) 1.3 World Wide Web(WWW) 1.4 HTTP request message, HTTP response message	5
2	**2. Web Design** 2.1 Concepts of effective web design 2.2 Web design issues including Browser Bandwidth and Cache 2.3 Display resolution 2.4 Look and Feel of the Website 2.5 Page Layout and linking 2.6 User centric design 2.7 Sitemap 2.8 Planning and publishing website 2.9 Designing effective navigation	9

SPPU/BBA(CA) SYLLABUS SEMESTER-II CBCS/2019 PATTERN

4	**Concurrency Control & Recovery System**	Lock Based Protocol	To understand meaning Locks, Granting of Locks ,Two Phase Locking Protocol	To understand concept of shared and exclusive lock
		Timestamp Based Protocol	To understand Timestamp and timestamp ordering protocol	To learn how to prevent deadlock situation
		Deadlock Handling	To understand dead lock detection, prevention and recovery	Understand what deadlock is and how it can occur when giving mutually exclusive access to multiple resources
		Failure Classification	To understand transaction failure and system crash	To learn concepts related to hardware failures
		Recovery & Atomicity	To understand log based recovery and checkpoint	Data recovery with different techniques
		Recovery with concurrent transaction	To understand concept of transaction rollback	Restoring of data which is changed by mistake

3.	**Transaction Management**	Transaction Concept	To understand effect of transaction process on database	Understanding use of transaction and effect on database
		Transaction Properties	To understand properties like atomicity, consistency, isolation and durability	Application of properties (Case solving)
		Transaction States	To understand various states such as active, partially committed, Failed , aborted, committed	Understanding of various states
		Concurrent Execution	To understand concept of reduction in waiting time	
		Serializability	To understand Conflict Serializability and View Serializability	
			procedure and compiled data	packages(S ial application using all contents)

K. J. Somaiya College, Kopargaon.
Department of Physics
List of Courses addresses crosscutting issues as per **New syllabus (CBCS- 2019 Pattern)**

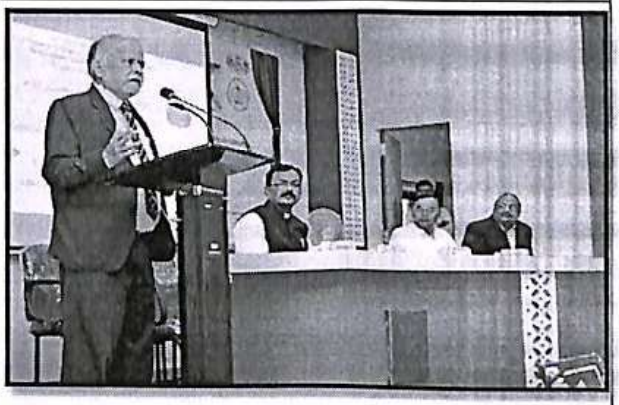
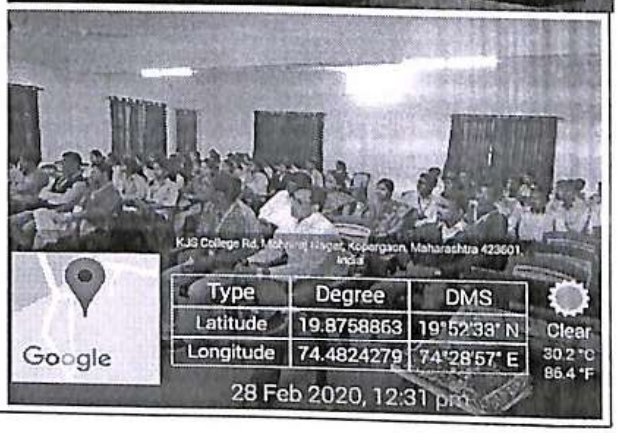
Sr. No.	Programme Name	Course code	Name of Course	Addressed issue (Professional Ethics, Environment and Sustainability)
1	B. Sc. Physics	PHY-111	Mechanics and Properties of Matter	Professional Ethics
2	B. Sc. Physics	PHY-112	Physics Principles and Applications	Professional Ethics
3	B. Sc. Physics	PHY-113	Physics Laboratory-1A	Professional Ethics
4	B. Sc. Physics	PHY-121	Heat and Thermodynamics	Professional Ethics
5	B. Sc. Physics	PHY-122	Electricity and Magnetism	Professional Ethics
6	B. Sc. Physics	PHY-123	Physics Laboratory-1B	Professional Ethics
7	B. Sc. Physics	PHY-231	Mathematical Methods in Physics-I	Professional Ethics
8	B. Sc. Physics	PHY-232	Electronics-I	Professional & Industrial Ethics
9	B. Sc. Physics	PHY-233	Physics Laboratory-2A	Professional Ethics
10	B. Sc. Physics	PHY-2310	Environment -I	Environment and Sustainability
11	B. Sc. Physics	PHY-241	Oscillations, Waves and Sound	Professional Ethics
12	B. Sc. Physics	PHY-242	Optics	Professional Ethics
13	B. Sc. Physics	PHY-243	Physics Laboratory-2B	Professional Ethics
14	B. Sc. Physics	PHY-2410	Environment -II	Environment and Sustainability
15	B. Sc. Physics	PHY-351	Mathematical Methods in Physics-II	Professional Ethics
16	B. Sc. Physics	PHY-352	Electrodynamics	Professional Ethics
17	B. Sc. Physics	PHY-353	Classical Mechanics	Professional Ethics
18	B. Sc. Physics	PHY-354	Atomic and Molecular Physics	Professional Ethics
19	B. Sc. Physics	PHY-355	Computational Physics	Professional Ethics
20	B. Sc. Physics	PHY-366(R)	Renewable Energy Sources-I	Environment and Sustainability
21	B. Sc. Physics	PHY-367	Physics Laboratory-3A	Professional Ethics
22	B. Sc. Physics	PHY-368	Physics Laboratory-3B	Professional & Industrial Ethics
23	B. Sc. Physics	PHY-369	Project-I	Professional & Industrial Ethics
24	B. Sc. Physics	PHY-3610(V)	Sensors and Transducer	Professional & Industrial Ethics
25	B. Sc. Physics	PHY-3611(AA)	Physics Workshop Skill	Professional & Industrial Ethics
26	B. Sc. Physics	PHY-361	Solid State Physics	Professional Ethics
27	B. Sc. Physics	PHY-362	Quantum Mechanics	Professional Ethics
28	B. Sc. Physics	PHY-363	Thermodynamics and Statistical Physics	Professional Ethics

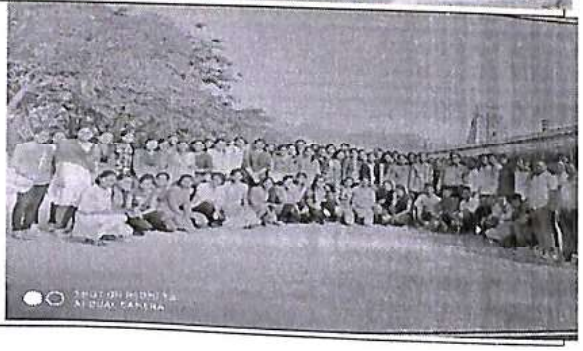
29	B. Sc. Physics	PHY-364	Nuclear Physics	Professional Ethics
30	B. Sc. Physics	PHY-365	Electronics-II	Professional & Industrial Ethics
31	B. Sc. Physics	PHY-356(D)	Laser	Professional & Industrial Ethics
32	B. Sc. Physics	PHY-357	Physics Laboratory-4A	Professional Ethics
33	B. Sc. Physics	PHY-358	Physics Laboratory-4B	Professional & Industrial Ethics
34	B. Sc. Physics	PHY-359	Project-II	Professional & Industrial Ethics
35	B. Sc. Physics	PHY-3510(J)	Solar PV System: Installation, Repairing and Maintenance	Professional Ethics
36	B. Sc. Physics	PHY-3511(K)	Radiation Physics	Professional Ethics
37	M. Sc. Physics	PHCT-111	Mathematical Methods in Physics	Professional Ethics
38	M. Sc. Physics	PHCT-112	Classical Mechanics	Professional Ethics
39	M. Sc. Physics	PHCT-113	Electronics	Professional Ethics
40	M. Sc. Physics	PHOT-114	Laser & Application	Professional & Industrial Ethics
41	M. Sc. Physics	PHOP-114	Laser & Application Practicals	Professional & Industrial Ethics
42	M. Sc. Physics	PHCP-115	Physics Laboratory – I (Electronics)	Professional & Industrial Ethics
43	M. Sc. Physics	PHCT-121	Electrodynamics	Professional Ethics
44	M. Sc. Physics	PHCT-122	Atoms and Molecules	Professional Ethics
45	M. Sc. Physics	PHCT-123	Quantum Mechanics	Professional Ethics
46	M. Sc. Physics	PHOT-124	Physics of Nano Materials	Professional Ethics
47	M. Sc. Physics	PHCP-125	Physics Laboratory - II	Professional Ethics
48	M. Sc. Physics	PHCT-231	Statistical Mechanics	Professional Ethics
49	M. Sc. Physics	PHCT-232	Solid State Physics	Professional Ethics
50	M. Sc. Physics	PHCT-233	Experimental Techniques in Physics - I	Professional & Industrial Ethics
51	M. Sc. Physics	PHOT-234	Energy Studies – I	Environment and Sustainability
52	M. Sc. Physics	PHCP-235	Physics Laboratory - III	Professional Ethics
53	M. Sc. Physics	PHCT-241	Nuclear Physics	Professional Ethics
54	M. Sc. Physics	PHCT-242	Experimental Techniques in Physics -II	Professional & Industrial Ethics
55	M. Sc. Physics	PHOT-243	Physics of Semiconductor Devices	Professional Ethics
56	M. Sc. Physics	PHOT-244	Energy Studies – II	Environment and Sustainability
57	M. Sc. Physics	PHCP-245	Project	Professional & Industrial Ethics

List of Add-on/Value Added/ **Certificate Courses:**

Sr. No.	Department	Name of Certificate Course	Course Code	Year of Introducing	Addressed issue (Professional Ethics)
1	Physics	'C'-Programming Language	CC.009	2018-19	Professional Ethics

List Showing Curricular and Extra Curricular activities to address Crosscutting Issues (Similar/repeated activities are not listed).

Sr. No.	Name of Activity and Date of Implementation	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)	Representative Photograph
1.	Department of Physics Organized Two-Days National Conference on on **"Renewable Energy & Environment"** on **19th & 20th January 2018.**	Environment and Sustainability	
2.	Department of Physics celebrated the 'National Science Day' on 28th February 2020. On this occasion Dr. B. D. Gavhane delivered a lecture for science stream students on the topic 'Current innovations in science and technology'	Professional Ethics, Human Values	 

3.	Guest lecture of Dr. V. D. Bharud, Department of Physics, M. J. College, Jalgaon on 15th Sep.2019 on the topic 'Carrier Guidance	Professional Ethics	
4.	Department of Physics Organized Workshop on on **"Intellectual Property Right"** on **26th February 2020**	Professional Ethics	
5.	Department of Physics Organized **One Day State Level Workshop on "Green Power and its Applications". Monday, 6th June2022.**	Professional, Environment and Sustainability	
6.	Department of Physics organized two days educational tour at Konkan Darshan: Aakvira Devi-Karle-Leni- Diveaagar-Janjira Fort on 5-6th May 2022. Thirty two students of department participated in this tour.	Professional Ethics, Gender, Human Values, Environment and Sustainability	 
7.	Department of Physics organized two days educational tour at Panchgani-Mahabaleshwar on 27-28th Jan. 2020. Thirty nine students of department participated in this tour.	Professional Ethics, Gender, Human Values, Environment and Sustainability	

Title of the Course: B.Sc. (Physics)

Preamble:

The curriculum for the B. Sc. (Physics) programme is designed to cater to the requirement of Choice Based Credit System following the University Grants Commission (UGC) guidelines. In the proposed structure, due consideration is given to Core and Elective Courses (Discipline specific - Physics), along with Ability Enhancement (Compulsory and Skill based) Courses. Furthermore, continuous assessment is an integral part of the CBCS, which will facilitate systematic and thorough learning towards better understanding of the subject. The systematic and planned curricula from first year to the third year (comprised of six semesters) shall motivate the student for pursuing higher studies in Physics and inculcate enough skills for becoming an entrepreneur.

Objectives:

- To foster scientific attitude, provide in-depth knowledge of scientific and technological concepts of Physics.
- To enrich knowledge through problem solving, minor/major projects, seminars, tutorials, review of research articles/papers, participation in scientific events, study visits, etc.
- To familiarize with recent scientific and technological developments.
- To create foundation for research and development in Physics.
- To help students to learn various experimental and computational tools thereby developing analytical abilities to address real world problems.
- To train studentsin skills related to research, education, industry, and market.
- To help students to build-up a progressive and successful career in Physics.

SEMISTER-I

Course code and title: PHY-111 Mechanics and Properties of Matter

Lectures: 36 **(Credits-02)**

1. Motion: **(9 Lectures)**

Introduction to motion, Types of motion, Displacement, Velocity, Acceleration, Inertia, Newton's laws of motion with their explanations, Various types of forces in nature, Frames of reference (Inertial and Non inertial), Laws of motion and it's real life applications, Problems.

2. Work and Energy: **(7 Lectures)**

Kinetic energy, Work Energy Theorem, Work done with constant force, Work done with varying force (spring force), Conservative and Non conservative forces, Potential energy, Law of energy conservation, Gravitational potential energy, Problems.

3. Fluid Mechanics: **(8 Lectures)**

Concept of viscous force and viscosity, Coefficient of viscosity, Steady and Turbulent flow, Reynolds number, Equation of continuity, Bernoulli's Principle, Applications of Bernoulli's Principle (Ventury Meter, PitotTube), Applications of viscous fluids, Problems.

4. Properties of Matter: **(12 Lectures)**

Surface tension, Angle of contact, Factors affecting surface tension, Jaeger's method for determination of surface tension, Applications of surface tension.

Stress and Strain, Hook's law and Coefficient of elasticity, Young's modulus, Bulk modulus, Modulus of rigidity, Work done during longitudinal strain, Volume strain, Shearing strain, Poisson's ratio, Relation between three elastic moduli, (Y, η, K), Applications of elasticity, Problems.

Reference Books

1. Physics: Resnick, Halliday& Walker 9/e, Wiley.
2. University Physics : Sears and Zeemansky, XIth/XIIth Edition, Pearson Education.
3. Mechanics: D. S. Mathur, S. Chand and Company, New Delhi.
4. Elements of Properties of Matter : D. S. Mathur, S. Chand, New Delhi.
5. Concepts of Physics: H. C. Verma, BharatiBhavan Publisher.
6. Problems in Physics: P. K. Srivastava, Wiley Eastern Ltd.
7. Applied Fluid Mechanics: Mott Robert, Pearson Benjamin Cummir VI Edition. Pearson Education/Prentice Hall International, New Delhi.
8. Fundamentals of Mechanics: J C Upadhyaya, Himalaya Publishing House.
9. Mechanics: D. S. Mathur, Revised by P. S. Hemne, S. Chand and Company, New Delhi.
10.

Course code and title: PHY-112 Physics Principles and Applications

Lectures: 36 **(Credits-02)**

Learning Outcomes:

On successful completion of this course students will be able to do the following:

1. To understand the general structure of atom, spectrum of hydrogen atom.
2. To understand the atomic excitation and LASER principles.
3. To understand the bonding mechanism and its different types.
4. To demonstrate an understanding of electromagnetic waves and its spectrum.
5. Understand the types and sources of electromagnetic waves and applications.
6. To demonstrate quantitative problem solving skills in all the topics covered.

1. Physics of Atoms **(08-Lectures)**

1.1 Introduction to Atom
1.2 Atomic Models:
- 1.2.1 Thomson's Atomic Model
- 1.2.2 Rutherford's Atomic Model
- 1.2.3 Bohr's Atomic Model

1.3 Atomic Spectra:
- 1.3.1 Emission line Spectrum
- 1.3.2 Absorption line spectrum
- 1.3.3 Uses of Atomic Spectra

1.4 Classical planetary model of Hydrogen Atom
1.5 The Bohr Theory of the Hydrogen Atom
1.6 The Hydrogen Spectrum
1.7 Frank-Hertz experiment
Problems

2. LASERS and Its Applications **(07-Lectures)**

2.1 Introduction to LASERS
2.2 Basic Principle of Lasers: Three Processes
2.3 Characteristics of Lasers: brief explanation
2.4 Boltzmann Distribution Law
2.5 Population Inversion and Pumping
2.6 Types of Lasers:
- 2.5.1 He-Ne Laser
- 2.5.2 Ruby Laser

2.7 Applications of Lasers
Problems

3. Physics of Molecules **(08-Lectures)**

3.1 Introduction to Bonding Mechanisms
3.2 Forces between Atoms
3.3 Types of Bonding:
- 3.3.1 Ionic Bonds
- 3.3.2 Covalent Bonds
- 3.3.3 van der Waal's Bonds
- 3.3.4 Hydrogen Bond
- 3.3.5 Metallic Bond

3.4 Rotation energy levels of a diatomic molecule
3.5 Vibration energy levels of a diatomic molecule
Problems

Course code and title: PHY-113 Physics Laboratory 1A

Practical: 10 (Credits-1.5)

Section I- Mechanics and Properties of Matter

Sr. No	Title of the experiment
1	Study and use of various measuring Instruments. 1. Vernier caliper 2. Micrometer Screw Gauge 3. Travelling Microscope
2	Study of Modulus of Rigidity of wire using Torsional Oscillations
3	Determination of coefficient of Viscosity by Poiseuille's method
4	Determination of "Y" and "η" by flat spiral spring
5	Determination of "Y" by bending method.
6	Study of surface tension by Jaeger's method
7	Study of Poisson's ratio of rubber using rubber tube /rubber chord
8	Study of surface tension of liquid using Fergusson Method

Section II-Physics Principles and Applications

Sr. No	Title of the experiment
1	Study of Spectrometer and determination of angle of prism
2	Study of Spectrometer calibration and determination of refractive indices of different colors
3	Study of divergence of LASER beam
4	Study of total internal reflection using LASER
5	Determination of Plank's constant
6	Determination of wavelength of LASER light by plane diffraction grating
7	Study of I-V characteristics of solar cell

Note: Any four experiments from each section be conducted during the semester, with a total of 10 experiments.

SEMISTER-II

Course code and title: PHY-121 Heat and Thermodynamics

Lectures: 36 **(Credits-02)**

1. Fundamentals of Thermodynamics **(10 Lectures)**

Concept of thermodynamic state, Equation of state, Van der Waal's equation of state, Thermal equilibrium, Zeroth law of thermodynamics, Thermodynamic processes: Adiabatic, Isothermal, Isobaric and Isochoric changes, Indicator diagram, Work done during isothermal change, Adiabatic relations, Work done during adiabatic change, Internal energy, Internal energy as state function, First law of thermodynamics, Reversible and Irreversible changes, Problems.

2. Applied Thermodynamics: **(9 Lectures)**

Conversion of heat into work and it's converse, Second law of thermodynamics, Concept of entropy, Temperature - entropy diagram, T-dS equations, Clausius - Clapeyron latent heat equations, Problems.

3. Heat Transfer Mechanisms **(9 Lectures)**

Carnot's cycle and Carnot's heat engine and its efficiency, Heat Engines: Otto cycle & its efficiency, Diesel cycle & its efficiency, Refrigerators: General principle and coefficient of performance of refrigerator, Simple structure of Vapour compression refrigerator, Air Conditioning: Principle and it's applications, Problems.

4. Thermometry: **(8 Lectures)**

Concept of heat & temperature, Principle of thermometry, Temperature scales & inter-conversions, Principle, Construction and Working: (Liquid thermometers, Liquid filled thermometers, Gas filled thermometers, Bimetallic thermometers, Platinum resistance thermometer, Thermocouple), Problems.

Reference Books:

1. Concept of Physics: H. C. Verma, BharatiBhavan Publisher.
2. Heat and Thermodynamics: Brijlal, N. Subrahmanyam, S. Chand and Company Ltd.
3. Heat and Thermodynamics: Mark W. Zemansky, Richard H. Dittman, 7th Edition, Mc-Graw Hill International Edition.
4. Thermodynamics and Statistical Physics: J. K. Sharma, K. K. Sarkar, Himalaya Publishing House.
5. Thermal Physics (Heat and Thermodynamics): A. B. Gupta, H. P. Roy books and Allied (P) Ltd. Calcutta.
6. Instrumentation:Devices & Systems, Rangan, Mani, and Sarma.

Course code and title: PHY-122 Electricity and Magnetism

Lectures: 36 **(Credits-02)**

Learning Outcomes:

On successful completion of this course students will be able to do the following:

1) To understand the concept of the electric force, electric field and electric potential for stationary charges.
2) Able to calculate electrostatic field and potential of charge distributions using Coulomb's law and Gauss's law.
3) To understand the dielectric phenomenon and effect of electric field on dielectric.
4) To Study magnetic field for steady currents using Biot-Savart and Ampere's Circuital laws.
5) To study magnetic materials and its properties.
6) Demonstrate quantitative problem solving skills in all the topics covered.

1. Electrostatics **(08-Lectures)**

1.1 Revision of Coulomb's law:
- 1.1.1 Statement
- 1.1.2 Variation of forces with distances

1.2 Superposition principle:
- 1.2.1 Statement
- 1.2.2 Explanation with illustration

1.3 Energy of system of charges
1.4 Concept of electric field
- 1.4.1 Due to point charge
- 1.4.2 Due to group charges

1.5 Concept of electric flex
1.6 Gauss's law in electrostatics
Problems

2. Dielectrics **(08-Lectures)**

2.1 Introduction to dielectric materials
2.2 Electric Dipole
- 2.2.1 Electric dipole
- 2.2.2 Dipole moment

2.3 Electric potential and intensity at any point due to dipole
2.4 Torque on a dipole placed in an electric field
2.5 Polar and non-polar molecules
2.6 Electric polarization of dielectric material
2.7 Gauss' law in dielectric
2.8 Electric vectors and its relation
Problems

3. Magnetization **(07-Lectures)**

3.1 Introduction to Magnetization
3.2 Magnetic materials
3.3 Types of Magnetic Materials
- 3.3.1 Diamagnetic materials
- 3.3.2 Paramgnetic materials
- 3.3.3 Ferromagnetic materials
- 3.3.4 Antiferromagnetic materials

Course code and title: PHY-123 Physics Laboratory 1B

Practical: 08 **(Credits-1.5)**

Section I- Heat and Thermodynamics

Sr No	Title of the experiment
1	Interpretation of Isothermal and Adiabatic curve on P-V diagram and theoretical study of Carnot's cycle by drawing graphs of Isothermal and Adiabatic curves
2	Study of temperature coefficient of Thermistor.
3	Study of Thermocouple and determination of inversion temperature
4	Study of thermal conductivity by Lee's method
5	Study of specific heat of Graphite
6	Study of Solar constant
7	Determination of calorific values of different fuels

Section II- Electricity and Magnetism

Sr No	Title of the experiment
1	Study of charging and discharging of capacitor
2	Study of LR circuit
3	Study of LCR circuit
4	Study of Kirchhoff's Laws
5	Study of Diode characteristics
6	Study of Voltmeter, Ammeter and Multimeter (AC, DC, ranges and least count)
7	Determination of frequency of AC mains
8	Comparison of capacitor using DeSauty's method

Note: Any four experiments from each section be conducted during the semester.

Faculty of Science and Technology

M. Sc. (Physics)

Choice Based Credit System (CBCS)

To be implemented from Academic Year 2020-2021

Structure and Syllabus

SAVITRIBAI PHULE PUNE UNIVERSITY
GANESHKHIND, PUNE-411007

Proposed Structure of M. Sc. (Physics) Syllabus (C. B. C. S.)

1. Title of the Course: M. Sc. Physics

2. Preamble:

The curriculum for the M. Sc. (Physics) programme is designed to cater to the requirement of Choice Based Credit System following the University Grants Commission (UGC) guidelines. In the proposed structure, due consideration is given to Core and Elective Courses (Discipline specific - Physics), along with Ability Enhancement (Compulsory and Skill based) Courses. Furthermore, continuous assessment is an integral part of the CBCS, which will facilitate systematic and thorough learning towards better understanding of the subject. The systematic and planned curricula divided into two years (comprised of four semesters) shall motivate the student for pursuing higher studies in Physics and inculcate enough skills for becoming an entrepreneur.

Objectives:

- To foster scientific attitude, provide in-depth knowledge of scientific and technological concepts of Physics.
- To enrich knowledge through problem solving, minor/major projects, seminars, tutorials, review of research articles/papers, participation in scientific events, study visits, etc.
- To familiarize with recent scientific and technological developments.
- To create foundation for research and development in Physics.
- To help students to learn various experimental and computational tools thereby developing analytical abilities to address real world problems.
- To train students in skills related to research, education, industry and market.
- To help students to build-up a progressive and successful career in Physics.

Detailed Syllabi:

Course Code and Title: PHCT-111 Mathematical Methods in Physics

Module 1: Complex Analysis **Credit-1**

Complex number, Complex function (polynomial, Exponential, Trigonometric complex function, Logarithm), Limit and Continuity, differentiation, Analytical function, Cauchy-Riemann condition, Line integrals, Cauchy integral formula, Derivative of analytical functions, Power Series, Taylor's theorem, Laurent's theorem, Calculus of residues, Evaluation of real definite integrals

References: 1-5

Module 2: Vector Space and Matrix Algebra **Credit-1**

Revision on Vector space: Vectors (dependent and independent), Vector space, Hilbert space, Dimension of vector space, Matrix representation, Similarity transformation, Eigen values and Eigen vectors, Inner product, Orthogonality, Introduction only to Gramm-Schmidt orthogonalization procedure, Self adjoint and unitary transformation, Eigen values and Eigen vectors of Hermitian and Unitary transformation, Diagonalization

References: 6, 7

Module 3: Special Functions **Credit-1**

Bessel function, Legendre, Hermite, and Laguerre functions – Generating function, Recurrence relations and their differential equations, Orthogonality properties, Bessel's function of first kind, Spherical, Associated Legendre function, Spherical harmonics

References: 4, 5, 7

Module 4: Fourier Series and Integral Transforms **Credit-1**

Fourier series: Definition, Dirichlet's Condition, Convergence, Fourier Integral and Fourier transform, convolution theorem, Parseval's identity, Application to the solution of differential equations, Laplace transform and its properties, Fourier transform and Laplace transform of Dirac Delta function

References: 3, 4, 7

Reference Books:

1. Complex Variables and Application- J. W. Brown, R. V. Churchill - McGraw Hill
2. Complex Variables – Seymour Lipschutz
3. Mathematics for Physical Sciences – Mary Boas, John Wiley and Sons
4. Mathematical methods in Physics- B. D. Gupta
5. Mathematical methods in Physics- Satyaprakash
6. Linear algebra – Seymour Lipschutz, Schaum Outline Series McGraw Hill Edition
7. Mathematical Method for Physicists, Arfken and Weber, 6th Edition, Academic Press, N. Y.

Course Code and Title: PHCT-112 Classical Mechanics

Module 1: Analytical Dynamics (Lagrangian and Hamiltonian Dynamics, Canonical Transformations and Poisson Brackets) **Credit-2**

Variational principle and its applications to problems like shortest distance, brachistochrone, geodesics etc. Lagrangian and Hamiltonian equations of motion - derivation using Hamilton's principle of least action and their applications to various problems. Hamiltonian for a charged particle. Properties of kinetic energy function. Time-dependence of total energy (theorem on total energy). Symmetry and conservation laws (energy and momentum). Gauge function for Lagrangian. Invariance under Galilean transformation.

Canonical transformations and their applications. Canonical transformations of the free particle Hamiltonian. Liouville's theroem. Area conservation properties of canonical flows. Poisson Brackets. Jacobi-Poisson theorem on Poisson Brackets. Invariance of Poisson brackets under canonical transformations. Dirac's formulation of generalized Hamiltonian.

Module 2: Central Forces and Non-inertial Frames of Reference **Credit-1**

Lagragian formulation of motion under central forces. Kepler problem. Stability of orbits. Motion of satellites. Rotating frames of reference. Coriolis force, banking of rivers, Foucault's pendulum, and tides.

Module 3: Rigid Body Dynamics and Small Oscillations **Credit-1**

Moment of inertia tensor. Euler angles. Euler equation of motion for rigid body motion. Symmetric top. Small oscillations. System of couple oscillators. Normal modes and normal coordinates.

Reference Books:

1. Classical Mechanics by H. Goldstein, C. Poole and J. Safko
2. Classical Mechanics by N. C. Rana and P.S. Joag
3. Mechanics by L. D. Landau and E.M. Lifshitz
4. Classical Mechanics by J.R. Taylor
5. Classical Mechanics by P.V. Panat
6. Classical Mechanics by Y.R. Waghmare

Course Code and Title: PHCT-113 Electronics

Module 1: Semiconductor Devices and its Applications **Credit-1**

1.1 SCR: Construction, working, Characteristics and applications as half wave and full wave rectifier

1.2 DIAC and TRIAC: Construction, working, characteristics and applications as fan regulator

1.3 DC-DC converter and SMPS: Concept and applications

(Ref. 1: page nos. 166 to 194 and Ref. 2, 3)

Module 2: Special Function ICs and their Applications **Credit-1**

2.1 Operational Amplifier: Function generator using two OPAMPS with variable controls, Astable and Monostable multivibrators using OPAMPs, Precision rectifiers (Half wave and Full wave), Instrumentation amplifier

2.2 Timer IC 555: Applications as PAM, PWM, FM and FSK generator

2.3 Voltage Controlled Oscillator (IC566): Block diagram and working

2.4 Phase Locked Loop (IC565): Block diagram and working and applications as FM detector, FSK detector, Frequency multiplier and Frequency Translator (Ref. 4, 5, and 6)

Module 3: Digital Logic Circuits I: Combinational Logic **Credit-1**

Review ofBoolean identities and its use to minimize Boolean expressions.Use of Karanaugh Map to design 4-variable logic circuits like BCD to 7-segment decoder, Binary-to-Gray and Gray-to-Binary code converter.

Digital Logic Circuits II: Sequential Logic

4-bit serial, parallel and combinational counter.Study of IC 7490 with applications as MOD counters (01 to 99)Study of IC 7495 and its use as SISO, SIPO, PIPO and PISO.UP-DOWN counters, Ring counter and their applications. (Ref.: 7, 8, and 9)

Credit-1

Module 4: Data Converters

4.1 Digital to Analog converters: Binary weighted and R-2R ladder type with practical circuit (Using Input switches, Level amplifiers, Control gates and Buffer amplifier)

4.2 Analog to Digital converters: Single slope, Dual slope, Flash (Simultaneous) type, Counter ramp type, Continuous type and Successive approximation type (Ref.: 7, 8, and 9)

Reference Books:

1. Power Electronics Circuits, Devices and Applications, 3rd Edition by Muhammad H. Rashid, Pearsons Publications
2. Electronic Devices and Circuits: An Introduction by Allen Mottershed
3. Solid State Electronic Devices, 6th Edition, by Ben G. Streetman
4. Operational Amplifiers, 5th Edition by G.B. Clayton
5. Linear Integrated Circuits, 4th edition by Roy Choudhari
6. Design with OPAMPS and Analog Integrated Circuits by Sergio Franco
7. Digital Electronics by R.P. Jain
8. Digital Principles and Applications by Leach and Malvino
9. Digital Electronics: An Introduction to Theory and Practice by W.H. Gothmann

Course Code and Title: PHCP-115 Physics Laboratory-I (Electronics)

(4 Credits)

Student has to perform Any **12 Experiments**

1. Diode Pump Staircase generator using UJT
2. Foldback Power Supply
3. Crystal Oscillator & Digital Clock
4. Voltage Control Oscillator using IC-566
5. Function generator using IC -8038
6. Optocoupler using OPAMPs and IC MCT-2E
7. Constant current Source using OP-AMP
8. DAC (Digital to Analogue Converter) using R-2R and Binary ladder
9. Active filters using OP-AMP / IC- 8038(L-P, H-P. Notch type)
10. Study of Multiplexer and Demultiplexer
11. Precision rectifier
12. Design, built and test oscillator – LC oscillator
13. 8-bit ADC
14. PLL application using IC565
15. OPAMP : logarithmic amplifier
16. Voltage to Frequency / Frequency to voltage converter using OP-AMP
17. Study of errors in electrical measurement and results due to loading
18. To determine the transition capacitance of a varactor diode and use it as a variable capacitor (Pg. 28, Experiments in Electronics, S.V. Subramanian, McMillan India Limited, 1982)
19. Measurement of efficiency of a power amplifier (IC 810) and study of its frequency response.(Pg. 118, Experiments in Electronics, S.V. Subramanian, McMillan India Limited, 1982)
20. Study of noise performance of an amplifier (Pg. 449, Art of Electronics, Horowitz and Hill, Cambridge, University Press, Low Price Edition, 1995.)
21. Fourier analysis (Pg. 18, Experiments in Electronics, S.V. Subramanian, McMillan India Limited, 1982)

Reference Books:

1. Signetic Manual
2. Power Supplies: B.S. Sonde
3. Digital Principles: Malvino (6th Edition, Tata McGraw Hill Publication Co. Ltd. Delhi)
4. Operational Amplifier: G.B. Clayton
5. OP-AMPS and Linear Integrated Circuits: Ramakant Gaikwad
6. Data Converters: B.S. Sonde, Tata Mc-Graw Hill Pub. Co. Ltd. (1974)
7. Pulse, Digital and Switching Circuits: Miliman and Taub
8. Electronic Integrated Circuits and Systems: Franklin, C. Fitchen (Van No strand Reinhold Company)
9. Digital Principles and Applications: Leach and Malvino, Tata Mc-Graw Hill Pub. Co. Ltd. N. Delhi (5^{th} Edition, 2002)

Course Code and Title: PHCT-121 Electrodynamics

Module 1: Multipole Expansions and Time Varying Fields 1 credit

Multipole expansions for a localized charge distribution in free space, linear quadrapole potential and field, static electric and magnetic fields in material media, boundary conditions, Time dependent fields, Faraday's law for stationary and moving media, Maxwell's displacement current, differential and integral forms of Maxwell's equations, Maxwell's equations for moving medium

(Ref: 1-4, 10)

Module 2: Energy, Force, Momentum Relations and Electromagnetic Wave Equations 1 credit

Energy relations in quasi-stationary current systems, Magnetic interaction between two current loops, Energy stored in electric and magnetic fields, Poynting's theorem, General expression for electromagnetic energy, Electromagnetic wave equations, Electromagnetic plane waves in stationary medium, Reflection and refraction of electromagnetic waves at plane boundaries (Oblique incidence), Electromagnetic waves in conducting medium, Skin effect and skin depth

(Ref: 1-6, 8, 10)

Module 3: Inhomogeneous Wave Equations 1 credit

Inhomogeneous wave equations, Lorentz's and Coulomb's gauges, Gauge transformations, Wave equations in terms of electromagnetic potentials, D'Alembertian operator, Hertz potential and its use in computation of radiation fields (Ref: 1, 2, 4, 5, 8, 10)

Module 4: Relativistic Mechanics and Covariance 1 credit

Experimental basis for special theory of relativity (Michelson – Morley experiment), Lorentz transformations, Relativistic velocity addition, Minkowski's space time diagram, Four vector potential, electromagnetic field tensor, Lorentz force on a charged particle. (Ref: 1-3, 6, 9, 10)

Reference Books:

1. Introduction to Electrodynamics, (3rd Edition) by David J. Griffith, Publication: Prentice-Hall of India, New Delhi
2. Introduction to Electrodynamics, by A.Z. Capri and P.V. Panat, Narosa Publishing House
3. Classical Electricity and Magnetism, by Panofsky and Phillips, Addison Wesley
4. Foundations of Electromagnetic Theory by Reitz and Milford, World Student Series Edition
5. Classical Electrodynamics, by J.D. Jackson, 3rd Edition John Wiley
6. Electromagnetic Theory and Electrodynamics, by Satya Prakash, Kedar Nath and Co. Meerut
7. Special Theory of Relativity, by Robert Resnick
8. Electromagnetics by B.B. Laud, Willey Eastern
9. Matrices and Tensors in Physics, A.W. Joshi, 3rd Edition, New Age International
10. Electrodynamics by Kumar Gupta and Singh

Course Code and Title: PHCT-122 Atoms and Molecules

1 credit

Module 1: Atoms

(a) Revision of Atomic models, Revision of Hydrogen atom, Revision of quantum numbers, exclusion principle, electron configuration, Hund's rule
(b) origin of spectral lines, selection rules, One electron spectra, Coupling schemes, two electron spectra, fine structure and hyperfine structure, The Hartree Theory, Results of Hartree theory, X-ray line
(c) Atoms in Electromagnetic field: Zeeman effect- Normal and Anomalous, Paschen- Back effect, Stark effect (weak field)

1 credit

Module 2: Molecules

Bonding mechanism in molecules, Molecular orbital methods, Valence band method, Molecular Spectra – Rotational and vibrational spectra for diatomic molecules, Electronics spectra of diatomic molecules, vibration course structure, vibrational analysis of band system, Frank – Condon principle, Dissociation energy and dissociation products, rotational fine structure of electronic vibration transitions, electronic angular momentum in diatomic molecules.

1 credit

Module 3: Spectroscopic Techniques

(a) Microwave Spectroscopy: microwave spectrometer, information derived from rotational spectra and analysis of microwave absorption by H2O
(b) Infrared spectroscopy: IR spectrophotometer and instrumentation, sample handling techniques, FTIR spectroscopy and analysis of HCl spectrum, Applications
(c) Raman spectroscopy: Theory of Raman scattering, Rotational Raman spectra, Mutual exclusion, Raman spectrometer, sample handling techniques, Fourier transform Raman spectrometer, Structure determination using IR and Raman spectroscopy (diamond), Applications

1 credit

Module 4: Resonance spectroscopy

(a)ESR- Principles of ESR, ESR spectrometer, total Hamiltonian, hyperfine structure.
(b)NMR-Magnetic properties of nucleus, resonance condition, NMR instrumentation, relaxation process, chemical shift, applications of NMR.

Reference Books:

1. Fundamentals of Molecular spectroscopy. Collin N. Banwell and Elaine M. McCash
2. Molecular structure and Spectroscopy G. Aruldhas
3. Quantum Physics – Robert Eiesberg and Robert Resnik

Course Code and Title: PHCT-123 Quantum Mechanics

Module 1: Revision and General Formalism — 1 Credit

Inadequacy of classical Physics, wave packets and uncertainity relations, Schrodinger wave equation and probability interpretation, Simple one dimensional problems wells, barriers and harmonic oscillator (One dimension)

Postulates of Quantum Mechanics

Representation of states and dynamical variables, observables, self adjoint operators, eigen functions and eigen values, degeneracy, Dirac delta function, Completeness and closure property, Physical interpretation of eigen values, eigen functions and expansion coefficients, eigen values and eigen functions of momentum operator.

Module 2: Representation of States – Dirac notation — 1 Credit

Hilbert space, Dirac's bra and ket notation, dynamical variables and linear operators, projection operators, unit operator, unitary operator, matrix representation of an operator, change of basis, unitary transformation. Eigen values and eigen functions of simple harmonic oscillator by operator method. **1 Credit**

Module 3: Angular Momentum

Eigen values and eigen functions of L^2 and Lz operators, ladder operators L_+ and L_-, Pauli theory of spins (Pauli's matrices), matrix representation of J in $|jm>$ basis. Addition of angular momenta, Computation of Clebsch-Gordon coefficients in simple cases ($J_1=1/2$, $J_2=1/2$) **1 Credit**

Module 4: Approximation Methods

Time-independent Perturbation theory: Non degenerate, Zeeman effect, Time dependent Perturbation theory: Transition amplitude 1st and 2^{nd} order, Fermi's golden rule, Harmonic perturbation, Introduction to WKB approximation, Variational method

Basic principles and applications to particle in box, SHO

Reference Books:

1. A Text-book of Quantum Mechanics by P.M.Mathews and K.Venkatesan.
2. Quantum mechanics by A. Ghatak and S. Lokanathan
3. Quantum Mechanics by L.I. Schiff
4. Modern Quantum mechanics by J. J. Sakurai
5. Quantum Physics by R. Eisberg and R. Resnick
6. Introduction to Quantum Mechanics by by David J. Griffiths
7. Introductory Quantum mechanics by Granier, Springer Publication.
8. Introductory Quantum Mechanics, Li Boff, 4^{th} Edition, Pearson Education Ltd
9. Quntum Mechanics Nouredine Zettili,, A John Wiley and Sons, Ltd., Publication
10. Shankar R. Principles of Quantum Mechanics, II^{nd} Edition (Plenum, 1994)

Course Code and Title: PHCP-125 Physics Laboratory-II (General Lab)

(4 Credits)

Student has to perform any **12 Experiments**

1. **Photoconductivity:**
   a) To plot the current voltage characteristics of a CdS photoresistor at constant irradiance.
   b) To measure the photocurrent as a function of irradiance at constant voltage.
2. **Speed of Light** : To determine the speed of light using transit time of light pulse as a function of a reflecting mirror.
3. **Faraday Effect**: Rotation of The Polarization Plane Φ As A Function of The Magnetic Field and Rotati n of The Polarization Plane 2Φ As A Function Of The Magnetic Field
4. **Dielectric constant**:
   a) To Measure the charge Q on a plate capacitor as a function of the applied voltage E.
   b) To determine the capacitance C as a function of areas A of plates.
   c) To determine the capacitance C with different dielectrics between the plates.
   d) To determine the capacitance C as a function of the distance d between the plates
5. **Millikan Oil Drop Apparatus:** To measure the rise and fall times of the oil droplets at different voltages having different charges.
   a) To determine the radii of droplets. b) To determine the charge '**e**' on the droplets
6. **Michelson's Interferometer:** To determine the wavelength of He-Ne LASER by using Michelson's Interferometer apparatus.
7. **Specific Heat of Solids**: To determine the specific heat of copper, lead and glass at three different temperatures.
8. **Electron Spin Resonance**: To study the Electron Spin Resonance and to determine Lande's g-factor
9. **Frank-Hertz experiment**: To study the discrete energy levels using Frank-Hertz experiment
10. **G.M. counter:** Counting statistics, Characteristics of GM tube and determination of end point energy of β-ray source
11. **G.M. counter:** Determination of dead time of GM tube by Double source method
12. **Skin depth :** Skin depth in Al using electromagnetic radiation
13. **Gouy's Method:** Mea urement of magnetic susceptibility of MnSO4
14. **Thermionic emission:** To determine work function of Tungsten filament
15. **Hall effect:** To determine charge concentration, conductivity of Ge-semiconductor
16. **Four Probe method:** Temperature variation and Band gap of Ge-semiconductor
17. Ionic Conductivity of NaCl
18. Fabry-Parot Etalon
19. Zeeman Effect
20. Stefan's constant – Black Body Radiation
21. To study absorption spectra of Iodine molecule and to determine its dissociation Energy using spectrometer

Reference Books:

1. Solid State Laboratory Manual in Physics, Department of Physics, University of Pune, Pune-7 (1977)
2. Experimental Physics, Wersnop and Flint.
3. Molecular structure and Spectroscopy, G.Aruldas Prentice-hall of India Pvt. Ltd.New Delhi.
4. Practical Physics, D.R. Behekar, Dr.S. T. Seman, V.M.Gokhale,P.G.Kale (KitabMahal Publication)
5. Introduction to experimental Nuclear Physics, R.M. Singru, Wiley Eastern private Ltd. New Delhi.

Course Code and Title: PHCT-231 Statistical Mechanics

Module1: Probability theory, Statistical Description of thermodynamic system (1 Credit)

Brief discussion on probability distributions (F. Reif Chap-1), Thermodynamical laws and basic thermodynamic relations including Maxwell's equations. Specification of the state of the system, Macroscopic and Microscopic states, Phase space, Statistical ensemble, Postulate of equal a priori probability, Probability calculations, Behaviour of density of states, Liouville's theorem (Classical). Distribution of energy between systems in equilibrium, Sharpness of the probability distribution, Equilibrium between interacting systems.

Module 2: Classical Statistical Mechanics (1 Credit)

Micro-canonical ensemble, Canonical ensemble, Partition function, Applications of canonical ensembles to Paramagnetism, Molecule in an ideal gas, Law of atmosphere. System with specified mean energy, Calculation of mean values and fluctuations in a canonical ensemble in terms of energy, enthalpy and pressure. Connection with thermodynamics and Calculations of thermodynamic quantities, Grand-canonical ensemble, Physical interpretation of Chemical potential (μ) in the equilibrium state. Mean values and fluctuations in grand canonical ensemble. Thermodynamic functions in terms of the Grand partition function.

Module 3: Applications of Statistical Mechanics and Quantum Distribution Functions (1 Credit)

Classical partition functions and their properties, Calculations of thermodynamic quantities, Ideal monoatomic gas, Gibbs paradox, Equipartition theorem and its some applications. i) Mean kinetic energy of a molecule in a gas ii) Brownian motion iii) Harmonic Oscillator iv) Specific heat of solid (Einstein and Debye Specific heat) v) Maxwell velocity distribution, related distributions and mean values

Symmetry of wave functions, Quantum distribution functions, Boltzmann limit of Boson and Fermion gases, Evaluation of the partition function, Partition function for diatomic molecules, Equation of state for an ideal gas, quantum mechanical paramagnetic susceptibility

Module 4: Ideal Bose and Fermi Systems (1 Credit)

Bose-Einstein statistics: Partition function, thermodynamic behaviour, Ideal Bose gas: Photon gas - i) Radiation pressure ii) Radiation density iii) Emissivity iv) Equilibrium number of photons in the cavity; Einstein derivation of Planck's law, Specific heat of on gas and Bose Einstein Condensation.

Fermi-Dirac distribution function: Ideal Fermi system. Fermi energy, Mean energy of fermions at absolute zero, Fermi energy as a function of temperature, Electronic specific heat, White – Dwarfs (without derivation)

Reference Books

1. Fundamentals of Statistical and Thermal Physics, - F. Reif, McGraw Hill International Edition (1985)
2. Statistical and Thermal Physics: With Computer Applications- Harvey Gould and Jan Tobochnik (Princeton University Press; 6.1.2010 edition (July 21, 2010)(ISBN-10: 0691137447, ISBN-13: 978-0691137445)
3. Statistical Physics, Berkeley Physics Course, F. Reif, (Tata McGraw-Hill, 2008)

Course Code and Title: PHCT-232 Solid State Physics

Module 1: Crystal Structure and Band Theory of Solids — 1 Credit

Revision of crystal structures, structure of atomic form factor, Geometrical structure factor, Atomic scattering factor, calculations for SC, BCC, FCC, HCP and diamond structure

Revision of nearly free electron model, DC and AC electrical conductivity of metals, Bloch theorem (with proof), Kronig-Penney model, Motion of electron in 1-D according to band theory, Fermi sphere, Tight binding approximation, Band structure (in R space) of semiconductor crystal, Cyclotron resonance, Quantization of electronic orbit in a magnetic field

Module 2: Diamagnetism and Paramagnetism — 1 Credit

Classical theory of diamagnetism, Langevin theory of Paramagnetism, Quantum theory of Paramagnetism, Paramagnetic susceptibility of conduction electron, Magnetic properties of rare earth ions & iron group ions with graphical representation, Crystal field splitting, quenching of orbital angular momentum

Module 3: Ferromagnetism and Antiferromagnetism — 1 Credit

Wiess theory, Curie point, Exchange integral, saturation magnetization and its temperature dependence, Saturation magnetization at absolute zero, ferromagnetic domains, Anisotropy energy, Bloch wall. Antiferromagnetism- Neel temperature and Ferrimagnetism (Explanation only for both)

Module 4: Superconductivity Dielectric Properties of Solids — 1 Credit

Properties of Superconductors: Meissner effect, Heat capacity, Energy gap, Isotope effect; Type I and II superconductors; Thermodynamics of superconductivity; London equation and London penetration depth; BCS theory; Quantization in a superconductivity ring and Qualitative discussion of Josephson superconductor tunneling

Macroscopic and local electric field, Polarizability, Dielectric constant, Clausius– Mossotti relation, Piezoelectricity, Dielectric behavior in $BaTiO_3$

Reference Books:

1. Solid State Physics, N. W. Ashcroft and N. D. Mermin, (CBS Publishing Asia Ltd.)
2. Introduction to Solid State Physics, C. Kittel, (John Wiley and Sons)
3. Introductory Solid State Physics, H. P. Myers, (Viva Books Pvt. Ltd.)
4. Solid State Physics, H. Ibach and H. Luth, (Springer-Verlag)
5. Fundamentals of Solid State Physics, J. R. Christman, (John Wiley and Sons)
6. Solid State Physics, A. J. Dekkar, (Prentice Hall)
7. Solid State Physics, J.J. Quinn and K-Soo Yi (Springer)

Structure of Syllabus

Structure of M.Sc. (Physics) Syllabus

(For Affiliated Colleges)
Revised Syllabus to be implemented from June 2014
Total Credits: 100

Semester I

Course Number	Course Name
PHYUT501	Classical Mechanics (4 Credits)
PHYUT502	Electronics (4 Credits)
PHYUT503	Mathematical Methods in Physics (4Credits)
PHYUT504	Atoms and Molecules (4 Credits)
PHYUT505	Experimental Techniques in Physics I(4 Credits)
PHYUP506	Physics Lab I (5 Credits)

Semester II

Course Number	Course Name
PHYUT601	Electrodynamics (4 Credits)
PHYUT602	Solid State Physics (4 Credits)
PHYUT603	Quantum Mechanics I (4 Credits)
PHYUT604	Lasers (4Credits)
PHYUT605	Experimental Techniques in Physics II(4Credits)
PHYUP606	Physics Lab II (5 Credits)

Semester III

Course Number	Course Name
PHYUT701	Statistical Mechanics in Physics (4 Credits)
PHYUT702	Physics of Semiconductor Devices/Quantum Mechanics II (4 Credits)
PHYDT703	Departmental Course I (4 Credits)
PHYDT704	Departmental Course II (4 Credits)
PHYDP705	Special Lab I (4 Credits)
PHYUP706	Physics Lab III (5 Credits)

Semester IV

Course Number	Course Name
PHYUT801	Nuclear Physics (4 Credits)
PHYUT802	Material Science (4 Credits)
PHYDT803	Departmental Course III (4 Credits)
PHYDT804	Departmental Course IV (4 Credits)
PHYDP805	Special Lab II (4 Credits)
PHYUP806	Physics Lab IV: Project (5 Credits)

List of Departmental Courses

Departmental Course I Semester III PHYDT703/PHYDT704 (4 credits)	Departmental Course II Semester IV PHYDT803/PHYDT804 (4credits)
Medical physics I	Medical physics II
Acoustics I	Acoustics II
Energy Studies I	Energy Studies II
Physics of Thin Films	Physics of Nano materials
Astronomy and Astrophysics I	Astronomy and Astrophysics II
Electronic Instrumentation-I	Electronic Instrumentation-II
Communication Electronics	Microwave Physics and Applications
Biomedical Instrumentation I	Biomedical Instrumentation II
Atmospheric Physics I	Atmospheric Physics II
Nuclear Techniques I	Nuclear Techniques II
Microcontroller Based Instrumentation System – I	Microcontroller Based Instrumentation System – II

The college can start any two of the departmental courses in 3rd semester and corresponding two courses shown against the 3rd semester course in 4th semester.

Kopargaon Taluka Education Society's

K. J. Somaiya College of Arts, Commerce and Science, Kopargaon

DEPARTMENT OF MICROBIOLOGY

CROSSCUTTING ISSUE

Sr. No.	Programme Name	Course Code	Name of Course	Addressed Issue (Professional Ethics, Gender, Human Values, Environment and Sustainability
1.	**(FY)B.Sc. Microbiology**	MB 111	Introduction to Microbial World	Professional Ethics
2.	B.Sc. Microbiology	MB 112	Basic Techniques in Microbiology	Professional Ethics
3.	B.Sc. Microbiology	MB 113	Practical Course based on theory papers MB 111 and MB112	Professional Ethics
4.	B.Sc. Microbiology	MB 121	Bacterial Cell and Biochemistry	Professional Ethics
5.	B.Sc. Microbiology	MB 122	Microbial cultivation and growth	Professional Ethics
6.	B.Sc. Microbiology	MB 123	Practical Course based on theory papers MB121 and MB122	Professional Ethics
7.	**(SY)B.Sc. Microbiology**	MB 231	Medical Microbiology and Immunology	Professional Ethics
8.	B.Sc. Microbiology	MB 232	Bacterial Physiology and Fermentation Technology	Professional Ethics
9.	B.Sc. Microbiology	MB 233	Practical based on MB 231 and MB 232	Professional Ethics
10.	B.Sc. Microbiology	MB 241	Bacterial Genetics	Professional Ethics
11.	B.Sc. Microbiology	MB 242	Air, Water and Soil Microbiology	Professional Ethics
12.	B.Sc. Microbiology	MB 243	Practical based on MB 241 and	Professional Ethics

			MB 242	
13.	**(TY) B.Sc. Microbiology**	MB 351	Medical Microbiology-I	Professional Ethics
14.	B.Sc. Microbiology	MB 352	Immunology-I	Professional Ethics
15.	B.Sc. Microbiology	MB 353	Enzymology	Professional Ethics
16.	B.Sc. Microbiology	MB 354	Genetics	Professional Ethics
17.	B.Sc. Microbiology	MB 355	Fermentation Technology-I	Professional Ethics
18.	B.Sc. Microbiology	MB 356	Agricultural Microbiology	Professional Ethics
19.	B.Sc. Microbiology	MB 357	Practical course-I based on: MB 351 Medical Microbiology-I MB 352 Immunology I	Professional Ethics
20.	B.Sc. Microbiology	MB 358	Practical course-II based on MB 353 Enzymology MB 354 Genetics	Professional Ethics
21.	B.Sc. Microbiology	MB 359	Practical course-III based on: MB 355 Fermentation Technology-I MB 356Agricultural Microbiology	Professional Ethics
22.	B.Sc. Microbiology	MB 3510	Marine Microbiology	Professional Ethics
23.	B.Sc. Microbiology	MB 3511	Dairy Microbiology	Professional Ethics
24.	B.Sc. Microbiology	MB 361	Medical Microbiology II	Professional Ethics
25.	B.Sc. Microbiology	MB 362	Immunology II	Professional Ethics
26.	B.Sc. Microbiology	MB 363	Metabolism	Professional Ethics
27.	B.Sc. Microbiology	MB 364	Molecular Biology	Professional Ethics
28.	B.Sc. Microbiology	MB 365	Fermentation Technology I	Professional Ethics
29.	B.Sc. Microbiology	MB 366	Food Microbiology	Professional Ethics
30.	B.Sc. Microbiology	MB 367	Practical course-I. Based on: MB 361 Medical Microbiology	Professional Ethics

			II and MB 362 Immunology II	
31.	B.Sc. Microbiology	MB 368	Practical course-II. Based on: MB 363 Metabolism and MB 364 Molecular Biology	Professional Ethics
32.	B.Sc. Microbiology	MB 369	Practical course III. Based on: MB 365 Fermentation technology-II and MB 366 Food Microbiology	Professional Ethics
33.	B.Sc. Microbiology	MB 3610	Waste management	Professional Ethics
34.	B.Sc. Microbiology	MB 3611	Nano biotechnology	Professional Ethics
35.	**(M.Sc-I).Microbiology**	MBCT 111	Microbial Systematics	Professional Ethics
36.	M.Sc. Microbiology	MBCT 112	Quantitative Biology	Professional Ethics
37.	M.Sc. Microbiology	MBCT 113	Biochemistry and Metabolism	Professional Ethics
38.	M.Sc. Microbiology	MBCP 1	Biochemical Techniques (Practical based on compulsory theory credits)	Professional Ethics
39.	M.Sc. Microbiology	MBTE 11	Fungal Systematics and Extremophiles	Professional Ethics
40.	M.Sc. Microbiology	MBPE11	Practicals Based on Fungal Systematics and Extremophiles	Professional Ethics
41.	M.Sc. Microbiology	MBCT 121	Instrumentation and Molecular Biophysics	Professional Ethics
42.	M.Sc. Microbiology	MBCT 122	Molecular Biology	Professional Ethics
43.	M.Sc. Microbiology	MBCT 123	Enzymology, Bioenergetics and Metabolism	Professional Ethics
44.	M.Sc. Microbiology	MBCP 124	Molecular biology, Enzymology and Instrumentation Techniques	Professional Ethics

			(Practical basedon compulsory theory credits)	
45.	M.Sc. Microbiology	MBET 127	Nitrogen Metabolism, Respiration and Photosynthesis	Professional Ethics
46.	M.Sc. Microbiology	MBEP 127	Practicals Based on Nitrogen Metabolism, Respiration and Photosynthesis	Professional Ethics
47.	**(M.Sc-II). Microbiology**	MBCT 231	Immunology	Professional Ethics
48.	M.Sc. Microbiology	MBCT 232	Molecular Biology	Professional Ethics
49.	M.Sc. Microbiology	MBCT 233	Clinical Microbiology	Professional Ethics
50.	M.Sc. Microbiology	MBCP 234	Practicals based on Compulsory Theory Credits.	Professional Ethics
51.	M.Sc. Microbiology	MBET 236	Bioremediation and Biomass utilization	Professional Ethics
52.	M.Sc. Microbiology	MBEP 236	Practical based on Bioremediation and Biomass utilization	Professional Ethics
53.	M.Sc. Microbiology	MBCT 241	Pharmaceutical Microbiology	Professional Ethics
54.	M.Sc. Microbiology	MBCT 242	Microbial Technology	Professional Ethics
55.	M.Sc. Microbiology	MBCP 243	Dissertation	Professional Ethics
56.	M.Sc. Microbiology	MBTE 41	Quality Assurance and Validation in Pharmaceutical Industry and Development Of Anti infectives	Professional Ethics
57.	M.Sc. Microbiology	MBPE 41	Practicals based on Quality Assurance AndValidation In Pharmaceutical Industry And Development Of Anti infectives	Professional Ethics

58.	M.Sc. Microbiology	MBTE 43	Industrial Waste Water Treatment andIndustrial Production of Vaccines	Professional Ethics
59.	M.Sc. Microbiology	MBPE 43	Practicals based on Industrial Waste WaterTreatment and Industrial Production of Vaccines	Professional Ethics
60.	All PG Programmes		Democracy, Election and Governance	Human Values
61.	All PG Programmes		Human Rights - I	Human Values
62.	All PG Programmes		Cyber Security -I	Human Values
63.	All PG Programmes		Cyber secuirity -II	Human Values
64.	All PG Programmes		Cyber secuirity -III	Human Values
65.	All PG Programmes		Cyber secuirity -IV	Human Values
66.	All PG Programmes		Skill Development –I	Human Values
67.	All PG Programmes		Skill Development –II	Human Values
68.	All PG Programmes		Introduction to Constitution	Human Values
69.	All PG Programmes		Introduction to Indian Constitution	Human Values
70.	All UG Programmes		EVS 231 – Environmental Awareness	Environment and Sustainability
71.	All UG Programmes		Physical Education	Human Values
72.	S.Y.B.S.c. Microbiology		Certificate course in Health and Environment Awareness	Environment and Sustainability

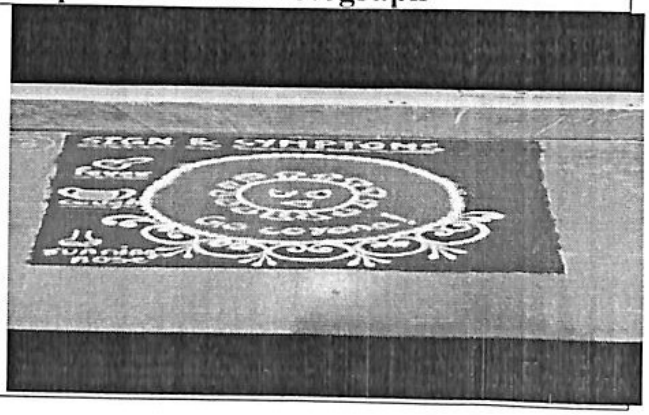
Head
Department of Microbiology
K. J. Somaiya College, Kopargaon

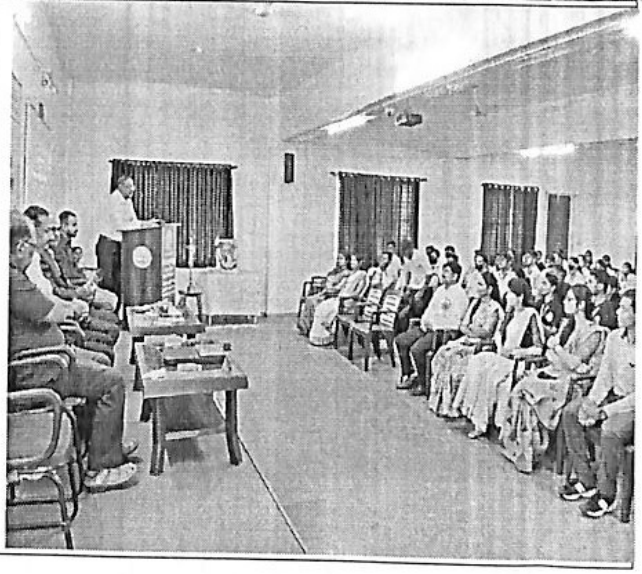
Principal
K.J.Somaiya College of Arts
Commerce & Science,Kopargaon

List of Add-on/Value Added/ Certificate Courses

Sr. No.	Department	Name of Certificate Course	Course Code	Year of Offering	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	Microbiology	Health and Environment Awareness	—	From 2018-19 till Current Year...	Professional Ethics

List Showing Curricular and Extra Curricular activities to address Crosscutting Issues (Similar/repeated activities are not listed).

Sr. No.	Name of Activity and Date of Implementation	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)	Representative Photograph
1	"Immunology Rangoli competition" on 22nd Aug 2019.	Professional Ethics, Human Values	

2	Microbiome Food Festival-2019 on13th Jan 2019	Human Values, Environment and Sustainability	
3	Guest lecture for Postgraduate students on topic 'Recent Trends in Life science Research on 27th Feb 2021.	Professional Ethics, Human Values	
4	On the occasion of "National Science Day," the Department of Microbiology organized 'National Science fest 2021	Professional Ethics, Gender, Human Values, Environment and Sustainability	

Representative Example

Crosscutting issue: Professional Ethics

Programme Name – M Sc-I (Microbiology)

Course Name – Microbial Systematics

Course Code – MBCT 111

	Semester I	
Credits	**MBCT 111: Microbial Systematics** **Core Compulsory Theory Paper** Total: 4 Credits; Workload: -15 hrs /credit (Total Workload: - 4 credits x 15 hrs = 60 hrs in semester)	**Lectures**
Credit I	**Bacterial Systematics** 1. Species concept in prokaryotes and eukaryotes 2. 5-Kingdom classification system 3. 3-Domain classification system 4. Determinative Bacteriology (Phenetic Approach) 5. Systematic Bacteriology (Phylogenetic Approach) 6. Polyphasic Approach 7. Molecular clocks, phylogeny and molecular distances	**15**
Credit II	**Microbial Diversity** Facets of microbial diversity: morphological, structural, metabolic, ecological, behavioral and evolutionary Species divergence and measurement of microbial diversity Measures and indices of diversity; alpha, beta and gamma diversity	**15**
Credit III	**Exploration of Un-culturable microbial diversity:** 1. Concept of 'unculturable' bacterial diversity 2. Strategies for culture of 'unculturable' bacteria 3. Culture independent molecular methods for identifying unculturable bacteria (PCR, RFLP,ARDRA, DGGE, TGGE, RAPD, Microarray, FISH, RISA) 4. Methods of extracting total bacterial DNA from a habitat and metagenome analysis	**15**

Credit IV	**Evolution** 1. History and development of evolutionary theory (Lamarckism, Darwinism), Neo Darwinism: Spontaneous mutation controversy, evolution of rates of mutation, types of selection, levels of selection, group selection and selfish gene. 2. Socio-biology, kin selection, evolutionary stability of cooperation, sociality and multi- cellularity in microorganisms, Game theory. Co-evolutionary strategies, host parasite co- evolution 3. Molecular evolution: origin of life, the origin of new genes and proteins ageing, evolutionary trade-offs, r and k selection	**15**

References:

1. Barnett H. L. and Hunter B. B. (1960). Illustrated Genera of Imperfect Fungi.BurgessPublishing Co., Minnesota.
2. Black J. G. (2013). Microbiology: Principles and Explorations. 6th Edition. JohnWiley&Sons, Inc
3. Bromham L. and Penny D. (2003). The Modern Molecular Clock. Nat Rev Genet.4(3):216-224. Nature Publishing Group.
4. Brown J. (2014). Principles of Microbial Diversity. ASM Press.
5. Buchanan, R. E. and Gibbons, N. E. (editors). 1974. Bergey's Manual of Determinative Bacteriology. 8th ed. Williams & Wilkins Co., Baltimore

Representative Example

Crosscutting issue: Professional Ethics
Programmer Name – M Sc-I (Microbiology)
Course Name – Quantitative Biology
Course Code – MBCT 112

	Semester I	
Credits	**MBCT 112: Quantitative Biology** **Core Compulsory Theory Paper** Total: 4 Credits Workload: -15 hrs /credit (Total Workload: - 4 credits x 15 hrs = 60 hrs in semester)	**Lectures**
Credit I	Descriptive Statistics 1. Fundamental concepts –Sample Statistics and Population parameter, data (qualitative and quantitative data, discrete and continuous series data), data sources, variables, measurement scales (nominal, ordinal, interval and ratio), variability and uncertainty in measurements	**15**
	Descriptive Statistics 2. Measures of central tendency – Mean Mode, median 3. Measures of dispersion – Mean deviation Standard deviation and Variance 4. Data presentation-Tables and Graphs (Histogram, bar, pie and line) 5. Simple linear Regression and correlation (significance testing not necessary) *(Sr. No. 1: - only theory questions to be asked in exam.* *Sr. No. 2 – 5: - only problem-solving questions to be asked in exam.)*	
Credit II	**Inferential Statistics-1** 1. Uncertainty: Variation, Probability and inference 2. Central Limit Theorem, Standard deviation of the means standard error and confidence interval 3. The concepts of null hypothesis, Test statistics, P-value significance level, type I and type II errors, one tailed and two tailed tests, degrees of freedom, Parametric and nonparametric test, statistical decision tree, Parametric statistical test: Z-test, t-test and F-test *(Sr. No 1 – 3: - only theory questions to be asked in exam except Z-test, T-test and F-test.)*	**15**
Credit III	**Inferential Statistics-2** 1. Test of Significance: Chi square test (Goodness of fit and Independence), 2. Comparison of 3 or more samples – ANOVA One way and two-way, Post Hoc test (Tukey's) 3. Nonparametric Tests: comparison to parametric tests, Sign test, Wilcoxon's signed rank testand Mann-Whitney U test	**15**

Credit IV	**Probability and Probability Distribution** 1. Concept of experiment, event (mutually exclusive & non-exclusive events, dependent &independent events); 2. Laws of probability (addition and multiplication); 3. Probability distribution – Normal (x-scale and z-scale), Binomial and Poisson distributions	**15**

References:

1. Bailey N. T. J. (1981). Statistical Methods in Biology. United Kingdom: Hodder andStoughton. ISBN: 9780340247563,
2. Brown D. and Rothery P. (1993). Models in biology: mathematics, statistics, andcomputing. United Kingdom: Wiley. ISBN: 9780471933229. Digitized 20th June 2009
3. Chetwynd A., Chetwynd A. G. and Diggle P. J. (2011). Statistics and Scientific Method:An Introduction for Students and Researchers. Italy: OUP Oxford. ISBN:9780199543182
4. Daniel W. W. and Cross C. L. (2018). Biostatistics: A Foundation for Analysis in theHealth Sciences. United Kingdom: Wiley. ISBN: 9781119282372

	Semester I	
Credits	**MBCT 111: Microbial Systematics** **Core Compulsory Theory Paper** Total: 4 Credits; Workload: -15 hrs /credit (Total Workload: - 4 credits x 15 hrs = 60 hrs in semester)	**Lectures**
Credit I	**Bacterial Systematics** 1. Species concept in prokaryotes and eukaryotes 2. 5-Kingdom classification system 3. 3-Domain classification system 4. Determinative Bacteriology (Phenetic Approach) 5. Systematic Bacteriology (Phylogenetic Approach) 6. Polyphasic Approach 7. Molecular clocks, phylogeny and molecular distances	**15**
Credit II	**Microbial Diversity** Facets of microbial diversity: morphological, structural, metabolic, ecological, behavioral and evolutionary Species divergence and measurement of microbial diversity Measures and indices of diversity; alpha, beta and gamma diversity	**15**
Credit III	**Exploration of Un-culturable microbial diversity:** 1. Concept of 'unculturable' bacterial diversity 2. Strategies for culture of 'unculturable' bacteria 3. Culture independent molecular methods for identifying unculturable bacteria (PCR, RFLP,ARDRA, DGGE, TGGE, RAPD, Microarray, FISH, RISA) 4. Methods of extracting total bacterial DNA from a habitat and metagenome analysis	**15**
Credit IV	**Evolution** 1. History and development of evolutionary theory (Lamarckism, Darwinism), Neo Darwinism: Spontaneous mutation controversy, evolution of rates of mutation, types of selection, levels of selection, group selection and selfish gene. 2. Socio-biology, kin selection, evolutionary stability of cooperation, sociality and multi- cellularity in microorganisms, Game theory. Co-evolutionary strategies, host parasite co- evolution 3. Molecular evolution: origin of life, the origin of new genes and proteins ageing, evolutionary trade-offs, r and k selection	**15**

	Semester I	
Credits	**MBCT 112: Quantitative Biology** **Core Compulsory Theory Paper** Total: 4 Credits Workload: -15 hrs /credit (Total Workload: - 4 credits x 15 hrs = 60 hrs in semester)	**Lectures**
Credit I	Descriptive Statistics 1. Fundamental concepts –Sample Statistics and Population parameter, data (qualitative and quantitative data, discrete and continuous series data), data sources, variables, measurement scales (nominal, ordinal, interval and ratio), variability and uncertainty in measurements	**15**
	Descriptive Statistics 2. Measures of central tendency – Mean Mode, median 3. Measures of dispersion – Mean deviation Standard deviation and Variance 4. Data presentation-Tables and Graphs (Histogram, bar, pie and line) 5. Simple linear Regression and correlation (significance testing not necessary) *(Sr. No. 1: - only theory questions to be asked in exam.* *Sr. No. 2 – 5: - only problem-solving questions to be asked in exam.)*	
Credit II	**Inferential Statistics-1** 1. Uncertainty: Variation, Probability and inference 2. Central Limit Theorem, Standard deviation of the means standard error and confidence interval 3. The concepts of null hypothesis, Test statistics, P-value significance level, type I and type II errors, one tailed and two tailed tests, degrees of freedom, Parametric and nonparametric test, statistical decision tree, Parametric statistical test: Z-test, t-test and F-test *(Sr. No 1 – 3: - only theory questions to be asked in exam except Z-test, T-test and F-test.)*	**15**
Credit III	**Inferential Statistics-2** 1. Test of Significance: Chi square test (Goodness of fit and Independence), 2. Comparison of 3 or more samples – ANOVA One way and two-way, Post Hoc test (Tukey's) 3. Nonparametric Tests: comparison to parametric tests, Sign test, Wilcoxon's signed rank testand Mann-Whitney U test	**15**
Credit IV	**Probability and Probability Distribution** 1. Concept of experiment, event (mutually exclusive & non-exclusive events, dependent &independent events); 2. Laws of probability (addition and multiplication); 3. Probability distribution – Normal (x-scale and z-scale), Binomial and Poisson distributions	**15**

	Semester I	
Credit	**MBCT 113: Biochemistry and Metabolism** **Core Compulsory Theory Paper** Total: 4 Credits Workload: -15 hrs /credit (Total Workload: - 4 credits x 15 hrs = 60 hrs in semester)	**Lectures**
Credit I	**Protein Chemistry:** 1. Structural features of amino acids, classification of amino acids, Amino acids as buffers, 2. Henderson Hasselbalch equation and its role in buffer formulation Peptide linkage, partial double bond nature of peptide bond 3. Determination of primary structure of polypeptide (N-terminal, C-terminal determination, methodof sequencing of peptides), 4. Structural classification of proteins: primary, secondary, tertiary, quaternary structures of proteins, 5. Non-covalent interactions, Conformational properties of proteins, Polypeptide chain geometry, Resonance forms of the peptide group, cis/trans isomers of peptide group Ramachandran plot 6. Secondary, Super-secondary, Motif & Domain, 7. Tertiary and Quaternary structures of proteins, (Myoglobin &hemoglobin)	**15**
Credit II	**Biochemistry and Molecular Biology Techniques:** 1. Chromatography: Principles and applications of gel filtration, Ion exchange, affinity chromatography 2. Electrophoresis: Agarose, Native PAGE, SDS PAGE 3. Polymerase chain reaction: Principle, variations of PCR (Hot start, Nested, Reverse transcription, real time PCR) and its applications. 4. Sequencing methods: a) RNA-sequencing methods and applications, b) DNA sequencing: Classical and next generation sequencing methods (Pyro-sequencing, Ion torrent, Nano-pore sequencing).	**15**

Credit III	**Developmental Biology:** 1. Introduction to developmental biology. Different model systems used to study developmental biology 2. Conserved nature of development, Concepts of commitment, determination and differentiation, 3. Morphogen gradients in developmental regulation, Hox code, MPF 4. Gastrulation and cellular movements involved in it, Organizer and its importance giving examplesof invertebrates (*Drosophilla*) and vertebrate (*Xenopus*) model systems, pattern formation in body axis, antero-posterior and dorso-ventral polarity. 5. Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; transition to flowering, floral meristems and floral development in *Arabidopsis*.	**15**
Credit IV	**Cell biology:** 1. Structural organization and function of Endoplasmic Reticulum, Golgi apparatus, Nucleus, Mitochondrion, chloroplast, Lysosomes, peroxisomes; Cytoskeleton and function of Molecularmotors. 2. Protein trafficking among various cellular compartments (by secretory and cytosolic pathway: targeting to secretory vesicles, cell membrane, lysosomes, nucleus, mitochondria and peroxisomes) 3. Events in cell cycle, Regulation of cell cycle. Apoptosis	**15**

Semester I

Suggested References: MBCT 113 Biochemistry and Metabolism

Credit I and II : Protein Chemistry, Biochemistry and Molecular Biology Techniques

1. Branden C. I. and Tooze J. (2012). Introduction to Protein Structure. United States:CRC Press. ISBN:9781136969898,
2. Garrett, R. H. and Grisham, C. M. (2004) Biochemistry. 3rd Ed. Brooks/Cole, PublishingCompany, California.
3. Moat A. G., Foster J. W. and Spector M. P. (2003) Microbial Physiology. Germany: Wiley. ISBN: 9780471461197
4. Nelson D. L. and Cox M. M. (2021). Lehninger's Principles of Biochemistry.8thEdition. Mac Millan Worth Pub. Co. New Delhi. ISBN:9781319228002
5. Segel I. H. (2010). Biochemical Calculations. 2nd Ed. Wiley India Pvt. Limited. ISBN:9788126526437

	Semester I
	MBCP 114: Biochemical Techniques **Core Compulsory Practical Paper** Total: 4 CreditsWorkload: -30 hrs /credit (Total Workload: - 4 credits x 30 hrs. = 120 hrs in semester)
1.	Safety rules in Laboratory: Laboratory safety, hazard from chemicals, handling of chemicals, disposal of chemicals and cultures, recording of scientific experiments. Standardization of laboratory procedures, calibration and validation instruments, preparing / designing SOP for the same, maintenance of instruments
2.	Buffer: Determination of pKa of a monoprotic weak organic acid; Preparation of buffers using KH_2PO_4 and K_2HPO_4, acetic acid and sodium acetate, K_2HPO_4 and H_3PO_4.
3.	Computer applications: Using data sheets, and sorting data with different parameters, plotting graphs – bar charts, line graphs, pie charts, adding error bars. (Using Microsoft Excel Statistical analysis of data – Students t test, ANOVA, Chi square test, F test using computer softwares (Using Microsoft Excel)
4.	Enrichment, Isolation and identification of the following extremophiles from natural samples: Alkaliphiles and Thermophiles Identification of the bacteria to at least the Genus level using the Bergey's Manuals is expected. The identification key must be designed for each isolated and identified bacterium. Students are expected to isolate at least one Genus from each group. (At least 5 different types of samples should be processed to obtain isolates)
5.	Studying the stages mitosis in growing tip of onion root cells and to observe polyploidy induced by colchicine treatment on root tip. Demonstration of mounting of embryos (frog and fruit fly) at various developmental stages on permanent slides
6.	Demonstration of mounting of embryos (frog and fruit fly) at various developmental stages on permanent slides
7.	Extraction of Protein and Exo-polysaccharide from bacterial culture (may use TCA and ethanol method)
8.	Colorimetry and spectrophotometry: estimation of above sample: Bradford and UV Spectrophotometry (purity using A_{280} method).

9.	Chromatography: Separation of hydrolyzed protein and EPS sample (above) using paper and thin layer chromatography. (*Explain concept of two-dimensional chromatography and descending chromatography*)
10.	Electrophoresis: SDS-PAGE of above proteins / To determine the ion-exchangecapacity and nature of given resin using anion exchange chromatography
11.	Interpretation of Ramachandran Plot and study of conformations of protein molecule using Molecular Graphics Visualization Tool (e.g., Swiss PDB)

Semester I

Suggested references MBCP 114: Biochemical Techniques

1. Safety rules in Laboratory: Laboratory safety, hazard from chemicals, handling of chemicals, disposal of chemicals and cultures, recording of scientific experiments. Standardization of laboratory procedures, calibration and validation instruments, preparing / designing SOP for the same, maintenance of instruments

- Fuscaldo A. (2012). Laboratory Safety Theory and Practice. United Kingdom: Elsevier Science.
- Leboffe M. J. and Pierce B. E. (2010). Microbiology Laboratory theory and Application. Chapter 1. Introduction: Safety and laboratory guidelines. 3rd edition. Morton Publishing Company. 1-8.
- Plummer M. and Plummer D.T. (2001). Introduction to practical biochemistry. 3rd Edition, Tata McGraw- Hill Edition.
- United States Environmental protection agency (EPA), EPA QA/G-6. 2007. Guidance for preparing SOP. 1-6.
- World Health Organization Staff, World Health Organization. Laboratory Biosafety Manual, 3/Ed. (2006). India: AITBS Publishers.
- https://www.labmanager.com/lab-health-and-safety/science-laboratory-safety-rules-guidelines-5727

2. Buffer: Determination of pKa of a monoprotic weak organic acid; Preparation of buffers using KH_2PO_4 and K_2HPO_4, acetic acid and sodium acetate, K_2HPO_4 and H_3PO_4.

- Jayaraman J. (2004). Laboratory Manual in Biochemistry. India: New AgeInternational (P) Limited Publishers.

	Semester I	
Credits	**MBET 115: Fungal Systematics and Extremophiles** **Choice based Optional Theory Paper (Elective)** Total: 2 Credits Workload: -15 hrs /credit (Total Workload: - 2 credits x 15 hrs = 30 hrs in semester)	**Lectures**
Credit I	**Fungal Systematics:** 1. Six Classes of Fungi 2. Differentiating characters among different Classes of fungi 3. Importance of morphological characters in fungal differentiation and classification	**15**
Credit II	**Extremophiles** 1. Enrichment, isolation, classification, properties and application of extremophiles: Thermophiles, Psychrophiles, Halophiles, Acidophiles, Methanogens 2. Adaptation mechanisms of extremophiles	**15**

Semester I

Suggested References: MBET 115: Fungal Systematics and Extremophile

Credit I : Fungal Systematics:

1. Athearn Bessey E. (2020). Morphology and Taxonomy of Fungi. India: Alpha Editions. ISBN: 9789354009730,
2. Barnett H. L. and Hunter, B. B. 1960. Illustrated Genera of Imperfect Fungi. Burgess Publishing Co., Minnesota.
3. Carlile M. J., Watkinson S. C. and Gooday G. W. (2001). The Fungi. Netherlands: Elsevier Science. ISBN: 9780127384467
4. Lodder J. (1974). The Yeasts: A Taxonomic Study, North Holland Publishing Co. Amsterdam
5. Manoharachary C. and Mukerji K. G. (2010). Taxonomy and Ecology of Indian Fungi. India: I.K. International Publishing House Pvt. Limited.ISBN:9789380026923

Credit II : Extremophiles

1. Gerday C. and Glansdorff N. (2009). Extremophiles. United Kingdom: EolssPublishers. ISBN: 9781905839933
2. Horikoshi K., Stetter K. O., Antranikian G., Robb F. and Bull A. (2010).Extremophiles Handbook. Germany: Springer.
3. Sharma V. and Salwan R. (2020). Physiological and Biotechnological Aspects of Extremophiles. Netherlands: Elsevier Science. ISBN: 9780128183236
4. Stan-Lotter H., Oren A. and Seckbach J. (2013). Polyextremophiles: Life UnderMultiple Forms of Stress. Netherlands: Springer Netherlands.
5. Subba Rao D. V. and Durvasula R. V. (2018). Extremophiles: From Biology to Biotechnology. United States: CRC Press. ISBN: 9781351650731

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Credits	Semester I MBEP 115: Practicals Based on Fungal Systematics and Extremophiles Choice based Optional Practical Paper (Elective) Total: 2 Credits Workload: -30 hrs /credit (Total Workload: - 2 credits x 30 hrs = 60 hrs in semester)	Lectures
Credit I	**Isolation and identification of yeasts and saprophytic molds from natural samples.** The identification key must be designed for each isolated and identified fungus. Students are expected to isolate at least one Genus from Mold and Yeast each *(Varied types of samples should be processed to obtain representative isolate of the groups)*	30
Credit II	**Isolation and identification of the following extremophiles from natural samples: Acidophiles and Halophiles** Identification of the bacteria to at least the Genus level using the Bergey's Manuals is expected. The identification key must be designed for each isolated and identified bacterium. Students are expected to isolate at least one Genus from each group. *(At least 5 different types of samples should be processed to obtain isolates)*	30

Semester I

Suggested References: MBEP 115:

Practicals Based on Fungal Systematics and Extremophiles

Credit I : Isolation and identification of yeasts and saprophytic molds from naturalsamples.

- Alexopoulos C. J., Mims C. W. and Blackwell M. (2007). Introductory Mycology, 4th Edition. India: Wiley India Pvt. Limited.
- Bills G. F., Mueller G. M. and Foster M. S. (2011). Biodiversity of Fungi: Inventoryand Monitoring Methods. Netherlands: Elsevier Science.
- Deacon J. W. (2013). Fungal Biology. Germany: Wiley.
- Hudson H. J. (1992). Fungal Biology. United Kingdom: Cambridge University Press.
- Kreger-Van Rij N. J. W. (2013). The Yeasts: A Taxonomic Study. Netherlands:Elsevier Science.

Credit	Semester II MBCT 121: Instrumentation and Molecular Biophysics Core Compulsory Theory Paper Total: 4 Credits Workload: -15 hrs /credit (Total Workload: - 4 credits x 15 hrs = 60 hrs in semester)	Lectures
Credit I	**Separation and analysis of biomolecules:** 1. Techniques for sample preparation: Dialysis, ultra-filtration, centrifugal vacuum concentration 2. Chromatography- i. Partition Coefficient, Selectivity, Resolution, Column Efficiency, Van Deemter equation, Interpretation of chromatograms, ii. Principle, instrumentation and applications of High Performance Liquid Chromatography (HPLC), iii. Fast Protein Liquid Chromatography (FPLC), iv. Supercritical Fluid Chromatography v. Reversed Phase Chromatography and Gas chromatography. 3. Electrophoresis Methods: Pulse field gel electrophoresis, capillary electrophoresis, isoelectric focusing, 2-dimensional electrophoresis, immune-electrophoresis	15
Credit II	**Spectroscopy** 4. Introduction: Electromagnetic spectrum, Atomic orbitals, Molecular orbitals, Electronic, Rotational and Vibrational transitions in spectroscopy, Interpretation of spectra. 5. UV/Visible spectroscopy- Instrumentation, Molar Absorptivities, Beer and Lamberts Law, Bathochromic and hypochromic shifts. 6. Fluorescence spectroscopy- Instrumentation, Quantum Yield, Quenching, FRET, Binding and Folding studies, Flow cytometry and FACS 7. Infrared spectroscopy- Principle, Instrumentation, Absorption bands, FTIR and its applications 8. Mass spectroscopy- Principles of operation, Ionization, Ion fragmentation, Mass Analysers, GC- MS, MALDI-TOF	15

Credit III	**Biophysical Techniques** 1. NMR spectroscopy: i. Basic Principles of NMR, Chemical shift, Intensity, Line width, Relaxation parameters, Spin coupling, ii. Nuclear Overhauser Effect Spectroscopy, Correlation Spectroscopy, Approach to structure determination by 2D-NMR 2. X-ray crystallography: i. Purification of proteins, Crystallization of proteins, Instrumentation, ii. acquisition of the diffraction pattern, basic principles of x-ray diffraction, iii. Crystal Structures (Bravais Lattices), Crystal planes and Miller Indices, Direct Lattice and Reciprocal lattice, iv. Fourier Transform and Inverse Fourier, v. Ewald sphere, Electron density Maps, Phase determination	**15**
Credit IV	**Radioisotopes in Biology and Confocal Microscopy** 3. Radioisotopes in Biology: i. Principles and applications of radio tracers in medicine, agriculture, industry, and fundamental research ii. Radiation and Radioactive isotopes: Types, Quantities and units of estimation, half-life of isotopes iii. Detection and measurement of radioactivity- Autoradiography, Liquid scintillation counting. iv. Effect of radiation on biological system 4. Confocal Microscopy: i. Scanning optical microscope, confocal principle, ii. Resolution and point spread function, light source: gas lasers & solid-state, primary beam splitter; beam scanning, iii. Pinhole and signal channel configurations, detectors; pixels and voxels; contrast, iv. Spatial sampling: temporal sampling: signal-to noise ratio, multichannel images	**15**

	Semester II	
Credit	**MBCT 122: Molecular Biology** **Core Compulsory Theory Paper** Total: 4 Credits Workload: -15 hrs /credit (Total Workload: - 4 credits x 15 hrs = 60 hrs in semester)	**Lectures**
Credit I	**RNA processing &Molecular Techniques** 1. Eukaryotic RNA Processing: i. mRNA splicing (Spliceosome and auto splicing by Intron I and Intron II); rRNA processing; tRNA processing; RNA Editing, ii. Nuclear export of mRNA iii. Regulatory RNAs and noncoding RNAs: Si RNA, Micro RNA, RNA interference (RNAi) iv. Pi RNA (Piwi interacting RNAs) 2. Molecular Techniques: Knockout mice, phage display system, expressed sequence tags, yeast two and three hybrid assay, Activity gel assay, DNA helicase assay, Chromatin Immuno-precipitation (ChIP), Designing probe, Epitope tagging	**15**
Credit II	**Tools for Genetic engineering** 3. i. Enzymes: Restriction endonucleases and methylases DNA ligase, klenow enzyme, T4 DNA polymerase, polynucleotide kinase, alkaline phosphatase; ii. Cohesive and blunt end ligation, linkers; adaptors; homopolymeric tailing labeling of DNA: iii. Nick translation, random priming, radioactive and non-radioactive probes iv. Hybridization techniques: Northern, Southern, south-western and far-western and colony hybridization, fluorescence *in situ* hybridization. 4. Vectors for cloning and gene expression: i. Plasmids; Bacteriophages; M13 mp vectors; PUC19 and Blue script vectors, *Baculovirus* and *Pichia* vectors, plant-based vectors (Ti and Ri as vectors). Vectors for gene expression:	**15**

Credit III	**Biophysical Techniques** 1. NMR spectroscopy: i. Basic Principles of NMR, Chemical shift, Intensity, Line width, Relaxation parameters, Spin coupling, ii. Nuclear Overhauser Effect Spectroscopy, Correlation Spectroscopy, Approach to structure determination by 2D-NMR 2. X-ray crystallography: i. Purification of proteins, Crystallization of proteins, Instrumentation, ii. acquisition of the diffraction pattern, basic principles of x-ray diffraction, iii. Crystal Structures (Bravais Lattices), Crystal planes and Miller Indices, Direct Lattice and Reciprocal lattice, iv. Fourier Transform and Inverse Fourier, v. Ewald sphere, Electron density Maps, Phase determination	15
Credit IV	**Radioisotopes in Biology and Confocal Microscopy** 3. Radioisotopes in Biology: i. Principles and applications of radio tracers in medicine, agriculture, industry, and fundamental research ii. Radiation and Radioactive isotopes: Types, Quantities and units of estimation, half-life of isotopes iii. Detection and measurement of radioactivity- Autoradiography, Liquid scintillation counting. iv. Effect of radiation on biological system 4. Confocal Microscopy: i. Scanning optical microscope, confocal principle, ii. Resolution and point spread function, light source: gas lasers & solid-state, primary beam splitter; beam scanning, iii. Pinhole and signal channel configurations, detectors; pixels and voxels; contrast, iv. Spatial sampling: temporal sampling: signal-to noise ratio, multichannel images	15

	Semester II	Lectures
Credit	**MBCT 122: Molecular Biology** **Core Compulsory Theory Paper** Total: 4 Credits Workload: -15 hrs /credit (Total Workload: - 4 credits x 15 hrs = 60 hrs in semester)	
Credit I	**RNA processing &Molecular Techniques** 1. Eukaryotic RNA Processing: i. mRNA splicing (Spliceosome and auto splicing by Intron I and Intron II); rRNA processing; tRNA processing; RNA Editing, ii. Nuclear export of mRNA iii. Regulatory RNAs and noncoding RNAs: Si RNA, Micro RNA, RNA interference (RNAi) iv. Pi RNA (Piwi interacting RNAs) 2. Molecular Techniques: Knockout mice, phage display system, expressed sequence tags, yeast two and three hybrid assay, Activity gel assay, DNA helicase assay, Chromatin Immuno-precipitation (ChIP), Designing probe, Epitope tagging	15
Credit II	**Tools for Genetic engineering** 3. i. Enzymes: Restriction endonucleases and methylases DNA ligase, klenow enzyme, T4 DNA polymerase, polynucleotide kinase, alkaline phosphatase; ii. Cohesive and blunt end ligation, linkers; adaptors; homopolymeric tailing labeling of DNA: iii. Nick translation, random priming, radioactive and non-radioactive probes iv. Hybridization techniques: Northern, Southern, south-western and far-western and colony hybridization, fluorescence *in situ* hybridization. 4. Vectors for cloning and gene expression: i. Plasmids; Bacteriophages; M13 mp vectors; PUC19 and Blue script vectors, *Baculovirus* and *Pichia* vectors, plant-based vectors (Ti and Ri as vectors). Vectors for gene expression:	15

	types (pMal, GST, pET-based vectors), ii. Protein tagging and purification (His-tag, GST-tag, MBP-tag) 5. Construction of genomic DNA and cDNA libraries	
Credit III	**Genome projects** 6. i. Concept and meaning of genome projects ii. Techniques used in deciphering genome (blotting, sequencing) iii Applications of genome projects 7. Introduction to Genome projects of *E. coli*, yeast (*Saccharomyces cerevisia*), *Plasmodium*, Mouse (*Mus musculus*), *Drosophila*, Rice (*Oryza sativa*) and comparative genomics 8. Gene annotation 9. Human Genome project and its applications	**15**
Credit IV	**Molecular diagnostics and applications** 11. Introduction to protein array, protein arrays to detect polygenic diseases, Immunoassay for protein confirmation in specific disorders 12. Detection of diseases-associated changes in gene expression using microarray 13. Detection of RNA signatures of 'Antibiotic Resistance' in bacteria 14. Detection of micro RNA (miRNA): A signature of cancer diagnostics	**15**

Semester II
Suggested References: MBCT 122: Molecular Biology
1. Alberts B. (2017). Molecular Biology of the Cell. Sixth Edition. United States: W.W. Norton.
2. Amon A., Berk A., Martin K. C., Lodish H., Kaiser, C. A., Ploegh H., Krieger M., Bretscher A. (2016). Molecular Cell Biology. United States: Macmillan Learning.
3. Cooper G. M. and Hausman R. E. (2007). The Cell: A Molecular Approach. United Kingdom: ASM Press.
4. Farrell Jr. R. E. (2017). RNA Methodologies: Laboratory Guide for Isolation and Characterization. United Kingdom: Elsevier Science.
5. Garg N. and Kumar A. (2005). Genetic engineering. New York: Nova Biomedical Books

	Semester II	
Credit	**MBCT 123: Enzymology, Bioenergetics and Metabolism** **Core Compulsory Theory Paper** Total: 4 Credits Workload: -15 hrs /credit (Total Workload: - 4 credits x 15 hrs = 60 hrs in semester)	**Lectures**
Credit I	**Enzymology:** 1. Purifications of enzyme, purification chart, 2. Kinetics of reversible inhibitions: Competitive, uncompetitive, non-competitive, mixed, substrate. Primary and secondary plots, Determination of Ki using secondary plots. Significance of inhibitors 3. King Altman approach to derive – two substrate enzyme catalysed reactions 4. Concept of allosterism, positive and negative co-operativity, models of allosteric enzymes (Monad, Wyamann and Changuax and Koshland, Nemethy and Filmer model), kinetics of allosteric enzyme, Hill plot, examples of allosteric enzymes and their significance in regulation.	**15**
Credit II	**Bioenergetics:** 1. Laws of thermodynamics, entropy, enthalpy, free energy, free energy and equilibrium constant Gibbs free energy equation with reference to biological significance. 2. Determination of free energy of hydrolytic and biological oxidation reduction reactions under standard and non-standard conditions 3. High energy compounds 4. Coupled reactions 5. Determination of feasibility of reactions 6. Problems based on 2 and 4. 7. Atkinson's energy charge.	**15**
Credit III	**Lipid Chemistry and Metabolism:** 1. Classification of lipids according to chemical structure, 2. Fatty acids, saturated, unsaturated, branched, nomenclature system,	**15**

	Semester II	
Credit	**MBCT 123: Enzymology, Bioenergetics and Metabolism** **Core Compulsory Theory Paper** Total: 4 Credits Workload: -15 hrs /credit (Total Workload: - 4 credits x 15 hrs = 60 hrs in semester)	**Lectures**
Credit I	**Enzymology:** 1. Purifications of enzyme, purification chart, 2. Kinetics of reversible inhibitions: Competitive, uncompetitive, non-competitive, mixed, substrate. Primary and secondary plots, Determination of Ki using secondary plots. Significance of inhibitors 3. King Altman approach to derive – two substrate enzyme catalysed reactions 4. Concept of allosterism, positive and negative co-operativity, models of allosteric enzymes (Monad, Wyamann and Changuax and Koshland, Nemethy and Filmer model), kinetics of allosteric enzyme, Hill plot, examples of allosteric enzymes and their significance in regulation.	**15**
Credit II	**Bioenergetics:** 1. Laws of thermodynamics, entropy, enthalpy, free energy, free energy and equilibrium constant Gibbs free energy equation with reference to biological significance. 2. Determination of free energy of hydrolytic and biological oxidation reduction reactions under standard and non-standard conditions 3. High energy compounds 4. Coupled reactions 5. Determination of feasibility of reactions 6. Problems based on 2 and 4. 7. Atkinson's energy charge.	**15**
Credit III	**Lipid Chemistry and Metabolism:** 1. Classification of lipids according to chemical structure, 2. Fatty acids, saturated, unsaturated, branched, nomenclature system,	**15**

	3. Structure and function of: triglycerides, phospholipids,sphingolipids, terpencs, prostaglandins,waxes, and steroids. 4. Synthesis of storage lipids: Fatty acids and triacylglycerols, 5. Synthesis of membrane lipids: Glycerophospholipids,sphingolipids, sterols, 6. Degradation of fatty acids (beta oxidation and unsaturatedfatty sacid) and fats in animals 7. Lipids as signal molecules (eg phosphatidyl inositol and eicosanoids).	
Credit IV	**Carbohydrate Chemistry and Metabolism:** 1. Mono, di, oligosaccharides and polysaccharides, with examples 2. Isomerism in sugars: asymmetric centres in sugars, dextro, leavo-rotatory, sugar anomers (reducing and non-reducing sugars), sugar epimers 3. Sugar derivatives such as sugar alcohols, amino sugars, sugar acids, deoxy sugars 4. Glycolysis and gluconeogenesis, Regulation of glycolysis and gluconeogenesis, 5. Synthesis of microbial exopolysaccharides (alginate) 6. Cellulose synthesis and breakdown 7. Regulation of Glycogen synthesis; breakdown, 8. Metabolic flux and its regulation by various metabolicintermediates 9. TCA cycle- regulation, role in energy generation, Role in generating biosynthetic intermediates and glyoxylate cycle	**15**

Semester II

Suggested References MBCT 123: Enzymology, Bioenergetics and Metabolism

1. Cornish-Bowden A. (2014). Fundamentals of Enzyme Kinetics. Netherlands: ElsevierScience.
2. Farrell S. O., Bettelheim F. A., Torres O., Brown W. H. and Campbell M. K. (2015).Introduction to General, Organic and Biochemistry. United States: Cengage Learning.
3. Ferguson S. J. and Nicholls D. G. (2014). Bioenergetics 2. United Kingdom: ElsevierScience.
4. Frayn K. N., Gurr M. I. and Harwood J. L. (2008). Lipid Biochemistry: AnIntroduction. Germany: Wiley.

Semester II

MBCP 124: Molecular Biology, Enzymology and InstrumentationTechniques
Core Compulsory Practical Paper

Total: 4 Credits Workload: -30 hrs /credit
(Total Workload: - 4 credits x 30 hrs = 120 hrs in semester)

1. Concept of lac-operon: Lactose induction of Beta galactosidase; Glucose Repression;Diauxic growth curve of *E. coli.*
2. Plasmid DNA isolation, DNA quantitation and characterization by gel electrophoresis.
3. Construction of restriction digestion map of plasmid DNA
4. Curing of bacterial Plasmid
5. Gene annotation
6. Purification of enzymes (Amylase/Invertase): (ammonium sulphate precipitation, organic solvent precipitation, gel filtration (any two methods); Establishment of enzyme purification chart
7. Determination of Km, Vmax and Kcat values of enzyme
8. Determination of molecular extinction coefficient of biomolecule
9. Isolation of Aflatoxin producing organism. Extraction and detection of Aflatoxin in food.
10. Isolation and characterization of lipase/cellulase/chitinase producing microbe.
11. Scientific Communication and Research Methodology

    Concept of effective communication: Presentation skills, formal scientific presentation skills; Preparing power point presentation, Presenting the work, Scientific poster preparation and oral presentation; Participating in group discussions. Technical writing skills: Types, Formats of scientific reports, scientific writing skills, Significance of communicating science, ethical issues, copyrights and plagiarism, Components of a research paper, publishing scientific papers - peer review process and problems. Use of search engines for scientific data mining, use of reference, use of reference management tools (e.g. Zotero). (Assignment/activity-based teaching method may be used)
12. Virtual lab exercise to understand the instrumentation, experimentation and interpretation of data obtained using HPLC, FACS, FTIR, GC-MS, NMR, X-Ray crystallography MALDI TOF, SEM, TEM, AFM, Confocal Microscope (representative websites)
13. Visit to any lab or institute to understand the principle and working of the bio-analytical instrument studied in theory courses(optional)

	3. Structure and function of: triglycerides, phospholipids,sphingolipids, terpenes, prostaglandins,waxes, and steroids. 4. Synthesis of storage lipids: Fatty acids and triacylglycerols, 5. Synthesis of membrane lipids: Glycerophospholipids,sphingolipids, sterols, 6. Degradation of fatty acids (beta oxidation and unsaturatedfatty sacid) and fats in animals 7. Lipids as signal molecules (eg phosphatidyl inositol and eicosanoids).	
Credit IV	**Carbohydrate Chemistry and Metabolism:** 1. Mono, di, oligosaccharides and polysaccharides, with examples 2. Isomerism in sugars: asymmetric centres in sugars, dextro, leavo-rotatory, sugar anomers (reducing and non-reducing sugars), sugar epimers 3. Sugar derivatives such as sugar alcohols, amino sugars, sugar acids, deoxy sugars 4. Glycolysis and gluconeogenesis, Regulation of glycolysis and gluconeogenesis, 5. Synthesis of microbial exopolysaccharides (alginate) 6. Cellulose synthesis and breakdown 7. Regulation of Glycogen synthesis; breakdown, 8. Metabolic flux and its regulation by various metabolicintermediates 9. TCA cycle- regulation, role in energy generation, Role in generating biosynthetic intermediates and glyoxylate cycle	**15**

Semester II

Suggested References MBCT 123: Enzymology, Bioenergetics and Metabolism

1. Cornish-Bowden A. (2014). Fundamentals of Enzyme Kinetics. Netherlands: ElsevierScience.
2. Farrell S. O., Bettelheim F. A., Torres O., Brown W. H. and Campbell M. K. (2015).Introduction to General, Organic and Biochemistry. United States: Cengage Learning.
3. Ferguson S. J. and Nicholls D. G. (2014). Bioenergetics 2. United Kingdom: ElsevierScience.
4. Frayn K. N., Gurr M. I. and Harwood J. L. (2008). Lipid Biochemistry: AnIntroduction. Germany: Wiley.

Semester II

MBCP 124: Molecular Biology, Enzymology and InstrumentationTechniques
Core Compulsory Practical Paper

Total: 4 Credits Workload: -30 hrs /credit
(Total Workload: - 4 credits x 30 hrs = 120 hrs in semester)

1. Concept of lac-operon: Lactose induction of Beta galactosidase; Glucose Repression;Diauxic growth curve of *E. coli.*
2. Plasmid DNA isolation, DNA quantitation and characterization by gel electrophoresis.
3. Construction of restriction digestion map of plasmid DNA
4. Curing of bacterial Plasmid
5. Gene annotation
6. Purification of enzymes (Amylase/Invertase): (ammonium sulphate precipitation, organic solvent precipitation, gel filtration (any two methods); Establishment of enzyme purification chart
7. Determination of Km, Vmax and Kcat values of enzyme
8. Determination of molecular extinction coefficient of biomolecule
9. Isolation of Aflatoxin producing organism. Extraction and detection of Aflatoxin in food.
10. Isolation and characterization of lipase/cellulase/chitinase producing microbe.
11. Scientific Communication and Research Methodology

    Concept of effective communication: Presentation skills, formal scientific presentation skills; Preparing power point presentation, Presenting the work, Scientific poster preparation and oral presentation; Participating in group discussions. Technical writing skills: Types, Formats of scientific reports, scientific writing skills, Significance of communicating science, ethical issues, copyrights and plagiarism, Components of a research paper, publishing scientific papers - peer review process and problems. Use of search engines for scientific data mining, use of reference, use of reference management tools (e.g. Zotero). (Assignment/activity-based teaching method may be used)
12. Virtual lab exercise to understand the instrumentation, experimentation and interpretation of data obtained using HPLC, FACS, FTIR, GC-MS, NMR, X-Ray crystallography MALDI TOF, SEM, TEM, AFM, Confocal Microscope (representative websites)
13. Visit to any lab or institute to understand the principle and working of the bio-analytical instrument studied in theory courses(optional)

Semester II		
Credit	**MBET 127: Nitrogen Metabolism, respiration and Photosynthesis** **Choice based Optional Theory Paper (Elective)** Total: 2 Credits Workload: -15 hrs /credit (Total Workload: - 2 credits x 15 hrs = 30 hrs in semester)	**Lectures**
Credit I	**Nitrogen Metabolism** 1. Biochemistry of biological nitrogen fixation, properties of nitrogenase and its regulation 2. Ammonia assimilation, glutamine synthetase, glutamate dehydrogenase, glutamate synthetase, their properties and regulation, 3. Biosynthesis of five families of amino acids and histidine, 4. Biosynthesis of purine and pyrimidine bases	**15**
Credit II	**Respiration and photosynthesis:** 5. Respiration: Concept of anaerobic respiration, oxidized sulfur compounds and nitrate as electron acceptor with respect to electron transport chain and energy generation, Biochemistry of methanogenes. 6. Photosynthesis: a) Organization of photosystem I and II, cyclic and non-cyclic flow of electrons, Z scheme, Hill reaction, photolysis of water b) C3, C4 CAM plants, Photorespiration, Regulation of photosynthesis	**15**

Semester I
MB 111: Introduction to Microbial World

Credit	Topic	No. of Lectures (36)
Credit I	**1. Amazing world of Microbiology**	
	a. Development of microbiology as a discipline -Discovery of microscope and Microorganisms (Anton von Leeuwenhoek and Robert Hooke), Abiogenesis v/s biogenesis (Aristotle's notion about spontaneous generation, Francesco Redi's experiment, Louis Pasteur's & Tyndall's experiments)	4
	b. Golden Era of Microbiology	
	i. Contributions of - Louis Pasteur (Fermentation, Rabies, Pasteurization and Cholera vaccine-fowl cholera experiment) Robert Koch (Koch's Postulates, Germ theory of disease, Tuberculosis and Cholera-isolation and staining techniques of causative agent) Ferdinand Cohn (Endospore discovery)	4
	ii. Discovery of viruses (TMV and Bacteriophages), River's Postulates,Contribution of Joseph Lister (antiseptic surgery), Paul Ehrlich (Chemotherapy), Elie Metchnikoff (Phagocytosis), Edward Jenner (Vaccination) and Alexander Fleming (Penicillin) in establishment of fields of medical microbiology and immunology, Discovery of Streptomycin by Waksman	4
	iii. Contribution of Martinus W. Beijerinck (Enrichment culture technique, Rhizobium), Sergei N. Winogradsky (Nitrogen fixation and Chemo-lithotrophy) in the development of the field of soil microbiology	2
	c. Modern Era of Microbiology	
	Carl Woese classification based on 16S r RNA Signification and Application of Human Microbiome, Nano-biotechnology and Space Microbiology	2
	d. Nobel laureates in Life Sciences of 21st Century	2
	(Project Based Learning: Assignments should be given to student)	

Credit		
II	**2. Types of Microorganism and their differentiating characters**	
	a. Prokaryotes, Eukaryotes, three domain and five domain system of classification	2
	b. Bacteria (Eubacteria and Archaebacteria)	1
	c. Protozoa	1
	d. Fungi	1
	e. Algae	1
	f. Viruses, Viroids and Prions	1
	g. Actinomycetes	2
	3. Beneficial and Harmful effects of microorganisms:	1
	a. Medical Microbiology (Enlist diseases caused by various microorganisms, vaccines and antibiotics)	1
	b. Environmental Microbiology (Eutrophication, red tide, Sewage treatment, bioremediation)	2
	c. Food and Dairy Microbiology (Food spoilage, food borne diseases, Probiotics and fermented food)	1
	d. Agriculture Microbiology (Plant diseases and Biofertilizers and Bio-control agents)	1
	e. Industrial Microbiology (Production of antibiotics, enzymes, solvents and contaminants-bacteria and phages)	2
	f. Immunology (Normal flora, Three lines of defence)	2

References:

1. Ahmed M. and Basumatary S. K. (2019). Applied Microbiology. MJP Publisher, Chennai, Tamil Nadu. India.
2. Beck R. W. (2000). A Chronology of Microbiology in Historical Context. United Kingdom: ASM Press.
3. Bender K. S., Buckley D. H., Stahl D. A., Sattley W. M. And Madigan M. T. (2017). Brock Biology of Microorganisms. E-Book, Global Edition. United Kingdom: Pearson Education.
4. Dubey H. C. (2004). A textbook of fungi, bacteria and Viruses. Vikas Publishing House Private Limited. New Delhi, India
5. Dubey R. C. and D. K. Maheshwary. (2012). A textbook of Microbiology. S Chand and Company. New Delhi, India

23. Schlegel H. G. (2005). General Microbiology. Cambridge University Press, United States.
24. Sherwood L., Woolverton C. J. and Willey J. (2016). Prescott's Microbiology. Singapore: McGraw-Hill Education.
25. Stanier R. Y. (2003). General Microbiology. United Kingdom: Palgrave Macmillan Limited.
26. Subba Rao N. S. (2016). Advances in Agricultural Microbiology. Netherlands: Elsevier Science.
27. Tortora G. J., Funke B. R. and Case C. L. (2016). Microbiology: an Introduction. Twelfth edition. Pearson, London.
28. Verma D. K. (2019). Microbiology for Sustainable Agriculture, Soil Health, and Environmental Protection. United States: Apple Academic Press.
29. Woolverton C. J., Sherwood L. And Willey J. M. (2011). Prescott's Microbiology. United Kingdom: McGraw-Hill.

Semester I

MB 112: Basic Techniques in Microbiology

Credit	Topic	No. of Lectures (36)
I	**1. Units of measurement – Introduction to Modern SI units**	1
	2. Microscopy	3
	a. Bright field microscopy:	
	• Electromagnetic spectrum of light	
	• Structure, working of and ray diagram of a compound light microscope; concepts of magnification, numerical aperture and resolving power.	
	• Types, ray diagram and functions of – condensers (Abbe and cardioid) eyepieces and objectives	
	• Concept of aberrations in lenses - spherical, chromatic, comma and astigmatism	
	b. Principle, working and ray diagram of	2
	• Phase contrast microscope	1
	• Fluorescence Microscopy	3
	• Electron Microscopy – TEM, SEM	

	3. Staining Techniques: **a.** Definition of Stain; Types of stains (Basic and Acidic), Properties and role of Fixatives, Mordants, Decolourisers and Accentuators **b.** Monochrome staining and Negative (Relief) staining **c.** Differential staining - Gram staining and Acid-fast staining **d.** Special staining- Capsule, Cell wall, Spore, Flagella, Lipid granules, metachromatic granules	2 1 2 3
II	**4. Sterilization and Disinfection** **a. Sterilization** • Physical Agents - Heat, Radiation, Filtration • Checking of efficiency of sterilization (Dry and Moist) – Biological and Chemical Indicators **b. Disinfection:** • Chemical agents and their mode of action - Aldehydes, Halogens, Quaternary ammonium compounds, Phenol and phenolic compounds, • Heavy metals, Alcohol, Dyes, Detergents and Ethylene oxide. • Characteristics of an ideal disinfectant • Checking of efficiency of disinfectant - Phenol Coefficient (Rideal–Walker method)	3 4 4 4 1 2

References:

1. Debnath M., Prasad G. B. and Bisen P. S. (2012). Microbes: Concepts and Applications. Germany: Wiley.
2. Dokland T., Hutmacher D. W. and Schantz J. and Ng M. M. (2006). Techniques In Microscopy For Biomedical Applications. Singapore: World Scientific Publishing Company
3. Eliasa E. A., Samuelb O., Emmanuela N., Abrahama O. (2013). Evaluation of Efficacy of Disinfectants Using Standard Methods in Healthcare Facilities in Kogi state, Northcentral Nigeria. Asian Journal of Biomedical and Pharmaceutical Sciences. 03 (27): 34-38.
4. Hugo and Russell's Pharmaceutical Microbiology. (2008). Denyer S. P., Hodges N. A., Gorman S. P. and Gilmore B. F. (Editors). Germany: Wiley.
5. McDonnell G. E. (2020). Antisepsis, Disinfection, and Sterilization: Types, Action, and Resistance. United States: Wiley.

Savitribai Phule Pune University

F. Y. B. Sc. Microbiology Practicals Syllabus

Semester I Practical Course MB 113 (Implemented from 2019) Based on theory paper I (MB 111) and Paper II (MB 112)		
Expt. No.	**Topics**	**No. of Practicals**
1	a. Safety measures and Good Laboratory Practices in microbiology laboratory. b. Introduction, operation, precautions and use of common microbiology laboratory instruments: Incubator, Hot air oven, Autoclave, Colorimeter, Laminar air flow hood, Clinical centrifuge.	2
2	a. Construction (mechanical and optical), working and care of bright field microscope. b. Permanent slide observation: Algae, Fungi and Protozoa c. Wet mount slide preparation and its observation for: Bacteria, Algae, Fungi and Protozoa.	3
3	a. Introduction and use of common laboratory glass wares: Test tubes, culture tubes, suspension tubes, screw capped tubes, Petri plates, pipettes (Mohr and serological) micropipettes, Pasteur pipettes, Erlenmeyer flask, volumetric flask, glass spreader, Durham's tube, Cragie's tube and inoculating needles (wire loop, stab needles). b. Learning basic techniques in Microbiology: Wrapping of glassware, cotton plugging, cleaning and washing of glassware, biological waste disposal.	2
4	Basic staining techniques: a. Monochrome staining b. Negative staining c. Gram staining of bacteria	3
5	Observation of motility in bacteria using: Hanging drop method and swarming growth method.	2
6.	Checking of efficacy of chemical disinfectant: Phenol Coefficient by Rideal–Walker method.	2
	TOTAL	14

Semester II

MB 121: Bacterial Cell and Biochemistry

Credits	Topic	No. of Lectures (36)
I	**1. Bacterial Cytology**	1
	Microbial cell size, shape and arrangements	
	2. Structure, chemical composition and functions of the following components in bacterial cell:	
	a. Cell wall (Gram positive, Gram negative)	2
	b. Concept of Mycoplasma, Spheroplast, protoplast, L-form	1
	c. Cell membrane	2
	d. Endospore (spore formation and stages of sporulation)	1
	e. Capsule	1
	f. Flagella	2
	g. Fimbriae and Pili	1
	h. Ribosomes	1
	i. Chromosomal & extra-chromosomal material	2
	j. Cell inclusions (Gas vesicles, carboxysomes, PHB granules, metachromatic granules, glycogen bodies, starch granules, magnetosomes, sulfur granules, chlorosomes)	4
II	**3. Chemical Basis of Microbiology**	
	a. Atom, Biomolecules, types of bonds (covalent, co-ordinate bond, non-covalent) and linkages (ester, phospho-diester, peptide, glycosidic)	2
	b. Chemistry of Biomolecules: Structure, organization and functions	1
	4. Carbohydrates: Definition, classification	
	a. Monosaccharides: Classification based on aldehyde and ketone groups; structure of Ribose, Deoxyribose, Glucose, Galactose and Fructose.	1
	b. Disaccharides: Glyosidic bond, structure of lactose and sucrose.	1
	c. Polysaccharides: Structure and types Examples-Starch, glycogen, Peptidoglycan, chitin	2

	5. Lipids: Definition, classification	2
	a. Simple lipids – Triglycerides, Fats and oils, waxes.	
	b. Compound lipids – Phospholipid, Glycolipids	
	c. Derived lipids – Steroids, Cholesterol	
	6. Proteins: Definition, classification	
	a. General structure of amino acids, peptide bond.	1
	b. Types of amino acids based on R group	1
	c. Structural levels of proteins: primary, secondary, tertiary and quaternary	1
	d. Study of Hemoglobin, flagellin and cytoskeletal proteins	1
	7. Nucleic acids: Definition, classification	2
	a. DNA – structure and composition	
	b. RNA – Types (m-RNA, t-RNA, r-RNA), structure and functions.	
	8. Classification of Bacteria: Introduction to Bergey's Manual of Determinative and Systemic Bacteriology	2
	9. Classification of Viruses: ICTV nomenclature	1

References:

1. Atlas R. M. (1988, Digitized 2010). Experimental Microbiology: Fundamentals and Applications. United States: Macmillan.
2. Bergey's Manual of Systematic Bacteriology. (2005). Volume Two: The Proteobacteria, Part A: Introductory Essays. Garrity G. editor. Springer. ISBN 978-0-387-24143-2
3. Bergey's Manual of Systematic Bacteriology. (2005). Volume Two: The Proteobacteria, Part B: The Gammaproteobacteria. Garrity G. Brenner D. J., Krieg N. R., and Staley J. R. (Eds.). Springer. ISBN 978-0-387-24144-9
4. Bergey's Manual of Systematic Bacteriology. (2005). Volume Two: The Proteobacteria, Part C: The Proteobacteria. Garrity G. Brenner D. J., Krieg N. R., and Staley J. R. (Eds.). Springer. ISBN 978-0-387-24145-6
5. Bergey's Manual of Systematic Bacteriology. (2009). Volume Three: The Firmicutes. Part C: The Proteobacteria. Vos, P., Garrity, G., Jones, D., Krieg, N.R., Ludwig, W., Rainey, F.A., Schleifer, K.-H., Whitman, W. (Eds.). Springer. ISBN 978-0-387-

24. Tsai C. S. (2007). Biomacromolecules: Introduction to Structure, Function and Informatics. Germany: Wiley.
25. Tortora G. J., Funke B. R. and Case C. L. (2016). Microbiology: an Introduction. Twelfth edition. Pearson, London.
26. Yadav M. (2017). Microbiology. Discovery Publishing House, New Delhi, India. ISBN 13: 9788171417315

Semester II

MB 122: Microbial cultivation and growth

Credit	Topic	No. of Lectures (36)
I	**1. Cultivation of Microorganisms:**	
	a. Nutritional requirements and nutritional classification.	3
	b. Design and preparation of media: Common ingredients of media and types of media.	3
	c. Methods for cultivating photosynthetic, extremophilic and chemo-lithotrophic bacteria, anaerobic bacteria, algae, fungi, actinomycetes and viruses.	4
	d. Concept of Enrichment, Pure Culture, Isolation of culture by streak plate, pour plate, spread plate.	3
	e. Maintenance of bacterial and fungal cultures using different techniques.	3
	f. Culture collection centres and their role.	1
	g. Requirements and guidelines of National Biodiversity Authority for culture collection centres.	1
II	**2. Bacterial growth:**	
	a. Kinetics of bacterial growth (Exponential growth model)	3
	b. Growth curve and Generation time	2
	c. Diauxic growth	1
	d. Measurement of bacterial growth- Methods of enumeration:	4
	e. Microscopic methods (Direct microscopic count, counting cells using improved Neubauer, Petroff-Hausser's chamber)	1
	f. Plate counts (Total viable count)	

	g. Turbidometric methods (including Nephelometry)	**1**
	h. Estimation of biomass (Dry mass, Packed cell volume)	**1**
	i. Chemical methods (Cell carbon and nitrogen estimation)	**1**
	j. Factors affecting bacterial growth [pH, Temperature, Solute Concentration (Salt and Sugar)] and Heavy metals.	**4**

References:

1. Atlas R. M. (2005). Handbook of Media for Environmental Microbiology. United States: Taylor and Francis.
2. Atlas R. M. (2010). Handbook of Microbiological Media. Ukraine: Taylor and Francis.
3. Bisen P.S. and Varma K. (2009). Handbook of Microbiology. CBS Publishers and Distributors, New Delhi. India
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5. Dubey R. C. and D. K. Maheshwary. (2012). A textbook of Microbiology. S Chand and Company. New Delhi, India
6. Dubey R. C. and Maheshwari D. K. (2012). Practical Microbiology. S. Chand and Company Limited, New Delhi, India
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12. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume I. Himalaya Publishing House Private Limited, Pune, India.
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14. Purohit S. S. (2006). Microbiology: Fundamentals and Applications. AGROBIOS, Jodhpur, Rajasthan, India

15. Singh R. P. (2012). Microbiology. Kalyani Publishers, New Delhi, India Stanier R. Y. (2003). General Microbiology. United Kingdom: Palgrave Macmillan Limited.
16. Tortora G. J., Funke B. R. and Case C. L. (2016). Microbiology: an Introduction. Twelfth edition. Pearson, London.
17. Yadav M. (2017). Microbiology. Discovery Publishing House, New Delhi, India. ISBN 13: 9788171417315

Semester II
Practical Course MB 123
based on theory paper I (MB 121) and Paper II (MB 122)

Expt. No.	Topics	No. of Practicals
1	**i.** Preparation of simple laboratory nutricnt media (Nutrient agar/broth, MacConkey's agar). **ii.** Checking sterilization efficiency of autoclave using a biological indicator (*B. stearothermophilus*) **iii.** Preparation of Winogradsky's column and observation of different types of microorganisms using bright field microscope.	1 1 1
2	**Special staining techniques:** **i.** Endospore staining **ii.** Capsule staining	2
3	**Isolation of bacteria:** Streak plate technique (Colony and cultural characteristics)	1
4	**Enumeration of bacteria from fermented food / soil / water by:** **i.** Spread plate method **ii.** Pour plate method	2
5	**Study of normal flora of skin:** **i.** Cultivating and observing different morpho-forms of bacteria from skin. **ii.** Study of effect of washing on skin with soap and disinfectant on it's microflora.	2
6	**To study the effect of different parameters on growth of *E. coli*:** **i.** pH, temperature, sodium chloride concentration **ii.** Study of oligodynamic action of heavy metal	3
7	**Preservation of cultures on:** Slants, soil and on grain surfaces; revival of these cultures and lyophilized cultures.	1
	TOTAL	**14**

Kopargaon Taluka Education Society's

K.J. Somaiya College of Arts, Commerce & Science,

Kopargaon, Dist. Ahmednagar.

Department of Zoology
Cross cutting issues (w.e.f. from 2019)

List of Courses addresses crosscutting issues for U.G Course as per Syllabus

(CBCS 2019 Pattern)

Sr. No.	Programme Name	Course code	Name of Course	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	F.Y.B. Sc. Zoology	ZO-111	Animal Diversity I	Biodiversity, conservation, climate change, environmental pollution, human-wildlife conflict, sustainable development
2	F.Y.B. Sc. Zoology	ZO-112	Animal Ecology	Climate change, environmental pollution, human-wildlife conflict, sustainable development
3	F.Y.B. Sc. Zoology	ZO-121	Animal Diversity II	Biodiversity, conservation, climate change, environmental pollution, human-wildlife conflict, sustainable development
4	F.Y.B. Sc. Zoology	ZO-122	Cell Biology	Biotechnology, bioinformatics, zoological research methods, zoological ethics
5	S.Y.B. Sc. Zoology	ZO-231	Animal Diversity III	Biodiversity, conservation, climate change, environmental pollution, human-wildlife conflict, sustainable development

6	S.Y.B. Sc. Zoology	ZO-232	Applied Zoology I	Biotechnology, bioinformatics, zoological research methods, zoological communication, zoological education and outreach
7	S.Y.B. Sc. Zoology	ZO-241	Animal Diversity IV	Biodiversity, conservation, climate change, environmental pollution, human-wildlife conflict, sustainable development
8	S.Y.B. Sc. Zoology	ZO-242	Applied Zoology II	Biotechnology, bioinformatics, zoological research methods, zoological communication, zoological education and outreach
9	S.Y.B. Sc. Zoology	EVS- 231	Environmental awareness	Biodiversity, conservation, climate change, environmental pollution, human-wildlife conflict, sustainable development
10	S.Y.B. Sc. Zoology	EVA- 241	Environmental awareness	Biodiversity, conservation, climate change, environmental pollution, human-wildlife conflict, sustainable development
11	T.Y.B. Sc. Zoology	ZO-351	Pest Management	Biodiversity, conservation, climate change, environmental pollution, sustainable development
12	T.Y.B. Sc. Zoology	ZO-352	Histology	Biotechnology, bioinformatics, zoological research methods, zoological ethics
13	T.Y.B. Sc. Zoology	ZO-353	Biological Chemistry	Biotechnology, bioinformatics, zoological research methods
14	T.Y.B. Sc. Zoology	ZO-354	Genetics	Biotechnology, bioinformatics, zoological research

				methods, zoological ethics
15	T.Y.B. Sc. Zoology	ZO-355	Developmental Biology	Biotechnology, bioinformatics, zoological research methods, zoological ethics
16	T.Y.B. Sc. Zoology	ZO-356	Parasitology	Biodiversity, conservation, climate change, environmental pollution, sustainable development
17	T.Y.B. Sc. Zoology	ZO-3510	Aquarium Management	Biodiversity, conservation, sustainable development
18	T.Y.B. Sc. Zoology	ZO-3511	Poultry Management	Biodiversity, conservation, sustainable development
19	T.Y.B. Sc. Zoology	ZO-361	Medical and Forensic Zoology	Biodiversity and conservation
20	T.Y.B. Sc. Zoology	ZO-362	Animal Physiology	Biotechnology, bioinformatics, zoological research methods, zoological ethics
21	T.Y.B. Sc. Zoology	ZO-363	Molecular Biology	Biotechnology, bioinformatics, zoological research methods
22	T.Y.B. Sc. Zoology	ZO-364	Entomology	Biodiversity, conservation, climate change, environmental pollution, sustainable development
23	T.Y.B. Sc. Zoology	ZO-365	Techniques in Biology	Zoological research methods
24	T.Y.B. Sc. Zoology	ZO-366	Evolutionary Biology	Biodiversity, conservation, climate change, environmental pollution, sustainable development
25	T.Y.B. Sc. Zoology	ZO-3610	Environmental Impact Assessment	Biodiversity, conservation, climate change, environmental pollution, sustainable development

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List of Courses addresses crosscutting issues for P.G Course as per new syllabus (CBCS-2019 Pattern)

Sr. No.	Programme Name	Course code	Name of Course	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	M. Sc. Zoology	ZOUT-111	Biochemistry and Biochemical Techniques	Biotechnology, bioinformatics, zoological research methods, zoological ethics
2	M. Sc. Zoology	ZOUT-112	Cell Biology and Developmental Biology	Biotechnology, bioinformatics, zoological research methods, zoological ethics
3	M. Sc. Zoology	ZOUT-113	Genetics and English in Scientific Communication	Biotechnology, bioinformatics, zoological research methods, zoological communication
4	M. Sc. Zoology	ZODT-114	Freshwater Zoology	Biodiversity, conservation, climate change, environmental pollution, human-wildlife conflict, sustainable development
5	M. Sc. Zoology	ZOUT-121	Molecular Biology and Bioinformatics	Biotechnology, bioinformatics, zoological research methods
6	M. Sc. Zoology	ZOUT-122	Endocrinology and Parasitology	Biotechnology, bioinformatics, zoological research methods, zoological ethics
7	M. Sc. Zoology	ZOUT-123	Comparative Animal Physiology and Environmental Biology	Biodiversity, conservation, climate change, environmental pollution, sustainable development
8	M. Sc. Zoology	ZODT-124	Metabolic Pathways	Biotechnology, bioinformatics, zoological research methods, zoological ethics

9	M. Sc. Zoology	ZOUT-231	Animal Physiology I	Biotechnology, bioinformatics, zoological research methods, zoological ethics
10	M. Sc. Zoology	ZOUT-232	Fundamental of Systematics and Economic Zoology	Biodiversity, conservation, climate change, environmental pollution, sustainable development
11	M. Sc. Zoology	ZOUT-233	Research methodology and Insect Physiology and Biochemistry	Biotechnology, bioinformatics, zoological research methods
12	M. Sc. Zoology	ZODT-234	Immunology	Biotechnology, bioinformatics, zoological research methods, zoological ethics
13	M. Sc. Zoology	ZOUT-241	Animal Physiology II	Biotechnology, bioinformatics, zoological research methods, zoological ethics
14	M. Sc. Zoology	ZOUT-242	Mammalian Reproductive Physiology and Aquaculture	Biodiversity, conservation, climate change, environmental pollution, sustainable development
15	M. Sc. Zoology	ZODT-243	Pest Control	Biodiversity, conservation, climate change, environmental pollution, sustainable development
16	M. Sc. Zoology	ZODT-244	Pollution Biology	Biodiversity, conservation, climate change, environmental pollution, sustainable development

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List of Add-on/Value Added/ Certificate Courses

Sr. No.	Department	Name of Certificate Course	Course Code	Year of Offering	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	Zoology	Vermiculture and Vermicomposting	CC-007	2011	Biodiversity Conservation Climate change Environmental pollution Human-wildlife conflict Sustainable development

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Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Zoology

(Faculty of Science & Technology)

F.Y.B.Sc. Zoology

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

1. Course Structure:

Course Structure with Credit Distribution of the Undergraduate Science Program in Zoology

Course	Course Code and Name of the Course		Cre
F.Y.B.Sc.	**SEMESTER I**	**SEMESTER II**	
CC	ZO-111 Animal Diversity I	ZO-121 Animal Diversity II	2+2
CC	ZO-112 Animal Ecology	ZO-122 Cell Biology	2+2
CC	ZO-113 Zoology Practical Paper	ZO-123 Zoology Practical Paper	1.5+
S.Y.B.Sc.	**SEMESTER III**	**SEMESTER IV**	
CC	ZO-231 Animal Diversity III	ZO-241 Animal Diversity IV	2+2
CC	ZO-232 Applied Zoology I	ZO-242 Applied Zoology II	2+2
CC	ZO-233 Zoology Practical Paper	ZO-243 Zoology Practical Paper	2+2
AECC	EVS 231-Environment Awareness	EVA 241-Environment Awareness	2+2
AECC	LA 231-English/Marathi	LA 241- English /Marathi	2+2
T.Y.B.Sc.	**SEMESTER V**	**SEMESTER VI**	
DSEC	ZO-351 Pest Management	ZO-361 Medical & Forensic Zoology	2+2
DSEC	ZO-352 Histology	ZO-362 Animal Physiology	2+2
DSEC	ZO-353 Biological Chemistry	ZO-363 Molecular Biology	2+2
DSEC	ZO-354 Genetics	ZO-364 Entomology	2+2
DSEC	ZO-355 Developmental Biology	ZO-365 Techniques in Biology	2+2
DSEC	ZO-356 Parasitology	ZO-366 Evolutionary Biology	2+2
DSEC	ZO-357 Zoology Practical Paper 1	ZO-367 Zoology Practical Paper 1	2+2
DSEC	ZO-358 Zoology Practical Paper 2	ZO-368 Zoology Practical Paper 2	2+2
DSEC	ZO-359 Zoology Practical Paper 3	ZO-369 Zoology Practical Paper 3	2+2
SEC	ZO-3510 Aquarium Management	ZO-3610 Environmental Impact Assessment	2+2
SEC	ZO- 3511 Poultry Management	ZO-3611 Project	2+2

Detailed Syllabus of F.Y.B.Sc.

aper	Semester I Course Code & Course	Credits	No of Lectures	Marks (Internal + University)	Semester II Course Code & Course	Credits	No of Lectures	Marks (Internal + University)
I	ZO-111 Animal Diversity I	02	30	15+ 35= 50	ZO-121 Animal Diversity II	02	30	15+ 35 = 50
II	ZO-112 Animal Ecology	02	30	15+ 35 = 50	ZO-122 Cell Biology	02	30	15+ 35 = 50
III	ZO-113 Zoology Practical Paper	01	15 practical	15+ 35 = 50	ZO-123 Zoology Practical Paper	01	15 Practical	15+ 35 = 50

Course No.	Course Title	Total Number of lectures/practical per Term	Standard of passing		
			Internal marks	**University marks**	**Total marks**
ZO-111 (First term)	Animal Diversity–I	Three lectures/Week (Total 30 lectures per	15	35	50
ZO-121 (Second term)	Animal Diversity-II	Three lectures/Week (Total 30 lectures per term)	15	35	50
ZO-112 (First term)	Animal Ecology	Three lectures/Week (Total30lecturesper term)	15	35	50
ZO-122 (Second Term)	Cell Biology	Three lectures/Week (Total30lecturesper term)	15	35	50
ZO-113 (First term)	Zoology Practical Paper	Practical session of 3 hours. 15 Practicals	15	35	50
ZO-123 (Second Term)	Zoology Practical Paper	Practical sessionof3 hours. 15 Practicals	15	35	50

1. Course Structure:

Course Structure with Credit Distribution of the Undergraduate Science Program in Zoology

Course	Course Code and Name of the Course		Credits
F.Y.B.Sc.	**SEMESTER I**	**SEMESTER II**	
CC	ZO-111 Animal Diversity I	ZO-121 Animal Diversity II	2+2
CC	ZO-112 Animal Ecology	ZO-122 Cell Biology	2+2
CC	ZO-113 Zoology Practical Paper	ZO-123 Zoology Practical Paper	1.5 +1.5
S.Y.B.Sc.	**SEMESTER III**	**SEMESTER IV**	
CC	ZO-231 Animal Diversity III	ZO-241 Animal Diversity IV	2+2
CC	ZO-232 Applied Zoology I	ZO-242 Applied Zoology II	2+2
CC	ZO-233 Zoology Practical Paper	ZO-243 Zoology Practical Paper	2+2
AECC	EVS 231-Environment Awareness	EVA 241-Environment Awareness	2+2
AECC	LA 231-English/Marathi	LA 241- English /Marathi	2+2
T.Y.B.Sc.	**SEMESTER V**	**SEMESTER VI**	
DSEC	ZO-351 Pest Management	ZO-361 Medical & Forensic Zoology	2+2
DSEC	ZO-352 Histology	ZO-362 Animal Physiology	2+2
DSEC	ZO-353 Biological Chemistry	ZO-363 Molecular Biology	2+2
DSEC	ZO-354 Genetics	ZO-364 Entomology	2+2
DSEC	ZO-355 Developmental Biology	ZO-365 Techniques in Biology	2+2
DSEC	ZO-356 Parasitology	ZO-366 Evolutionary Biology	2+2
DSEC	ZO-357 Zoology Practical Paper 1	ZO-367 Zoology Practical Paper 1	2+2
DSEC	ZO-358 Zoology Practical Paper 2	ZO-368 Zoology Practical Paper 2	2+2
DSEC	ZO-359 Zoology Practical Paper 3	ZO-369 Zoology Practical Paper 3	2+2
SEC	ZO-3510 Aquarium Management	ZO-3610 Environmental Impact Assessment	2+2
SEC	ZO- 3511 Poultry Management	ZO-3611 Project	2+2

Detailed Syllabus of F.Y.B.Sc.

Paper	Semester I Course Code & Course	Credits	No of Lectures	Marks (Internal + University)	Semester II Course Code & Course	Credits	No of Lectures	Marks (Internal + University)
I	ZO-111 Animal Diversity I	02	30	15+ 35= 50	ZO-121 Animal Diversity II	02	30	15+ 35 = 50
II	ZO-112 Animal Ecology	02	30	15+ 35 = 50	ZO-122 Cell Biology	02	30	15+ 35 = 50
III	ZO-113 Zoology Practical Paper	01	15 practical	15+ 35 = 50	ZO-123 Zoology Practical Paper	01	15 Practical	15+ 35 = 50

Course No.	Course Title	Total Number of lectures/practical per Term	Standard of passing		
			Internal marks	**University marks**	**Total marks**
ZO-111 (First term)	Animal Diversity–I	Three lectures/Week (Total 30 lectures per	15	35	50
ZO-121 (Second term)	Animal Diversity-II	Three lectures/Week (Total 30 lectures per term)	15	35	50
ZO-112 (First term)	Animal Ecology	Three lectures/Week (Total30lecturesper term)	15	35	50
ZO-122 (Second Term)	Cell Biology	Three lectures/Week (Total30lecturesper term)	15	35	50
ZO-113 (First term)	Zoology Practical Paper	Practical session of 3 hours. 15 Practicals	15	35	50
ZO-123 (Second Term)	Zoology Practical Paper	Practical sessionof3 hours. 15 Practicals	15	35	50

Animal Diversity I & II

Objectives:

1. To understand the Animal diversity around us.
2. To understand the underlying principles of classification of Animals.
3. To understand the terminology needed in classification.
4. To understand the differences and similarities in the various aspects of classification.
5. To classify invertebrates and to be able to understand the possible group of the invertebrate observed in nature to understand our role as a caretaker and promoter of life.

Expected Outcomes:

1. The student will be able to understand classify and identify the diversity of animals.
2. The student understands the importance of classification of animals and classifies them effectively using the six levels of classification.
3. The student knows his role in nature as a protector, preserver and promoter of life which he has achieved by learning, observing and understanding life.

Course Title: Animal Diversity –I

Course Code-ZO-111

Semester I

(2 credits-30 lectures)

No.	Title & Contents	Number of lectures
1.	**Principles of Classification:** Taxonomy & Systematics	**(05)**

1.1 Taxonomy: Basic terminology and Introuction

- Alpha, Beta and Gamma levels of taxonomy, Micro-taxonomy
- Macro taxonomy: Phenetics (numerical taxonomy, Cladistics (Phylogenetic systematics), Evolutionary taxonomy (evolutionary systematics)
- Classical taxonomy and experimental or neo taxonomy (biochemical taxonomy and Cytotaxonomy)
- Significance of Taxonomy

1.2 Systematics: definition introduction

1.3 Linnaean system of classification (Six level classification: Phylum, class, order, family, genus, species)

1.4 Concept of Species: Biological & Evolutionary

1.5 Introduction to Binomial Nomenclature.

1.6 Introduction to Five kingdom system.

2. **General Features of kingdom Animalia** **(02)**

2.1 General characters of Kingdom Animalia, Grades of organization

2.2 Symmetry.

3. **Kingdom Protista (Phylum: Protozoa)** **(07)**

3.1 Introduction to Phylum Protozoa

3.2 Salient features of Phylum Protozoa

3.3 Classification of Phylum Protozoa up to classes with two examples of each class (names only).

Class Rhizopoda (e.g :*Entamoebahistolytica, Arcella*),

Class Mastigophora (e.g: *Euglena viridis, Trypanosomagambiense*),

Class Ciliata (e.g*Paramoeciumcaudatum, Opalinaranarum*),

Class Sporozoa (e.g*Plasmodium vivax*, *Toxoplasmagondii*)

3.4 Locomotion in Protozoa: Amoeboid, Ciliary and Flagellar with suitable examples

3.5 Type Study: ***Paramecium caudatum***: Classification, Habit and Habitat, External morphology, Feeding and digestion, Excretion, Reproduction (binary fission and Conjugation)

3.6. Economic importance of Protozoa (three harmful and one useful protozoan)

3.6.1-**Harmful Protozoa**:

Plasmodium vivax (malarial parasite),

Entamoebahistolytica (Amoebic dysentery),

Trypanosomagambiense (Gambian sleeping sickness).

3.6.2- **Useful Protozoa**:

Trichonympha

4. **Origin of Metazoa** **(01)**

4.1 Introduction Origin and importance of Metazoa

5. **Phylum Porifera** **(06)**

5.1. Introduction to Phylum Porifera

5.2 Classification of Phylum Porifera up to classes with two examples of each class (names only, no description of specimens).

Class Calcarea (e.g.: *Leucosolenia, Sycon (Scypha)*

Class Hexactinellida (e.g: *Euplectella* (venus flower basket), *Hyalonema* (glass sponge))

Class Demospongiae (e.g: *Chalina* (Mermaid's gloves, *Spongilla* (fresh water sponge))

5.3 Canal system in sponges: Ascon, Leucon and Rhagon type.

5.4 Skeleton in sponges: Spicules, its types:

Microscleres&Megascleres,

Monoaxon – monactinal, diactinal, Amphidiscs, Triaxon, Polyaxon,

Spongin fibres.

5.5 Regeneration in sponges.

5.6 Economic importance of Phylum Porifera.

6. **Phylum: Cnidaria** **(05)**

6.1 Introduction to Phylum Cnidaria

6.2 Salient features of Phylum Cnidaria

6.3 Classification of Phylum Cnidaria up to class level with given examples each class (names of examples only)

Class Hydrozoa e.g.: Hydra, *Physalia* (Portuguese man of war)

Class Scyphozoae.g: *Aurelia* (Jelly fish), *Leucernaria* (trumpet shaped Jellyfish)

Class Anthozoa: e.g; Metridium (Common sea anemone0

6.4 Polymorphism in Hydrozoa: Polyps & Medusa (polyp types: gastrozooids, dactylozooids, gonozooids) and functions

6.5 Economic importance of Cnidarians with reference to Corals and Coral reefs.

7. **Phylum Platyhelminthes** **(04)**

7.1 Introduction to Phylum Platyhelminthes

7.2 Salient features of Phylum Platyhelminthes

7.3 Classification of Phylum Platyhelminthes up to classes with two examples each class (names of examples only).

Class: Turbellaria (e.g: *Dugesia, Bipallium*)

Class: Trematoda (e.g*: Fasciola hepatica, schistosomahaematobium*)

Class Cestoda: (*Taeniasolium* (pork tape worm),*Echinococcusgranulosus* (dog tapeworm)

7.4 Parasitic adaptations in Platyhelminthes: structural and physiological.

7.5 Economic importance of Platyhelminthes

Course Title: Animal Ecology

Course Code: ZO 112

Semester I (2 Credits-30 Lectures)

Learning outcomes for the course:

- The learners will be able to Identify and critically evaluate their own beliefs, values and actions in relation to professional and societal standards of ethics and its impact on ecosystem and biosphere due to the dynamics in population.
- To understand anticipate, analyse and evaluate natural resource issues and act on a lifestyle that conserves nature.
- The Learner understands and appreciates the diversity of ecosystems and applies beyond the syllabi to understand the local lifestyle and problems of the community.
- The learner will be able to link the intricacies of food chains, food webs and link it with human life for its betterment and for non-exploitation of the biotic and abiotic components.
- The working in nature to save environment will help development of leadership skills to promote betterment of environment.

ZO 112: Animal Ecology

(2 Credits-30 Lectures)

No.	Topic & Content	Number of lectures
1.	**Introduction to Ecology** 1.1 Concepts of Ecology, Environment, Population, Community, Ecosystem, Biosphere, Autecology and synecology.	(02)
2.	**Ecosystem** 2.1 Types of ecosystems: Aquatic (Freshwater, estuarine, Marine and terrestrial (Forest, Grassland and Desert) 2.2 Structure and Composition of Ecosystem (Abiotic components and biotic components. 2.3 Food chain: Detritus and grazing food chains, Food web, Energy flow through the ecosystem, Ecological pyramids: Number, Biomass, and Energy. 2.4 concept of Eutrophication in lakes and rivers.	(08)
3	**Population** 3.1Characteristic of population: Density, Natality, Mortality, Fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion. 3.2Exponential and logistic growth, 3.3 Population regulation – density-dependent and independent factors. Population interactions, Gause's Principle with laboratory and field interactions, 3.4 Quadrate, line and belt transect methods.	(08)
4.	**Community** 4.1Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Eco tone and edge effect; Ecological succession with one example.	(07)
5.	**Animal interactions** 5.1Introduction to Animal interactions 5.2 Types of Animal interactions with at least to suitable examples of each 5.2.1-Competition: Interspecific and intraspecific	(05)

5.2.2- Beneficial Associations:

Commensalism (remora fish on shark, Cattle egrets on livestock),

Mutualism (Termite and Trichonympha, bees and flowers, cleaning symbiosis in fish by prawns.

5.3 Antagonistic associations: Parasitism (Ascaris and man, lice and humans), Prey predation (Lion and deer).

Course Title: Zoology Practical Paper

Course Code: ZO113

Semester I **(1.5 Credits-45 Hours)**

Animal Diversity –I

1. Museum Study of phylum Protozoa: Euglena, Paramecium, Amoeba, Plasmodium sp.
2. Museum study of Phylum Porifera: *Sycon*, *Euplectella*,*Chalina*, Spongilla.
3. Museum study of phylum Cnidaria: *Hydra, Physalia, Aurelia, Metridium*.
4. Museum Study of phylum Platyhelminthes: *Planeria, Faciola hepatica, Taeniasolium*
5. Study of Paramecium: Culture, External morphology, Conjugation and Binary fission.
6. Study of permanent slides: Spicules and Gemmules in Sponges, T.S. of *Sycon*, T.S. of Hydra, Taeniasolium: Scolex, Gravid proglottid.
7. Identification of any three museum specimen with help of taxonomic identification key.
8. Visit to Zoological survey of India/ Museum/National Park.

Animal Ecology:

1. Estimation of Dissolved oxygen from given water sample.
2. Estimation of Water Alkalinity from given water sample.
3. Study of animal community structure by quadrate method (Field or Simulation).
4. Determination of density, frequency and abundance of species by quadrat method.
5. Study of microscopic fauna of freshwater ecosystem (from pond).
6. Estimation of water holding capacity of given soil sample.
7. Estimation of dissolved and free carbon dioxide from water sample.
8. Study of Eutrophication in lake/river.

Course Title: Animal Diversity –II

Course Code: ZO-121:

Semester II **(2 credits-30 lectures)**

No.	Title & Contents	Number of lectures
1.	**Phylum Aschelminthes** 1.1 Introduction to phylum Aschelminthes 1.2 Salient features of Phylum Aschelminthes 1.3 Classification of Phylum Aschelminthes (Class Nematoda only with two examples – *Ascarislumbricoides* (common round worm), *Wuchereriabancrofti* (Elephantiasis)). 1.4 Economic importance of class Nematoda.	(04)
2.	**Phylum Annelida** 2.1 Introduction to Phylum Annelida 2.2 Salient features of Phylum Annelida. 2.3 Classification of Phylum Annelida up to classes with examples of following classes (names of examples only). Class Polychaeta (e.g: *Nereispelagica (neries*/ sand worm, *Aphroditaaculeata* (=Aphrodite/ seamouse) Class Oligochaeta (e.g.: *Pheritimaposthuma* (earthworm), Class Hirudinea (e.g: *Hirudinaria granulosa* common cattle leech) 2.4 Economic importance of Annelida with reference to earthworms as friends of farmers and in their role in vermicomposting.	(06)
3.	**Phylum Arthropoda** 3.1 Introduction to Phylum Arthropoda 3.2 Salient features of Phylum Arthropoda 3.3 Classification of Phylum Arthropoda with specific classes and mentioned examples (names only) Class:Crustacea:*Palaemonpalaemon* (Prawn) *Brachyura* spp. crabs) Class: Chilopoda: *Scolopendra* sp. (centipede) Class: Diplopoda: *Julus* sp. (millipede)	(06)

Class Insecta*: Periplanetaamericana* (American Cockroach), *Anopheles stephensii* (mosquito).

Class: Arachnida- Spiders, *Buthussp (*scorpion)

3.4 mouth parts in insects: Mandibulate (cockroach), Piercing and sucking (female Anopheles mosquito), chewing and lapping type (honey bee)

3.5 Economic importance of Arthropoda

Useful Insects: Honey bee, Lac insect, Silkworm.

Harmful insects: Female Anopheles mosquito, Red cotton bug, Rice weevil

4.	**Phylum Mollusca** 4.1 Introduction to Phylum Mollusca 4.2 Salient features of Phylum Mollusca 4.3 Classification of Phylum Mollusca with specific classes and mentioned examples (names only) Class Gastropodae.g*Pila globosa* (apple snail) Class Pelecypodae.g*Lamellidensmarginalis*(Bivalve) Class Polyplacophorae.g*Chiton* Class: Cephalopodae.g: *Octopus vulgaris* (common octopus), *Sepia officinalis* (common Cuttle fish) 4.4 Economic importance of Mollusca.	(06)
5.	**Study of Phylum Echinodermata** 5.1 Introduction to Phylum Echinodermata 5.2 Salient features of Phylum Echinodermata. 5.3 Classification of Phylum Echinodermata with specific classes and mentioned examples (names only) Class Asteroidea (*Asteriasrubens* sea stars or starfish) Class: Holothuroidea. *Holothuria sp*. sea cucumbers) Class: Echinoidea*(Echinus esculentis*common sea urchins)	(08)

Class: Crinoidea (sea lilies or feather stars)

5.4 **Type study:** ***Asteriasrubens*** **(Sea Star):** Classification, Habit Habitat, External Morphology, Digestive system, Water vascular System and autotomy and regeneration

5.5Pedicillaria in Echinodermata: straight, crossed, valvate, tridactylous, globigerous.

5.6 Economic importance of Echinidermata.

Course Title: Cell biology

Course Code: ZO122:

Semester II(2 credits-30 lectures)

Learning outcomes for Cell Biology

- The learner will understand the importance of cell as a structural and functional unit of life.
- The learner understands and compares between the prokaryotic and eukaryotic system and extrapolates the life to the aspect of development.
- The dynamism of bio membranes indicates the dynamism of life. Its working mechanism and precision are responsible for our performance in life.
- The cellular mechanisms and its functioning depends on endo-membranes and structures. They are best studied with microscopy.

ZO122: Cell biology

(2 credits-30 lectures)

No.	Title & Contents	Number of lectures
1.	**Introduction:**	**(04)**
	1.1 Introduction cell biology,	
	1.2 Cell as basic unit of life.	
	1.3 Importance of Cell Biology and its applications in industry.	
	Overview of Cells	
	1.3 Introduction to Prokaryotic and Eukaryotic cells.	
	1.4 Structure and function of Prokaryotic *(E. coli)*	

1.5 Structure and function of Eukaryotic cells (Animal and Plant Cell)

2	**Techniques in Cell Biology:**	**(04)**
	3.1 Introduction	
	3.2 Microscopy: Basic Principle, Simple, Compound and applications of Electron Microscope.	
	3.3 Stains and dyes: Types of Stain: Acidic, basic and neutral.	
	Dye (Preparation and chemistry of dyes not expected)	
	3.4 Micrometry.	
3	**Plasma Membrane:**	**(06)**
	4.1Introduction	
	4.2 Structure of plasma membrane: Fluid mosaic model.	
	4.3Transport across membranes: Active and Passive transport, Facilitated transport, exocytosis, endocytosis, phagocytosis – vesicles and their importance in transport.	
	4.4 Other functions of Cell membrane in brief Protection, cell recognition, shape, storage, cell signalling.	
	4.5 Cell Junctions: Tight junctions, gap junctions, Desmosomes.	
4	**Nucleus: Structure and function**	**(04)**
	5.1Introduction to Nucleus	
	5.2 Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleoplasm, Nucleolus	
	5.3 Chromatin: Eu-chromatin and Hetro-chromatin, nature and differences.	
	5.4 Functions of nucleus	
5.	**Endomembrane System**	**(04)**
	6.1 Introduction	
	6.2 Structure, location and Functions: Endoplasmic Reticulum, Golgi apparatus, Lysosomes and vacuoles.	
7.	**Mitochondria and Peroxisomes**	**(03)**

7.1 Introduction

7.2 Mitochondria: ultrastructure and function of mitochondrion.

7.3 Peroxisomes

Cell Division **(05)**

7.1 Introduction

7.2 Cell cycle (G1, S, G2, M phases),

7.3 Mitosis.

7.4 Meiosis.

Course Title: Zoology Practical Paper

Course Code: ZO123

Semester II (1.5 Credits-45 Hours)

Animal Diversity –II

1. Museum study of Phylum Aschelminthes: *Ascarislumbricoides*,
2. Museum study of phylum Annelida: *Neries*, Earthworm, Leech.
3. Museum study of phylum Arthropoda: Prawn, Cockroach, Centipede, Millipede, Crab
4. Museum study of phylum Mollusca: *Pila*, *Chiton*, Bivalve, Octopus.
5. Museum study of phylum Echinodermata: Sea Star, Sea urchin, Brittle Star, sea cucumber.
6. Study of permanent slides: Mouthparts of Insects -Mandibulate, Piercing and sucking, Chewing and Lapping.
7. Types of Shells in Mollusca. *Pila*, Bivalve, Chiton, Sepia.
8. Economic importance of honey bees, Lac insects silk worms, red cotton bug, Anopheles mosquito
9. Earthworm: vermicomposting bin preparation and maintenance.
10. Visit to a vermicomposting unit/ field for insect pest collection and its identification

Cell Biology

1. Study of Microscope: Simple and Compound
2. Micrometry: Measurement of microscopic objects
3. Study of cell: Preparation of temporary mount of human buccal epithelial cells.
4. Preparation of blood smears to observe the blood cells
5. Temporary preparation of mitotic cell from onion roots

6. Study of Cell organelles (any three) by using microphotographs

Recommended Reference Books

Animal Diversity – I and II

1. Anderson, D.T (Ed) 1988: Invertebrate Zoology, Oxford University Press.
2. Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.
3. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
4. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
5. Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home.
6. Brusca, R.C andBrusca, G. J (2003): Invertebrate (2nd ed.) Sinauer Associates Inc., Publishers Sunderland.
7. Hadzi, J (1963): The Evolution of Metazoa, Macmillan Newyork.
8. Hyman, L. H (1940): Invertebrates Vol I, Protozoa through ctenophore.
9. Hyman. L. H (1955): The Invertebrates Vol: IV, Echinodermata, the coelomate bilateria, Mcgraw Hill, Newyork.
10. Modern Text-Book of zoology, Vertebrates. By Kotpal, RL., Rastogi and Co., Meerut.
11. Nigam H.C., Zoology of Chordates, Vishal Publication, Jalandhar-144008.
12. Phylum Protozoa to Echinodermata (series) by Kotpal, RL. Rastogi and Co., Meerut
13. Parker T.J and W.A Haswell (1972): A text book of Zoology, Vol –I (7th edition by Marshall and Williams) Mcmillan Press ltd.
14. Jordan, E.L. and P.s.Verma Invertebrate Zoology, S. Chand and Co., Ltd. Ram Nagar, New Delhi.
15. Russel Hunter: - A Biology of higher invertebrates, MacMillon Co. Ltd. London

Section II - Practicals in Evolutionary Biology

1. Study of morphological similarities and differences between man and ape	(C)	D
2. Study of types of fossils with the help of specimens/ charts/ photos	(C)	D
3. Study of animal adaptations in: Turtle, Draco, Exocoetus, Bat and Parrot	(C)	D
4. Study of evidences of evolution- embryological, paleontological, connecting links, morphology and comparative anatomy.	(C)	E
5. Study of successive stages of evolution of man : a) Australopithecus b) *Homo erectus* c) *Homo neanderthalis* d) Cro-Magnon man e) *Homo sapiens.*	(C)	D
6. To record Zoogeographical distribution of animals to respective zoogeographical Realms on the world map (Lung fishes, marsupials, flightless birds, Camel, Elephant, Ostrich etc.).	(C)	E

Savitribai Phule Pune University

(Formerly University of Pune)

Two Year Degree Program in Zoology

(Faculty of Science & Technology)

Revised Syllabi for

M.Sc. (Zoology) Part-I

(for Colleges Affiliated to Savitribai Phule Pune University)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Following is the syllabus of each course along with the course outcomes:

Course Code and Course Name:

ZOUT 111 Biochemistry and Biochemical Techniques. (4 Credits: 60 Lectures)

Semester I

After successfully completing this course, students will be able to:

CO1: Define basic terms in biochemistry and biochemical techniques.

CO2: Explain the applications of the various biochemical techniques.

CO3: Explain the structure and functions of various biomolecules.

CO4: Explain the importance of tools and techniques in biology.

CO5: Illustrate the importance of pH, buffer and water in living systems.

CO6: Illustrate the principle, working and applications of basic techniques used in biology.

CO7:Draw the structures of various carbohydrates and amino acids.

CO8: Classify enzymes with examples.

Biochemical techniques:

CO1: Explain the importance and applications of techniques in biochemistry.

CO2: Explain theprinciple and applications of various chromatographic techniques with examples.

CO3: Explain the principle, working, materials used and applications of electrophoresis.

CO4: Describe the concept of light, electromagnetic spectrum and its application in absorption spectroscopy.

CO5: Illustrate the importance of radioactive compounds and radioactivity in biology.

CO6: Demonstrate the principle and working of Warburg's apparatus.

CO7: Demonstrate the principle, working, applications of centrifugation.

CO8: Justify the applications of radioactivity compounds in biology.

CO9: Compare the various separation techniques.

Sr. No.	Name of the topic	Lectures allotted
	Biochemistry:	
1.	**Basics of chemistry**- Structure of atoms, molecules and chemical bonds, Normality, molarity, molality	(02L)
2.	**Chemistry of Water** : Structure of water and physicochemical properties of water, water as universal solvent, pH and Buffers, Biological Buffer System	(04L)
3.	**Carbohydrates:** Classification, basic Structures and functions, Biological Significance.	(03L)
4.	**Lipids:** Classification, structure and function and biological significance.	(03L)
5.	**Vitamins:** Classification- water-soluble and fat-soluble vitamins, Biological significance.	(02L)
6.	**Amino acids:** Classification, properties (Physical properties- Optical Isomerization, Absorption in UV light, Ionization; Chemical properties- Reactions with carboxyl group and amino group)	(05L)
7.	**Proteins:** **a.** Peptide bond formation, Ramachandran plot. b. Protein structure:-Primary structure, Secondary structure, Tertiary structure and Quaternary structures with examples, Biological significance of proteins.	(09L)
8.	**Enzymes:** a. Classification, nomenclature and properties b. Enzyme kinetics -one substrate reaction (Michaelis-Menten Equation) c. Factors affecting enzyme activity d. Enzyme inhibition e. Allosteric Enzymes. f. Isozymes (LDH) and coenzymes g. Clinical and industrial significance- Any 3	
	Biochemical Techniques:	
1.	**Chromatography:** Principle, working and applications of: Adsorption chromatography Partition chromatography, Ion-exchange chromatography, Molecular exclusion chromatography, Affinity chromatography,Gas chromatography, High Performance Liquid Chromatography.	(8L)

2. **Electrophoresis:** Moving boundary electrophoresis, zone electrophoresis, different supports used for electrophoresis, electrophoresis of proteins, electrophoresis of Nucleic acids, isoelectric focussing. **(5L)**

3. **Absorption spectroscopy:** Concepts of light & electromagnetic spectrum, Ultraviolet and Visible spectrophotometry, atomic absorption spectrometry and applications. **(5L)**

4. **Radioactivity:** Properties of radioisotopes, commonly used isotopes, structure & working of G.M, counter, isotopic dilution analysis, use of isotopes in biology, radiation hazards. **(3L)**

6. **Manometry:** Respiratory quotient determination, Principle of Warburg's apparatus, working and applications. **(2L)**

7. **Methods for protein sequencing.** **(4L)**

N-terminal sequencing

C-terminal sequencing.

Methods for DNA sequencing.

Maxam- Gilbert Sequencing

Chain termination method

Dye terminator sequencing

8. **Centrifugation:** Principle, Types of centrifugation- Preparative and Analytical.applications of centrifugation. **(3L)**

REFERENCE BOOKS:

1.Biochemistry, 3rd Ed. (2005), Voet Donald and Voet Judith G. John, Publisher: Wiley & sons, New York.

2.Biochemistry 6th Ed, (2007) Berg Jeremy, Tymoczko John, StryerLubert, Publisher: W. H. Freeman, New York.

3.Lehninger's Principles of Biochemistry, 4th edition, (2005) Nelson D. L. and Cox M. M. W. H. Freeman & Co. NY.

4.Biochemical Calculations, 2nd Ed., (1997) Segel Irvin H., Publisher: John Wiley and Sons, New York.

5.Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001) Palmer Trevor, Publisher: Horwood Pub. Co., England.

6.Biochemistry, Geoffrey Zubay, William C Brown Pub; 4th edition (June 1999)

7.Principles and Techniques of Biochemistry and Molecular Biology, 6th edition (2008), Keith Wilson and John Walker, Publisher–Cambridge University Press.

8.Light Microscopy in Biology: A Practical Approach, 2nd edition (1999), Alan J. Lacey, Publisher–Oxford University Press.

9.Electron Microscopy: Principles and Techniques for Biologists, (1992), Lonnie D. Russell, Publisher-Jones & Bartlett

Course Code and Course Name:

ZOUT 112 Cell Biology and Developmental Biology(4 Credit: 60 Lecture)

Semester I

After successfully completing this course, students will be able to:

Cell Biology:

CO1: Label the various cell parts

CO2: Sketch and label various types of cells and cell organelles.

CO3: Explain carbon as backbone of biomolecules.

CO4: Explain the ultrastructure and functions of various cell organelles.

CO5: Explain the concepts of cell signalling.

CO6: Illustrate the chemistry and organization of cytoskeleton.

CO7: Illustrate the types, development and causes of tumor.

CO8: Diagrammatically represent the cell cycle phases and its regulation.

Developmental Biology:

CO1: Define the terms in developmental biology

CO2: Explain the significance of model organism for developmental studies.

CO3: Explain the types of eggs, concept of fertilization and cleavage pattern.

CO4: Explain the concept of mesoderm induction and pattern formation with examples.

CO5: Describe neural competence and induction.

CO6: Explain the concept of growth and differentiation.

CO7: Illustrate postembryonic development.

CO8: Compare and contrast spermatogenesis and oogenesis.

Sr. No.	Name of the topic	Lectures allotted
1.	Cell theory, general organisation of cell and characteristics of living systems.	(02L)
2.	Overview of chemical nature of the cell and importance of carbon in biologically important molecules.	(02L)
3.	Plasma membrane: Ultrastructure, membrane proteins; membrane transport – channels, carriers and pumps; membrane potential and synaptic transmission.	(04L)
4.	Endomembrane system: (Endoplasmic reticulum, Golgi complex, Lysosomes); protein trafficking – secretory and endocytic pathways.	(04L)
5.	Mitochondria: Structure, genetic system, functions; protein import	(03L)
6.	Nucleus: Ultrastructure – nuclear envelope, nuclear lamina, nuclear pore complex, nucleolus.	(03L)
7.	Cell Cycle: Phases, check points, mechanism of regulation; regulators of cell cycle progression – MPF, cyclins and cyclin dependent kinases (CDKs).	(03L)
8.	Cytoskeleton: Types, chemistry, organisation, associated proteins and their role.	(03L)
9.	Cancer: Types, development, causes; characteristics of cancer cell, tumour viruses, oncogene and tumour suppresser gene.	(03L)
10.	Cell signalling: Signalling molecules and their receptors, cell surface receptors,significance of cell signalling.	(03L)
	Developmental Biology:	
1.	**Introduction to developmental biology:** Early theories of Developmental biology Concepts of Developmental biology – Growth, cell division, cell differentiation, cell communication, signalling, patterning, induction and competence.	(3L)
2.	**Model Organisms:** Invertebrate: *Drosophila melanogaster,* Pisces: Zebra Fish- *Danio rerio*, Amphibians: *Xenopuslaevis,* Birds: Chicken, Mammals: Mouse.	(3L)
3.	**Gametogenesis:** Spermatogenesis: spermatogenesis, structure of sperm, regulation of sperm motility, Oogenesis: structure of ovum, previtellogenesis, vitellogenesis and post-vitellogenesis	(2L)
4.	**Fertilization:**: Concept of fertilization, types of fertilization, Species specific sperm attraction, recognition of egg & sperm, acrosome reaction, signal transduction, molecular strategy to avoid polyspermy in fertilization	(4L)

5. **Types of eggs:** Based on amount of distribution of yolk, Cleavage: types and significance. **(2L)**

6. **Morphogenesis:** Blastulation: Amphiouxus, Frog, Chick, Mid Blastula Transition, **(5L)**
Comparative study of Gastrulation in Amphioxus, Frog, Chick
Neurulation: Frog, Chick
Organogenesis: Development of the vertebrate eye –formation of eye field, cell differentiation

7. **Pattern formation: Setting up the body axis** **(4L)**
   1. Animal vegetal axis: Amphibians,
   2. Dorsal ventral axis: Amphibians
   3. Antero-posterior axis: *Drosophila*-role of bicoidnanos hunchback.

8. **Organizers:** **(2L)**
Spemann and Mangold: Primary embryonic induction, Functions of organizer, Molecular mechanisms of Amphibian axis formation **(3L)**

9. **Regeneration:**
Limb regeneration: Salamander, Regeneration in Hydra **(2L)**

10. Apoptosis, aging and senescence.

REFERENCE BOOKS:

1. Karp Gerald (2010) *Cell Biology*. 6th Edition, John Willey & Sons (Asia) Pte. Ltd.
2. Cooper Geoffrey M. (1997) *The Cell: A Molecular Approach*. ASM Press, Washington D.C., U.S.A.
3. Sadava David E. (1993) *Cell Biology – Organelle Structure and Function*. Jones &Barlett Publishers, Boston, London.
4. Hardin Jeff, Gregory Bertoni and Lewis J. Kleinsmith (2012) *World of the Cell*. 8th Edition, Pearson Education, Inc., San Francisco, U.S.A.
5. Alberts B., A. Johnson, J. Lewis, M. Raff, K. Roberts and P. Walter (2008) *Molecular Biology of the Cell*. 5th Edition, Garland Science, New York, U.S.A.
6. Lodish H., D. Baltimore, A. Berk, L. Zipursky, M. Matsudaira and J. Darnell (1995) *Molecular Cell Biology*. Eds. 3, Scientific American &

W. H. Freeman, New York.

7. De Robertis E. D. P. and De Robertis E. M. E. (1987) *Cell and Molecular Biology*. 8th Edition, Lea and Febiger, Philadelphia.
8. Loewy A. G., P. Siekevitz, J. R. Menninger and J. A. N. Gallant (1991) *Cell Structure & Function*. Saunders College Publishing, U.S.A.
9. Nelson D. L. and Cox M. M. (2008) *Lehninger Principles of Biochemistry*. 5th Edition, W. H. Freeman & Co. NY.
10. *Developmental Biology*, 9th edition (2010), S.F. Gilbert. Publisher – Sinauer,Associates Inc.
11. *Principles of Development*, 3rd edition (2007), Lewis Wolpert, Publisher- Oxford,University Press.
12. *An Introduction to Embryology*, 5th edition (2004), B. I. Balinsky. Publisher – ThomasAsia Pvt. Ltd.
13. *Developmental Biology*, (2001), R. M. Twyman, Publisher - Bios Scientific, Publishers LTD.
14. Analysis of Biological Development , 2000, Klaus Kalthoff, McGraw-Hill Science/Engineering/Math; 2nd Ed edition.

Course Code and Course Name: **(4 Credit: 60 Lecture)**

ZOUT 113 Genetics and English in Scientific Communication.

Semester I

After successfully completing this course, students will be able to:

Genetics:

CO1: Define the basic terminologies in genetics.

CO2: Identify genetic disorders based on Karyotypes and traits.

CO3: Explain the concept of Mendelian genetics, gene, gene regulation and multiple alleles.

CO4: Discuss Linkage and crossing with their types and significance.

CO5: Explain the principles of Population genetics.

CO6: Illustrate the modified Mendelian laws of inheritance.

CO7: Justify the inheritance of qualitative and quantitative traits.

CO8: Solve the problems based on gene frequency.

English in Scientific Communication:

CO1: Write the outline of a scientific paper.

CO2: Write the title, abstract, discussion and citations of a given scientific article.

CO3: Prepare a scientific presentation using PowerPoint.

CO4: Explain language as a tool for effective scientific communication.

CO5: Use the formal elements of specific types of scientific writing.

CO6: Critically analyze data from research; incorporate it into assigned writing clearly, concisely, and logically; and attribute the source with proper citation.

CO7: Practice the unique qualities of professional rhetoric and writing style, such as sentence conciseness, clarity, accuracy, honesty, avoiding wordiness or ambiguity, using direct order organization, readability, coherence and transitional devices.

CO8: Justify the importance of plagiarism check and Proof-read given article.

Sr. No.	Name of the topic	Lectures allotted
1.	Recapitulation of Mendelian principles; Practical applications of genetics in brief	(02L)
2.	Classical concept of a gene:Allele, pseudoalleles, multiple alleles (blood groups)	(02L)
3.	Gene interactions and epistasis and their types.	(02L)
4.	Linkage and crossing over: Linkage, linkage groups, types of crossing over, sex linkage, sex limited and sex influenced characters, Recombination,recombination maps in diploids for 2 point and 3 point test cross, (determination of gene order with suitable examples)	(06L)
5.	Quantitative genetics : Polygenic inheritance, heritability and its measurementsand Quantitative Traits Locus mapping	(03L)
6.	Principles of Population Genetics: Hardy-Weinberg law and its application for autosomal genes. Calculations of gene frequencies with suitable examples.	(05L)
7.	Somatic cell genetics and its applications.	(02L)
8.	Microbial genetics : Methods of genetic transfers – transformation, conjugation, transduction	(03L)

9. Extra chromosomal inheritance:Inheritance of Mitochondria. **(01L)**

10. Human genetics: dominant and recessive disorders, physical traits. **(04L)**

English in Scientific Communication:

1. Language as a communication tool; relationship among reading, writing, listening and speaking **(2L)**

2. Pragmatic competence:co-operative principles and politeness principles **(1L)**

3. Organisation of English language: sentence structure, basic grammar, sequence and tenses, syntax, paragraphs, paraphrases and précis writing, synonyms and antonyms **(3L)**

4. Common errors in written and spoken English: tautology, double negative, double positive, superfluous words **(2L)**

5. Oral presentation: How to prepare a presentation, power point slides, use of communication and IT, voice, speed of delivery, obstacles in effective communication **(2L)**

6. Drafting of a researchproject for financial assistance from funding agency, writing of scientific paper using word processor. **(2L)**

7. Outline of a scientific research paper: **(14L)**

7.1Hypothesis, theory and concept

7.2Title designing, framing Abstract and Keywords

7.3 Introduction: statement of the problem and justification; aim, objectives, need, significance and rationale of the study, review of literature.

7.4Materials and Methods: contents, importance of measurements, reproducibility etc.

7.5Observations and Results: text and data presentation, tables, graphs, histograms, diagrams, photographic plates, legends and captions

7.6Discussion: logical sequence and critical analysis of ideas and evidences, data conclusion

7.7 References: finding references from journals, books and databases; Citation - styles of citations

7.8Summary, Acknowledgements

8. Editing and correcting: proof-reading symbols, jargons and abbreviations **(3L)**

9. Plagiarism: meaning, types, avoiding plagiarism. **(1L)**

REFERENCE BOOKS:

1. Genetics, 3Rd Edn by Strickberger, Pearson India, 2015, Paperback, 9789332555105
2. Principles of Genetics,Gardner, E.J., Peter & Simmons, M.J. and Snustad, D.P. 8thEdn.John Wiley and Sons, New York, 2006.
3. Concepts of Genetics. William S Klug and Michael R Cummings. 10thEdn. Pearson Education India, 2016.
4. Lewin, Benjamin. Genes IX. John Wiley and Sons, New York,2008.
5. Genetics By Verma,PS. And Agrawal, VK., S.Chand and Co.,New Delhi
6. Genetics By Gupta, PK., Rastogi Publication, Meerut
7. Genetics By Sarin,C., Tata McGraw Hill,New Delhi
8. Genetics: Daniel J Fairbanks, W. Ralph Andersen; Brooks / Cole Publ. co. (1999).
9. iGenetics: A Molecular Approach, 3rdEdn by Peter J Russell, Pearson India, 2016, Paperback, 9789332571624
10. O'Conner M. and F. P. Woodford (1975) Writing Scientific Papers in English. Elsevier-ExcerptaMedica-North Holland Publ., Amsterdam.
11. Trelease S. F. (1958) How to Write Scientific and Technical Papers. Williams and Wilkins Co. Baltimore, U.S.A.
12. Day Robert (1996) How to Write and Publish a Scientific Paper. Cambridge University Press.
13. McMillan V. (1997) Writing Papers in the Biological Sciences. Edn. 2, W. H. Freeman, New York.
14. Winkler Anthony C. and Jo Ray McCuen-Metherell (2008) Writing the Research Paper, A Handbook. 7th Edition, Wadsworth Cengage Learning, Boston, M.A., U.S.A.
15. Vijayalakshmi G. and C. Sivapragasam (2008) Research Methods – Tip & Techniques. M.J.P. Publishers, Chennai.
16. *Kothari C. R. (2009) Research Methodology: Methods & Techniques.* 2nd Revised Edition, New Age International Publishers, New Delhi.
17. Levinson Stephen C. (2003) Pragmatics. Cambridge University Press, Cambridge.
18. Yule George (2012)Pragmatics (Oxford Introduction to Language Study

Sr. No.	Name of the topic	Lectures allotted
1.	**Introduction:** 1.1 Applications and Uses of Statistics 1.2 Population & sample, Different types of Sample 1.3 Exercise & Problems.	(02L) (3L)
2.	**Data Classification:** 2.1 Some important terms (Class frequency, class- limits, Class-width, class mark) 2.2Frequency distribution, Cumulative frequency, Graphical representation of data (Histogram, Pie-Diagram, Ogive-Curve.) 2.3 Exercise & Problems	(3L)
3.	**Measures of central tendency:** 3.1 Concept of central tendency, Types of central tendency (Arithmetic mean, Median and mode) combined mean. 3.2 Partition values (Quartiles, Deciles, and Percentiles), Box plot. 3.3 Exercise & Problems.	(4L)
4.	**Measures of dispersion:** 4.1 Concept of dispersion, absolute and relative measure of dispersion. 4.2 Different measures of dispersion (Range, Quartile- Deviation, Variance and standard-deviation, Coefficient of Variation) combined variance 4.3 Exercise & Problems.	(5L)
5.	**Correlation and Regression:** 5.1 Bivariate data, concept of correlation, Types of Correlation, Scatter diagram, Karl Pearson's coefficient of correlation and its properties. 5.2 Concept of regression, Linear regression, regression Coefficients and its properties. 5.3 Exercise & Problems.	(5L)
6.	**Probability and probability distribution:** 6.1 Some important terms (types of experiment, sample Space and types of sample space, events and types of events.) 6.2 Definition of probability (mathematical and classical) Conditional	

probability. Concept of random variable Univariate Probability Distribution and its mathematical expectation.

6.3 Some standard probability distributions (binomial, Poisson and normal) their probability distribution, mean, variance, and properties of these distribution.

6.4 Exercise & Problems. **(8L)**

7. **Test of hypothesis:**

7.1 Some important terms (hypothesis, types of hypothesis, Test, Critical region, acceptance region, type I error, type II error, level of significance, p-value)

7.2 Test for mean and equality of two population means, Test for proportion and equality of two population proportions.

7.3 chi-square test for goodness of fit, Unpaired and paired t test. F test for equality of two population variances.

7.4 Software used for Statistical analysis

7.5 Exercise & Problems.

Course Code and Course Name: **(2 Credits- 60 Hours)**

ZODP 114 Practical Biostatistics.

Semester I

After successfully completing this course, students will be able to:

CO1: Construct frequency distribution chart.

CO2: Graphically represent the given data.

CO3: Solve the statistical problems based on Central Tendency, Dispersion, Correlation andregression.

CO4: Apply computer software for statistical analysis.

CO5: Solve numerical problems on test of hypothesis using biological data.

CO5: Illustrate the physicochemical properties of water.

CO6: Demonstrate the effect of pollutants on freshwater bodies

CO7: Justify the presence of zooplanktons and aquatics forms in freshwater bodies.

Sr. No.	Name of the topic	Lectures allotted
1.	Introduction to freshwater habitats. Lotic habitat: Major rivers in India Lentic habitat: Lakes, ponds, wetlands and ephemeral water bodies. Thermal stratification in lakes.	(02L)
2.	Physico-chemical conditions of freshwater and its implications on freshwater biota. Physical conditions: Water current, water colour, turbidity and temperature. Chemical conditions : pH, carbon dioxide, dissolved oxygen, hardness, acidity and alkalinity, nitrate, phosphate and sulphates.	(7L)
3.	General characters of plankton with special emphasis on the characters used in taxonomy and reproduction: Rotifera, Copepoda, Cladocera and Ostracoda.	(4L)
4.	Introduction to minor phyla: Gastrotricha, Bryozoa and Tardigrada (water bears).	(2L)
5.	Diversity and economic importance of freshwater Crustacea and Mollusca.	(2L)
6.	Locomotory and respiratory adaptation in freshwater insect orders: Ephemeroptera,Odonata, Plecoptera, Coleoptera, Diptera and Hemiptera. .	(2L)
7.	Diversity and distribution of vertebrates in the freshwater bodies of India. (Excluding fishes)	(6L)
8.	Adaptive physiology of freshwater fauna: Osmotic and ionic, thermal, respiratory, reproductive and life cycle, mechanical, locomotory and sensory adaptations.	(3L)
9.	Anthropogenic impact on freshwater: Waste and pollution, sewage and silage, mining waste, agricultural chemicals, industrial outflows and invasions. Eutrophication : Causes and problems.	

Course Code and Course Name:

ZODP 114 Practical Freshwater Zoology. **(2 Credits = 60 lectures.)**

Semester I

After successfully completing this course, students will be able to:

CO1: Identify commercially important freshwater fish.

CO2: Identify the aquatic adaptations in common freshwater forms.

CO3: Prepare the culture of *Paramecium* and *Daphnia.*

CO4: Estimate the hardness and chloride content in water samples.

CO5: Analyze the Zooplanktons from local freshwater bodies.

CO6: Evaluate the bio-indicators of pollution in freshwater.

Sr. No.	ZODP 114 Practical Freshwater Zoology	No. of Practicals
1.	Estimation of total carbon dioxide and chloride form given water sample.	(1P)
2.	Estimation of phosphates forms given water sample.	(1P)
3.	Estimation of total nitrate from given water sample.	(1P)
4.	Estimation of calcium and total hardness of given water sample.	(1P)
5.	Estimation of total alkalinity of given water sample.	(1P)
6.	Collection, preservation and identification of zooplankton from freshwater habitat. (Prepare permanent slides and Identify up to genus level using taxonomic key).	(2P)
7.	A qualitative and quantitative analysis of zooplankton from a given freshwater sample using Lackey's drop count method/ Sedgwick rafter counting cell.	(1P)
8.	Identification of economically important freshwater crustaceans and fishes.	(1P)
9.	Study of locomotory and respiratory adaptations in aquatic insects and larvae (*Ranatra, Notonecta, Gerris, Bellostoma and Dytiscus*).	(1P)
10.	Study of aquatic and semiaquatic adaptations in amphibians and reptiles.	(1P)
11.	Estimation of primary productivity with dark and light bottle method	(2P)
12.	To prepare and maintain a culture of paramecium, Daphnia and Hydra	(1P)
13.	A Compulsory visit to local freshwater body and preparation of report on physicochemical conditions and faunal organisms.	(1P)

REFERENCE BOOKS:

1. Limnology: lake and river ecosystem, Robert G. Wetzel. Academic Press,

3rd edition.

2. Treatise of Limnology. Hutchinson G. E. John Willy Publication, New York (3 volumes).
3. Field Guide to freshwater invertebrates of North America. Thorp and Rogers. Academic press.
4. Environmental Physiology of Animals. Pat Wilmer, Graham Stone and Ian Johnston. Wiley-Blackwell; 2nd edition.
5. Current status of freshwater resources of India. Kailash Chandra, Gopi K.C., Rao D.V., Valarmathi K. and Alfred J.R.B. Zoological survey of India, 2017.
6. Freshwater Ecology: Concepts and Environmental Applications of Limnology. Academic press, 2nd edition.
7. Freshwater invertebrates of the United States. Robert Pennak. A Wiley-Interscience Publication.
8. Freshwater Biology. Whipple and Ward. John Wiley & Sons Inc; 2nd edition (December 1959).
9. Freshwater Invertebrates: Ecology and General Biology. Thorp and Covich. Academic Press, 4th edition.
10. Limnological Methods. Paul and Welch. Mcgraw –Hill publication.
11. Limnological analysis. Wetzel Robert G., Springer Publication.

Course Code and Course Name:

ZOUP 115 Basic Zoology Lab-1. **(4 Credits- 120 hours)**

Semester I

Note: A total of 30 practicals are to be conducted. 10 practicals from each module are to be conducted. 1 practical is of 4 clock hour duration.

After successfully completing this course, students will be able to:

CO1: Identify the developmental stages of chick embryo, cell structures and phases of cell division

CO2: Identify the grammatical mistakes from the given paragraph and common errors in written and spoken presentations.

CO3: Write a scientific project and research article along with its proof reading.

CO4: Demonstrate the working of different microscopes, colorimetric and spectrophotometric methods,cell fractionation and ligature in *Drosophila* larvae,

CO5: Determine the gene distance and order, genotype and phenotype ratios and allelic frequencies from the given data.

CO6: Estimate sugar and protein by suitable biochemical method, and isolate protein from biological source.

CO7: Prepare acid and base solutions of desired strength, buffers, bacterial Culture, chick embryo culture and *Drosophila* culture.

CO8: Prepare temporary slide of various cells to demonstrate the cell morphology and cell division, giant chromosome and pedigree analysis chart.

CO9: Calculate % retention and % elution of amino acids on given ion exchanger.

Sr. No.	Name of the Practical	No. of Practicals
	Module-I Biochemistry and Biochemical Techniques	
1.	Preparation of Acid & Alkali solutions and acid-base titration **(Compulsory)**	1P
2.	Principle and working of Colorimetry and spectrophotometry	1P
3.	To prepare Buffers of known pH and molarity and measurement of pH of various samples, Buffering capacity	1P
4.	Units and specific activity of enzymes.	1P
5.	Effect of substrate concentration on enzyme activity **(Compulsory)**	

6	Determine the concentration of Vitamin C by titration method from various sources.	1P
7.	Estimation of Sugar (Glucose) by Folin Wu method. **(Compulsory)**	1P
8.	Isolate proteins by salting out / by adjusting isoelectric point. **(Compulsory)**	1P
9.	Estimation of protein by Biuret method method.**(Compulsory)**	1P
10	Principle and uses of different microscopes	1P
11	Principles of electrophoresis, separation of proteins using Gel electrophoresis.**(Compulsory)**	1P
12.	To find out the capacity and nature of a given ion-exchanger. Investigate the % retention and %elution of amino acids on a given ion exchanger	1P
13	To study the effect of different solvents for a given dye using thin layer chromatography **(Compulsory)**	2P
14.	Enzyme isolation and purification by fractionation methods.	1P
	Module-II Cell Biology and Developmental Biology	
1	Study of ultrastructure of cell organelles. **(Compulsory)**	1P
2	Study of different types of cells. **(Compulsory)**	1P
3	Temporary preparation of human cheek epithelial cells. **(Compulsory)**	1P
4	Study of different stages of mitosis in suitable material. **(Compulsory)**	1P
5	Study of meiosis in Grasshopper testes / Onion flower buds / *Aloe vera* with emphasis on all stages of prophase. **(Compulsory)**	2P
6	Limits of cleanliness (To check for microbial flora)	2P
7	Cell fractionation – Nuclei, mitochondria observation, nuclear count.	1P
8	Mounting of chick embryos and preparation of permanent mounts **(Compulsory)**	1P
9	Filter paper ring method for *in vitro* culturing of chick Embryo & observations.	1P
10	Gross anatomy and histology of chick embryo upto 72 hrs. Brain, heart, lens, ear development.**(Compulsory)**	1P
11	Study of embryonic and post-embryonic development using frog egg as a model system.	1P
12	Study of life cycle of *Drosophila melanogaster*.**(Compulsory)**	1P
13	Study of effect of ligature in Drosophila / House fly larva	1P
14	Study of regeneration in *Hydra/ Planaria.*	

15	Study the early developmental stages in any freshwater snail.	1P
	Module-III Genetics and English in Scientific communication	1P
1	Study of sex linked inheritance in *Drosophila sp.*	1P
2	Study of monohybrid and Dihybrid ratio in *Drosophila sp.*(**Compulsory**)	1P
3	Determination of gene distances and gene order for a given three-point test cross.(**Compulsory**)	1P
4	Polytene chromosomes of *Drosophila or Chironomous*-examination of puff and bands.(**Compulsory**)	1P
5	Estimation of allelic frequencies, heterozygote frequencies in human populations.(**Compulsory**)	1P
6	Pedigree Analysis: Sex-Linked, Autosomal dominant and recessive.	1P
7	Culturing *E.Coli* on solid and liquid media	1P
8	English vocabulary, word formation, basic grammar-verb, adverb, adjective, noun, pronoun (**Compulsory**)	1P
9	Syntax, paraphrasing and précis writing, synonyms, antonyms, abbreviations.	1P
10	Spoken English: pronunciation, diphthong, accent, clarity, speed, punctuation, simplicity and syntax	1P
11	Common errors in written and spoken presentation- Tautology, double negatives and double positives, sequence and tenses, ambiguity, spellings, jargons.	1P
12	Outline of a scientific paper; preparation of a research project.	1P
13	Writing abstracts, conclusion/ summary and acknowledgements, key words and suggest a suitable title to the given abstract/paper(**Compulsory**)	1P
14	Assigning legends to given graphs, figures and captions to given tables, Deciphering the given pictorals.	1P
15	Study of proof correction symbols; proof- reading the given text & correcting the proofs.	1P
16	How to write materials and methods ,observation section of a research paper.	1P
17	Write discussion section for the given discussion-less research paperand writingCitations/ Bibliography (**Compulsory**)	1P
18	Oral presentation: Rhythm, style, control, mock presentation of 10 minutes.	1P

M.Sc. Zoology (Semester - 2)

Course Code and Course Name:

ZOUT 121: Molecular Biology and Bioinformatics. **(4 Credits = 60 lectures)**

Semester II

After successfully completing this course, students will be able to:

CO1: Explain the DNA structure & types, topology, Physical properties; chromatin structure and organization.

CO2: Discuss genome organization, DNA and Protein sequencing with their application in evolutionary studies.

CO3: Explain the mobile DNA elements.

CO4: Explain mechanism of DNA damage and repair.

CO5: Illustrate the process of DNA replication, transcription, translation and their regulations.

CO6: Illustrate the database tools with their significance.

CO7: Schematically represent the processes of central dogma.

CO8: Justify the post translational and post transcriptional modifications.

Sr. No.	Name of the topic	Lectures allotted
1.	**DNA structure and topology** :-Structure of chromatin, nucleosome, chromatin organization and remodeling, higher order organization - chromosome, centromere, telomere, Histones and its effect on structure and function of chromatin, type of DNA **(A,B,Z)**	**(5L)**
2.	**Physical propertiesof DNA:** Tm, hypo and hyper chromicity, solubility, mutarotation and buoyancy.	**(2L)**
3.	**Genome organization:** *C* value paradox and genome size, Cot curves, repetitive and non-repetitive DNA sequence and their importance Cot ½ and, kinetic and sequence complixicity, satellite DNA.	**(2L)**
4.	**DNA Replication:** DNA replication in *E. coli*, Origin of replication, , types of replication, connection ofreplication to cell cycle. Different models of replication for linear and circular DNA replication features of single stranded *E. coli* DNA polymerases, details of replication process, regulation of	**(10L)**

phages. Eukaryotic DNA replication, multiplereplicons, eukaryotic DNA polymerases, ARS in yeast, Origin Recognition Complex(ORC), regulation of replication. (5L)

5. **DNA damage and repair:** Different types in DNA damages, Different DNA repair systems: Nucleotide excision repair, Base excision repair, mismatch repair, recombination repair, Double strand break repair, transcriptional coupled repair, Nick Translation and SOS Repair (8L)

6. **Transcription:**Transcriptional Unit in prokaryotes and eukaryotes, role and significance of promoter, enhancer, intron, exon, silencer, Transcriptional factors, mechanism of prokaryotic gene transcription, type and structure of RNA polymerase, post transcriptionalprocessing: Capping, polyadenylation and splicing in eukaryotes and significance, Ribonucleoproteins(SnRNPs&ScRNPs) (3L)

7. **Gene regulation and expression** in prokaryotes- Lac, arabinose and Trp operon. (6L)

8. **Protein synthesis:** Genetic Code ribosome structure, activation of amino acids, peptide bond formation and translocation of peptides, post-translational modifications, inhibitors of protein synthesis (4L)

9. **Mobile DNA elements:** Transposable elements in bacteria, IS elements, composite transposons, replicative, non-replicative transposons, Mu transposition Controlling elements in Tn A and Tn 10 transposition, SINES and LINES. Retroviruses and retrotransposon. (2L)

Bioinformatics

1. **Introduction**

Introduction to Bioinformatics and Bioinformatics web resource (NCBI, EBI, ExPASy, PubMed, OMIA), Applications of Bioinformatics (4L)

2. **Databases – Tools and their uses**

Biological databases, Primary sequence databases, Nucleic acid sequence databases (GenBank, EMBL-EBI, DDBJ),Protein sequence data bases (UniProtKB, PIR, PDB) Secondary sequence databases, Derived databases - PROSITE, BLOCKS, Pfam/ Prodom, Structure databases and bibliographic databases

3. Sequence alignment methods (4L)

BLAST, FASTA

Significance of sequence alignment

Pairwise sequence alignment (Needleman &Wunsch, Smith & Waterman methods) Multiple sequence alignment (PRAS, CLUSTALW)

4. Predictive applications using DNA and protein sequences (5L)

Evolutionary studies: Concept of phylogenetic trees, Parsimony and Bayesian approaches, synonymous and non-synonymous substitutions, convergent and parallel evolution, Pharmacogenomics: Discovering a drug: Target identification Protein Chips and Functional Proteomics: Different types of protein chip, detecting and quantifying; applications of Proteomics

Metabolomics: Concept and applications

REFERENCE BOOKS:

1. *Genes IX*, 9th edition (2008), Benjamin Lewin, Publisher - Jones and BarlettPublishers,Inc.
2. *Molecular Biology of the Gene*, 5th Edition (2004), James D. Watson, Tania Baker,
3. Stephen P. Bell, Alexander Gann, Michael Levine, Richard Lodwick. Publisher -Pearson Education, Inc. and Dorling Kindersley Publishing, Inc
4. Bioinformatics - Concepts, Skills, and Applications; S.C. Rastogi& others; CBS Publishing; 2003.
5. Bioinformatics - A practical guide to analysis of Genes & Proteins; Andreas D Baxevanis& B F Francis; John Wiley; 2000.
6. Introduction to Bioinformatics; 1st Edition; T K Attwood, D J parry-Smith; Pearson Education, 11th Reprint; 2005.
7. Bioinformatics; 1st Edition; C S V Murthy; Himalaya Publishing House; 2003
8. Bioinformatics sequence and genome analysis; David W. Mount; Cold spring harbor laboratory press; 2004
9. Basic Bioinformatics; S. Ignacimuthu, S.J.; Narosa Publishing House; 1995

10. An Introduction to Bioinformatics Algorithms; Neil C. Jones and Pavel A. Pevzner; MIT Press, First Indian Reprint; 2005
11. Bioinformatics - Managing Scientific Data; Zoe Lacroix, Terence Critchlow; Morgan Kaufmann Publishers (Elsevier Science); 2003 (for the V unit)
12. Phylogenetics: Theory and Practice of Phylogenetic Systematics; Second edition; Bruce S. Lieberman; Wiley-Blackwell; 2011
13. Molecular Evolution: A Phylogenetic Approach; Roderick D.M. Page, Dr Edward C. Holmes; Well Publishing; 1998
14. Essential Bioinformatics; JinXiong; Cambridge University Press; 2006
15. Proteomics - From Protein Sequence to Function; 12 S. R. Pennington, M. J. Dunn; First edition; Springer publications; 2001
16. Proteomics; Timothy Palzkill; Springer; 2002
17. Metabolomics - A Powerful Tool in Systems Biology; Jens Hřiriis Nielsen, Michael C. Jewett; Springer; 2007
18. Systems Metabolic Engineering; Dr. Christoph Wittmann, Sang Yup. Lee; Springer; 2012
19. Bioinformatics (Bios Instant Notes); Second Edition (Special Indian Edition); T. Charlie Hodgman, Andrew French and David R. Westhead; Garland Science (Taylor and Francis Group); 2010
20. Understanding Bioinformatics; Marketa Zvelebil and Jeremy O. Baum; Garland Science (Taylor and Francis Group); 2008
21. Bioinformatics Computing – The complete practical guide to bioinformatics for life scientists; Bryan Bergeron; Eastern Economy Edition; Prentice-Hall of India Pvt. Ltd., New Delhi; 2003
22. Bioinformatics; Prakash S. Lohar; MJP Publishers, Chennai; 2009
23. A text book of Molecular Biology- J.Pal and S. Ghaskadabi, Oxford Publication- India.
24. Freifelders Essentials of Molecular Biology, Malacinski G.M (2006) (Fourth Edition). Narosa Publishing House, New Delhi.
25. Karp's Cell and Molecular Biology: Concepts and Experiments, 8th Edition by Gerald Karp, Janet Iwasa, et al. 2016, Wiley Publication

Course Code and Course Name:

ZOUT 122 Endocrinology and Parasitology. **(4 Credits= 60 lecturers)**

Semester II

After successfully completing this course, students will be able to:

Endocrinology:

CO1: Discuss the roles of Pituitary gland and pineal body.

CO2: Explain hormonal regulation of biomolecules and mineral metabolism.

CO3: Describe the role of osmoregulatory and gastrointestinal hormones.

CO4: Explain the role of hormones in moulting, change in body colour of crustaceans; yolk synthesis in amphibians; insect development.

CO5: Explain the hormonal regulation of metabolism.

CO6: Illustrate the mechanism of hormone action and role of hormone receptors.

CO7: Justify hormones as coordination molecules.

CO8: Justify the significance of biological clocks and rhythms.

Parasitology:

CO1: Define the terminologies of parasitology.

CO2: Explain the concepts of animal association with examples.

CO3: Describe the role of parasites in public health and hygiene.

CO4: Explain the morphology and life cycle of common parasites.

CO5: Explain the pathogenicity and control measures of common parasites.

CO6: Illustrate the process of parasitic infections to human.

CO7: Justify the importance of control strategies against parasitic infections.

CO8: Justify the significance of vectors and disease transmission.

Sr. No.	Name of the topic	Lectures allotted
	Endocrinology:	
1.	Hormones as chemical messenger, types of hormones-protein and non-protein	(2L)
2.	Hormone receptors; on the plasma membrane, cytoplasm & nucleus	(2L)
3.	Mechanism of hormone action- signal transduction cascade.	(2L)
4.	Hypothalamic hypophysiotropins	(2L)

encoding Circumsporozoite protein &merozoites S- antigens, surface antigendiversity. Resistance of Malaria to drugs, its mechanism & assessment.

3.3 Platyhelminthes: Inseminative behaviour, parthenogenesis and polyspermy, sexdetermination, sex linked inheritance in Schistosomes. **(6L)**

4 **Serology & immunodiagnostic methods:**

4.1 Serology & antibody synthesis, preparation & demonstration of specific antigensof *Entamoeba, Plasmodium, Trypanosoma&Leishmania*

4.2Immunodiagnostic assays, Immunodiffusion, haemogglutination test, Radioimmuno assay, ELISA, complement fixationtest. **(2L)**

5. **Prophylaxis & control:** Biologic, Genetic, Chemical, Physical & Other methods.

REFERENCE BOOKS:

1. Bentley, P.J. (1998). Comparative vertebrate endocrinology, edn.3, CambridgeUniversity Press, London.
2. Bollander, F. (1994). Molecular endocrinology, edn.2,Acad. Press, SanDiego.
3. Hadely, M.E. (1996). Endocrinology. Edn.4, Prentice Hall, Upper Saddle Park.
4. Thomdyke, M.C. and Goldsworthy, G.J. (1988). Neurohormones in Invertebrates. Cambridge University Press.
5. Hoar, W.S. and Hickman, C.P., Jr. (1983). A laboratory companion for general and comparative physiology. Edn.3, Prenticed- Hall, Englewood Cliffs, N.J., USA.
6. Kobayashi, H. Malsumolo, A. and Ishii, S. (Eds.) (1992).Atlas of endocrine organs: vertebrates and invertebrates. Springer Verlag, Berlin.
7. Zarrow, M.X., Yachim, J.M. and McCarthy, J.L. (1964). Experimental endocrinology: a sourcebook of basic techniques. Academic Press, New York
8. Comparative protozoology, Ecology, Physiology, Life history, Anderson, O.R. , Springer verlag, Berlin.
9. General Parasitology, Cheng T. C., Academic Press.
10. Modem Parasitology, Cox F.E.G.,Eds.Parasitology in focus, facts &

trends, Melhorn h.,Eds., SprigerVerlag, Beriin.

11. Medical Parasitology, Piakarsky G. L., Springer Verlag, Berlin.
12. Modern Parasitology, Cellular immunological & immunological aspects, Wyler D. J., Eds.,
13. Molecular Parasitology: Protozoan parasites and their MoleculesWalochnik, J, Duchene M, 2016

Course Code and Course Name:

ZOUT 123 Comparative Animal Physiology & Environmental Biology.

Semester II

(4 Credits= 60 lecturers)

After successfully completing this course, students will be able to:

Comparative Animal Physiology:

CO1: Explain the physiology of processes like digestion, respiration, muscle contraction and excretion.

CO2: Describe the mechanism of thermoregulation in both poikilotherms and homeotherms.

CO3: Explain the mechanism of chemical communication in vertebrates.

CO4: Comment on the structure and functions of various sense organs.

CO5: Illustrate the concept of osmotic regulation in various animals with suitable examples.

CO6: Compare the physiology of regulatory mechanisms in various groups of animals.

CO7: Justify the survival strategies of organism in varied climatic conditions.

CO8: Justify the evolution of various life processes in living forms.

Environmental Biology:

CO1:List the endangered, endemic and extinct animal species of India.

CO2:Identify various types of natural resources, human impact on these resources, and common resourcemanagement practices.

CO3:Explain the structure and impact of biogeochemical cycles, ecosystems and energy transformation across trophic levels.

CO4: Describe concepts in population ecology and their significance.

CO5: Discuss environmental hazards and risks and the socio-economic implications.

CO6: Illustrate the impact of climate and anthropogenic factors on biodiversity with reference to India.

CO7: Illustrate the wildlife management practices and their significance.

CO8: Analyze the impact of lifestyle on the environment and animal life.

Topic No.	Name of the topic	Lecturesallotted
1.	**Digestion:** Physiology of digestion.	(03L)
2.	**Respiration:** Respiratory Surfaces: comparison of ventilation associated with gills and pulmonary respiration. Blood pigment, role in Oxygen transport.O2 dissociation curves physiological and ecological significance, CO2	(04L)
3.	**Muscle contraction:** Structure (light & electron microscopic) of the skeletal muscle, proteins of the myofilaments, nature of actin-myosin interaction, sarcoplasmic recticulum and role of Ca++ in contraction	(04L)
4.	**Osmotic regulation:** Concepts of osmole, osmolarity and tonicity, ionic regulation, Hyper-and hypo-osmotic regulators, ureosmotic animals.	(04L)
5.	**Excretion:** Basic processes in urine formation, renal function in animals specially the mammalian kidney, Renal pressure system, Comparative biochemistry of nitrogen excretion.	(04L)
6.	**Thermoregulation:**Biokinetic Zones, tolerance and resistance. Thermobiological terminologies. Compensatory patterns in piokilotherms. Critical temp, and zone of thermal neutrality. Mechanism of thermoregulation in homeotherms.	(03L)
7.	**Chemical Communication**: Nuerosecretion, neuroheamal& endocrine organs.	(04L)
8.	**Sense organ:** classification & functions (details of photoreception as a model).Reflexes, Principles of neural integration.	
	Environmental Biology	
1.	Introduction: Fundamentals of Ecology, Ecosystems: Definition and, concept of ecosystems, energy flow in ecosystems, Nutritional Flux. Development and evolution of the ecosystems. Biogeochemical cycles, Food-chains, ecotone, edge effects, ecological niche, and ecosystem stability.	(5L)
2.	Environmental Microbiology: Microbes - classification and their	(2L)

applications in the environmental sciences. Cultivation and growth of microorganisms. Microorganisms and their association with man, animals and plants. Microbes as anti-microbial agents.

3. Biomes and Habitat Diversity: Classification of biomes, major biotic elements of each biome and their characteristics. Human impact on the natural environment. **(2L)**

4. Biological diversity of India: Definition and nature, India's biogeographically history, physiography, climate and its impact on biodiversity. Indian forest and vegetation types and diversity of flora and fauna. **(4L)**

5. Population and Community Ecology

6. Wetlands Forests and Semi-Arid Habitats of India: Definition and types of wetlands, important wetlands and their conservation issues. Forests and semi-arid habitats and their distribution in India, ecological status of forests and arid lands, and their conservation. **(2L)** **(3L)**

7. Endangered, Endemic and Extinct Species of India: Threatened species categories of IUCN, threatened species of animals and the reasons, Red data book, Biodiversity hotspots of India. **(4L)**

8. Wildlife management and conservation. Protected Areas Network in India: Goals of management, Strategies for planning. Factors influencing wildlife management such as habitats, population, behaviour, food-habits, health, etc., tools for data collection and analysis. Human land-use and wildlife management units, important projects for the conservation of wildlife in India, Role of local communities in wildlife management. **(6L)**

9. Introduction to human animal conflict. **(2L)**

REFERENCE BOOKS:

1. Comparative animal physiology, Clifford Ladd Prosser, John Wiley & Sons
2. Animal physiology, Richard W. Hill, Gordon A. Wyse. Harper and Row

3. Comparative animal physiology, Philip Carew Withers, Saunders College Pub., 1992
4. Fundamentals of Ecology: E. P. Odum
5. Modern concepts in Ecology: H: D. Kumar
6. Microbes, Man and Animals: The Natural History of Microbial Interactions: Linton, A. H. andBurns, R.G. John Wiley and Sons.
7. Elements of Microbiology: Pelczar, M.J. and Chan ECS, McGraw Hill.
8. General Microbiology: Stainer, R.Y, Adelberg, EA and Ingraham, J.L. . Macmillan Press.
9. Microbial Methods for Environmental Biotechnology: Grainer, J.M. and Lynch, J.M. . Academic Press.
10. Microbiological Methods for Environmental Scientists and Enginners
11. Gaudy, A.F. and Guady, E.T. McGraw Hill.

Course Code and Course Name:

ZODT 124: Metabolic Pathways.(2 Credits= 30 lecturers)

Semester II

CO1: Define basic terminologies of metabolic pathways.

CO2: Explain the laws of thermodynamics, concept of free energy and ATP as currency molecule.

CO3: Describe the Concepts and regulation of metabolism.

CO4: Discuss the oxidation of fatty acids and its significance.

CO5: Illustrate the electron transport chain and oxidative phosphorylation.

CO6: Illustrate the reactions, energetics and regulation of glycolysis, glycogen biosynthesis, TCA cycle, Purine and Pyrimidine metabolism

CO7: Write the general reactions of various metabolic pathways.

CO8: Justify the role of enzymes in metabolism

Sr. No.	Name of the topic	Lectures allotted
1.	Basic law of thermodynamics, internal energy, enthalpy, entropy, concept of free energy, redox potentials, high energy compounds, structure and function of ATP.	(4L)
2.	Concepts of metabolism, Metabolic pathways-Catabolic and anabolic, regulation of metabolic pathways	(2L)
3.	Carbohydrate Metabolism 1. Steps of Glycolysis (EMP Pathway). 2. PFK 3. Regulation of Glycolysis. 4. Glycogenesis, Glycogenolysis and Glyconeogenesis 5. Inborn errors of metabolism- Von- Gerkes disease, Tarui'sdisease, Galactosemia, Maple syrup urine	(7L)
4.	Electron transport chain and oxidative phosphorylation.	(3L)
5.	Citric acid cycle: Detailed study, energetics, regulation and significance, Role of PDH.	(4L)
6.	Oxidative degradation of amino acids: transamination, oxidative deamination.	(2L)
7.	Biosynthesis of purine and pyrimidine nucleotides	(3L)
8.	A Lipid metabolism: Introduction, oxidation of even chain saturated fatty acids, oxidation of unsaturated fatty acids, oxidation of odd chain fatty acids, omega (ω)-oxidation of fatty acids, Ketogenesis. Transport of Fatty Acids.	(5L)

Course Code and Course Name:

ZODP 124: Practical in Metabolic Pathways.

Semester II **(2 Credits- 60 Hours)**

After successfully completing this course, students will be able to:

CO1: Identify the common diseases/conditions caused due to errors in metabolism.

CO2: Explain the principle of Colorimetry and Spectrophotometry.

CO3: Use the basic equipment in biochemistry lab.

CO4: Illustrate the enzyme activity from suitable material.

CO5: Demonstrate the effect of various physical and chemical factors on enzyme activity.

CO6: Demonstrate the absorption studies of biomolecules.

CO7: Estimate the concentration of cholesterol, uric acid, amino acids and starch.

CO8: Separate biomolecules by chromatographic methods.

Sr. No.	ZODP 124: Practical in Metabolic Pathways.	No. of Practicals
1.	Estimation of Starch.**(Compulsory)**	(1P)
2.	Separation amino acids by paper chromatography	(2P)
3.	Estimation of uric acid in wall Lizard excreta/ Human blood any other suitable material.**(Compulsory)**	(1P)
4.	To find absorption spectrum of haemoglobin, BSA, Tyrosine.	(1P)
5.	Estimation of Protein by Lowry et al Method.**(Compulsory)**	(1P)
6.	Estimation of Sugar by DNSA method.	(1P)
7.	Separation of amino acids by TLC **(Compulsory)**	(1P)
8.	Estimation of free amino acids by Ninhydrin method.**(Compulsory)**	(1P)
9.	Estimation of cholesterol.	(2P)
10.	Study α-Amylase Activity in Germinating Seeds.	(1P)
11.	Determination of saponification value of a fat.	(1P)
12.	Study the effect of pH and temperature on enzyme activity.	(1P)
13.	Study of human diseases caused due to errors in metabolic pathways with the help of pictures/charts/models/laboratory reports.	

REFERENCE BOOKS:

1. Biochemistry, 3rd Ed. (2005), Voet Donald and Voet Judith G. John, Publisher: Wiley & sons, New York.
2. Biochemistry 6th Ed, (2007) Berg Jeremy, Tymoczko John, StryerLubert, Publisher: W. H. Freeman, New York.
3. Lehninger's Principles of Biochemistry, 4th edition, (2005) Nelson D. L. and Cox M. M. W. H. Freeman & Co. NY.
4. Biochemical Calculations, 2nd Ed., (2010) Segel Irvin H., Publisher: John Wiley and Sons, New York.
5. Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001) Palmer Trevor, Publisher: Horwood Pub. Co., England.
6. Biochemistry, Geoffrey Zubay, William C Brown Pub; 4th edition (June 1999)
7. Principles and Techniques of Biochemistry and Molecular Biology, 6th

edition (2008), Keith Wilson and John Walker, Publisher–Cambridge University Press.

8. Biochemical Methods, 2018, S.Sadashivam, New Age International Pvt Ltd Publishers; Third edition.
9. An Introduction to Practical Biochemistry,2017, David Plummer, McGraw Hill Education; 3th edition.
10. Medical Biochemistry,2018- John W Baynes and Marek H. Dominiczak, Publisher- Elsevier; 5th edition.
11. Harper's Illustrated Biochemistry, 2018, Victor W.Rodwell, David A., Bender, Kathleen M.,Botham, Peter J.,Kennelly, P. AnthonyWeil, McGraw-Hill; Illustrated edition,
12. Principles of Medical Biochemistry-2016, Gerhard Meisenberg, William H. Simmons,Elsevier; 4th edition.

Course Code and Course Name:

ZODT 124: Ichthyology(2 Credits= 30 lecturers)

Semester II

After successfully completing this course, students will be able to:

CO1: Identify the common fishes in India.

CO2: Explain the general characters and evolution of fishes.

CO3: Explain the fish morphology and anatomical modifications.

CO4: Illustrate the physiology of reproductive and endocrine organs in fish.

CO5: Discuss the signs, symptoms and control measures of common diseases in fish.

CO6: Justify the role of respiratory and excretory organs in survival of fishes.

CO7: Classify fishes upto order level.

CO8: Setup aquarium and manage it.

Topic No.	Name of the topic	Lecture allotted
1.	Introduction, general characteristics, evolutionary succession and fossil history of fishes. The early evolution of fishes: Chondrichthian fishes - Sharks, Skates and Rays.	(3L)
2.	Eschmeyer's classification of fishes and diagnostic characters up to orders (one major order from each class).	(4L)
3.	External morphology, body form, appendages, pigmentation, skin and scales.	(1L)
4.	Food and feeding habits, Digestive system and its anatomical modifications.	(2L)
5.	Respiratory mechanism: Respiratory gills and lungs. Accessory respiratory organs: Origin of air breathing organs; skin, buccopharynxopercular cavity and air bladder.	(2L)
6.	Circulatory system: Heart and accessory pumps.	(3L)
7.	Excretion and Osmoregulation: Glomerular and aglomerular kidneys; Nitrogen (ammonia, urea, TMAO) excretions. Water and salt balance in steno- and euryhayline fishes. Role of skin and gills.	(2L)
8.	Reproduction: Structure of gonads, gametogenic cycles; spawning.	(3L)
9	Nervous system and Sense organs: Organization of the central and peripheral nervous systems. Olfactory, taste buds, touch receptors, photoreceptors, lateral line and internal ear	(2L)
10	Endocrine system: Pituitary gland, urohypophysis, adrenal gland, gonads, and thyroid gland.	(2L)
11	Fish pathology: Signs of sickness and effects on fish; Pathological procedure for diagnosis of fish diseases,Symptoms and control measures of viral, bacterial, fungal, protozoan, worm and crustacean diseases.	(4L)
12	Ornamental Fish production and management: World trade of ornamental fishes. Different varieties of exotic and indigenous ornamental fishes. Principles of a balanced aquarium. Fabrication, setting up and maintenance of freshwater aquarium. Water quality management. Water filtration system – biological, mechanical and chemical. Types of filters. Aquarium plants and their propagation methods. Lighting and aeration. Aquarium accessories and decoratives. Aquarium fish feeds. Dry, wet and live	

feeds. Breeding and rearing of ornamental fishes. Common diseases and their control. Conditioning, packing, transport and quarantine methods. Trade regulations and wild life act in relation to ornamental fishes.

Course Code and Course Name:

ZODP 124: Practical in Ichthyology (2 Credits – 60 hours)

Semester II

Sr. No.	Name of the Practical	No.ofPractical
1.	Study of fish evolution with the help of charts/models/Pictures.	(1P)
2.	General external characters, fins and scales (permanent slides & temporary preparations and submission during examination).	(1P)
3.	Classification of fishes (one example from each order); use of diagnostic keys.	(2P)
4.	Length-weight relationship, condition factor, gonado-somatic index of any one fish species.	(1P)
5.	Adaptations of fishes (adhesive organs, accessory respiratory organs, stomachless fishes, spiral valve, electric organs and sense organs.)	(1P)
6.	Study of Weberian ossicles in Heteropneustes/ Labeo.	(1P)
7.	Anatomical observations, demonstration and detailed explanation of fish in general, Digestive, urino-genital system, Endocrine glands of carp/ catfish/ Tilapia.	(1P)
8.	Identification of fish developmental stages: egg, spawn, fry fingerling and adult.	(1P)
9.	Cranial nerves (V, VII, IX & X) and eye ball musculature and innervations in Scoliodon/ carp/ catfish.	(1P)
10.	Histology of digestive, respiratory, excretory, reproductive and endocrine organs.	(1P)
11.	Study of common diseases in fish their diagnosis and control strategies.	(1P)
12.	Setting up of an aquarium and its management and study of breeding behaviour of gourami, Siamese fighting and swordtail.	(2P)
13.	Visit to fish farm/ fish breeding centre/fish market and preparation of detail visit report.	(1P)

M. Sc. [I]
Zoology

feeds. Breeding and rearing of ornamental fishes. Common diseases and their control. Conditioning, packing, transport and quarantine methods. Trade regulations and wild life act in relation to ornamental fishes.

Course Code and Course Name:

ZODP 124: Practical in Ichthyology (2 Credits – 60 hours)

Semester II

Sr. No.	Name of the Practical	No.ofPractical
1.	Study of fish evolution with the help of charts/models/Pictures.	(1P)
2.	General external characters, fins and scales (permanent slides & temporary preparations and submission during examination).	(1P)
3.	Classification of fishes (one example from each order); use of diagnostic keys.	(2P)
4.	Length-weight relationship, condition factor, gonado-somatic index of any one fish species.	(1P)
5.	Adaptations of fishes (adhesive organs, accessory respiratory organs, stomachless fishes, spiral valve, electric organs and sense organs.)	(1P)
6.	Study of Weberian ossicles in Heteropneustes/ Labeo.	(1P)
7.	Anatomical observations, demonstration and detailed explanation of fish in general, Digestive, urino-genital system, Endocrine glands of carp/ catfish/ Tilapia.	(1P)
8.	Identification of fish developmental stages: egg, spawn, fry fingerling and adult.	(1P)
9.	Cranial nerves (V, VII, IX & X) and eye ball musculature and innervations in Scoliodon/ carp/ catfish.	(1P)
10.	Histology of digestive, respiratory, excretory, reproductive and endocrine organs.	(1P)
11.	Study of common diseases in fish their diagnosis and control strategies.	(2P)
12.	Setting up of an aquarium and its management and study of breeding behaviour of gourami, Siamese fighting and swordtail.	(1P)
13.	Visit to fish farm/ fish breeding centre/fish market and preparation of detail visit report.	

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2. Bone Q., N. B. Marshall & J. H. S. Blaxter (1995). Biology of Fishes, Edn.2, Blackie, Academic % Professional (Chapman & Hall), London.
3. C. Vandujn. Diseases of fishes – Narendra Publishing House, New Delhi.
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5. Jayaram K. C. (1981). The freshwater fishes of India. Pakistan, Bangladesh, Burma and Sri Lanka- A Handbook. Zool. Survey of India, Academic Press, New York.
6. Khanna, S. S. (1984). An Introduction to Fishes. Central Book Depot., Allahabad.
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9. Talwar P.K. & A.G. Jhingran (1991). Fish and Fisheries of India and Adjacent Countries, Vols. I & II. Oxford & I.B.H., New York.
10. Wake, M.H. (Ed.) (1979). Hyman's Comparative Vertebrate Anatomy. Edn.3, University of Chicago Press, Chicago
11. Wedemeye G. A. Environmental stress and fish diseases –Narendra. Publishing House.
12. William N. Eschmeyer (2019). Eschmeyer'sCatalog of Fishes (Vol. 1, 2 & 3). Published by the California Academy of Sciences, San Francisco © 1998.

Course Code and Course Name:

ZOUP 125 Basic Zoology Lab-2(4 Credits, 120 hours)

Semester II.

Note: A total of 30 practicals are to be conducted. 10 practicals from each module are to be conducted. 1 practical is of 4 clock hour duration.

After successfully completing this course, students will be able to:

CO1: Identify the various parasites and parasitic stages of common parasites, nitrogenous wasteproducts of animals, feshwater planktons and slides of endocrine glands.

CO2: Explain the principle and significance of gonadectomy, thyrodectomyand pancreactomy.

CO3: Demonstrate the role of eye stalk and insulin in sugar level in crab.

CO4: Demonstrate the retro cerebral complex in cockroach.

CO5: Demonstrate the RBCs of common vertebrates and effect of various osmolarities.

CO6: Demonstrate the effect of body size, oxygen consumption and Insulin on aquatic animal.

CO7: Determine the bleeding and clotting time, heartbeat of crab, species richness in selected area, physico- chemical properties of soil and water.

CO8:Perform Sterilization of lab equipment, prepare microbial culture, Isolate Bacterial, liver DNA and RNA from given sample, quantify and resolve them using electrophoretic procedures, analyse protein sample by PAGE and SDS PAGE and construct phylogenetic tree using tools inbioinformatics.

Sr. No.	Name of the Practical	No. of Practicals
	Module-I Molecular Biology and Bioinformatics	
1.	Lab Safety Techniques and sterilization.	1P
2.	Isolation of bacterial DNA and estimation by UV spectrophotometry	2P
3.	Isolation of Liver DNA and quantification, Agarose gel electrophoresis of isolated DNA.**(Compulsory)**	2P
4.	Isolation of RNA and agarose gel electrophoresis.	1P
5.	Concept of biological database, gene and protein search by BLASTA and **(Compulsory)**	1P

	FASTA **(Compulsory)**	
6	To analyse protein on native PAGE and SDS-polyacrylamide gel electrophoresis.(**Compulsory)**	**2P**
7.	Construction of phylogenetics tree for DNA and protein **(Compulsory)**	**1P**
8.	Demonstration of DNA amplification by PCR	**1P**
	Module- II Endocrinology and Parasitology	**1P**
1	Histology of invertebrate and vertebrate neurosecretory and endocrine structures.(Compulsory)	**1P**
2	Blood sugar regulation in the crab- role of eye stalk. **(Compulsory)**	**1P**
3	Study of retrocerebral complex of the cockroach.	**1P**
4	Introduction of alloxan diabetes in the mouse/ rat / human. **(Compulsory)**	**2P**
5	Gonadectomy in the mouse/ rat.	**1P**
6	Pancreatectomy in the mouse/ rat.	**1P**
7	Effect of insulin on blood sugar, hepatic and muscle glycogen of the rat/human. **(Compulsory)**	**1P**
8	Thyroidectomy in the rat.	**2P**
9	Study of life cycle, role as vector & control measures of: Ticks(*Argas, Boophilus*) Mosquito – any two from- *Anopheles/ Aedes/ Culex* Any two flies: *Tabanus/ Phlebotomus/ Sarcophaga*.Cyclops. **(Compulsory)** (Specimen, Slides or charts may be used.)	
10	Ectoparasites&Endoparasites of wild rat, cattle, dog, chick & human including stages in excreta.	**2P**
11	Study of life cycle of parasitic protozoa: *Trypanosoma, Leishmania.***(Compulsory)**	**1P**
12	Study of life cycle of helminth parasites: *Schistosoma. Echinococcus, Ancylostoma, Dracunculus***(Compulsory)**	**2P**
13	Study of Parasites from digestive tract of Cockroach/gut / parasites of hen. (Compulsory)	**1P**

University of Pune
S.Y.B.A Political Science

General Paper G-2 (OR)
GOVERNMENT AND POLITICS OF U.K., U.S.A
(80-20 Pattern to be implemented from 2014-2015)

Course Objectives:
This paper studies the major constitutions of the World by adopting a comparative approach. The constitutional and legal provisions, the ideological basis, the institutional arrangement and their social and economic background are to be explained, analyzed and evaluated critically. The historical backgrounds to individual constitutions are to be emphasized to gain an understanding of its evolution. The comparative perspective enables the student to understand the differences and similarities between the various constitutional arrangements. Furthermore the political institutions are to be studied in light of the political process to gain an understanding of the dynamics of actual politics and policy making.

Term-I

	Weightage
Unit: 1 - Constitutions Nature and Evolution (U.S.A, U.K)	12
Unit: 2 - Legislature Parliament (UK): Structure, powers & Role Congress (USA): Structure, powers & Role	12
Unit: 3- Executive Prime Minister & Cabinet (U.K), President and Cabinet (U.S.A)	12
Unit: 4- Judiciary Nature, Power & Functions of Judiciary (U.K & U.S.A)	12

Term-II

Unit: 5- Political Parties Political Parties: Relation between political parties & government. Two party system, features and role of parties in UK, USA	12
Unit: 6- Interest groups Interest groups: their roles and performance in UK and USA	12
Unit: 7- State Governments State Governments in UK and USA	12
Unit: 8- social movements Social Movements: Human Rights, Women's Movement, Ethnic Movements	12

Special Paper-I
WESTERN POLITICAL THOUGHT
(80-20 Pattern to be implemented from 2014-2015)

Course Objectives:
This paper studies the classical tradition in political theory from Plato to Marx with the view to understand how the great Masters explained and analysed political events and problems of their time and prescribed solutions. The texts are to be interpreted both in the historical and philosophical perspectives to understand the universality of the enterprise of political theorizing. The limitations of the classical tradition, namely its neglect of women's concerns and issues and the non-European world are critically examined. The legacy of the thinkers is explained with the view to establish the continuity and change within the Western political tradition.

Term-I	**Weight age**
Unit: 1 - Plato a) Ideal State & Philosopher King b) Views on Education c) Views on Justice & Communism	12
Unit: 2 - Aristotle a) Views on State b) Views on Property, Views on Slavery c) Views on Revolution	12
Unit: 3 - Machiavelli a) Views on Human Nature b) Views on Religion & Morality c) Theory of Statecraft	12
Unit: 4 – J.S.Mil a) Views on Utilitarianism b) Views on Liberty c) Views on Representative Government & State	12
Term-II	
Unit: 5 – Karl Marx a) Historical Materialism b) Theory of Class & Struggle c) Theory of State & Revolution	12
Unit: 6 - Hobbes a) State of Nature b) Views on Human Nature c) Theory of Social Contract	12
Unit: 7 – John Locke a) Theory of Social Contract b) Views on natural Rights c) Views on civil society & State	12
Unit: 8 - Rousseau a) State of Nature & Views on Human Nature b) Theory of General Will c) Theory of Social Contract	12

Special Paper-II

POLITICAL SOCIOLOGY

(80-20 Pattern to be implemented from 2014-2015)

Section I

1. Definition, Nature and Scope of Political Sociology
2. Intellectual Foundation of Political Sociology
a) Marx b) Max Weber c) Behavioral Approach
3. Political Culture.
a) Meaning and Nature
b) Types of Political Culture
4. Political Socialization
a) Process and Agencies of Socialization

Section II
5. Political Ideology
a) Meaning and Nature
6. Political Participation
a) Meaning and Nature
b) Levels of Participation
c) Agencies of Recruitment
7. Legitimacy and Influence
a) Meaning and Nature
b) Types
8. Political Change, Political Development.
a. Meaning and Nature
b. Types of Political Change
c) Concept of Political Development

SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE.

POLITICAL SCIENCE

Syllabus for TYBA

80:20 Pattern to be implemented from 2015-16

SYLLABUS FOR TYBA POLITICAL SCIENCE (G-3)

POLITICAL IDEALOGIES

Course Rationale:

This paper studies the role of different political ideologies and their impact in politics. Each ideology is critically studied in its historical context. In course of its evolution and development, the different streams and subtle nuances within each ideology, the changes and continuities in its doctrine and its relevance to contemporary times are highlighted. The close link between an idea and its actual realization in public policy needs to be explained as well. The philosophical basis of the ideologies is emphasized with special emphasis on key thinkers and their theoretical formulations. The legacy of all the major ideologies is to be critically assessed.

SECTION-I

UNIT-I: - Ideology **08**

a) Origin, Meaning, Definition

b) Nature and Scope

UNIT-II: - Nationalism **14**

a) Meaning, Definitions and Elements

b) Progressive and Reactionary

c) Internationalism

UNIT-III: - Democratic Socialism **14**

a) Meaning, Nature and Features

b) Achievements and Limitations

c) Types : Febianism, Syndicalism, Guild Socialism

UNIT-IV: - Fascism **12**

a) Factors responsible for the rise of Fascism

b) Principles

c) Corporate State

SECTION-II

UNIT-V: - Marxism **12**

a) Historical Materialism

b) Theory of Surplus Value

c) Marxian State

UNIT-VI: - Phule-Ambekarism **12**

a) Equality

b) Religion

c) Democracy

UNIT-VII: - Gandhism **12**

a) Truth and Non-Violence

b) Theory of Satyagraha

c) Gram Swaraj

UNIT-VIII: - Feminism **12**

a) Meaning and Nature

b) Liberal Feminism

c) Feminism in India : Caste, Patriarchy, Women's Representation

SYLLABUS FOR TYBA POLITICAL SCIENCE (S-3)
PUBLIC ADMINISTRAION

Course Rationale:

This paper is an introductory course in Public Administration. The essence of Public Administration lies in its effectiveness in translating the governing philosophy into programmes, policies and activities and making it a part of community living. The paper covers personnel public administration in its historical context thereby proceeding to highlight several of its categories, which have developed administrative salience and capabilities to deal with the process of change. The recent developments and particularly the emergence of New Public Administrations are incorporated within the larger paradigm of democratic legitimacy. The importance of legislative and judicial control over administration is also highlighted

SECTION-I

UNIT-I: - Public Administration 12

a) Meaning
b) Nature
c) Scope and Significance

UNIT-II: - New Public Administration 12

a) Evolution
b) Salient Features
c) Goals

UNIT_III:- Approaches to Public Administration. 12

a) Traditional Approach
b) Behavioral Approach
c) System Approach

UNIT-IV: - Governance 12

a) Idea of Good Governance
b) E-Governance
c) Public Private Partnership

SECTION-II

UNIT-V:- Bureaucracy 12

a) Meaning and Definitions
b) Administrative Reforms

UNIT-VI: - Personnel Administration 12

a) Recruitment
b) Training
c) Promotion

UNIT-VII: - Budget 12

a) Meaning and types
b) Budgetary Process in India

7

UNIT-VIII: - Accountability and Control 12

a) Administrative Accountability
b) Legislative Control
c) Judicial Control

SYLLABUS FOR TYBA POLITICAL SCIENCE (S-4)
INTERNATIONAL POLITICS

Course Rationale:

This paper deals with concepts and dimensions of international relations and makes an analysis of different theories highlighting the major debates and differences within the different theoretical paradigms. The dominant theories of power and the question of equity and justice, the different aspects of balance of power leading to the present situation of a unipolar world are included. It highlights various aspects of conflict and conflict resolution, collective security and in the specificity of the long period of the post Second World War phase of the Cold War, of Détente and Deterrence leading to theories of rough parity in armaments.

SECTION-I:

UNIT I :- International Politics 12

a) Nature and Scope

b) Theories of Idealism and Realism

UNIT II :- Approaches to the Study of International Relations 12

a) Power Approach

b) Decision Making Approach

c) System Approach

UNIT III :- Power 12

a) Meaning

b) Elements

c) Changing Nature of the National Power

UNIT IV :- Balance of Power 12

a) Meaning and Nature

b) Characteristics

c) Changing Nature of the Balance of Power

SECTION –II

UNIT V :- Security 12

a) Meaning and definition

b) Regional Security

c) Collective Security

UNIT VI :- Diplomacy 12

a) Meaning

b) Types of Diplomacy

c) Challenges To Diplomacy

9

UNIT VII :- Disarmament 12

a) Meaning and Nature

b) Types of Disarmament

c) Issues and Challenges

UNIT VIII :- Issues in International Politics 12

a) Human Rights –Its variations and Measures

b) Terrorism – Causes and Consciousness

UNIVERSITY OF PUNE
Political Science
Syllabus for M. A. Part II
Credit and Semester System to be implemented from 2013-14 at college centers
M. A. Part II Semester III

PO-C7: Political Thinking in Modern India

Objectives: The course introduces the student to the key ideas of political thinking in modern India as it shaped in the colonial context. The course is woven around ideas/ issues and **not around individual thinkers.** Students will be encouraged to understand and decipher the diverse and often contesting ways in which ideas of nationalism, democracy and social transformation were discussed by leading Indian thinkers.

1. Imagining the Modern: Rammohan Roy, Nehru
2. The idea of the nation : Tilak, Azad
3. Democracy: Ambedkar, Gandhi
4. Liberty, Equality, Justice: Lohia, Periyar
5. Economic Transformation and Development: M N Roy, Nehru
6. Swarajya and Sarvodaya: Gandhi, Jayprakash Narayan

PO-C8: Political Sociology

Objectives: This Course will introduce the overall scope of the sub-discipline of political sociology. The focus of the course will be on the political sociology of power. The emphasis is on the nature of power in modern societies—more in the form of organizations and social formations than as individual power. Students are also expected to understand different forms of justifications of power and the role of ideology in this regard. State will be studied as a repository of power in society while class and patriarchy are two instances of how the nature of power is shaped by social factors.

1. Meaning and intellectual foundations of political sociology:
a. Origins b. Legacy of Marx and Weber
2. Power and Authority:
a. Meaning and nature of Power and Authority,
b. Sources of power and authority
3. Ideology and Hegemony:
a. Role of Ideology and End of Ideology debate
b. Meaning of hegemony
4. State, Military and bureaucracy:
a. State and Globalization
b. Military and Bureaucracy as apparatuses of state
5. Class:
a. Meaning and nature
b. Criticisms of Marx's class model
6. Patriarchy:
a. Meanings of the term b. Caste, Race, Religion and patriarchy

PO-C9: Theory of International Relations

Objectives: This course introduces the students to the evolution and important theories. Students need a brief history of international politics to understand why we study the subject and how current scholarship is informed by what preceded it. Theories provide interpretative frameworks for understanding what is happening in the world and the levels of analysis. Competing theories are presented.

1. Introduction: The end of the Cold war, the Classical tradition and International Change
2. Realism, Liberalism, Marxism
3. Behaviouralism and Systemic explanations, Structure and Polarity.
4. Geopolitical and Conflict Theories
5. Positivist and Post Positivist debates
a. Critical theory, post-modernism
b. Constructivism and Normative theory.
6. New Issues – Environment, Gender.

PO-O10: Indian Administration

Objectives: The purpose of this course is to provide students with broad understanding of key dimensions of Indian Administration functioning at different levels. The objective of the course is to help students to understand and analyze the administrative reforms introduced recently to make administration people-centric and to what extent that goal has been realized.

1. Evolution
a. Colonial Legacy
b. Context: Value premises, Parliamentary Democracy, Federalism
2. Central Administration
a. Prime Minister, Prime Minister's Office (PMO) and Council of Ministers
b. Central Secretariat and Cabinet Secretariat
3. State Administration
a. Governor- Role and Responsibilities
b. Chief Minister and Council of Ministers
c. State Secretariat and Directorates
4. Restructuring Indian Administration
a. Civil Service Reform in the context of Liberalization
b. New Regulatory Institutions
5. Citizen Centric Administration- Some Initiatives
a. Citizens' Charter
b. Right to Information (RTI)
c. E-Governance
6. Challenges Before Indian administration
a. Governance challenges
b. Socio-economic challenges
c. Political challenges

M. A. Part II Semester IV

PO-C10: Traditions of Political Thought

Objectives: This Course is meant to serve as a window on the major traditions of thought that have shaped political discourse in different parts of the world over the last three millennia. It stresses the great diversity of social contexts and philosophical visions that have informed the ideas of key political thinkers across epochs. The chief objective is to project the history of political thought as a series of critical, interconnected and open-ended conversations about the ends and means of the good life.

1. Ancient Era: Confucius, Plato
2. Medieval Era: Abu Nasr al-Farabi, Thomas Aquinas
3. Early Modern Era: Niccolo Machiavelli, John Locke
4. Modern Era: Jean-Jacques Rousseau, G. W. F. Hegel
5. Industrial Era: John Stuart Mill, Karl Marx
6. Colonial Era: M. K. Gandhi, Frantz Fanon

PO-C11: Political Process in India

Objectives: The course will introduce to the student the key issues and details of the political process in post independence India. It will also try to develop among students a perspective to understand and analyse Indian politics. The aim is to help students understand the expansive meaning of political process as it shapes in the arena of electoral and party politics, in the form of mass mobilizations and as politics of interests.

1. Overview of electoral politics
a. 1951-1967 b. 1968-1989 c. 1990-2009
2. Nature of party system
a. One party dominance
b. Competitive multi party system
3. Politics of Regionalism
a. Politics of language
b. Issues of autonomy and ethnicity
c. Inter- state disputes
4. Role of caste in Indian politics
a. Dalit politics
b. OBC politics
c. Limits of caste politics post1999n
5. Political economy
a. Economic reforms
b. Inequalities and redistribution
6. Politics of mass mobilizations
a. Naxalite movements
b. Farmers' movements
c. NGOs

PO-C12: Political Participation

Objectives: This course is a continuation of the study of power. Political action is seen as integrally related to search for and justifications of power. Political socialization is the process that shapes the durable set of attitudes and beliefs which affect nature and extent of participation. Public opinion also shapes political activity. The course expects that students will go beyond the study of routine participation and understand the relevance of collective action in the form of social movements and/or collective violence.

1. Political Socialization and Political Culture:
a) Meaning
b) Socialization as reservoir of support
c) Idea of civic culture
2. Public Opinion:
a) Meaning and relation with political culture
b) Media and Public Opinion
3. Routine Political participation:
a) Costs and Benefits of political participation
b) Determinants of political participation
4. Women and Politics:
a) Extent of women's participation
b) Measures for ensuring fair participation of women in politics
5. Social Movements:
a) Meanings
b) Typologies
c) New Social Movements
6. Collective Violence:
a) Violence as participation
b) Forms of collective violence

PO-O14: Party System in India

Objectives: The course introduces students to the nature of party system in India and to the functioning of main political parties operating in the system. The course will also acquaint students with analytical perspectives on party politics in India.

1. Early phase of party politics
a. Nationalist movement and issues of representation b. Party politics up to 1950
2. Congress
a. Congress dominance b. Decline of the Congress c. Congress resurgence
3. BJP
a. BJS b. Rise of the BJP c. BJP's stagnation post 1999
4. Other all- India parties
a. Left parties b. BSP
5. State parties
a. Role before 1980 b. Rise of regional parties after 1980
6. Perspectives on party politics in India
a. Dominant party system b. Convergence party system

S.Y.B.Sc. Computer Science Theory Paper I
Semester – 1
CS 211- DATA STRUCTURES USING 'C'
(Compulsory Course)

Total Lectures: 48
Objective:
1. To learn the systematic way of solving problem
2. To understand the different methods of organizing large amount of data
3. To efficiently implement the different data structures
4. To efficiently implement solutions for specific problems

Prerequisites: Knowledge of C Programming Language

1. Introduction to data structures [3]
- 1.1 Concept
- 1.2 Data type, Data object, ADT
  - 1.2.1 Data Type
  - 1.2.2 Data Object
  - 1.2.3 ADT -Definition, Operation, examples on rational number
- 1.3 Need of Data Structure
- 1.4 Types of Data Structure

2. Algorithm analysis [2]
- 2.1 Algorithm – definition, characteristics
- 2.2 Space complexity, time complexity
- 2.3 Asymptotic notation (Big O, Omega Ω)

3. Linear data structures [6]
- 3.1 Introduction to Arrays - array representation
- 3.2 Sorting algorithms with efficiency
  - Bubble sort, Insertion sort, Merge sort, Quick Sort
- 3.3 Searching techniques –Linear Search, Binary search

4. Linked List [8]
- 4.1 Introduction to Linked List
- 4.2 Implementation of Linked List – Static & Dynamic representation,
- 4.3 Types of Linked List
- 4.4 Operations on Linked List
  - create, display, insert, delete, reverse, search, sort, concatenate &merge
- 4.5 Applications of Linked List – polynomial manipulation
- 4.6 Generalized linked list – Concept and Representation

S.Y.B.Sc. Computer Science Theory paper-II

Semester – I

CS-212-Relational Database Management System

(Compulsory Course)

Total Lectures: 48

Objective:-

-To teach fundamental concepts of RDBMS (PL/PgSQL)

-To teach principles of databases

-To teach database management operations

-To teach data security and its importance

-To teach client server architecture

Prerequisites: Knowledge of DBMS

1. **Relational Database Design [14]**

1.1 Preliminaries

Functional Dependencies

Basic concepts : Closure of a set of functional dependencies, Closure of attribute set, Canonical cover, Decomposition.

1.2 PL/PgSqL: Datatypes, Language structure

1.3 Controlling the program flow, conditional statements, loops

1.4 Views

1.5 Stored Functions, Stored Procedures

1.6 Handling errors and exceptions

1.7 Cursors

1.8 Triggers

2 **Transaction Concepts and concurrency control [14]**

2.1 Describe a transaction, properties of transaction, state of the transaction.

2.2 Executing transactions concurrently associated problem in concurrent execution.

2.3 Schedules, types of schedules, concept of Serializability, precedencegraph for Serializability.

S.Y.B.Sc. Computer Science Theory Paper I
Semester II

CS 221 -Object Oriented Concepts using C++

Total Lectures: 48

Objective:-

1. Acquire an understanding of basic object oriented concepts and the issues involved in effective class design
2. Write C++ programs that use object oriented concepts such as information hiding, constructors, destructors, inheritance etc.

Prerequisites: Knowledge of C Programming Language

1. Object oriented concepts [2]

1.1 Object oriented concepts
1.2 Features, advantages and Applications of OOPS

2. Introduction to C++ [6]

2.1 Data types, new operators and keywords, using namespace concept
2.2 Simple C++ Program
2.3 Introduction to Reference variables
2.4 Usage of 'this' pointer
2.5 Classes and Objects
2.6 Access specifiers
2.7 Defining Data members and Member functions
2.8 Array of objects

3. Function in C++ [8]

3.1 Call by reference, Return by reference
3.2 Function overloading and default arguments
3.3 Inline function
3.4 Static class members
3.5 Friend Concept – Function, Class

4. Constructors and destructor [4]

4.1 Types of constructors
4.2 Memory allocation (new and delete)
4.3 Destructor

S.Y.B.Sc.**Computer Science Theory paper-II**

Semester – II

CS - 222: Software Engineering

Total Lectures : 48

Objectives:-

- To teach basics of System Analysis and Design.
- To teach principles of Software Engineering
- To teach various process models used in practice
- To know about the system engineering and requirement engineering
- To build analysis model

Prerequisites: Basic knowledge of DBMS

1. System Concepts [5] (R1 : Chapter 1 & R3 : Chapter 1)

1.1 System Definition

1.2 Characteristics of a System : Organization, Subsystem, Interaction, Interdependence, Integration, Central objective, Standards, Black-box

1.3 Elements of a system : Outputs, Inputs, Processor(s), Control, Feedback, Environment, Boundaries, Interface.

1.4 Types of Systems : Physical & Abstract Systems, Open & Closed Systems, Computer-based Systems (MIS : Management Information System & DSS : Decision Support System)

2. Software and Software Engineering [5] (R2 : Chapter 1)

2.1 The Nature of Software

2.1.1 Defining Software

2.1.2 Software Application Domains

2.1.3 Legacy Software

2.2 Software Engineering

2.3 The Software Process

CS-223 : Data structures Practicals and C++ Practicals

(semester 1)

Objective:-

1. Design and implement Data structures and related algorithms
2. Understand several ways of solving the same problem.

S.Y.B.Sc.(Computer Science) : Paper III : Data Structures using C Assignments		
No	Topic	Lectures
1	Sorting Algorithms – Bubble sort, Insertion	4
2	Recursive Sorting Algorithms – Quick sort , Merge Sort	4
3	Searching Method-Linear search, Binary search	4
4	Static/Dynamic stack implementation, infix to postfix, infix to prefix and evaluation of Postfix.	8
5	Static and Dynamic Queue Implementation – Linear Queue, Circular queue	8
6	Dynamic implementation of Singly Linked List, Doubly Linked List and Circular Linked List.	8
7	Polynomial addition (Using Linked list).	4
8	Binary Search Tree Traversal: Create, add, delete, and display nodes.	8
9	Adjacency matrix to adjacency list conversion, in degree, out degree	4
10	Graph: DFS, BFS.	4

CS-224:Database Practicals & Mini Project using Software Engineering techniques

(Semester 1)

Title: Database Assignments and Mini Project using Software Engineering techniques

Objective:-

- Understanding the use of cursors, triggers, views and stored procedures
- Understanding the steps of system analysis and design
- Understanding Data requirements for a specific problem domain
- Designing Data base as per the Data requirements
- Designing queries as per the functional requirements

No	Topic	Lectures
1	Simple Queries	4
2	Nested Queries, using aggregate functions	4
3	Queries using Views	8
4	Queries using loops and conditional statements	8
5	Stored Function	12
6	Exception Handling	4
7	Cursors and Triggers	12

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER : Systems Programming
Code No. : CS-331

Semester III **Total Lectures : 48**

Aim : To understand the design and implementation issues of System programs that play an important role in program development.

Objectives :

- To understand the design structure of a simple editor.
- To understand the design structure of Assembler and macro processor for an hypothetical simulated computer.
- To understand the working of linkers and loaders and other development utilities.
- To understand Complexity of Operating system as a software.

.

1. Introduction **[4]**

1.1. Types of program – System program and Application program.
1.2. Difference between system programming and application programming.
1.3. Elements of Programming environment - Editor, Preprocessor, Assembler, Compiler, Interpreter, Linker and Loader, Debugger, Device drivers, Operating System.
1.4. Simulation of simple computer smac0 (hypothetical computer) -Memory, Registers, Condition Codes, Instruction format, Instruction Set, smac0 programs.

2. Editors **[2]**

2.1 Definition, need/purpose of editor.
2.2 Types of editor- Examples ed, sed, VIM & emacs
2.3 Structure of editor

3. Assembler **[10]**

3.1 Definition.
3.2 Features of assembly language, advantages
3.3 Statement format, types of statements – Imperative, Declarative, Assembler Directive.
3.4 Constants and Literals.
3.5 Advanced assembler directives (LTORG, ORIGIN, EQU),
3.6 Design of assembler – Analysis Phase and Synthesis Phase.
3.7 Overview of assembling process
3.8 Pass Structure of Assembler – One pass, Two pass assembler.
3.9 Problems of 1-pass assembler - forward reference, efficiency, Table of Incomplete Instructions.
3.10 Design of 2-pass Assembler – Pass-I and Pass-II
3.11 Data structure of 2-pass assembler.
3.12. Intermediate Code – Need, Forms-variant I and Variant II

4. Macros and Macro Processors **[10]**

4.1 Definition
4.2 Macro definition and call
4.3 Macro expansion – positional and keyword parameters
4.4 Design of Data structures to be used for Macro definition and use
4.5 Nested macro calls
4.6 Advanced macro facilities – alteration of flow of control during expansion, expansion time variable, conditional expansion, expansion time loops. (with examples)
4.7 Design of macro preprocessor – Design overview, data structure, processing of macro definition and macro expansion (Except algorithms)

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER : Theoretical Computer Science
Code No. : CS-332

Semester III **Total Lectures : 48**

Aim:
To have a introductory knowledge of automata, formal language theory and computability.

Objectives:
- To have an understanding of finite state and pushdown automata.
- To have a knowledge of regular languages and context free languages.
- To know the relation between regular language, context free language and corresponding recognizers.
- To study the Turing machine and classes of problems.

Prerequisite:
- Sets, Operations on sets, Finite & infinite sets Formal Language
- Relation, Equivalence Relation,(reflexive, transitive and symmetric closures)

1. Introduction [3]
1.1 Symbol, Alphabet, String, Prefix& & Suffix of Strings, Formal Language, Operations on Languages.
1.2 Regular Expressions (RE) : Definition & Example
1.3 Regular Expressions Identities.

2. Finite Automata [12]
2.1 Deterministic finite Automaton – Definition, DFA as language recognizer, DFA as a pattern recognizer.
2.2 Nondeterministic finite automaton – Definition and Examples.
2.3 NFA TO DFA : Method (From Book 4)
2.4 NFA with ε- transitions Definition and Examples.
2.5 NFA with ε-Transitions to DFA & Examples
2.6 Finite automaton with output – Mealy and Moore machine, Definition and Examples.
2.7 Minimization of DFA, Algorithm & Problem using Table Method.

3. Regular Languages [5]
3.1 Regular language-Definition and Examples.
3.2 Conversion of RE To FA-Examples.
3.3 Pumping lemma for regular languages and applications.
3.4 Closure properties of regular Languages
(Union, Concatenation, Complement, Intersection and Kleene closure)

4. Context Free Grammar and Languages [12]
4.1 Grammar - Definition and Examples.
4.2 Derivation-Reduction - Definition and Examples.
4.3 Chomsky Hierarchy.
4.4 CFG : Definition & Examples. LMD, RMD, ,Parse Tree
4.5 Ambiguous Grammar : Concept & Examples.
4.6 Simplification of CFG :
- 4.6.1 Removing Useless Symbols,
- 4.6.2 Removing unit productions
- 4.6.3 Removing ϵ productions & Nullable symbols

4.7 Normal Forms :
- 4.7.1 Chomsky Normal Form (CNF) Method & Problem

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER : Computer Networks -I
Code No. : CS-333

Semester III **Total Lectures : 48**

Pre-requisites: Basics of computer, Knowledge of 'C' for assignment.

Objectives: This course will prepare students in Basic networking concepts.

1. Understand different types of networks, various topologies and application of networks.
2. Understand types of addresses, data communication.
3. Understand the concept of networking models, protocols, functionality of each layer.
4. Learn basic networking hardware and tools.

Ch.No.	Name of Chapter	Reference Book
1	**Chapter 1 Introduction to Computer Networks**	**[Lectures 8]**
1.1	Computer Networks- Goals and applications – Business Application , Home Application, Mobile User, Social Issues	Book 1 CH1 (Pg. No.3 -14)
1.2	Network Hardware - Broadcast and point-to-point	Book 1 CH1 (Pg. No.14-16)
1.3	topologies – star, bus, mesh, ring etc.	Book 2 CH1 (Pg. No. 9-13)
1.4	Network Types-LAN, MAN, WAN, Wireless Networks, Home Networks, Internetwork	Book 1 CH1 (Pg. No.16-26)
1.5	Data Communication-Definition, components, data representation, Data Flow	Book 2 CH1 (Pg. No. 3-7)
1.6	Protocols &Standards De facto and De jure standard,	Book 2 CH1 (Pg. No. 19-20)
1.7	Network Software - Protocol Hierarchies -layers, protocols, peers, interfaces Network architecture, protocol stack, Design issues of the layers –addressing, error control, flow control, multiplexing and demultiplexing, routing Connection-oriented and connectionless service, Service Primitives – listen, connect, receive, send, disconnect and Berkley Socket ,the relationships of services to protocols.	Book 1 CH1 (Pg. No.26-37)
2.	Network Models	[Lectures 5]
2.1	OSI Reference Model - Functionality of each layer	Book 2 CH2 (Pg. No 29-42)

3. Page no listed above may vary according to year of publication of 4th edition but topics remain same.
4. All sub topics listed pages of respective reference books should be covered.

SAVITRIBAI PHULE PUNE UNIVERSITY

T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER : Internet Programming I
Code No. : CS-334

Semester III **Total Lectures: 48**

Aim: To Design dynamic and interactive Web pages.
Objective:

- Learn Core-PHP, Server Side Scripting Language
- Learn PHP-Database handling.

Prerequisite: HTML.

1. **Introduction to web techniques** [8]
1.1 HTTP basics, Introduction to Web server and Web browser
1.2 Introduction to PHP
1.3 What does PHP do?
1.4 Lexical structure
1.5 Language basics
Book 1 chapter 2

2. **Function and String** [10]
2.1Defining and calling a function
2.2 Default parameters
2.3 Variable parameters, Missing parameters
2.4 Variable function, Anonymous function
2.5 Types of strings in PHP
2.6 Printing functions
2.7 Encoding and escaping
2.8 Comparing strings
2.9 Manipulating and searching strings
2.10 Regular expressions
Book 1 chapter 3 and 4

3. **Arrays** [6]
3.1 Indexed Vs Associative arrays
3.2 Identifying elements of an array
3.3 Storing data in arrays
3.4 Multidimensional arrays
3.4Extracting multiple values
3.5 Converting between arrays and variables
3.6 Traversing arrays
3.7 Sorting
3.8 Action on entire arrays
3.9 Using arrays
Book 1 chapter 5

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B.Sc. COMPUTER SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER : Programming in Java-I
Code No. : CS-335

Semester IV **Total Lectures: 48**

Prerequisite:

- Knowledge of C Programming language

Objective:

- To learn Object Oriented Programming language
- To handle abnormal termination of a program using exception handling
- To create flat files
- To design User Interface using Swing and AWT

1. An Introduction to Java [4]

1.1 A Short History of Java
1.2 Features or buzzwords of Java
1.3 Comparison of Java and C++
1.4 Java Environment
1.5 Simple java program
1.6 Java Tools – jdb, javap, javadoc
1.7 Java IDE – Eclipse/NetBeans (Note: Only for Lab Demonstration)

2. An Overview of Java [4]

2.1 Types of Comments
2.2 Data Types
2.3 Final Variable
2.4 Declaring 1D, 2D array
2.5 Accepting input using Command line argument
2.6 Accepting input from console (Using BufferedReader class)

3. Objects and Classes [8]

3.1 Defining Your Own Classes
3.2 Access Specifiers (public, protected, private, default)
3.3 Array of Objects
3.4 Constructor, Overloading Constructors and use of 'this' Keyword
3.5 static block, static Fields and methods
3.6 Predefined class – Object class methods (equals(), toString(), hashcode(), getClass())
3.7 Inner class
3.8 Creating, Accessing and using Packages
3.9 Creating jar file and manifest file
3.10 Wrapper Classes
3.11 Garbage Collection (finalize() Method)
3.12 Date and time processing

4. Inheritance and Interface [7]

4.1 Inheritance Basics (extends Keyword) and Types of Inheritance
4.2 Superclass, Subclass and use of Super Keyword
4.3 Method Overriding and runtime polymorphism

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER : Object Oriented Software Engineering
Code No. : CS-336

Semester III **Total Lectures: 48**

Prerequisites
- Knowledge of Object Oriented Concepts
- Knowledge of Classical Software Engineering

Aim
To Understand Object Oriented Modeling techniques and their applicability.

Objectives
- Understanding importance of Object Orientation in Software engineering
- Understand the components of Unified Modeling Language
- Understand techniques and diagrams related to structural modeling
- Understand techniques and diagrams related to behavioral modeling
- Understand techniques of Object Oriented analysis, design and testing

1. Object Oriented Concepts and Principles [4]
1.1 What is Object Orientation ? - Introduction , Object , Classes and Instance , Polymorphism, Inheritance
1. 2 Object Oriented System Development- Introduction, Function/Data Methods (With Visibility), Object Oriented Analysis, Object Oriented Construction
1.3 Identifying the Elements of an Object Model
1.4 Identifying Classes and Objects
1.5 Specifying the Attributes (With Visibility)
1.6 Defining Operations
1.7 Finalizing the Object Definition

2. Introduction to UML [2]
2.1 Concept of UML
2.2 Advantages of UML

3. Basic Structural Modeling [5]
3.1 Classes
3.2 Relationship
3.3 Common Mechanism
3.4 Class Diagram (Minimum three examples should be covered)

4. Advanced Structural Modeling [7]
4.1 Advanced Classes
4.2 Advanced Relationship
4.3 Interface
4.4 Types and Roles
4.5 Packages
4.6 Object Diagram (Minimum three examples should be covered)

5. Basic Behavioral Modeling [9]

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER : Operating Systems
Code No. : CS-341

Semester IV **Total Lectures : 48**

Aim : To understand the design and implementation issues of Operating System.

Objectives :

- To understand design issues related to process management and various related algorithms
- To understand design issues related to memory management and various related algorithms
- To understand design issues related to File management and various related algorithms

1. Introduction [2]

1.1 Operating System Structure – Simple structure, Layered approach, Micro kernels, Modules
1.2 Virtual Machines – Introduction, Benefits
1.3 System Boot

2. Process Management [4]

2.1 Process Concept – The process, Process states, Process control block.
2.2 Process Scheduling – Scheduling queues, Schedulers, context switch
2.3 Operations on Process – Process creation with program using fork(), Process termination
2.4 Interprocess Communication – Shared memory system, Message passing systems.

3. Multithreaded Programming [2]

3.1 Overview
3.2 Multithreading Models

4. Process Scheduling [8]

4.1 Basic Concept – CPU-I/O burst cycle, CPU scheduler, Preemptive scheduling, Dispatcher
4.2 Scheduling Criteria
4.3 Scheduling Algorithms – FCFS, SJF, Priority scheduling, Round-robin scheduling, Multiple queue scheduling, Multilevel feedback queue scheduling
4.4 Thread Scheduling

5. Process Synchronization [6]

5.1 Background
5.2 Critical Section Problem
5.3 Semaphores: Usage, Implementation
5.4 Classic Problems of Synchronization – The bounded buffer problem, The reader writer problem, The dining philosopher problem

6. Deadlocks [8]

6.1 System model
6.2 Deadlock Characterization – Necessary conditions, Resource allocation graph
6.3 Deadlock Prevention
6.4 Deadlock Avoidance - Safe state, Resource allocation graph algorithm, Banker's Algorithm
6.5 Deadlock Detection
6.6 Recovery from Deadlock – Process termination, Resource preemption

7. Memory Management [11]

7.1.Background – Basic hardware, Address binding, Logical versus physical address space, Dynamic loading, Dynamic linking and shared libraries

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER : Compiler Construction
Code No. : CS-342

Semester IV **Total Lectures : 48**

Aim :
To understand the various phases of a compiler and to develop skills in designing a compiler

Objective :
- To understand design issues of a lexical analyzer and use of Lex tool
- To understand design issues of a parser and use of Yacc tool
- To understand issues related to memory allocation
- To understand and design code generation schemes

1. Introduction [5]

1.1 Definition of Compiler, Aspects of compilation.
1.2 The structure of Compiler.
1.3 Phases of Compiler – Lexical Analysis,Syntax Analysis, Semantic Analysis, Intermediate Code generation, code optimization, code generation.
1.4 Error Handling
1.5 Introduction to one pass & Multipass compilers, cross compiler, Bootstrapping.

2. Lexical Analysis(Scanner) [5]

2.1 Review of Finite automata as a lexical analyzer,
2.2 Applications of Regular Expressions and Finite Automata (lexical analyzer, searching using RE), Input buffering, Recognition of tokens
2.3 LEX: A Lexical analyzer generator (Simple Lex Program)

3. Syntax Analysis(Parser) [20]

3.1 Definition , Types of Parsers
3.2 Top-Down Parser –
- 3.2.1Top-Down Parsing with Backtracking: Method & Problems
- 3.2.2 Drawbacks of Top-Down parsing with backtracking,
- 3.2.3Elimination of Left Recursion(direct & indirect)
- 3.2.4Need for Left Factoring & examples

3.3 Recursive Descent Parsing : Definition
- 3.3.1Implementation of Recursive Descent Parser Using Recursive Procedures

3.4 Predictive [LL(1)]Parser(Definition, Model)
- 3.4.1Implementation of Predictive Parser[LL(1)]
- 3.4.2 FIRST & FOLLOW
- 3.4.3 Construction of LL(1) Parsing Table
- 3.4.4Parsing of a String using LL(1) Table

3.5 Bottom-Up Parsers
3.6 Operator Precedence Parser -Basic Concepts
- 3.6.1Operator Precedence Relations form Associativity & Precedence
- 3.6.2 Operator Precedence Grammar
- 3.6.3 Algorithm for LEADING & TRAILING(with ex.)
- 3.6.4Algorithm for Operator Precedence Parsing (with ex.)
- 3.6.5Precedence Functions

3.7 Shift Reduce Parser
- 3.7.1Reduction, Handle, Handle Pruning
- 3.7.2Stack Implementation of Shift Reduce Parser (with examples)

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16

TITLE OF PAPER : Computer Networks -II

Code No. : CS-343

Semester IV **Total Lectures: 48**

Pre-requisites: Basics of computer networks covered last semester, Knowledge of 'C'.

Objectives: This course will prepare students in

1. Basic networking concepts.
2. Understand wired and wireless networks, its types, functionality of layer.
3. Understand importance of network security and cryptography.

Ch. No.	Name of Chapter	Reference Book
1.	Wired LANs	[Lectures 9]
1.1	IEEE Standards Data Link Layer, Physical Layer	Book 2 CH13 (Pg. No 395-397)
1.2	Standard Ethernet MAC Sublayer – Frame Format, Frame Length, Addressing, Access Method	Book 2 CH13 (Pg. No 397-402)
1.3	Physical Layer – Encoding and Decoding, 10Base5, 10Base2, 10Base-T, 10Base-F,	Book 2 CH13 (Pg. No 402-405)
1.4	Changes In The Standard – Bridged Ethernet, Switched Ethernet, Full Duplex Ethernet	Book 2 CH13 (Pg. No 406-409)
1.5	Fast Ethernet – Goals, MAC Sublayer,Topology, Implementation	Book 2 CH13 (Pg. No.409-410)
1.6	Gigabit Ethernet – goals, MAC Sublayer, Topology, Implementation	Book 2 CH13 (Pg. No 412-414)
1.7	Ten-Gigabit Ethernet – goals, MAC Sublayer, Physical Layer	Book 2 CH13 (Pg. No 416)
1.8	Backbone Networks Bus Backbone, Star Backbone, Connecting Remote LANs	Book 2 CH15 (Pg. No 456-458)
1.9	Virtual LANs Membership, Configuration, Communication between Switches, IEEE standards Advantages	Book 1 CH1 (Pg. No 458-463)
2.	Wireless LAN	[Lectures 2]
2.1	IEEE 802.11 Architecture – Basic Service Set, Extended Service Set, Station Types	Book 2 CH14 (Pg. No421-422)

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER : Internet Programming II
Code No. : CS-344

Semester IV **Total Lectures: 48**

Aim: To Design dynamic and interactive Web pages.

Objective:

- Learn different technologies used at client Side Scripting Language
- Learn XML,CSS and XML parsers.
- One PHP framework for effective design of web application.
- Learn JavaScript to program the behavior of web pages.
- Learn AJAX to make our application more dynamic.

1. Web Techniques **[10]**

1.1 Variables
1.2 Server information
1.3 Processing forms
1.4 Setting response headers
1.5 Maintaining state
1.6 SSL
Book 1 chapter 7

2. Handling email with php **[8]**

2.1 Email background
2.2 Internet mail protocol
2.3 Structure of an email message
2.4 Sending email with php
2.5 Email attachments.
2.6 Email id validation and verification
2.7 PHP error handling.
Book 2 chapter 15

3. PHP framework **[4]**

3.1 Introduction to PHP framework.
3.2 Features, Applications.
3.3 One example like JOOMLA,DRUPAL.
Book 11, https://api.drupal.org

4. XML **[8]**

4.1What is XML?
4.2 XML document Structure
4.3 PHP and XML
4.4 XML parser
4.5 The document object model
4.6 The simple XML extension
4.7 Changing a value with simple XML
Book 2 chapter 8

5. WEB DESIGNING TECHNOLOGIES(JavaScript-DHTML) **[10]**

5.1 Overview of JavaScript, DHTML
5.2 Object Orientation and JavaScript

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T.Y. B.Sc. COMPUTER SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER : Programming in Java-II
Code No. : CS-345

Semester IV **Total Lectures : 48**

Prerequisite:

- Knowledge of Core Java (CS – 345)

Objectives:

- To learn database programming using Java
- To study web development concept using Servlet and JSP
- To develop a game application using multithreading
- To learn socket programming concept

1. Collection [6]

1.1 Introduction to the Collection framework
1.2 List – ArrayList, LinkedList and Vector,Stack,Queue
1.3 Set - HashSet, TreeSet, and LinkedHashSet
1.4 Map – HashMap, LinkedHashMap, Hashtable and TreeMap
1.5 Interfaces such as Comparator, Iterator, ListIterator, Enumeration

2. Database Programming [10]

2.1 The design of jdbc, jdbc configuration
2.2 Types of drivers
2.3 Executing sql statements, query execution
2.4 Scrollable and updatable result sets
2.5 Metadata – DatabaseMetadata, ResultSetMetadata
2.6 Transactions – commit(), rollback(), SavePoint
(Database : PostgreSQL)

3. Servlet [12]

3.1 Introduction to Servlet and Hierarchy of Servlet
3.2 Life cycle of servlet
3.3 Tomcat configuration (Note: Only for Lab Demonstration)
3.4 Handing get and post request (HTTP)
3.5 Handling a data from HTML to servlet
3.6 Retriving a data from database to servlet
3.7 Session tracking – User Authorization, URL rewriting, Hidden form fields, Cookies and HttpSession

4. JSP [10]

4.1 Simple first JSP program
4.2 Life cycle of JSP
4.2 Implicit Objects
4.3 Scripting elements – Declarations, Expressions, Scriplets, Comments
4.4 JSP Directives – Page Directive, include directive
4.5 Mixing Scriplets and HTML
4.6 Example of forwarding contents from database to servlet, servlet to JSP and displaying it using JSP scriplet tag

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER :Computer Graphics
Code No. : CS-346

Semester IV **Total Lectures: 48**

Pre – Requisites

- Computer programming skills in C programming language
- Basic understanding of use of data structures
- Basic Mathematical concepts related to matrices and geometry

Objectives

- To study how graphics objects are represented in Computer
- To study how graphics system in a computer supports presentation of graphics information
- To study how interaction is handled in a graphics system
- To study how to manipulate graphics object by applying different transformations
- To provide the programmer's perspective of working of computer graphics

1. Introduction to Computer graphics [4]

1. 1 Introduction to computer graphics & graphics systems
1.2 Components of Computer Graphics Representation, Presentation , Interaction and Transformations
1.3 Applications of Computer Graphics
1.3 Pixel/Point ,Raster v/s Vector ,RGB color model, intensity
1.4 Programming essentials – event driven programming. OpenGL library

2. Input devices and Interaction tasks [4]

2.1 Logical Interaction – Locator, valuator , pick and choice;
2.2 Physical devices used for interaction – keyboard, mouse, trackball,spaceball, tablets, light pen, joy stick, touch panel, data glove;
2.4 Keyboard , Mouse interaction in OpenGL
2.5 Graphical User Interfaces- cursors , radio buttons, scroll bars, menus, icons
2.6 Implementing GUI in open GL

3. Presentation and Output devices [4]

3.1 Presentation Graphics - frame buffer, display file, lookup table;
3.2 Display devices, Random and Raster scan display devices; CRT,
3.3 Hardcopy devices - Plotters and Printers

4. Raster Scan Graphics [10]

4.1 Line drawing algorithms; DDA algorithm, Bresenham's line drawing algorithm, Circle generation algorithm;
4.2 Scan conversions- Generation of the Display, Image compression
4.3 Displaying Lines and characters
4.3 Polygon filling -Scan converting polygons, fill algorithms, Boundary fill algorithm, flood fill algorithm

5. Transformations [7]

5.1 Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, Reflection, shear
5.2 Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline
5.3 Window to viewport co-ordinate transformation. Setting window and viewport in OpenGL.

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER : System Programming & Operating System
Code No. : CS-347

Aim:
To understand the process of designing and implementing System programs and operating system components.

Objective :-
1. Design and implement System programs with minimal features to understand their complexity.
2. Design and implement simulations of operating system level procedures.

Syllabus

Sr. No	Topic	Lectures
1	Line Editor	8 lectures
2	SMAC0 simulator	8 lectures
3	Assembler	12 Lectures
4	Macro processor	12 lectures
5	DFA driver	8 lectures
6	Development Utilities	8 lectures
7	Toy shell	8 Lectures
8	CPU Scheduler	12 lectures
9	Deadlock detection	8 lectures
10	Page Replacement Algorithms	12 lectures
11	File Allocation methods	12 Lectures

Examination

Internal Marks : Activity + Labbook(10+10)

External Marks : two programs(35each) oral(5) Activity(5)

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T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER :Lab Course II – Programming in Java
Code No. : CS-348

Aim:
To understand the process of designing and implementing Core and Advanced Java programs.

Objective :-
1. Implement core Java programs to solve simple problems
2. Implement Client and Server end Java programs

Syllabus

Sr. No	Topic	Lectures
Core and Advanced Java		
1	Simple Java programs	8 Lectures
2	Arrays and Packages	8 Lectures
3	Inheritance and Interfaces	8 Lectures
4	Exception Handling	8 Lectures
5	File Handling	8 Lectures
6	GUI designing & Event Handling	8 Lectures
7	Database Programming	8 Lectures
8	Multithreading	4 Lectures
9	Collection	8 Lectures
10	Servlets	8 Lectures
11	JSP	8 Lectures
12	Socket Programming	4 Lectures
Computer Graphics		
1	Simple Graphics program using OpenGL	4 Lectures
2	Using graphics primitives to display graphics	4 Lectures
3	Window to viewport transformations and other transformations	4 Lectures
4	Using simple Keyboard and Mouse interaction	4 Lectures
5	Graphics Mini project	16 Lectures

Examination

Internal Marks : Activity(CG) + Seminar(Enhanced java+ listening) (10+10)

External Marks : two programs(30each) oral(5) Activity(5)+ Labbook(10)

SAVITRIBAI PHULE PUNE UNIVERSITY
Proposed Draft of
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FROM ACADEMIC YEAR 2015-16
TITLE OF PAPER :Lab Course III – Programming in PHP & Project
Code No. : CS-349

Aim:
To understand the process of designing and implementing Web applications, using PHP.

Objective :-
1. Implement Simple PHP programs to solve simple problems

Syllabus

Sr. No	Topic	Lectures
PHP		
1	String manipulation	8 Lectures
2	Arrays	8 Lectures
3	Inheritance	8 Lectures
4	File Handling	8 Lectures
5	Form designing	8 Lectures
6	Database Connectivity	8 Lectures
7	Sessions and cookies	8 Lectures
8	Java script with AJAX	
Networking		4 Lectures
1	Setting a LAN Environment	4 Lectures
2	Configuring the Server	4 Lectures
3	Use of Service Primitives	12 Lectures
4	Use of Networking Tools	
Project		
1	Choose Project topic and Prepare problem description	
2	Study of Existing System	
3	Identifying users and functionalities of proposed system	
4	Preparing the Design of the proposed system- Data Design Screen and Report Designs	
5	Implementation	

Examination

Internal Marks: Project (20) Continuous Evaluation.

External Marks: One programs (30) (large program on PHP + small program PHP), networking(10) – Internal, Lab book(10), Project(30) -20 Marks External + 10 Marks Internal for Project Demo before Final Practical Exam

(CORE) CS 301: Software Metrics & Project Management

No of lectures: 48

Pre-requisites

- Software Engineering
- Basic testing concepts

Objectives

- Software Metrics and Project Management covers skills that are required to ensure successful medium and large scale software projects.
- It examines Requirements Elicitation, Project Management, Verification and Validation and Management of Large Software Engineering Projects.
- Student learn to select and apply project management techniques for process modeling, planning, estimation, process metrics and risk management; perform software verification and validation using inspections, design and execution of system test cases.

[4]

Chapter 1 : Introduction to Project Management

- What is a Project?
- What is Project management?
- Project phases and project life cycle
- Organizational structure
- Qualities of Project Manager

[6]

Chapter 2 : Project Management Components

- Project Integration Management-Project plan development and execution
- Change controls
- Configuration management

[4]

Chapter 3 : Scope Management

- Strategic planning
- Scope planning, definition
- Verification and control

[2]

Chapter 4 : Time management

- Activity planning
- Schedule development and control

(CORE) CS 302: Mobile Computing

No of Lectures: 48

Prerequisites

- Concepts of multiplexing and modulation
- Concepts of Networking
- Conversant with OS internals
- Familiar with event handling
- Web browsers
- Create and Compile Java Programs
- Brief History of wireless communication

Objectives

- To familiarize the students with the buzz words and technology of mobile communication
- Understand the GSM architecture
- Understand the issues relating to Wireless applications

Chapter 1 : Introduction to Mobile Computing [2]

- Introduction and need for Mobile computing
- Mobility and portability
- Mobile and Wireless devices
- Applications
- Brief History of wireless communication

Chapter 2 : Wireless Transmission [3]

- General Concepts of multiplexing and modulation
- Spread Spectrum
- Cellular Systems

Chapter 3 : Medium Access Control Layer [4]

- Why specialized MAC?
  a. hidden and exposed terminals
  b. near and far terminals
- ii. General Concepts and comparison of SDMA, FDMA, TDMA , CDMA [8]

Chapter 4 : Mobile IP

- Goals, assumptions and requirements
- Entities and terminologies
- Agent Discovery
- Registration
- Tunneling and encapsulation

(CORE) CS 303: Soft Computing

No of Lectures: 48

Objective

- To understand the concepts of how an intelligent system work and its brief development process.

Prerequisites

- Probability
- First Order Predicate Logic
- Classical Logic
- Calculus

Description

Intelligent systems can function as intelligent assistants, augmenting or supplementing human expertise while increasing productivity. This course exposes learners to Neural Network, Fuzzy Logic and Genetic Algorithms, which are the major building blocks of Intelligent Systems.

Chapter 1 : Introduction to Fuzzy Logic [16 to 20]

The Illusion : Ignoring Uncertainty and accuracy, Uncertainty and information, Fuzzy set and membership, Chance versus Fuzziness. Classical Sets, Fuzzy Sets, Cartesian Product, Crisp Relations, Fuzzy relations, Tolerance and equivalence Relations, Fuzzy Tolerance and equivalence Relations, Value assignments, Other Forms of the Composition Operations, Features of the membership Function, various forms, Fuzzification, Defuzzification to Crisp set, λ-Cuts for fuzzy Relations, Defuzzification to Scalars, Fuzzy Logic, Approximate Reasoning, Others forms of implication operations, Natural Language, Linguistic Hedges, Fuzzy (Ruled-Based) system, Graphical technique of inference, Membership value assignment-Intuition, Inference.

From Book 1 Chapters 1,2,3,4,5,6

Chapter 2 : Fuzzy System and Classification [10 to 12]

Fuzzy System Simulation- Fuzzy Relation, Equations, Nonlinear Simulation Using Fuzzy Systems, Fuzzy Associative Memories.
Fuzzy Classification- Classification by Equivalence Relations, Cluster Analysis, Cluster Validity, c-Means Clustering, Hard c-Means, Fuzzy c-Means, Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering.
Fuzzy Arithmetic and Extension Principle-Extension Principle, Fuzzy Arithmetic, Interval Analysis in Arithmetic, Approximate Methods of Extension.

From Book 1 Chapters 8, 10, 12

Chapter 3 : Neural Network [20 to 22]

Neural networks: Artificial Neural Network: Definition, Advantages of Neural Networks
Application Scope of Neural Networks

(ELECTIVE) CS 304: Project

- The Project can be platform, Language and technology independent.
- Project will be evaluated by project guide.
- Assessment will be done weekly in the respective batch.
- Evaluation will be on the basis of weekly progress of project work, progress report, oral, results and documentation and demonstration.
- You should fill your status of the project work on the progress report and get the Signature of project guide regularly. Progress report should sharply focus how much time you have spent on specific task. (The format of progress report is given as follow.)
- You should keep all signed progress report.
- Project will not be accepted if progress report is not submitted and all responsibility remains with student.
- Students should prepare design document using SE/UML techniques depends on your project.

About project Report: -

- The report should be typed on A4 size, executive bond paper for the final submission. The report should be in the good quality Rexene bound. We suggest, using one-and-half spaced printing, Times New Roman 12 font sizes for the normal text, 14-16 font sizes for headings & page titles.
- Number of copies:
  For one project you should prepare 2 copies of the project report. One for yourself, one for college (**College copy can be in CD**).

Evaluation for internal 50 Marks

Description	Marks
UML Diagrams	10 M
Technology And Design Based First Demo	15 M
Project Technology Based 2 assignments	10 M
Second Demo	15M

Evaluation for external 50 Marks

Description	Marks
Demo	15 M
Report	15 M
Presentation	15 M
Viva	05M

(ELECTIVE) CS 305: Web Services

No of lectures: 48

Pre-requisites

- Strong knowledge about Java programming.
- Good Understanding of Object Oriented Programming concepts.
- Must be familiar with XML.

Objectives

- To Understand Web Services and implementation model for SOA
- To Understand the SOA, its Principles and Benefits
- Understanding cloud computing as a web service
- Discuss the concept of virtualization and data in cloud.

Chapter 1 : Web Service and SOA fundamentals **[8]**

Introduction, Concept of Software as a Service(SaaS), Web services versus Web based applications, Characteristics of Web services, Service interface and implementation, The Service Oriented Architecture(SOA), Quality of service (QoS), Web service interoperability, Web services versus components, RESTful services , Impact and shortcomings of Web services.

Chapter 2 : Web Services Architecture. **[8]**

Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services, developing web services enabled applications.

Chapter 3 : SOAP: Simple Object Access Protocol **[10]**

Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP communication model, Building SOAP Web Services, developing SOAP Web Services using Java, Error handling in SOAP, Advantages and disadvantages of SOAP.

(ELECTIVE) CS 308: Business Intelligence

No of lectures: 48

Pre-requisites

- Relational database concepts, database design and entity-relationship (E-R) modeling, data normalization, and Structured Query Language (SQL).
- Data Mining techniques

Objectives

- Understand the role of BI in enterprise performance management and decision support.
- Understand the applications of data mining and intelligent systems in managerial work.
- Understand data warehousing and online analytical processing (OLAP) concepts, including dimensional modeling, star and snowflake schemas, attribute hierarchies, metrics, and cubes.
- Learn data analysis and reporting using an available BI software.

Chapter 1 : Introduction to Business intelligence **[6]**

Definition and History of BI, Transaction processing versus analytical processing, BI implementation , Major tools and techniques of BI

Chapter 2 : Data warehousing **[10]**

Definition and concepts, , Data warehouse architecture, ETL process, data warehouse development, Top down vs. Bottom up, Data Mart vs. EDW, Implementation issues, Real-time data warehousing

Chapter 3 : Business performance management **[14]**

Key performance indicators and operational metrics, Balanced scorecard , Six Sigma , Dashboards and scorecards

Chapter 4 : Data Mining for Business Intelligence **[10]**

Data mining process, Data mining methods, ANN for Data Mining

(CORE) CS 401: Full Time Industrial Training/ Industrial Project

Period – Minimum 4 months

1. There will be a teacher coordinator for a group of students. A teacher coordinator will take care of joining letters from students along with other necessary submission listed below.

2. A student will have to submit 2 reports during the period of ITP to the Department of the college.

3. After the completion of the ITP, a student will have to submit a synopsis along with the project completion certificate from the respective industry/research institute /educational institute.

4. A student will submit one hard copy (Student Copy) and a soft copy's (preferably 2 CDs) of the work carried out towards ITP.

5. The project will be graded by the experts (One internal examiner, one external examiner(academic expert) and one industrial expert) as follows:

O – 75 and above	**C**– 50 and above	**F**- A student will have to carry out project once again for a complete semester
A – 65 and above	**D**– 45 and above	
B – 55 and above	**E**– 40 and above	

Important Note: A student can complete ITP with a research project of a teacher / an expert funded by the University of Pune/ a funding agency.

Evaluation for internal 50 Marks will be done according to Progress Report written by Teacher Coordinator

Evaluation for external 50 Marks will be done by Industrial Expert, Academic Expert and One Internal Examiner.

Kopargaon Taluka Education Society's

K. J. Somaiya College of Arts, Commerce & Science, Kopargaon

Crosscutting Issues in Syllabus of Geography

Crosscutting Issues in 2013 Pattern:

Sr. No.	Class	Course Code	Course Name	Addressed issues
1	B. A. Geography	Gg-220(S-1)	SYBA: Economic Geography OR Tourism Geography	Professional Ethics
2	B. A. Geography	Gg-201(S-2)	SYBA: Fundamentals of Geographical Analysis	Professional Ethics
3	B. A. Geography	Gg-301(S-4)	TYBA: Techniques of Spatial Analysis	Professional Ethics
4	M.A /M.Sc Geography	Gg-105	F Y MA: Practical in Physical Geography (Sem-I)	Professional Ethics
5	M.A /M.Sc Geography	Gg-106	F Y MA: Practical in Human Geography	Professional Ethics
6	M.A /M.Sc Geography	Gg-223	Geography of Rural Settlement	Professional Ethics
7	M.A /M.Sc Geography	Gg-202	F Y MA: Practical in Cartography(Sem-II)	Professional Ethics
8	M.A /M.Sc Geography	Gg-203	F Y MA: Practical in Surveying and Field visit(Sem-II)	Professional Ethics
9	M.A /M.Sc Geography	Gg-204	F Y MA: Geography of Tourism(Sem-II)	Professional Ethics
10	M.A /M.Sc Geography	Gg-207	F Y MA: Practical in Terrain Analysis(Sem-II)	Professional Ethics
11	M.A /M.Sc Geography	Gg-333	S Y MA: Population & Settlement Geography (Sem-III)	Professional Ethics
12	M.A /M.Sc Geography	Gg-302	S Y MA: Interpretation of Topographical Maps & Village Survey / Project work	Professional Ethics
13	M.A /M.Sc Geography	Gg-303	S Y MA: Research Method in Geography(Sem-III)	Professional Ethics
14	M.A /M.Sc Geography	Gg-305	S Y MA: Practical in Watershed analysis(Sem-III)	Professional Ethics
15	M.A /M.Sc Geography	Gg-441	S Y MA: Principles of Regional Geography & Project work	Professional Ethics
16	M.A /M.Sc Geography	Gg-420	S Y MA: Regional Planning and Development(Sem-IV)	Professional Ethics
17.	B. A. Geography	Gg-320(S-3)	TYBA: Population and Settlement Geography	Gender
18.	M.A /M.Sc Geography	Gg.-104	FYMA: Principles of Population and Settlement Geography	Gender

19.	B. A. Geography	Gg-310(G-3)	TYBA: Regional Geography of India OR Human Geography	Human Values
20.	M.A /M.Sc Geography	Gg-321	SYMA: Political Geography	Human Values
21.	M.A /M.Sc Geography	Gg-304	SYMA: Social &Cultural Geography(Sem-III)	Human Values
22.	M.A /M.Sc Geography	Gg-404	SYMA: Geography of Food Security of India	Human Values
23.	M.A /M.Sc Geography	Gg-405	SYMA: Geography of Health	Human Values
24.	M.A /M. Sc Geography	Gg- 407	SYMA: Regional Geography of SAARC countries	Human Values
25.	B. A. Geography	Gg-110 (G-1)	FYBA: Elements of Geomorphology	Environment and Sustainability
26.	B. A. Geography	Gg-210(G-2)	SYBA: Elements of Climatology and Oceanography OR Geography of Disaster Management	Environment and Sustainability
27.	M.A /M.Sc Geography	Gg.-101	FYMA: Principles of Geomorphology(Sem-I)	Environment and Sustainability
28.	M.A /M.Sc Geography	Gg.-102	FYMA: Principles of Climatology(Sem-I)	Environment and Sustainability
29.	M.A /M.Sc Geography	Gg-213	FYMA: Population Geography(Sem-II)	Professional Ethics & Human Value
30.	M.A /M.Sc Geography	Gg-205	FYMA: Geography of Disaster Management (Sem-II)	Environment and Sustainability
31.	M.A /M.Sc Geography	Gg- 313	SYMA: Urban Geography	Environment, Professional Ethics, Human Value
32.	M.A /M.Sc Geography	Gg-103	FYMA: Prin. Of Economic Geography	Environment and Sustainability Professional Ethics
33.	F.Y.B. Com		FYBCOM: Commercial Geography	Professional Ethics

Dr. G. K. Chavhan
Head, Dept. of Geography

Dr. V. C. Thange
IQAC, Coordinator

Dr. B. S. Yadav
Principal

Gg- 220 : Tourism Geography (S-1)

Objective:-

1) To acquaint the student's basic concepts of Geography & Tourism
2) To aware the students with the utility and application of Tourism
3) To help the students & society to understand the interrelationship between tourism and employment generation opportunities.
4) To understand the impact of tourism on Physical and Human Environments.

Section-I				
No.	Unit	Sub-unit	Learning Points	Periods
1	Introduction to Tourism Geography	(A) Introduction and Definition	1.Introduction 2.Definition of Tourists and Tourism	10
		(B) Nature of Tourism Geography	1.Uniqueness 2. Diversity 3.Recreational 4. Dynamic 5.Interdisciplinary 6.Non-Productive 7.Seasonal	
		(C) Scope of Tourism Geography	1 Tourism as a Basic Need of Mankind 2 Tourism and Transportation 3 Natural environment and Tourism 4. Culture and Tourism 5. Religion and Tourism 6. Tourism Products	
		(D) Importance	1 Relation Between Geography and Tourism 2 Importance of Tourism	
2	Concepts and Classification of Tourism	(A) Concepts	1 Geo-Tourism 2 Agro- Tourism 3 Heritage Tourism 4 Adventure Tourism 5 Religious Tourism 6 Health Tourism 7 Sport Tourism 8 Disaster Tourism	15
		(B) Classification Based on a)Nationality	1. International 2. National 3. Regional 4. Local	
		b) Travel Time	1. Long Haul 2. Short Haul.	
		c)Travel Distance	1. Global 2. National 3. Regional 4. Local	

		d) Number Of Tourists	1. Groups 2. Family Members 3. Individual	
		e) Purpose	1. Religious 2. Recreation 3. Heritage 4. Adventure 5. Nature 6. Health 7. Sports	
		f) Approach	1. Eco-tourism as an Approach	
3	Assessing Tourism Potentials -I	Physical Factors (A) Relief	1. Mountain 2. Plateau 3. Plain 4. Sea Beaches 5. River Source 6. Water Fall	10
		(B) Water bodies	1. Lakes/ Dams 2. Hot Spring 3. Natural gassers 4. River –Confluences	
		(C) Climatic	1. Hill Station 2. Snow Fall 3. Rainy Season 4. Sanatoriums	
		(D) Forest	1. National Park 2. Santuaries (With Indian Examples)	
4	Assessing Tourism Potentials -II	Socio- Cultural Factors (A) Religious (B) Historical (C) Socio-Cultural	Pilgrim – All Religious Centers Historical Monuments Culture, Festivals, Sports Centres, Warli Paintings, Ideal Village (With Indian Examples)	10
		Section -II		
5	Transportation and Communication	Infrastructure and Support System	1. Road 2. Rail 3. Water 4. Air 5. Space	10
			1. Guide 2. Telephone/ mobile/ TV 3. Internet 4. Electronic & Printing Media 5. Travel & Tourist Agencies	
6	Accommodation	Accommodation Types	1 Private Hotels, motels, Inn 2 Govt. accommodation- Tourist home, Guest House, Rest house, Youth Hostel, Tents, Caravans and Bed & Breakfast 3. Rail Yatribhavan 4. House boats 5. Dharmashala	10

Gg-201 : FUNDAMENTALS OF GEOGRAPHICAL ANALYSIS

From June 2014

Workload : Six periods per week per batch (12 Students Per Batch)
(Examination for the Course will be conducted at the end of academic year)

Objectives:

1. To enable the students to use various Projections and Cartographic Techniques.
2. To acquaint the students with basic of Statistical data.
3. To acquaint the students with the principles of surveying, its importance and utility in the geographical study.

SECTION- I

No	Topic	Learning Points	Exercises	No. of periods
1	Maps and Scales	1. Maps : Meaning, definition and Types 2. Map Scale : Definition and Types	1. Map : Meaning, Definition and Types. 2. Map Scale : Definition and Types Conversion of Verbal scale to numeric and vice-versa (in British and Metric Systems) i) Construction of simple graphical scale (Two examples) i) Construction of comparative scale (Two examples)	15
2	Map Projection	1. Definition and need of Map Projection 2. Classification of map projection based on method of construction and developable surfaces used.	1. Zenithal Polar projection. i. Zenithal Polar Gnomonic Projection ii. Zenithal Polar Stereographic Projection. 2. Conical Projection : i. Projection with one standard parallel ii. Bonne's Projection 3. Cylindrical Projection i. Cylindrical equal area Projection. ii. Mercator's Projection 4.Covenetional Map Projections i. Mollweide's Projection (Construction of above map projection with properties and uses of each group : one example from each hemisphere).	20
3	Data Representation by various techniques	1. Graphs and Diagrams	1. Simple Line Graph 2. Polygraph 3. Simple Bar Diagram 4. Compound Bar Diagram 5. Pie Diagram (Chart) 6. Choropleth Mapping Plotting & Presentation using computers	15

4	Basic analysis of Statistical Data	1. Population and Sample 2. Statistical Data and Frequency	1. Population, sample, Method of sampling, Characteristics of sample 2. Tally marks and frequency table. 3. Frequency distribution (histogram and polygon) 4. Cumulative Frequency and Ogive curve.	10
		SECTION II		
5	Surveying	1. Directions 2. Definition of Surveying 3. Types of Surveying 4. Measurement of Land	1. Various Methods of deciding North direction True, Magnetic and Grid North 2. Plane Table Survey. i. Radiation Method ii. Intersection methods 3. Prismatic Compass Surveying Methods: ii. Open Travers ii. Close Travers 4.GPS Survey & Plotting Finding Latitude (X), Longitude (Y) and Altitude (Z). Plotting of X and Y on graph paper 5. Dumpy Level Survey Plotting by- i. Rise and Fall Method *ii.* Collimation Plane Method 6. At least exercise involving of actual measurement of piece of a land.	40
6	Field Excursion / Village/ Urban Survey	Visit two places of geographical interest anywhere in the country.	One short tour of two days duration and Preparation of tour report. OR One long tour more than five days and preparation of tour report	20

Note : 1. Use of stencils, log tables, computer and calculator is allowed.
2. Journal should be completed and duly certified by practical in-charge and Head of the Department.
3. Int. and Ext examiner should set jointly the question paper for each batch

Reference Books :

1. Singh Lehraj, (1973) : Map Work and Practical Geography, Central Book Depot – Allahabad
2. D. Y. Ahirrao and E. K. Karanjkhele, (2002) : Pratyakshik Bhugol, Sudarshan – Nashik
3. P. G. Saptarshi and S. R. Jog, Statistical Methods
4. S. N. Karlekar, (2008) : Statistical Methods, Diamond – Pune
5. T. P. Kanetkar and S. V. Kulkarni, (1986) : Surveying and Leveling, Pune Vidyrthi Griha Prakashan – Pune
6. Arjun Kumbhare, Practical Geography
7. Pijushkanti Saha & Partha Basu. (2007), 'Advanced Practical Geography', Books and Allied (P) Ltd, Kolkata

Savitribai Phule Pune University, Pune

T.Y.B.A

Gg. 301: Techniques of Spatial Analysis (S-4)

Effective from-June-2015

Workload: Six periods per week per batch (12 students for per Batch)
(Examination for the course will be conducted at the end of academic year).

Objectives:

1. To Introduce the Students with SOI Toposheets and to acquire the Knowledge of Toposheet Reading/Interpretation.
2. To familiarize the students with the weather instruments and their applications in Geographical phenomena.
3. To acquaint the students with IMD weather maps and to gain the knowledge of weather map Reading / interpretation.
4. To train the students in elementary statistics as an essential part of geography.
5. To awareness about GIS among the students.

Section - I

nit).	Topic	Learning Points	Periods
1	Toposheets	a. Introduction to Survey of India (SOI) toposheets, Marginal Information, Grid reference, Conventional signs and symbols b. Types of toposheet/Indexing of toposheets i. 1: 1000000/Million sheet ii. 1:250000/Degree sheet/Quarter inch sheet iii. 1:100000/Half inch sheet iv. 1:50000/One inch sheet v. 1:25000 vi. 1: 5000	15
2.	Methods of Relief Representation	1. Methods of Relief Representation a. Qualitative :- Hachures, Hill shading, Layer Tint b. Quantitative:- Contours, Form lines, Bench Marks, Spot Heights, Triangulation Mark, Relative Height (r) 2. Representation of Relief features by Contours a. Concave Slope, Convex Slope, Steep Slope, Gentle Slope, Terraced / Uniform b. Conical Hill, Spur, Plateau, Ridge, Saddle, Pass, Cliff & Waterfall 3. Profile a. Drawing and Description of Cross Profile of any Region from toposheet b. Drawing and Description of Longitudinal Profile of a Road or a River	15
3.	Toposheet Reading, Interpretation & data generation	1. Reading of at least three SOI toposheets one each for Plain, Plateau and Mountainous/hilly Region 2. One day field Excursion for Orientation of toposheet, Observation and Identification of Geographical Features and Preparation of a Brief Report	15

6.	Digital Terrain analysis II	Digital Terrain analysis using GIS softwares	Determination of Primary attributes any 4	05
7.	Digital Terrain analysis III	Digital Terrain analysis using GIS softwares	Determination of Secondary attributes any 4	05

References

1. Brändli, M., 1997. Modelle und Methoden für die Extraktion geomorphologischer und hydrologischer Objekte aus digitalen Geländemodellen. Unpublished . Geographisches Institut der Universität Zürich.
2. Burrough, P. A., McDonnell, R. A., 1998. Principles of Geographical Information Systems. New York: Oxford University Press.
3. Chilès, J., Delfiner, P., 1999. Geostatistics: Modeling Spatial Uncertainty. New York: John Wiley and Sons.
4. Foley, J.D., van Dam, A., Feiner, S.K., Hughes, J.F., 1992. Computer Graphics: Principles and Practice. Reading: Addison-Wesley. [Second Edition, Revised Fifth Printing.]
5. Goodchild, M.F., 1980. Algorithm 9: Simulation of Autocorrelation for Aggregate Data. Environment and Planning, 12, 1073-1081.
6. Kotz, S., Johnson, N. L., 1985. Encyclopedia of Statistical Sciences. New York: John Wiley and Sons.
7. Longley, Paul A., Goodchild, Michael F., Maguire, David J., Rhind, David W., 1999. Geographical Information Systems. Principles, techniques, applications and management. New York: John Wiley and Sons. [2 volumes. 580 pages. 2nd edition]
8. Moore, I. D., 1996. Hydrological Modeling and GIS. In: M. F. Goodchild, L. T. Steyaert, B. O. Parks, C. Johnston, D. Maidment, M. Crane, and S. Glendinning, ed. GIS and Environmental Modeling: Progress and Research Issues. Fort Collins, Colorado: GIS World Books.
9. Quinn, P., Beven, K., Chevalier, P., Planchon, O., 1991. The Prediction of Hillslope Flow Paths for Distributed Hydrological Modelling Using Digital Terrain Models. Hydrological Processes, 5(1), 59-79.
10. Sigle, M., Hellwich, O., Köstli, A., 1992. Intersection and Combination of Digital Elevation Models - Methods and Applications. International Archives of Photogrammetry and Remote Sensing, 29(B4), 878-882.
11. Sutherland, I.E., Sproull, R.F., Schumacker, R.A., 1974. A Characterization of Ten Hidden-Surface Algorithms. ACM Computing Surveys, 6(1), 1-55.
12. Wilson, J. , Gallant, J., 2000. Terrain Analysis: Principles and Applications. New York: John Wiley and Sons.
13. Yoeli, P., 1985. The Making of Intervisibility Maps with Computer and Plotter. Cartographica, 22(3), 88-103.

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MA/MSc Syllabus in Geography (Credit System)

Sem-III: Revised Syllabus (from June-2014)

Code No. Gg: 333 **Title: Practicals in Population and Settlement Geography**

No. of Credits: 03 **Total Periods : 45**

Sr. No.	Topic	Sub-Topic	Learning Points	Period Each Practical of 3 Hours
1	Population Geography	1. Demographic indices	1. Mean age at marriage and fertility relationship 2. Mean age at marriage and infant mortality rate 3. Underweight children of age 1- 47 months and under 5 years mortality rate. 4. % of woman married to blood relative and infant mortality.	8
		2. Determination of Demographic Transition	1. Demographic transition – applied to Maharashtra 2. Pull-push factors affecting volume of migration – simple correlation matrix. 3. Relationship between per capita income and infant mortality	
2	Settlement Geography	Indices	1. Delimitation of CBD by Vance and Murphy 2. Relationship between Basic/ Non-basic ratio and growth rate 3. Relationship between land values and land use. 4. Gravity model by W. J. Relly and Zipf, its application (Potential Population surfaces) 5. Primary Index (Jefferson) Multiple Primacy. 6. Stages according to urbanization Curve. 7. Rate of growth and level of Urbanization. 8. Rank size rule. 9. Huff's Model. 10. Gini's Coefficient concentration index	7

Books :

1. Economic and Political Weekly – Special issue of population survey
2. Liendzore J.M. Techniques in Human Geography
3. Martin Cad : Analytical Urban Geography
4. Siddhart, K and Mukherjee, S (1999) : Cities urbanization and urban system. Transworld Media and Communication, Patana.
5. Chandana, R.C. Population, Geography
6. Yeats, M.H. (1978) : An introduction to quantitative analysis in human geography.

UNIVERSITY OF PUNE

MA/MSc Syllabus in Geography (Credit System)

Sem-III: Revised Syllabus (from June-2014)

Code No. Gg: 302 **Title: Interpretation of Topographical Maps and Village Survey / Project Report**

No. of Credits: 04 **Total Periods : 60**

Sr. No.	Topics	Sub-topics	Learning Points	Practicals (3 hrs)	No: of sheets (minimum)
	a. Interpretation of Topographical Maps (for 50 marks)				
1	Study of S.O.I and O.S Topographical Maps (1: 50,000 Series)	1.Indexing systems and conventional signs and symbols (OS)	1. 15' 15' 2. 7.1/2' 7.1/2' 3. 5' 7.1/2'	4	2 (One each for S.O.I and O.S. sheets)
			1. 4-figure grid 2. 6-figure grid 3. International grid reference		
		2. Grid references.	1. Latitudinal & Longitudinal extension 2. Contour interval		
		3. Locational and Relief aspects of the area	3. Maximum and Minimum heights		
2	Interpretation of S.O.I and O.S. toposheets.	1. Patterns of Relief	1. Distribution of Spot heights, bench marks, Trigonometrical Points etc. 2. Types of Slopes (convex, concave, uniform etc.) 3. Major landforms from contour patterns	10	SOI –3 sheets OS – 3 sheets
		2. Patterns of Drainage network	1. Types-trellis, dendritic, radial, etc. 2. Streams with water, without water. 3. Influence of relief on drainage		
		3. Patterns of Vegetation.	1. Types of vegetation 2. Association of relief and drainage 3. Reserved Forest and Protected Forest		
		4. Patterns of Settlements.	1. Types, amenities, facilities and communication, etc 2. Distribution, relative size, relative distance (dispersed, nucleated etc)		
		5. Patterns in Land Use.	1. Agriculture, mining etc, areal distribution, impact of physical landscape.		
	b. Village Survey / Project Report with oral (for 30 marks)				

3	Physical Survey	Location	1. Location on toposheet (lat. & long), extension, grid reference if available, height above mean sea level, area, site and situation) 2. Map showing physical features surrounding the village./ Project area 3. Position of the village on the cross-section line. 4. Location of the village /Project area shown in the map of catchment area.	6	
		Geology and climate	Information regarding geology, climate, soils and vegetation of the village		
4	Socio-Economic Survey	Population characteristics	1. Population, population structure, facilities available 2. Information regarding households-based on 10% sample survey.		
		Village morphology	1. Plan prepared by pace survey 2. Description of the plan.		

Note:

1. The selection of the village must be based on the availability of S.O.I. toposheet and/ or Cadastral Map.
2. As far as possible the village should be selected from the nearby area, so that the students can undertake at least two field visits.
3. Collection of data / information should be undertaken by the student by visiting the various Government Offices
4. The Village Survey Report should includes all geographical and socio-economic aspects.
5. Appropriate maps, diagrams, graphs, sketches etc should be included.
6. The Report should not preferably exceed 25 pages and **a group of maximum 5 students is permissible.**
7. Village survey is equivalent to 6 Practicals.

Reference Books :

1. Tamaskar B.G. and Deshmukh V.M. (1974), Geographical Interpretation of Indian Topographical Maps.
2. Ramamurthy, K. (1982): Map interpretation, Madras
3. Petrie N. (1992), Analysis and Interpretation of Topographical Maps. Orient Longman Limited Calcutta.
4. Dury G.H. (1960), Map Interpretation. Sir Isaac Pitman and Sons Limited, Pitman House, Bath.
5. Meux A. H. (1960), Reading Topographical Maps. University of London Press Limited
6. Jones P. A. (1968), Field work in Geography. Longmans, Green and Company Limited
7. Archer J. E and Dalton T. H. (1968), Field work in Geography B.T. Batsford Limited London
8. Wheeler K.S. Ed (1970), Geography in the field. Blond Educational, London.
9. Gupta, K. K. and Tyagi, V. C. (1992): Working with maps, Survey of India Publication, Dehradun
10. Vaidyanadhan. R. (1968). Index to a set of 60 topographical maps, CSIR, New Delhi

UNIVERSITY OF PUNE

MA/MSc Syllabus in Geography (Credit System)

Sem-III: Revised Syllabus (from June-2014)

Code No. Gg: 303 **Title: Research Method in Geography**

No. of Credits: 03 **Total Periods : 45**

Sr. No.	Topic	Sub-topic	Learning Points	Lectures
1.	Surveying And Map projections	Definition Importance and types	1. Plane and geodetic Survey 2. Methods of Survey 3. Principles and methods of Dumpy level and theodolite survey 4. UTM projection	6
2.	SOI Toposheet	Interpretation and use	1. Indexing system of SOI Toposheet 2. Data base creation for physical and cultural features 3. Drainage basin demarcation, terrain cross profiles	6
3.	Aerial photographs and satellite images	Interpretation and use	1. Concept of stereoscopic view 2. Geometry of Aerial photograph: flight line, overlap, fiducial marks, Measurement of relative heights 3. Data base creation from aerial photographs and satellite images	6
4.	Statistical methods	Application	1. Nature of data Geographical data. 2. Descriptive and inferential statistics 3. Bivariate and multivariate correlation analysis 4. Testing of hypothesis: parametric and non parametric tests (Chi squared, ks, t, f)	6
5.	GIS	Use of GIS	1. Use of GIS in spatial data analysis and modelling	5
6.	Field work	Components	Field sampling Questionnaire, interviews, measurements and field mapping.	5
7.	Report writing	Technique	Research problem, survey of literature, research methods applied, analysis, conclusions References and Bibliography	6

Reference Books:

1. Shaw G and Wheller D. (1985): Statistical techniques in geographical analysis. John Wiley and sons, New- York
2. Sumner G J (1978): Mathematics for physical geographers. Edward Arnols
3. Karlekar Shrikant and Kale Mohan (2005): Statistical analysis of Geographical data, Dimond publication
4. P. A. Burrough and R.A. McDonnell, Principle of Geographical Information System, 2000, Oxford University Press.
5. Geoge Joseph (2003): Fundamental of Remote Sensing, Universities Press, Hyderabad.
6. Ebdon David (1989): Statistical for Geographers
7. King, (1975): Statistical Geography
8. Norcliffe G. B. (1977): Inferential statistics for Geographers (Hutchinson, London)
9. Rogerson P. A. (2001): Statistics for Geography (SAGE pub., London, New Delhi}
10. Singh & Kanauja : Map work and Practical Geography.
11. Maslov A. V.Gordeev A. V. Batrakov Yu. G. (1984) : Geodetic surveying, Mir Publishers, Moscow
12. Kanetkar T. P. & Kulkarni S.V. 1986. Surveying & leveling, Pune Vidyarthi Griha Prakshan, Pune
13. V. Natarajan P., Adler Ron K:. Advanced Surveying, B. 1 Publ. Bombay
14. Richardus P., Adler Ron K (1972) : Map projections, North Holland publ. Co. Amsterdam
15. Maling .H. (1973) : Co ordinates systems and map projections, George Philip, London.

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MA/MSc Syllabus in Geography (Credit System)

Sem-III: Revised Syllabus (from June-2014)

Code No. Gg: 305

No. of Credits: 03

Title: Practicals in Watershed analysis

Total Periods : 45

Ex No.	Topic	Sub topic	Learning points	Practical(3hrs)
1	Delineation of Watershed/Drainage basin	Delineation of Watershed/Drainage basin from toposheet	3 to 5 th order basin delineation from Toposheet	1
2	Basin perimeter, shape and area	Basin perimeter, shape and area	Calculation of Basin perimeter, shape and area	1
3	Linear aspects of Drainage basin	Stream ordering(Strahler's method)	Stream ordering, Numbering, Measurement and calculation of Stream length, Mean stream length, Stream length ratio, Bifurcation ratio	2
4	Relief aspects of Drainage basin	Relief ratio, relative relief, Ruggedness number	Calculation of Relief ratio, relative relief, Ruggedness number	2
5	Aerial aspects of Drainage basin	Drainage density, Drainage frequency, Texture ratio, Form factor, circularity ratio, Elongation ratio,	Calculation of Drainage density, Drainage frequency, Texture ratio, Form factor, circularity ratio, Elongation ratio,	2
6	Preparation of DEM	Digitization of contours from Toposheet	Preparation of TIN model and Grid based DEM	2
7	Software based	Delineation of watershed	DEM based	2
8		Digitization of layers	Point ,line and Polygon	
9		Finding ridge line and valley floor	Finding ridge line and valley floor within basin/Watershed	
10	Profile drawing	DEM based	Set of Profiles at an equal interval 5 to 8 profiles	1
11	Hypsometric Integral	DEM based	Plotting of Hypsometric curve and Calculation of Hypsometric Integral	2

UNIVERSITY OF PUNE

MA/MSc Syllabus in Geography (Credit System)
Sem-IV: Revised Syllabus (from June-2014)

Code No. Gg: 441 **Title: Principles of Regional Geography and Project Work**

No. of Credits: 04 **Total Periods : 60**

Theory of Principles of Regional Geography = 2 credits.

Project Work = 2 credits.

Sr. No.	Topic	Learning Points	Periods
01.	Introduction	1. Definition and Concept of Regional Geography. 2. Principles and importance of Regional Geography.	5
2	Regionalisation and Planning	1. Regional Approach 2. Planning through Regionalisation	5
3	Theoretical Structure of Planning	1. Central Place Theory 2. Growth Pole Theory 3. Gunnar Myrdal's Cumulative Causation. 4. Application of these theories in India.	7
4	Regional Disparities	1. Causes, Effects of Regional Disparities. 2. Remedies on Disparities.	5
5	Presentation	Student Presentation on any one topic related to Regional Geography with issues and solutions.	8

Reference Books:

1. Chandana, R. C. (2000): Regional Planning - A Comprehensive Text, Kalyani Publishers, Ludhiana
2. Friedmann, J Alanso W (1967): Regional Development and planning - A Reader, MIT Press Mass
3. Mishra R. P (Ed.) (1992): Regional Planning, Concepts, Techniques, Policies and Case Studies, Concept Pub. New Delhi.
4. Dube K. N. (ed) (1990): Planning and Development in India, Asia Publishing House, New Delhi
5. Govt. of India (1986), Regional Plan 2001 - National Capital Region, NCRPB, Ministry of Urban Development, New Delhi
6. Bhat, L. S. (1973): Regional Planning in India, Statistical Publishing Society, Kolkata.
7. MacLeod and Jones M. (2001): Renewing The Geogrpahy of Regions, Environment and Planning.

UNIVERSITY OF PUNE

MA/MSc Syllabus in Geography (Credit System)

Sem-IV: Revised Syllabus (from June-2014)

Title: Regional Planning and Development

Code No. Gg: 420

Total Periods : 45

No. of Credits: 03

Sr. No.	Topic	Learning Points	Periods
01.	Concept and Role of Regional Planning	1. The Concept and Need of Regional Planning 2. Role of Geography in Regional Planning. 3. Approaches in Regional Planning. 4. Hierarchy of Planning 5. Types of Planning 6. Levels of Planning	7
02.	Region	1. Concept of a Region. 2. Type of a Region. 3. Concept of Planning Region. 4. Indicators of Developments 5. Measurement of Regional Development.	5
3	Surveys of Regional Planning	1. Regional, 2. Techno-Economic 3. Diagnostic surveys.	6
4	Methodology and Techniques	1. Methodology of regional Planning 2. Techniques of regional planning. 3. New trend in regional planning	6
5	Planning Strategies	1. Concept of Planning Strategies in Regional Development. 2. Concentration versus dispersal 3. Case studies from developed and developing countries.	8
6	Regional Policies	1. Regional Policies in India's Five Year Plans. 2. Experience of Regional Planning in India. 3. Multilevel planning (State, District and Block Level Planning).	10
7	Regionalisation	1. Concept of Regionalisation. 2. Planning of Metropolitan regions. 3. Planning of tribal, Hilly areas, command areas, river basins. 4. National Capital Region.	10

Reference Books:

1. Chandana, R. C. (2000): Regional Planning - A Comprehensive Text, Kalyani Publishers, Ludhiana
2. Friedmann, J Alanso W (1967): Regional Development and planning - A Reader, MIT Press Mass
3. Mishra R. P (Ed.) (1992): Regional Planning, Concepts, Techniques, Policies and Case Studies, Concept Pub. New Delhi.
4. Dube K. N. (ed) (1990): Planning and Development in India, Asia Publishing House, New Delhi
5. Govt. of India (1986), Regional Plan 2001 - National Capital Region, NCRPB, Ministry of Urban Development, New Delhi
6. Bhat, L. S. (1973): Regional Planning in India, Statistical Publishing Society, Kolkata.

Savitribai Phule, Pune University, Pune
T.Y.B.A
Gg-320: Population and Settlement Geography (S-3)
Effective from-June-2015

Objective:-

1. To provide an understanding of spatial and structural dimensions of population
2. To familiarizing the students with global and regional level problems.
3. To acquaint the students with the spatial, political and structural characteristics of human settlement under varied environmental conditions.

Section-A. Population Geography

nit	Topic	Sub Topic	Learning Points	Periods
1	Introduction	Nature and Scope	Definitions, Nature and Scope of Population Geography	10
		Source of Population Data	Census, National Sample Survey, Sample Registration Survey, NFHS, DLHS Data, Demographic Surveys and other Sources	
2	Population Dynamics	Spatial Pattern of Distribution	1) Determinates of Distribution and Density of Population 2) Distribution of Population – World & Indian Scenario 3) Population Growth- Global & Indian Trend	10
		Composition of Population	Population Composition: Age and Sex, Rural-Urban &Economic	
3	Demographic Attributes	Human Migration	1. Migration-Classification, Determinants and Consequences of Migration. 2.Measures – Fertility, Morbidity and Mortality, Marital Status 3.Human Development Index 4. Illegal Migrations and its Impacts Migration and its Impacts on Smarts Cities and Smart Villages	14
		Theories of Population Growth	1) Demographic Transition Model [DTM] 2) Malthus: Population Theory	
4	Population Policies	Population Policies and Programmes	1.Population Policies in the Context of Growth, Structure, Distribution &Quality Life 2. Evolution of Family Welfare Programme in India 3.National Population Policies in India [After 1991]	11

Section-B- Settlement Geography

5	Introduction of Settlement Geography	Definition, Nature and Scope	Definition, Nature and Scope of Settlement Geography	12
		Characteristics	1) Characteristics of Settlement Geography 2) Branches of Settlement Geography	
6	Man-Environment Relationship	Factors Influencing the Growth and Distribution of Settlements.	1. Physical 2. Economic 3. Social 4. Political	10
7	Settlement	Site and Structure	Site, Situation, Type, Size, Spacing and Patterns	12

5. Concepts related to Settlement	1. Various Concepts 2. Settlement Theory	1. Nodality 2. Centrality 3. Range 4. Threshold & Hierarchy 5. Rank-size distribution		08
6. Concentration of Population and Levels of Urbanization	1. Urbanization 2. Factors of Urban Growth	1. Christaller and Losch's Model	Concept of Urbanization 1.Improvement in transportation & Communication. 2.Changes in Industrial Production. 3.Industrialization 4.Food supply and Public hygiene	08
7. Population Distribution	Factors influencing the Distribution of Population	1. Physical 2. Economic 3. Social 4. Political		08
8. Theories of Population Growth	1. Thomas Malthus 2. Ricardo 3. Demographic Transition Model	1. Concept 2. Scope 3. Applications 4. Relevance		08
9. Population as a resource	Various aspects of population	1. Size 2. Growth 3. Age 4. Education		06

Savitribai Phule Pune University, Pune
T.Y.B.A
Gg.: 310 Regional Geography of India (G-3)
June 2015

Objective : -

1. To acquaint the students with geography of our Nation.
2. To make the student aware of the magnitude of problems and Prospects at National level.
3. To help the students to understand the inter relationship between the subject and the society.
4. To help the students to understand the recent trends in regional studies.

SECTION - I

Sr. No.	Topic	Sup Topic	Learning Points	Periods
1	Introduction	Location , Extent and Geopolitical Significance	1.Historical Background 2.Location and Extent 3.Relationship with Neighboring Countries 4.Geopolitical Importance of Indian Ocean.	10
2	Physiography	Major Physiographic Regions and their Importance	1. The Northern Mountains 2.The North Indian Plains 3.The Peninsular Plateau 4.The Costal low lands 5.The Islands	12
3	Drainage	Drainage System of India The Himalayan River System The Peninsular River System	1.The Indus , The Ganga , The Brahmaputra 2.East Flowing Rivers- Mahanadi, Godavari, Krishna, Kaveri. 3.West Flowing Rivers- Narmada, Tapi, Mahi 4.Rivers of the Sahyadri - Amba & Damanganga	12
4	Climate	Characteristics , Origin and Mechanism of Monsoon, Various Seasons	1. Characteristics of Indian Climate 2.Role of Various Controlling Factors on Climate of India 3.Monsoon: Origin and Mechanism 4.Various Seasons and Weather Associated with them	11
			SECTION – II	
5	Soils and Natural Vegetation	Types and Distribution	Types of Soils and its Distribution Soil Degradation and Conservation Types of Natural Vegetation and its Distribution	12

6	Minerals and Energy Resources	Mineral Resources Energy Resources	Deforestation and Conservation 1.Mineral Resources & its distribution Iron ore, Manganese, Bauxite, Copper 2.Energy Resources- a)Major Conventional & its Distribution Coal, Mineral Oil, Natural Gas b)Non-conveniional - Hydroelectricity, Solar energy, Wind energy, Biogas, Atomic energy	12
7	Agriculture	Significance and Recent Trends in Agriculture	1. Significance of Agriculture in Indian Economy 2. Green Revolution 3. White Revolution 4.Blue Revolution 5. Livestock Resources, 6.Tissue Culture & Horticulture 7. Poly House and Agriculture	11
8	Planning and Development	Regional Planning and development	1.Concept, Objectives, Need, Nature of Regional Planning 2.Experience of Regional Planning in India 3.Regional Development of Maharashtra	10

Suggested Readings:

1. *Aher A.B , Chaodhari A. P & Chaodhari Archna. Regional Geography of India Prashant Publication Jalgaon 2015*
2. *Deshpande C.D: India-A Regional Interpretation Northern Book Centre, New Delhi.1992.*
3. *Farmer, B.H.: An Introduction to South Asia. Methuen, London, 1983.*
4. *Govt. of India: India - Reference Annual, 2001 Pub. Div, New Delhi, 2001.*
5. *Govt. of India: National Atlas of India, NATMO Publication, Calcutta..*
6. *Learmonth, A.T.A. et.al(ed.) : Man and Land of South Asia Concept, New Delhi, 1965.*
7. *Mitra, A.: Levels of Regional Development India Census of India, Vol I, Part I-A (i) and (ii) New Delhi, 1967.*
8. *Routray, J.K.: Geography of Regional Disparity Asian Institute of Technology, Bangkok, 1993.*
9. *Shafi, M: Geography of South Asia, McMillan & Co., Calcutta, 2000.*
10. *Singh, R.L.(ed.): India: A Regional Geography. National Geogphical Society. India, Varanasi, 1971.*
11. *Spate, O.H.K. and Learmonth, A.T.A.; India and Pakistan - Land, People and Economy Methuen & Co., London, 1967.*
12. *P. G. Saptarshi, J. C. More, V. R. Ugale & A. H. Musmade :A Geographical Region of India : Diamond Publication (2009) (Marathi)*
13. *Patil S. G., Suryawanshi R. S., Pachame S., Choudhar A. H. : Economic Geography, Atharav Prakashan, Pune. (2014) (Marathi).*
14. *Aher A. B. , Arekar R.: Commercial Geography , Atharav Prakashan, Pune. (2013) (Marathi).*
15. *Datt & Sundaram, Indian Economy (S.C.A.)*

UNIVERSITY OF PUNE

MA/MSc Syllabus in Geography (Credit System)

Sem-III: Revised Syllabus (from June-2014)

Code No. Gg: 321 **Title: Political Geography**

No. of Credits: 03 **Total Periods : 45**

Sr. No	Topic	Sub- Topic	Learning Points	Periods
1	Introduction to political Geography	Nature, Scope, Development	1) Definition 2) Geography & politics 3) History & development of political Geography	5
2	Approaches to the Study of Political Geography	Types of Approaches	1) Whittlesey's landscape approach 2) Functional approach 3) Centrifugal & centripetal forces, analysis of external functions, 4) Unified Field Theory	6
3	Concept of Nation & State	Geographical Perspective	1) Territoriality 2) State & Nation 3) State formation. 4) Nation building / Nationalism	5
4	Frontiers & Boundaries	1. Definition. 2. Classification	1) Definition of frontiers & boundaries 2) Distinction between frontiers & boundaries 3) Genetic, functional & morphological classification of boundaries	7
5	Global Geo-Strategic View	Land, Sea, & Air Power	Views of Mahan, Mackinder, Spyk man & Cohen	5
6	Resource Development & Power	Resources & National Strategy	1) Classification of resources 2) Resources & National strategy 3) Resource management & power of Nation	5
7	Geopolitical Significance of Indian Ocean	Geopolitics Indian Ocean Border States and England	Political Geography of SAARC region.	5
8	Political Geography of India	Contemporary Issues	1) Changing political map of India. 2) Unity in diversity. 3) Stability & instability in state politics 4) Interstate water & language Disputes. 5) Problems of border states of India 6) Emergence of new states.	7

Reference Books :

1. Alexander L.M (1963): World Political Patterns, Ram McNally, Chicago.
2. Political Geography By Sudeepta Adhikari, Rawat Publication.
3. Dikshit R.D (1996): Political Geography: A Contemporary Perspective, Tata McGraw Hill, New Delhi.
4. Dikshit R.D (1999): Political Geography: A Century of Progress, Sage, New Delhi.
5. De Blij. H. J And Glassner, M. (1968) Systematic political Geography, John Wiley, New York.
6. Pounds N.J.G (1972): Political Geography, McGraw, New York.
7. Taylor, R.J.(1989) Political Geography, Longman UK.

UNIVERSITY OF PUNE

MA/MSc Syllabus in Geography (Credit System)

Sem-III: Revised Syllabus (from June-2014)

Code No. Gg: 304 **Title: Social and Cultural Geography**

No. of Credits: 03 **Total Periods : 45**

Sr. No.	Topic	Subtopics	Learning points	Periods
01	Introduction	Nature, Scope andDevelopment	1. Definitions 2. Early Contributions 3. Subject Matter 4. Conceptual and Methodological approaches 5. Trends and Developments	04
02	Philosophical bases Social and Cultural Geography	Bases and Concepts	1. Materialism, Idealism,Phenomenalism, Existentialism, Structuralism,Radicalism, liberalism, Positivism, Humanism 2. Origin and Diffusion of Culture	05
03	Space and Society	Structure and Processes of Social Patterns	1. Individual's space- Intimate, Personal, Socialand Public Space. 2. Theoretical space – Organic, Perceptive andSymbolic space 3. Interaction and Social relations	06
04	Social Groups	1. Activities 2. Concepts 3. Processes 4. Types and Structure	1. Groups in Society 2. Social Structure, 3. Models of Assimilation andSegregation 4. Industrialization, Migration, Urbanization, Modernization, Globalization	07
05	Socio- Cultural Regions	1. Origin anddiffusion ofculture 2. Bases ofregion formation	1. Cultural Diversities 2. Role of Race, Religion, Caste, Ethnicity, Tribe 3. Language and Dialect 4. Literacy, Education,Economic Activities, Class and Power 5. Transformations and Changes. 6. Cultural regions of the World and India	07
06	Social Well-being	1. Concepts 2. Components and Indicators 3. Measurementand Patterns	1. Quality of Life and Human Development 2. Components of Regional and SocioCultural Indicators 3. Human Development Index. 3. Methods of Measuring well-being byweighingIndicators. 4. Patterns of social well-being –States, Indiaand World	08
07	Human Settlements	1. Relation to Ideology, Social Structure and Technology.	1. Social areas in Urban and Rural Settlements. 2. Social and Physical Infrastructure. 3. Rural urban contrasts- Housing, Health,Education, Social structure, Economic andCulturalCharacteristics. 5. Impact of Technologyon HumanSettlements. 4. Redistribution of Resource for Social Justice, Equality and Welfare.	08

Reference Books:

1. AnandAijazuddin (1999) : Social Geography, Rawat Publications, New Delhi
2. Bulsara, J. F. (1970) : Patterns of Social Life in Metropilitan Areas, Popular Prakashan, Bombay
3. Censys of India (1974) : Economic and Socio-Cultural Dimensions of Rationalization Census Centenary, Monograph No. 7, Govt. of India, New Delhi
4. Coates, B. E. et. al. (1977) : Geography and Inequality, Oxford University Press, London
5. Orang, Mike (1998) : Cultural Geography. Routledge Publication, London

UNIVERSITY OF PUNE

MA/MSc Syllabus in Geography (Credit System)

Sem-IV: Revised Syllabus (from June-2014)

Title: Geography of Food Security of India

Code No. Gg: 404

No. of Credits: 03

Total Periods : 45

Sr. No.	Topics	Learning points	Periods
1.	Introduction	1.Concept of food security. 2. Importance and availability of food. 3. Accessibility, utilisation food stability 4. Hunger and Malnutrition.	6
2	Economics of Food	1.Economic Growth. 2. Physical Factors affecting food security. 3. Agricultural productivity, Land Availaility, Land degradation. 4. Land rights and holding.	7
3.	Food Crops	1. Food and cash crops. 2. Distribution of major food and cash crops. 3. Production of food crops. 4. Availability of food for masses. 5. Socio-economic factor in food security.	8
4.	Food Sovereignty	1. Concept of food justice. 2. Food Sovereignty. 3. Economic constraint on access and availability, 4. Social injustice- gender inequalities. 5. Food Security conditions in India at national and state level.	10
5	India's Food Security Bill	1. India's Food Security Bill 2013. 2. Benefits and detriments of Food Security Bill. 3. Importance of Food Security in India.	8
6.	Pedagogy	1. Regional and National news analysis from magazines, journals and newspapers is essential. 2. An interdisciplinary approach will be useful in knowing the multi-dimensions of food security. 3. Study of spatio-temporal aspects by various physical and socio-economic maps.	6

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MA/MSc Syllabus in Geography (Credit System)

Sem-IV: Revised Syllabus (from June-2014)

Title: Geography of Health

Code No. Gg: 405

Total Periods : 45

No. of Credits: 03

Sr. No.	Topic	Sub topic	Learning points	No of Lectures
1	Geography of health	Definition and approaches to study	Definition, development, achievements and challenges, approaches to geography of health care	5
2	Geographical factors	Geographical factors affecting human health	Geographical factors affecting human health and diseases arising from them	5
3	Classification of diseases	genetic, communicable, non – communicable, occupational, deficiency diseases, WHO classification of diseases	genetic, communicable, non – communicable, occupational, deficiency diseases, WHO classification of diseases	5
4	Ecology, etiology, transmission of major diseases	Diffusion of diseases and causes	Diffusion of Diseases and causes of the same. Deficiency disorders and problems of malnutrition	6
5	Health care systems in India		Socio-political context – Sources of health care – Demand and supply	6
6	Rural environment and health		Custom, social practice and disease 2.2. Food habit and health- 2.3. Environment and health – 2.4.Health problems of tribal	6

			communities with special reference to India	
7	**Urban environment and health**		Occupational health hazards Environmental Pollution and related impact on health in urban and peri-urban are . Relevant case studies.	6
8	Significance of primary health care centers		Planning of health care centers and health services.	6

References:

1. Akhtar, R. and Learmonth, A.T.A. (eds) (1956): Geographical Aspects of Health and Disease in India, Concept Pub. Co.
2. McGlashan, N.D(ed)(1972): Medical Geography: Techniques and Field Studies, Methuen.
3. Pacione, M. (1986):.Medical Geography: Problems and Prospect, Croom. Helm.
4. Smith, D.M.(1977): Human -Geography, A Welfare Approach, Arnold Heinemann.
5. McGlashan, N.D. and Blunde J.R.(eds)(1983):Geographical Aspects of Health, Academic Press.
6. Trevethick, R.A.(1973): Environmental and Industrial Health Hazards, William Heinemann Medical Books Ltd.
7. Bhat, V.N. (1980):Public Health in India, Amar Prakashan.
8. Banerji, D. (1985):Health and Family Planning Services in India, Lok Prakash, New Delhi.

Books for further reading:

1. Anthamatten P, (2011), Introduction to the Geography of Health, Rawat Publications, Jaipur
2. Pyle, G. F.(1979): Applied Geography, Wiley & Sons.
3. Howe, G.M.(1977): A World Geography of Human Discases, Academic Press.
4. Denton, J.A. (1978) : Medical Geography, Houghton Mifflin, U.S.A.
5. Eyles, J. and Wood, K.(1983):The Social Geography of Medicine and Health, Croom Helm.
6. Bastide, R.(1972): The Sociology of Mental Disorder, Routledge and Kegan Paul.
7. Banerji, D. (1986) :Social Sciences and Health Services in India, Lok Prakashan, New Delhi.
8. Mishra, R.P.(1970): Medical Geography of India, National Book Trust of India.
9. Mishra, R.P.(2002)), Geography of health : a treatise on geography of life and death in India, Concept Publishing Co., New Delhi

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MA/MSc Syllabus in Geography (Credit System)

Sem-IV: Revised Syllabus (from June-2014)

Title: Regional Geography of SAARC Countries

Code No. Gg: 407 **Total Periods : 45**

No. of Credits: 03

Sr. No.	Topic	Learning Points	Periods
01.	Introduction	1. History of SAARC Organisation. 2. Importance and Relevance of SAARC Countries 3. General Locations of SAARC Countries- India, Pakistan, Nepal, Bhutan, Bangladesh, Shrilanka, Maldives. 4. Strategic location of India. 5. Salient Features of SAARC Organisation.	8
02.	India	Physiography, Climate, Drainage, Vegetation, Agriculture, Economic, Demographic and Cultural Aspects of India.	8
03	Pakistan	Physiography, Climate, Drainage, Vegetation, Agriculture, Economic, Demographic and Cultural Aspects of Pakistan	6
04	Bangladesh	Physiography, Climate, Drainage, Vegetation, Agriculture, Economic, Demographic and Cultural Aspects of Bangladesh	6
05	Nepal	Physiography, Climate, Drainage, Vegetation, Agriculture, Economic, Demographic and Cultural Aspects of Nepal	5
06	Bhutan	Physiography, Climate, Drainage, Vegetation, Agriculture, Economic, Demographic and Cultural Aspects of Bhutan	3
07	Shrilanka	Physiography, Climate, Drainage, Vegetation, Agriculture, Economic, Demographic and Cultural Aspects of Shrilanka	3
08	Maldives	Physiography, Climate, Drainage, Vegetation, Agriculture, Economic, Demographic and Cultural Aspects of Maldives	3
09	Afghanistan	Physiography, Climate, Drainage, Vegetation, Agriculture, Economic, Demographic and Cultural Aspects of Afghanistan	3

N.B. According need of topics, maps are expected.

Reference Books :

1. Agrawal A. N. - Indian economy, Problems of Development and Planning.
2. Chopra S. N. - India, An Area Study.
3. Dubey and Negi - Economic Geography of India.
4. Gopal Singh - India.
5. Memoria I.B. - Geography of India.
6. R. L. Singh - Regional Geography of India.
7. Sharma and Continuo - Economic and Commercial Geography of India.
8. Regional and Geographic and Economic books on respective SAARC Countries.
9. Various websites related to the countries.

4.	Trends	Global	Urban disasters, Pandemics, complex emergencies, Climate change	6
5.	Disaster management	Disaster cycle Preparedness & Mitigation	Phases of disaster cycle i. Factors of Disaster Management. ii. First Aid. iii. Role of Civilians and NGO'S in Natural & man- made Calamities. iv. Home guard. v. Role of Armed forces in Natural man- made Calamities. vi. Role of Para-Military forces in Natural man- made Calamities. vii. Role of Police forces in Natural man- made Calamities	10
6.	Technologies for Disaster Management	Technologies	Role of IT in Disaster Preparedness Remote Sensing, GIS and GPS Use and Application of Emerging Technologies Application of Modern Technologies for the Emergency communication. · Application and use of ICST for different disasters.	8
7.	Disasters in India	Disasters and management	Various disasters in India and their management issues	2

UNIVERSITY OF PUNE

MA/MSc Syllabus in Geography (Credit System)

Sem-III: Revised Syllabus (from June-2014)

Title: Urban Geography

Total Periods : 45

Code No. Gg: 313

No. of Credits: 03

Sr. No.	Topic	Sub-Topic	Learning Points	Periods
1	Introduction	Nature, Scope and significance of Urban Geography	1. Nature and scope 2. Significance 3. Relation to other disciplines	4
2	Urbanization	Concept and Process	1. Meaning of Urban settlement and urbanization. 2. Brief review of spatial- temporal variations in urbanization in the world 3. Urbanization curve 4. Contemporary factors of urbanization	5
3	Urban Morphology	Models of urban structure	1. Park and Burgess Model 2. Homer Hoyet Model. 3. Harris and Ullman Model 4. Characteristics and demarcation of CBD	5
4	Urban Classification	Criteria Used for Classification Functional Classification	1. Urban functions 2. Functional classification of towns and cities by C.D. Harris and H. J. Nelson	4
5	Urban Demography	Characteristics of urban populations	1. Growth of urban population 2. Density of population in cities. 3. Age, sex and occupational structure	4
6	Rural-Urban fringe	Characteristics and methods of demarcation	1. Meaning of rural-urban fringe. 2. characteristics of rural-urban fringe 3. Concepts of conurbation, megalopolis and satellite towns.	4
7	City and its Region	Concept, characteristics and demarcation	1. Concepts of city region and various synonymous terms used. 2. Criteria used to demarcate the city region	4
8	Central place concepts	Central place theory and urban Hierarchy	1. Christaller's Central Place Theory. 2. Rank-size relationship and rank-size rule 3. Hierarchy of urban settlements	5
9	Contemporary Urban issues	Nature of issues	1. Price of land and vertical and horizontal growth of cities 2. Scarcity of housing and growth of slums 3. Problems of civic amenities 4. Urban transport problem 5. Urban Environmental pollution	5
10	Urban policy and planning	Development policies and	1. Policies of Urban development. 2. Need of city planning	5

QIM 1.3.1 List of Courses addresses crosscutting issues as per Syllabus (2019 Pattern)

Sr. No.	Programme Name	Course code	Name of Course	Addressed issue (Professional Ethics, Gender, Human Values, Environment & Sustainability)
1	B. Sc. Botany	BO.111	Plant Life and Utilization-I	Environment & Sustainability
2	B. Sc. Botany	BO.112	Plant Morphology andAnatomy	Professional Ethics
3	B. Sc. Botany	BO.113	Practical Based on BO.111 & BO.112	Professional Ethics
4	B. Sc. Botany	BO.121	Plant Life and Utilization-II	Professional Ethics
5	B. Sc. Botany	BO.122	Principles of Plant Science	Professional Ethics
6	B. Sc. Botany	BO.123	Practical Based on BO. 121 &BO. 122	Professional Ethics
7	B. Sc. Botany	BO.231	Taxonomy of Angiospermsand Plant Ecology	Environment & Sustainability
8	B. Sc. Botany	BO.232	Plant Physiology	Professional Ethics
9	B. Sc. Botany	BO.233	Practical based on BO. 231 & BO. 232	Professional Ethics
10	B. Sc. Botany	BO.241	Plant Anatomy andEmbryology	Professional Ethics
11	B. Sc. Botany	BO.242	Plant Biotechnology	Professional Ethics
12	B. Sc. Botany	BO.243	Practical based on BO.241 &BO.242	Professional Ethics
13	B. Sc. Botany	BO.351	Algae and Fungi	Environment & Sustainability
14	B. Sc. Botany	BO.352	Archegoniate	Environment & Sustainability
15	B. Sc. Botany	BO.353	Spermatophyta and Paleobotany	Environment & Sustainability
16	B. Sc. Botany	BO.354	Plant Ecology	Environment & Sustainability
17	B. Sc. Botany	BO.355	Cell and Molecular Biology	Human Values
18	B. Sc. Botany	BO.356	Genetics	Human Values
19	B. Sc. Botany	BO.357	Practical Based on BO.351 &BO.352	Professional Ethics
20	B. Sc. Botany	BO.358	Practical Based on BO.353 &BO.354	Professional Ethics
21	B. Sc. Botany	BO.359	Practical Based on BO.355 &BO.356	Professional Ethics
22	B. Sc. Botany	BO.3510	Medicinal Botany	Human Values
23	B. Sc. Botany	BO.3511	Plant Diversity and HumanHealth	Environment & Sustainability
24	B. Sc. Botany	BO.361	Plant Physiology	Environment & Sustainability
25	B. Sc. Botany	BO.362	Biochemistry	Environment & Sustainability
26	B. Sc. Botany	BO.363	Plant Pathology	Professional Ethics
27	B. Sc. Botany	BO.364	Evolution and Populationgenetics	Professional Ethics
28	B. Sc. Botany	BO.365	Advanced Plant Biotechnology	Environment & Sustainability
29	B. Sc. Botany	BO.366	Plant Breeding and SeedTechnology	Professional Ethics
30	B. Sc. Botany	BO.367	Practical based on BO.361 &BO.362	Professional Ethics
31	B. Sc. Botany	BO.368	Practical based on BO.363 &BO.364	Professional Ethics

QIM 1.3.1 List of Courses addresses crosscutting issues as per Syllabus (2019 Pattern)

Sr. No.	Programme Name	Course code	Name of Course	Addressed issue (Professional Ethics, Gender, Human Values, Environment & Sustainability)
1	B. Sc. Botany	BO.111	Plant Life and Utilization-I	Environment & Sustainability
2	B. Sc. Botany	BO.112	Plant Morphology andAnatomy	Professional Ethics
3	B. Sc. Botany	BO.113	Practical Based on BO.111 & BO.112	Professional Ethics
4	B. Sc. Botany	BO.121	Plant Life and Utilization-II	Professional Ethics
5	B. Sc. Botany	BO.122	Principles of Plant Science	Professional Ethics
6	B. Sc. Botany	BO.123	Practical Based on BO. 121 &BO. 122	Professional Ethics
7	B. Sc. Botany	BO.231	Taxonomy of Angiospermsand Plant Ecology	Environment & Sustainability
8	B. Sc. Botany	BO.232	Plant Physiology	Professional Ethics
9	B. Sc. Botany	BO.233	Practical based on BO. 231 & BO. 232	Professional Ethics
10	B. Sc. Botany	BO.241	Plant Anatomy andEmbryology	Professional Ethics
11	B. Sc. Botany	BO.242	Plant Biotechnology	Professional Ethics
12	B. Sc. Botany	BO.243	Practical based on BO.241 &BO.242	Professional Ethics
13	B. Sc. Botany	BO.351	Algae and Fungi	Environment & Sustainability
14	B. Sc. Botany	BO.352	Archegoniate	Environment & Sustainability
15	B. Sc. Botany	BO.353	Spermatophyta and Paleobotany	Environment & Sustainability
16	B. Sc. Botany	BO.354	Plant Ecology	Environment & Sustainability
17	B. Sc. Botany	BO.355	Cell and Molecular Biology	Human Values
18	B. Sc. Botany	BO.356	Genetics	Human Values
19	B. Sc. Botany	BO.357	Practical Based on BO.351 &BO.352	Professional Ethics
20	B. Sc. Botany	BO.358	Practical Based on BO.353 &BO.354	Professional Ethics
21	B. Sc. Botany	BO.359	Practical Based on BO.355 &BO.356	Professional Ethics
22	B. Sc. Botany	BO.3510	Medicinal Botany	Human Values
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28	B. Sc. Botany	BO.365	Advanced Plant Biotechnology	Environment & Sustainability
29	B. Sc. Botany	BO.366	Plant Breeding and SeedTechnology	Professional Ethics
30	B. Sc. Botany	BO.367	Practical based on BO.361 &BO.362	Professional Ethics
31	B. Sc. Botany	BO.368	Practical based on BO.363 &BO.364	Professional Ethics

32	B. Sc. Botany	BO.369	Practical based on BO.365 &BO.366	Professional Ethics
33	B. Sc. Botany	BO.3610	Nursery and GardeningManagement	Professional Ethics
34	B. Sc. Botany	BO.3611	Biofertilizers	Professional Ethics
35	M. Sc. Botany	BOUT 111	Botany Theory Paper 1 Plant systematics I	Professional Ethics
36	M. Sc. Botany	BOUT 112	Botany Theory Paper 2 Cell Biology and Evolution	Professional Ethics
37	M. Sc. Botany	BOUT 113	Botany Theory Paper 3 Cytogenetics and Plant Breeding	Professional Ethics
39	M. Sc. Botany	BODT 114	Botany Theory Paper 4- a)Pomoculture and Fruit processing technology	Professional Ethics
40	M. Sc. Botany	BODP 114	Botany Practical Paper 4- Based on BO.114	Professional Ethics
41	M. Sc. Botany	BOUP 115	Botany Practical Paper based on BOUT 111, BOUT 112 and BOUT 113	Professional Ethics
42	B. Sc. Botany	BOUT 121	Botany Theory Paper 1-PlantSystematics II	Environment & Sustainability
43	M. Sc. Botany	BOUT 122	Botany Theory Paper 2-Molecular Biology	Professional Ethics
44	M. Sc. Botany	BOUT 123	Botany Theory Paper 3-Biochemistry	Professional Ethics
45	M. Sc. Botany	BODT 124	Botany Theory Paper 4- a.Floriculture and Nursery Management	Professional Ethics
46	M. Sc. Botany	BODP 124	Botany Practical paper 4-based on BODP 124	Professional Ethics
47	M. Sc. Botany	BOUP 125	Botany Practical paper based on BOUT 121, BOUT 122 and BOUT 123	Professional Ethics
48	M. Sc. Botany	BOUT 231	Botany Theory Paper 1-Computational Botany	Professional Ethics
49	M. Sc. Botany	BOUT 232	Developmental Botany	Environment & Sustainability
50	M. Sc. Botany	BOUT 233	Botany Theory Paper 3- PlantPhysiology	Professional Ethics
51	M. Sc. Botany	BODT 234	Botany Theory Paper seed science	Professional Ethics
52	M. Sc. Botany	BODP 234	Botany Practical Paper basedon BODT 234	Professional Ethics
53	M. Sc. Botany	BOUP 235	Botany Practical Paper basedon BOUT 231, BOUT 232, BOUT 233	Professional Ethics
54	M. Sc. Botany	BOUT 241	Botany Theory Paper 1-Botanical Techniques	Professional Ethics
55	M. Sc. Botany	BOUT 242	Advanced Plant Ecology	Environment & Sustainability
56	M. Sc. Botany	BODT 243	a) Seed technology	Professional Ethics
57	M. Sc. Botany	BODT 244	Research methodology	Professional Ethics
58	M. Sc. Botany	BODP 243	Botany Practical paper basedon BODT 243 BODT b) Herbal Technology	Professional Ethics
59	M. Sc. Botany	BODP 244	Botany Practical Paper basedon BODT 244 Or PG Dissertation based on BODT 244	Professional Ethics
60	M. Sc. Botany	BOUP 245	Botany Practical paper based on BOUT 241 and BOUT 242	Professional Ethics

Title of the Course: B. Sc Botany

1. Structure of Course:

Structure B.Sc. Botany syllabus					
Year	Semester	Course Type	Course code	Course Name	Credits
1	1	Compulsory Course	BO 111	Plant life and utilization I	2
			BO 112	Plant morphology and Anatomy	2
			BO 113	Practical based on BO 111 & BO 112	1.5
	2	Compulsory Course	BO 121	Plant life and utilization II	2
			BO 122	Principles of plant science	2
			BO 123	Practical based on BO 121 & BO 122	1.5
2	3	Compulsory Course	BO 231	Botany Theory Paper 1	2
			BO 232	Botany Theory Paper 2	2
			BO 233	Botany Practical Paper	2
	4	Compulsory Course	BO 241	Botany Theory Paper 1	2
			BO 242	Botany Theory Paper 2	2
			BO 243	Botany Practical Paper	2
3	5	Discipline Specific Elective Course	BO 351	Botany Theory Paper 1	2
			BO 352	Botany Theory Paper 2	2
			BO 353	Botany Theory Paper 3	2
			BO 354	Botany Theory Paper 4	2
			BO 355	Botany Theory Paper 5	2
			BO 356	Botany Theory Paper 6	2
			BO 357	Botany Practical Paper 1	2
			BO 358	Botany Practical Paper 2	2
			BO 359	Botany Practical Paper 3	2
		Skill Enhancement course	BO 3510	Botany Theory Paper 7	2
			BO 3511	Botany Theory Paper 8	2
3	6	Discipline Specific Elective Course	BO 361	Botany Theory Paper 1	2
			BO 361	Botany Theory Paper 2	2
			BO 362	Botany Theory Paper 3	2
			BO 363	Botany Theory Paper 4	2
			BO 364	Botany Theory Paper 5	2
			BO 365	Botany Theory Paper 6	2
			BO 366	Botany Practical Paper 1	2
			BO 367	Botany Practical Paper 2	2
			BO 368	Botany Practical Paper 3	2
		Skill Enhancement course	BO 3610	Botany Theory Paper 7	2
			BO 3611	Botany Theory Paper 8	2

SEMESTER-I: PAPER-I

BO-111: PLANT LIFE AND UTILIZATION I (30 Lectures)

CREDIT-I **15 Lectures (15 Hours)**

1. INTRODUCTION **3 L**

General outline of plant kingdom (**Lower Cryptogams**: Thallophytes- Algae, Fungi & Lichens; **Higher Cryptogams**: Bryophytes and Pteridophytes; **Phanerogams**: Gymnosperms and Angiosperms- Dicotyledons and Monocotyledons). Distinguishing characters of these groups and mention few common examples from each.

2. ALGAE **9 L**

2.1: Introduction
2.2: General Characters
2.3: Classification (Bold and Wynne 1978) up to classes with reasons
2.4: Life Cycle of *Spirogyra* w.r.t. Habit, Habitat, Structure of thallus, structure of typical cell, Reproduction- Vegetative, Asexual and Sexual, systematic position with reasons
2.5: Utilization of Algae in Biofuel Industry, Agriculture, Pharmaceuticals, Food and Fodder

3. LICHENS **3 L**

3.1: Introduction
3.2: General Characters
3.3: Nature of Association, forms- Crustose, Foliose and Fruticose.
3.4: Utilization of lichens.

CREDIT-II

4. FUNGI **15 Lectures (15 Hours)** **9 L**

4.1: Introduction
4.2: General Characters
4.3: Classification (Ainsworth, 1973)
4.4: Life Cycle of Mushroom- *Agaricus bisporus* w.r.t. Habit, Habitat, Structure of thallus, Structure of Sporocarp, Structure of Gill, Reproduction- Asexual and sexual, Systematic position.
4.5: Utilization of Fungi in Industry, Agriculture, Food and Pharmaceuticals.

5. BRYOPHYTES **6 L**

5.1: Introduction
5.2: General Characters
5.3: Classification (G.M. Smith 1955)
5.4: Life Cycle of *Riccia* w.r.t. Habit, habitat, external and internal structure of thallus, Reproduction- vegetative, asexual and sexual- Structure of sex organs, fertilization, structure of mature sporophyte, structure of spore, systematic position with reasons.
5.5: Utilization: Bryophytes as ecological indicators, agriculture, fuel, industry and medicine.

(Development of sex organs not expected for all the above mentioned life cycles).

SEMESTER-I: PAPER-II

BO-112: PLANT MORPHOLOGY AND ANATOMY (30 Lectures)

CREDIT-I **15 Lectures (15 hours)**

1. MORPHOLOGY: **2 L**

1.1: Introduction, definition, descriptive and interpretative morphology.
1.2: Importance in identification, nomenclature, classification, phylogeny and Plant breeding.

2. MORPHOLOGY OF REPRODUCTIVE PARTS:

2.1: INFLORESCENCE: **3 L**

2.1.1 Introduction and definition
2.1.2 Types:
a) Racemose -Raceme, Spike, Spadix, Corymb, Umbel, Catkin and Capitulum.
b) Cymose -Solitary, Monochasial- Helicoid and scorpiod; Dichasial and Polychasial.
c) Special types -Verticillaster, Cyathium and Hypanthodium.
2.1.3 Significance

2.2: FLOWER: **7 L**

2.2.1 Introduction and definition
2.2.2 Parts of a typical flower: Bract, Pedicel, Thalamus- forms, Perianth- Calyx and Corolla, Androecium and Gynoecium.
2.2.3 Symmetry: Actinomorphic and zygomorphic, Sexuality- Unisexual ands bisexual, Insertion of floral whorls on thalamus- Hypogyny, Epigyny and perigyny, Merous condition-Trimerous, tetrmerous and pentamerous.
2.2.4 Floral whorls:
a) **Calyx:** Nature- Polysepalous, Gamosepalous; Aestivation- types, Modifications of Calyx- Pappus, Petaloid and Spurred.
b) **Corolla:** Forms of Corolla-
i) Polypetalous- Cruciform and Papilionaceous.
ii) Gamopetalous- Infundibuliform, Bilabiate, Tubular and Campanulate.
iii) Aestivation- types and significance.
c) **Perianth:** Nature- Polytepalous, Gamotepalous.
d) **Androecium:** Structure of typical stamen, Variations- cohesion and adhesion.
e) **Gynoecium:** Structure of typical carpel, number, position, cohesion and adhesion; placentation- types and significance.

2.3: FRUITS: **3 L**

2.3.1 Introduction and definition
2.3.2 Types of fruits:
a) **Simple:** Indehiscent - Achene, Cypsela, Nut and Caryopsis.
Dehiscent - Legume, Follicle and Capsule,
b) **Fleshy:** Drupe, Berry, Hespiridium and Pepo.
c) **Aggregate:** Etaerio of Berries and Etaerio of Follicles.
d) **Multiple fruits:** Syconus and Sorosis.

CREDIT- II **15 Lectures (15 Hours)**

3. ANATOMY:

3.1 Introduction and definition **2 L**

3.2 Importance in Taxonomy, Physiology, Ecological interpretations, Pharmacongnosy and Wood identification.

4. TYPES OF TISSUES:

Outline with brief description, simple and complex tissues. **8 L**

4.1: **Meristmatic tissues:** Meristem, characters and types based on origin, position and plane of division, functions.

4.2: **Permanent tissues:** Simple tissues - parenchyma, collenchymas, chlorenchyma and sclerenchyma.

4.3: **Complex/Vascular tissues:** Components of xylem and phloem, types of vascular bundles and functions.

4.4: **Epidermal tissues:** Epidermis, structure of typical stomata, trichomes, motor cells; functions.

5. INTERNAL ORGANIZATION OF PRIMARY PLANT BODY: **5 L**

5.1: Internal structure of dicotyledon and monocotyledon root.

5.2: Internal structure of dicotyledon and monocotyledon stem.

5.3: Internal structure of dicotyledon and monocotyledon leaf.

REFERENCES:

1. Chandurkar, P.J. (1989). Plant Anatomy. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Dutta, A.C. (2003). Botany for Degree students. Oxford University Press, New Delhi.
3. Eames, J. and Mc. Daniels (1994). An Introduction to Plant Anatomy. Tata McGraw Hill Publishing Comp., New Delhi.
4. Esau, K. (1993). Plant Anatomy. Wiley Eastern Ltd. New Delhi.
5. Esau, K. (2006). Anatomy of seed plants. John Wiley and Sons, New York.
6. Fahn, A. (1974). Plant Anatomy. Pergamum Press Oxford.
7. Gangulee, Das and Dutta (2002). College Botany. Vol. I. New Central Book Agency, Kolkata.
8. Lawrence, G.H.M. (2012). Taxonomy of vascular Plants. Scientific Publishers (India) Jodhpur.
9. Naik, V.N. (1994). Taxonomy of Angiosperms. Tata McGraw Hill Publishing Comp., New Delhi.
10. Pandey, B.P. (2007). Plant Anatomy. S. Chand and Co. Ltd. New Delhi.
11. Pandey, B.P. (2009). A Text Book of Botany- Angiosperms. S. Chand and Co. Ltd. New Delhi.
12. Radford, Albert E. (1986). Fundamentals of Plant Systematics. Publ. Harper and Row, New York.
13. Saxena, A.K. and Sarabhai, R.P. (1968). A Text Book of Botany. Vol. III. Ratan Prakashan mandir, Agra.
14. Sharma, O.P. (1993). Plant Taxonomy. 2nd Edition, McGraw Hill Education, New Delhi.
15. Singh, Gurucharan (2005). Systematics- Theory and Practice. Oxford IBH.
16. Sutaria, R.N.A. Text Book of Systematic Botany.
17. Tayal, M.S. (2012). Plant Anatomy. Rastogi Publications.

BO 113: PRACTICALS BASED ON BO 111 & BO 112 (1.5 CREDITS)

1. Study of Life Cycle of *Spirogyra.* 1 P
2. Study of Life Cycle of *Agaricus.* 1 P
3. Study of Life Cycle of *Riccia* 1 P.
4. Study of forms of Lichens- Crustose, Foliose and fruticose. 1 P
5. Study of Mushroom Cultivation. 1 P
6. One day visit to study Algae, Fungi, Bryophytes and Lichens. 1 P
7. Study of Inflorescence. 2 P
   a. Racemose: Raceme, Spike, Spadix, Catkin, Corymb, Umbel and Capitulum
   b. Cymose: Solitary cyme, Uniparous cyme: helicoid and scorpiod, Biparous cyme and Multiparous cyme.
   c. Special type: Verticillaster, Hypanthodium and Cyathium.
8. Study of flower with respect to Calyx, Corolla and Perianth, Androecium and Gynoecium. 2 P
9. Study of fruits with suitable examples. 2 P
   a) Simple fruit: Dry: Achene, Cypsella and Legume; Fleshy: Berry and Drupe.
   b) Aggregate fruit: Etaerio of follicles and Etaerio of Berries.
   c) Multiple fruit: Syconus and Sorosis.
10. Study of internal primary structure of dicotyledonous root and stem e.g. Sunflower. 1 P
11. Study of internal primary structure of monocotyledonous root and stem e.g. Maize. 1 P
12. Study of internal primary structure of dicotyledonous and monocotyledonous leaf e.g. Sunflower and Maize. 1 P

SEMESTER-II: PAPER-I

BO-121: PLANT LIFE AND UTILIZATION-II (30 Lectures)

CREDIT-I

15 Lectures (15 hours)

1. **INTRODUCTION:** Introduction to plant diversity- Pteridophytes, Gymnosperms and Angiosperms with reference to vascular plants. 3 L
2. **PTERIDOPHYTES:** General characters, Outline classification according to Sporne (1976) up to classes with reasons. Life cycle of *Nephrolepis* w.r.t. Habit, habitat, distribution, morphology, anatomy of stem and leaf, Reproduction – vegetative and sexual. 10 L
3. Utilization and economic importance of Pteridophytes. 2 L

CREDIT-II

15 Lectures (15 hours)

1. **GYMNOSPERMS:** General characters, Outline classification according to Sporne (1977) up to classes with reasons. Life cycle of *Cycas* w.r.t. Habit, Habitat, Distribution, Morphology and Anatomy of Stem, leaf and reproductive organs- Male cone, Microsporophyll, microspores and megasporophyll, megaspore; structure of seed; Utilization and economic importance of gymnosperms. 8 L
2. **ANGIOSPERMS:** General characters, Outline of classification of Bentham and Hooker's system up to series, comparative account of monocotyledons and dicotyledons.
3. Utilization and economic importance of Angiosperms: In food, fodder, fibers, horticulture and medicines. 4L 3L

REFERENCES:

1. Bendre, Ashok and Kumar, Ashok (1993). A Text Book of Practical Botany, Rastogy Publications, Meerut.
2. Chamberlain, C.J. (1934). Gymnosperms- Structure and Evolution. Chicago.
3. Coulter, J.M. and Chamberlain, C.J. (1917). Morphology of Gymnosperms. Chicago.
4. Davis, P.H. and Heywood, V.H. (1963). Principles of Angiosperms taxonomy. Oliver and Boyd Publ. London.
5. Dutta, S.C. (1988). Systematic Botany. Wiley Eastern Ltd., New Delhi.
6. Eames, E.J. (1983). Morphology of Vascular Plants. Standard University Press.
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8. Naik, V.N. (1994). Taxonomy of Angiosperms. Tata McGraw Hill Publishing Comp., New Delhi.
9. Parihar, N.S. (1976). Biology and Morphology of Pteridophytes. Central Book Depot.
10. Rashid, A. (1999). An Introduction to Pteridophyta. Vikas Publishing House Pvt. Ltd. New Delhi.
11. Sharma, O.P. (1990). Text Book of Pteridophyta. McMillan India Ltd. Delhi.
12. Singh, V. and Jain, D.K. (2010). Taxonomy of Angiosperms. Rastogy Publications, Meerut.

SEMESTER-II: PAPER-II

BO-122: PRINCIPLES OF PLANT SCIENCE (30 Lectures)

CREDIT-1: PLANT PHYSIOLOGY AND CELL BIOLOGY

15 Lectures (15 Hours)

1. Introduction, definition and scope of plant physiology. 1 L
2. Diffusion – definition, importance of diffusion in plants, imbibition as a special type of diffusion. 1 L
3. Osmosis – definition, types of solutions (hypotonic, isotonic, hypertonic), endosmosis, exo-osmosis, osmotic pressure, turgor pressure, wall pressure, importance of osmosis in plants. 2 L
4. Plasmolysis – definition, mechanism and significance. 1 L
5. Plant growth - introduction, phases of growth, factors affecting growth, 2 L
6. Structure of plant cell, differences between prokaryotic and eukaryotic cell. 2 L
7. Plant cell wall – components of primary cell wall, structure and functions. 1 L
8. Ultrastructure and functions of chloroplast 2 L
9. Cell cycle in plants- importance of cell cycle in plants, divisional stages of mitosis and meiosis. 3 L

CREDIT-II: MOLECULAR BIOLOGY **(15 Lectures) 15 Hours**

1. Introduction and scope of molecular biology, central dogma of molecular biology. 2 L
2. Structure of DNA, nucleoside and nucleotide 2 L
3. Watson Crick model of DNA and its characteristic features, types of DNA (A, B and Z DNA). 3 L
4. Types of chromosomes. 2 L
5. Structure and types of RNA. 3 L
6. DNA replication- Types of replication (conservative, semi-conservative and dispersive), enzymes involved, leading and lagging strands, Okazaki fragments. 3 L

REFERENCES:

1. Buchanan, B.B, Gruissem, W. and Jones, R.L (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists Maryland, USA.
2. Cooper, G.M. and Hausman, R.E. (2007). The Cell: Molecular Approach 4th Edition, Sinauer Associates, USA.
3. David, Nelson and Cox, Michael (2007). Lehninger Principles of Biochemistry. W.H. Freeman and Company. New York.
4. Devlin, R.M. (1983). Fundamentals of Plant Physiology. Mc. Millan, New York.
5. Dutta, A.C. (2000). A Class Book of Botany. Oxford University Press, UK.
6. Hopkins, William G. (1995). Introduction to Plant Physiology. Publ. John Wiley and Sons, Inc.

	inoculants and associative effect of different organisms 2.3.Azotobacter, classification and characteristics 2.4.Crop response to Azotobacter inoculums, Mass multiplication of Azotobacter 2.5.Applications of Azospirillum 2.6.Phosphate solubilizing Bacteria	
3.	**Algal Biofertilizers** 3:1. Cyanobacteria (Blue Green Algae): Isolation of Anabaena from Azolla, Mass Multiplication of Anabaena 3.2. Azolla - Anabaena relationship 3.3. Biological Nitrogen fixation 3.4. Blue Green algae in a rice cultivation. 3.5. Applications of BGA	**04**
	Credit-II	**15**
4	**Fungal Biofertilizers** 4.1. Introduction, Occurrence and Distribution of Mycorrhizal association. 4:2. Types of Mycorrhizal association, growth and yield - colonization of VAM - Vesicular Arbuscular Mycorrhiza 4.3. Mycorrhizal applications in agriculture	**09**
5.	**Compost and Manure** 5.1. Organic Farming, green manuring, organic manures and their uses 5.2. Recycling by composting method of biodegradable, municipal, agricultural and industrial wastes 5.3. Biocompost making methods, Types and methods of vermicomposting 5.4. Benefits of vermicompost, field applications	**06**

Suggested readings

Structure for M. Sc. Botany First Year:

Year	Semester	Course Type	Course code	Course Name	Credits
1	1	Core Compulsory Theory paper	BOUT 111	Botany Theory Paper 1-Plant Systematics I	4
			BOUT 112	Botany Theory Paper 2- Cell Biology and Evolution	4
			BOUT 113	Botany Theory Paper 3- Cytogenetics and Plant Breeding	4
		Choice Based optional paper	BODT 114	Botany Theory Paper 4- a) Biofertilizer and Algal Technology OR b) Pomoculture and Fruit Processing Technology	2
			BODP 114	Botany Practical Paper 4-based on BO 114	2
		Core Compulsory practical paper	BOUP 115	Botany Practical Paper based on BOUT 111, BOUT 112 and BOUT 113	4
1	2	Core Compulsory Theory paper	BOUT 121	Botany Theory Paper 1-Plant Systematics II	4
			BOUT 122	Botany Theory Paper 2- Molecular Biology	4
			BOUT 123	Botany Theory Paper 3- Biochemistry	4
		Choice Based optional paper	BODT 124	Botany Theory Paper 4- a. Floriculture and Nursery Management OR b. Mushroom Cultivation and Biopesticide Technology	2
			BODP 124	Botany Practical paper 4- based on BODP 124	2
		Core Compulsory practical paper	BOUP 125	Botany Practical paper based on BOUT 121, BOUT 122 and BOUT 123	4

Semester I

BOUT 111: Botany Theory Paper I-Plant Systematics I
(4 Credit- 60 Lectures)

Credits-1.5: Algae

22 Lectures

1. Systematics and Taxonomy – Principles, Concept of species and hierarchical taxa, Classification of algae up to order level as per Fritsch system (1935). **3 L**
2. Algological studies – Algal habitats, Pigment constitution in algae, Reserve food, Modes of perennation in algae, Origin and evolution of sex, Contribution of algal studies in India and world (any three Phycologists). **4 L**
3. Cyanophyta – Distinguishing characters, thallus organization, ultra-structure of heterocyst and its significance. **3 L**
4. Chlorophyta- Thallus organization, reproduction – asexual and sexual **3 L**
5. Introduction, Comparative structure and reproduction in Charophyta, Euglenophyta, Xanthophyta, Bacillariophyta and Chrysophyta. **4 L**
6. Phaeophyta and Rhodophyta–Morphology, Reproduction and life cycle pattern in any one from each. **3 L**
7. Applications of algae- Commercial applications of algae- Biofertilizer, Medicine, and Pollution. **2 L**

Credit-1.5: Fungi

23 Lectures

1. Thallus structure, Nutrition, Cell structure, Hyphal modifications in Fungi. Classification of fungi as per Ainsworth et al system (1973), Contribution of fungal studies in India and world. **3 L**
2. Myxomycotina- Distinguishing characters, types of Plasmodium and fruit bodies, Life cycle pattern **3L**
3. Mastigomycotina- Distinguishing characters, Thallus structure in Chytridiomycetes and Oomycetes. **3 L**
4. Zygomycotina - Distinguishing characters, Thallus structure, Heterothallism and sexual reproduction. **3 L**
5. Ascomycotina- Thallus structure, Fructifications, Comparative study of Hemiascomycetes and Euascomycetes. **3 L**

6. Basidiomycotina – Distinguishing characters, thallus structure, types and structure of basidia and basidiocarps. **3 L**
7. Deuteromycotina – Distinguishing characters, thallus structure, fructifications, types of conidia, conidial ontogeny. **3 L**
8. Applications of fungi- Biofertilizers, biocotrol, food and medicine. **2L**

Credit -1: Bryophytes

15 Lectures

1. Introduction, characters, Affinities with thallophytes and pteridophytes,Contributions of bryologists in world and India (any three), system of classification according to G.M. Smith 1955. Pteridophytean and algal hypothesis, evolution of sporophyte, theory of sterilization and reduction, apogamy and apospory. **3 L**
2. Distribution, Distinguishing characters, morphology and anatomy of gametophyte and sporophytes of following orders **11 L**
   Takakiales, Calobryales and Sphaerocarpales (1L), Marchantiales (1L), Jungermanniales (2L), Anthocerotales (1L), Sphagnales (1L), Polytrichales (1L), Funariales (1L), Andreaeales (1L), Eubryales (2L).
3. Applications of bryophytes- Antimicrobial properties, secondary metabolites, therapeutical, horticultural applications. **1 L**

References:

Algae:

1. Brodie J. and Lewis J. (2007). (Ed.) Unravelling the algae: the past, present and future of algal systematics. CRC press, New York, pp 335.
2. Bellinger E.G. and Sigee D.C. (2010). Freshwater algae: Identification and use as bioindicators, Willey-Blackwell, UK, pp. 271.
3. Cole K.M. and Sheath R.G. (1990). Biology of the red algae. Cambridge University Press.USA. pp. 503.
4. Desikachary T.V. (1959). Cyanophyta. ICAR, New Delhi.
5. Graham L.E. and Wilcox L.W. (2000). Algae.Penticce-Hall,Inc, pp. 640
6. Krishnamurthy V. (2000). Algae of India and neighboring countries I.Chlorophycota, Oxford & IBH, New Delhi.
7. Lee R.E. (2008). Phycology. Cambridge University Press, pp.547.
8. Misra J.N. (1996). Phaeophyceae in India. ICAR, New Delhi.
9. Prescott G.W. (1969). The algae.
10. Smith G.M. (1950). The fresh water algae of the United States, Mc-graw Hill

Book Depot, Allahabad.

6. PremPuri(1981). Bryophytes: Morphology, Growth and Differentiation. Atma Ram and Sons, New Delhi.
7. Udar R. (1975). Bryology in India.ChronicaBotanica, New Delhi.
8. Udar R. (1970). Introduction to Bryophytes.ShashidharMalaviyaPrakashan. Lucknow.
9. Watson E.V. (1971). Structure and Life of Bryophytes.3rd Edn. Hutchinson University Library, London.
10. Vashista B.R., Sinha A.K., Kumar A. (2008). Botany for degree students – Bryophyta, S.Chands Publication.

Semester I

BOUT 112: Botany Theory Paper II- Cell Biology and Evolution

(4 Credit- 60 Lectures)

Credit-I : Dynamic organization of the cell **15 L**

1. Universal features of cells: cell chemistry and biosynthesis, chemical organization of cells. 1L
2. Internal organization of the cell:
   - i. Cell Wall: Biogenesis, Ultra Structure and functions, primary and secondary wall, glycocalix. 1L
   - ii. Cell membrane: structure of cell membranes and concepts related to compartmentalization in eukaryotic cells. 1L
   - iii. Biogenesis, ultra structure and functions of endoplasmic reticulum and Golgi apparatus, lysosomes, vacuoles, glyoxysomes and peroxisomes, ribosomes, cellular cytoskeleton, mitochondria, chloroplasts and cell energetics; nuclear compartment: nucleus, nucleolus and chromosomes . 10L
   - iv. Giant chromosomes- lampbrush chromosomes, polytene chromosomes 2L

Credit-II : Cellular signaling, transport and trafficking **15L**

1. Types of receptors, G-proteins and G-protein coupled receptors, Phospholipid signaling, Ca^{2+}, Calmodulin cascade. 2L
2. Diversity in protein kinases and phosphatases, secondary messengers, regulation of signaling pathways. 2L
3. Specific signaling mechanisms with suitable examples- Biotic and abiotic stress, ABA induced stomatal closure, Stomatal guard cells signaling. 3L
4. Receptor Serine/ Threonine kinase, Ethylene mediated two component systems. 1L
5. Molecular mechanisms of membrane transport, nuclear transport, transport across mitochondria and chloroplasts; intracellular vesicular trafficking from endoplasmic reticulum through Golgi apparatus to lysosomes/cell exterior. Communication between cells and environment. 4L
6. Signaling at cell surface, signaling molecules, hormones and receptors signaling pathways that control gene activity, signal transduction and second messengers. 3

15

Credit-III : Cellular Processes

1. Cell cycle and its regulation; cell division: mitosis, meiosis and cytokinesis; cell differentiation: stem cells, their differentiation into different cell types and organization into specialized tissues. 3
2. Phases of cell cycle, functional importance of each phase, Molecular events during cell cycle, Regulation of cell cycle, Cyclins and protein kinase, MPF (Maturation promoting factor). 4
3. Method of study of cell cycle- labeled mitotic curve, flow cytometry, use of mutants, Cell aging and cell senescence. 4
4. Programmed cell death-molecular aspects, regulation of cell death, PCD in response to stress, Apoptosis- Role of different genes, cell organelles during apoptosis, genetic control of apoptosis. 4 L

15 L

Credit-IV (1 Cr): Evolution

1. Theories of Evolution: (3 L)

Steps and preview of evolution, Lamarckism, Darwinism- Concepts of variation, adaption, struggle for fitness and natural selection; Neo-Darwinism, Spontaneity of mutations, the evolutionary synthesis,

2. Origin of cells and cellular evolution:(3L)

Origin of basic biological molecules, abiotic synthesis of organic monomers and polymers, Concepts of Oparin and Haldane, Experiment of Miller (1953), The first cell, evolution of prokaryote, origin of eukaryotic cells, evolution of unicellular

eukaryotes, anaerobic metabolism, photosynthesis and aerobic metabolism, RNA world theory

3. Molecular Evolution: (3L)

Concepts of natural evolution, molecular clocks, molecular tools in phylogeny, classification and identification, protein and nucleotide sequence analysis, origin of new genes and proteins, gene duplication and divergence

4. Paleontology and Evolutionary History: (3 L)

Evolutionary time scale; Eras, periods and epoch; Major events in the evolutionary time scale; Multicellular evolution, Major groups of plants & Animals; Fossils-Formation, Nature, Types, Geological time scale

5. The Mechanisms: (3 L)

Population genetics – Populations, Gene pool, Gene frequency; Hardy-Weinberg Law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; Adaptive radiation; Isolating mechanisms; Speciation; Allopatricity and Sympatricity; Convergent evolution; Sexual selection; Co-evolution.

4L

References :

1. Gerald Karp. (2010) ,Cell Biology, 6th edition, John Wiley & Sons., USA.
2. Geoffrey M. Cooper, Robert E. Hausman (2013), The Cell: A Molecular Approach, 6th edition, Sinauer Associates, Inc. USA
3. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2008). *Molecular Biology of the Cell* (5th Ed.). New York: Garland Science.
4. Lodish, H. F. (2016). *Molecular Cell Biology* (8th Ed.). New York: W.H. Freeman.
5. Krebs, J. E., Lewin, B., Kilpatrick, S. T., & Goldstein, E. S. (2014). *Lewin's Genes XI*. Burlington, MA: Jones & Bartlett Learning.
6. Cooper, G. M., & Hausman, R. E. (2013). *The Cell: a Molecular Approach* (6th Ed.). Washington: ASM ; Sunderland.
7. Hardin, J., Bertoni, G., Kleinsmith, L. J., & Becker, W. M. (2012). *Becker's World of the Cell*. Boston (8th Ed.). Benjamin Cummings.
8. Watson, J. D. (2008). *Molecular Biology of the Gene* (5th ed.). Menlo Park, CA: Benjamin/Cummings.
9. Alberts B., Bray D., Lewis J., Raff M., Roberts K., Watson J.D. (1989). Molecular Biology of the Cell. 2nd Edn. Garlan Publ. Inc. New York.

Semester I

BOUT 113: Botany Theory Paper III-Cytogenetics and plant breeding (4 Credits- 60 Lectures)

Credit I: Classical Genetics **15 Lectures**

1. Principles of Mendelian inheritance and Interaction of genes: 3 L

- Introduction,
- Mendel's Laws- Dominance, Segregation, Independent assortment
- Chromosomal theory of inheritance
- Interaction of genes- Complementary, epitasis, inhibitory, polymeric and additive
- Concept of gene, allele, multiple alleles
- Applications of mendelian genetics
- . Introduction to Model systems in Genetics- E.*coli*, Yeast, *Drosophila, Arabidopsis*

3 L

2. Cytoplasmic inheritance:

- Maternal effect (*Limaneaperegra*)
- Plastid Inheritance (*Mirabilisjalapa* and *Zeamays*)
- Mitochondrial Inheritance (Yeast petite and Maize-Cytoplasmic male sterility)
- Interaction between nuclear and cytoplasmic genes

3 L

3. Quantitative inheritance:

- Multiple Factor Hypothesis, Polygenic Inheritance
- Quantitative traits, Continuous variation
- Inheritance of quantitative traits, (Corolla length in *Nicotiana*, Cob length in Maize)
- Heritability and its measurement
- QTL mapping

4 L

4. Linkage, Recombination and Crossing Over:

- Linkage and crossing over
- Linkage maps, lod score for linkage testing, mapping by 3 point test cross
- Mapping by tetrad analysis in Yeast and *Neurospora*
- Recombination: RecA, RecB, RecC, RecD; homologous and non-homologous
- Somatic cell Genetics
- Sex linkage, sex limited and sex influenced characters

2 L

5. Mutation:

- Mutation- types, causes and dctection
- Mutant type- lethal, conditional, biochemical; loss of function, gain of function
- Germinal versus somatic mutants
- Insertional mutagenesis, Point mutagenesis

Credit-II: Microbial Genetics & Cytogenetics

15 Lectures

1. Microbial & Phage Genetics: 5 L

- Methods of genetic transfers- transformation, conjugation and transduction in bacteria and genetic recombination
- Mapping of bacterial genome by interrupted mating
- Lytic and lysogenic cycles in phages, Types of transduction: Generalized and Specialized
- Site specific recombination in phage, Mapping the bacteriophage genome
- Fine structure analysis of rII gene in T_4 bacteriophage

2. Karyotype and Chromosome Banding: 2 L

- Preparation of chromosome for karyotype; Ideogram
- Role of karyotype in chromosome evolution and plant species identification
- Chromosome Banding Techniques

4. Structural alterations of chromosomes: 4 L

- Deletion, duplication, inversion, translocation,
- Complex translocation heterozygotes
- Robertsonian translocations, BA translocations,

3. Numerical alterations of chromosomes: 4 L

- Aneuploids: method of production, meiotic behavior, applications
- Polyoploids: cytological and genetical method of identification of autopolyploids and allopolyploids, Applications.
- Evolutionary advantages of autopolyploids versus allopolyploids and their maintenance and utilization in gene mapping and gene.

Credit-III (1 Cr): Plant breeding

1. Plant Breeding:

15 Lectures

Concept, Objectives and applications of plant breeding,Patterns of evolution in cultivate crop species, modern concepts in plant breeding : Targeting induced local lesions in genomes (TILLING), Unigenes, Pyramiding of genes and Phenomics 3 L

2. Plant Genetic Resources 5L

Historical perspectives and need for PGR conservation; Importance of plant genetic resources; Gene pool: primary, secondary and tertiary;Centres of origin and global pattern of diversity; Basic genetic resources and transgenes. Principles, strategies and practices of exploration, collection, characterization, evaluation and cataloging of PGR; Plant quarantine and phytosanitary certification; Principles of *in vitro* and cryopreservation. Germplasm conservation- *in situ, ex situ*, Registration of plant genetic resources and importance of NBPGR. 4 L

3. Methods in plant breeding:

Introduction, Selection, Hybridization, Back Cross, Test Cross,modes of pollination- Self & cross pollination mechanism,Pure line theory, pure line selection and mass selection methods; Line breeding, pedigree, bulk, single seed descent and multiline method; Inter-varietal and wide/distant crosses, Principles of combination breeding and its application.

4. Asexual reproduction in crop plants-

Reproduction and apomixes. Types and Applications of Apomixis, Selection methods in asexually propagated crops, *In vitro* Double haploids, Triploids 3 L

15 lectures

Credit IV : 6 L

5. Mutation Breeding:

Mutation Breeding and its history - Nature and classification of mutations: spontaneous and induced mutations, micro and macro mutations,- Detection of mutations in lower and higher organisms – paramutations.

Mutagenic agents: Physical mutagens, Chemical mutagens mechanism of action of mutagens. Dose determination and factors influencing chemical mutagenesis, - Treatment methods using physical and chemical mutagens, Mutagen effects in M1 generation: plant injury, lethality, sterility, chimeras *etc.*, - Observing mutagen effects in M2 generation - Estimation of mutagenic efficiency and effectiveness. *In vitro* mutagenesis – callus and pollen irradiation; Handling of segregating genrations and selection procedures; Validation of mutants.

6. Mutation breeding for various traits (disease resistance, insect resistance,quality improvement,etc) in different crops- Procedures for micromutations(oligogenic) breeding/polygenic mutations. Use of mutagens in genomics, allele mining, TILLING 4 L

7. Breeding for nutritional traits 5 L

Breeding for special traits viz. oil, protein, vitamins, amino acids, elimination of toxic substances ; Concept of biopharming and development of varieties producing targeted compounds, nutraceuticals and industrial products; Success stories in vaccines, modified sugars, gums and starch through biopharming.

REFERENCES: -

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2. Hartle D.L and Jones, E.W 1998 Genetics: Principles and Analysis (Fourth Edition). Jones and Bartlett Publishers, Massachusetts, USA.
3. Khush, G.S 1973. Cytogenetics of Aneuploids. Academic Press, New York, Lewis, R. 1997. Human Genetics: Concepts and Application (Second Edition). WCB McGraw Hill, USA.
4. Malacinski, G.M and Freifelder, D. 1998: Essentials of Molecular Biology (Third Edition). Jones and B. Artlet Publisher, Inc., London.
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6. Snustad, D.P and Simmons, M.J 2000. Principles of Genetics (Second Edition). John Wiley and Sons Inc., USA.
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9. Ahluwalia K.B 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, New Delhi.
10. Burus and Bottino 1989. (Sixth Edition). The Science of Genetics. Macmillan Publishing Company, New York (USA).
11. Pawar C.B 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai.
12. Strickberger 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
13. Allard R.W 1995. Priniples of Plant Breeding. John Wiley and Sons, Ice., Singapore.

14. Sharma J.R 1994 Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers Company Ltd., New Delhi.
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16. Chahal G.S and Gosal S.S 2002. Principles and Procedures of Plant Breeding, Narosa Publishing House, New Delhi.
17. Verma and Agarwal, Genetics, S. Chand Co, New Delhi.
18. Toun N and Trempy Janire 2004 (First Indian Reprint). Fundamental of Bacterial Genetics. Blackwell Publishing Co.
19. Singh B.D 2004. Genetics. Kalyani Publication, Ludhiana.
20. Gupta P.K Genetics and Cytogenetics, Rastogi Publications.
21. Gupta P. K. Genetics Rastogi Publications
22. Phundan Singh Genetics, Kalyani Publications
23. Phundan Singh Plant Breeding Kalyani Publications
24. Verma P.S and Agarwal V.K. (2006) Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S.Chand and Company, New Delhi.
25. Shukla R.S. & Chandel P.S. Cytogenetics, Evolution & Biostatistics. S.Chand Publications,
26. Tomar & Singh Evolutionary Biology, Rastogi Publications
27. Darbeshwar Roy Crop Evolution & Genetic Resources

Semester I

BODT 114: Botany Theory paper 4-Biofertilizer and Algal Technology

(2 Credits- 30 Lectures)

15 Lectures

Credit I (1 Cr): Biofertilizer

1. Introduction, Definition, need and significance of biofertlizers in agriculture 2 L
2. Types and scope of biofertilizers: Rhizobium, Azotobactor, Azospirillum, Phosphate solubilizing microorganisms, Cyanobacteria, Azolla, Mycorrhizae. 5 L
3. Production technology: Strain selection, multiplication, sterilization, large-scale biomass production of various strains. 3 L

4. Methods of Applications: Application for field and other crops, methods of application, quality control, agronomic importance. Application methods for different biofertilizers. 4 L
5. Use of Genetically Engineered Microorganisms for improvement of biofertilizers. 1 L

Credit II (1 Cr): Algal Technology

15 Lectures

1. Introduction to Algal Technology 2 L
2. Potential of algae as food and feed, pigments, pharmaceuticals and neutraceuticals, fine chemicals and fuel. 4 L
3. Algal biofertilizers, seaweed fertilizers – method of preparation and application 2 L
4. Biodiesel from algae- cultivation and extraction methods 2 L
5. Biohydrogen production from algae. 1 L
6. Algal Products- SCP-Spirulina mass cultivation & applications, Agar production. 4 L

References:

1. Bio-fertilizers in Agriculture and Forestry, 1995, by N.S. SubbaRao
2. Biofertilizer Manual 2006 FNCA Biofertilizer Project Group Forum for Nuclear Cooperation in Asia (FNCA)
3. N.S. SubbaRao. 1995. Bio-fertilizers in Agriculture and Forestry.
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5. N.S. Subbarao, Advances in Agril. Microbiology by, Oxford and IBH Publication Co, New Delhi
6. Tilak, K.K. Pal, RinkuDey. Microbes For Sustainable Agriculture
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8. Rangaswamy G. and D.J. Bhagyaraj 1988.Agricultural Microbiology, Oxford and IBH Publication Co. New Delhi.

Semester I

BODT 114: Botany Theory paper 4- Pomoculture and Fruit Processing Technology

(2 Credits- 30 Lectures)

Credit-I (1 Cr): Introduction to Pomology

15 Lectures

1. Scope and Importance of Fruit crops, Nutritive value of fruits in human nutrition, Classification of Fruits based on : climate adaptability, fruit morphology, Botanical Classification 3L

2. Present status of fruit growing :- In India and Maharashtra, Scope of fruit growing in India and Maharashtra, Importance of fruit growing 2L
3. Planning and Lay out of orchards: Location & site, Soil, Climate, Planning, Layout: Square system, Rectangular system, Hexagonal system, Quincunx system, Contour system 2L
4. Growth & Fruiting Habits: Growth & fruiting habits, Fruit bud differentiation, fruit setting, fruit drop, Seedlessness, cracking of fruits, problems of fruiting, Bahar treatment, Unfruitfulness, Pruning and Training, role of plant growth substances. 5L
5. Methods of Propagation: Vegetative and sexual Methods of propagation of Fruit trees, its advantages & Disadvantages 3L

15 Lectures

Credit-II (1 Cr): Fruit Processing Technology

1. Harvesting: Maturity indices, Estimation of Maturity, Harvesting, Method of harvesting technology for ripening, greening, Post-Harvest Handling, 5L
Packaging, Storage 2L
2. Preservation of Fruits :
Principles of Preservation, Methods of Preservation 6L
3. Processing of Fruits :
   a. Value addition:
   Preparation and preservation of Fruits: JAM, Jelly, Marmalade, Candy, Sauce & Ketchup, Pickle, fruit based carbonated juices, canning, pulp extraction, chutney, beverages like squashes, ready to serve (RTS) drinks and appetizer etc. from different fruits
   b. Fermented products:
   Production of alcoholic drinks like cider, wine, vermouth, vinegar etc is now an accepted practice for utilization of different fruits.Manufacture of champagne (sparkling wine), still wine and brandy from grapes
   c. By Product Waste Utilization:
   Pomace, Seeds, Stones/Pits skin, Peel : I)Pomace II) Vinegar Extracted from Mango peel, High fibre biscuits, Peel oil, pectin powder, peel candy and animal feed are some of the citrus peel products. Oil and fiber from oil palm.

4. Marketing of fruits: systems of marketing, export potential, air transport, transport by sea, cold storage of fruits 2L

References:

1. D. P Singh 2015. Fruit Crops : Published by Agrotech Press, Jaipur & New Delhi
2. Jitendrasingh 2014. Basic Horticulture, Published by Kalyani Publishers
3. S. N Gupta 2015. Instant Horticulture, 11th Edition, published by Jain Brothers.
4. Kunte Y. N, M. P Kawthalkarand K.S Yawalkar, 2005, Principles of Horticulture and Fruit Growing 10th edition, published by Agro-horticulture Publishing House, New Delhi
5. George Acquaah, 2009. HORTICULTURE: Principles & Practices, published by PHI Learning Pvt. Ltd.

Semester I

BODP 114: Botany practical4 based on BODT 114Biofertilizer and Algal Technology

Practical (2 Credits) **60 Hours**

1. Study of microorganisms used in biofertilizer production 1P
2. Isolation of Nitrogen fixing cyanobacteria 1P
3. Isolation of Phosphate solubilizing micro-organisms from rhizosphere 1P
4. Isolation of Rhizobium from root nodules of leguminous crop 1P
5. Culture establishment and production of Azolla biofertilizers. 2P
6. Mass multiplication of Rhizobium, Azotobacter, and Azospirillum inoculum 2P
7. Estimation of Phycobiliproteins from Cyanobacteria 1P
8. Study of production of algal fertilizers. 1P
9. Study of any six sea weeds with applications 1P
10. Isolation and culture of Spirulina. 1P

BODP 114: Botany practical 4 based on BODT 114 Pomoculture and Fruit Processing Technology

1. Study of Growth and Fruiting habit in any one locally cultivated fruit crop. 1P
2. Study of methods of Pruning and Training of fruit plants. 1P
3. Study of effect of Growth regulators in fruit ripening in Banana/Grapes/Mango. 1P
4. Study of methods of Propagation of fruit trees. 1P
5. Study Maturity indices and estimation of Maturity in locally grown Fruit plant. 1P
6. Study of Methods of Harvesting. 1P
7. Preparation of Jam, Jelly & Marmalade from Locally available fruits. 1P
8. Preparation of Squash, Candy. 1P
9. Demonstration of any one by-product of wastes of fruits. 1P
10. Visit to Fruit Processing Industry and preparation of Case study report on any one. 1P
11. Visit to fruit market and prepare report. 1P
12. Visit to Vineyard preparation of case study report on Vine Industry. 1P

Semester I

BOUP 115: Botany practical paper based on BOUT 111, BOUT 112, and BOUT 113

Practical based on BOUT 111-Plant Systematics I

Practical on Algae:

1. Morphological observations, documentation (description and illustrations) and classification according to Fritsch (1935) with reasons of taxa belonging to:

a. Any one member from Charophyta, Euglenophyta, Bascilariophyta and Chrysophyta, Cyanophyta. 1 P

b. Any three members from Phaeophyta, Chlorophyta and Rhodophyta. 2 P

Practical on Fungi:

2. Study of the representative genera belonging to following sub-divisions of fungi with respect to vegetative, reproductive structures and classification with reasons according to Ainsworth *et al* (1973). 1P

a. Any one member from each Sub-divisions: Myxomycotina, Mastigomycotina and Zygomycotina

b. Any three members of each Sub-divisions: Ascomycotina and Basidiomycotina and Deuteromycotina. 2P

Practical on Bryophytes:

3. Morphological, anatomical and reproductive studies of the following members:

a. Any three members from Hepaticopsida and one member from Anthocerotopsida 1 P

b. Any four members from Bryopsida (Musci). 1 P

Practical based on BOUT 112: Cell Biology and Evolution

4. Study of mitosis and meiosis 2P
5. Study of polytene chromosome from Chironomous larvae 1P
6. Differential centrifugation for isolation of cell fractions- Nuclear fraction 1P
7. Isolation of Chloroplasts to study
   a. Hill reaction to measure intactness, 1P
   b. Chlorophyll estimation
8. Isolation of mitochondria for:
   a. Estimation of succinic dehydrogenase activity 1p
   b. Microscopic observations using MitoTracker Green FM/ MitoTracker Red 580/ Janus green B
9. Isolation of Lysosomal fraction and estimation of acid phosphatase activity 1P
10. Study of induced cell senescence in leaf discs &Study of programmed cell death in plants
11. Study of different plant fossils & Geological Time Scale. 1P

Practical based on BOUT 113: Cytogenetics and Plant Breeding 1P

12. Karyotype analysis, preparation of C- metaphase chromosomes of appropriate material (*Allium / Aloe*). 1P
13. Study of Meiotic configuration in *Rhoeo* buds 1P
14. Study of polygenic inheritance in any suitable material (Wheat/Maize etc.) 1P
15. Problems of population genetics: Estimation of gene and genotypic frequencies, PTC testing ability in humans 1P
16. Gene mapping, *Neurospora* tetrad analysis 1P
17. Problems on Mendelian Inheritance and analysis of F_2 data by Chi-quare Test. 1P
18. Study of Polytene / Salivary gland Chromosomes from *Drosophilla / Chironomous* larva, with Balbiani rings, puff balls, bands & inter bands. 1P
19. Floral Biology, Study of Pollen Viability (any two major crops). Use of Colchicine for induction of polyploidy in appropriate plant material. 1P

Note: Visit to different plant diversity regions and visit to any plant breeding centre. Submission of report is Compulsory.

Semester II

BOUT 121: Botany Theory Paper 1- Plant Systematics II (4 Credit- 60 Lectures)

15 Lectures

Credit I (1 Cr): Pteridophytes

1. Distinguishing Characters, Classification as per Sporne System (1975), Apospory, Apogamy, Stelar evolution, Heterospory and seed habit, Contributions of Indian and world Pteridologist (any three) **3L**
2. Distribution, Distinguishing Characters, Morphology and anatomy of sporophyte and gametophyte of following orders **11L**
   Psilotales, Lycopodiales, Selaginellales, Isoetales, Equisetales, Ophioglossales, Marattiales, Osmundales, Filicales, Marsileales and Salviniales.
3. Applications of Pteridophytes: medicinal, horticultural, biotechnological and secondary metabolites **1L**

22 Lectures

Credit II (1.5 Cr) Gymnosperms

1. Classification of gymnosperms by Raizada and Sahni (1960). 2 L
2. Affinities of gymnosperms with Pteridophytes and Angiosperms. 2 L
3. Distribution of gymnosperms worldwide and India. 1 L
4. Economic aspects of gymnosperms 1 L
5. General characters, morphology and affinities of 10L
   Pteridospermales - *Glossopteris*
   Cycadcoidales - *Cycadeoidea*
   Pentoxylales - *Pentoxylon*
   Cordaitales - *Mesoxylon*
   Cycadales
   Ginkgoales
   Coniferales
   Gnetales
   Ephedrales
   Welwitschiales
6. Comparative account of morphology, anatomy, sporogenesis, gametogenesis, embryology, and interrelationship of Cycadales and Ginkgoales 4 L

7. Seed development in Gymnosperms 2 L

Credit 1.5 III Angiosperms **23 Lectures**

1. Characteristic features of angiosperms, Angiosperm as a dominant group 2 L
2. Importance and need for classification, hierarchical classification. Criteria used for classification; phases of plant classification. Overview on pre- and post-Darwinian systems of classification. 3 L
3. Phylogenetic systems of classification as per Cronquist (1981). 1 L
4. APG IV system of classification. 1 L
5. Phylogeny of Angiosperms: homology and analogy, parallelism and convergence, monophyly, paraphyly, polyphyly and clades, Phylogenetic tree and cladogram, Origin and evolution of angiosperms. 3 L
6. Study of plant families with respect to general characters, morphology, economic importance and affinities following Bentham and Hooker and APG system of classification

Amborellaceae, Nymphaeaceae, Hydatellaceae, Magnoliaceae, Araceae, Arecaceae, Papaveraceae, Amaranthaceae, Leguminosae, Malvaceae, Satalaceae, Acanthaceae, Asteraceae 13 L

References-

1. Balfour Austin (2016). Plant Taxonomy. Syrawood Publishing House
2. Chapman, J.L. and Reiss, M.J. (1998). Ecology: Principles and applications. Cambridge, University Press.
3. Chopra G.L. (1984). Angiosperms: Systematics and Life-Cycle., Pradeep Publications
4. Cooke, Theodore (1903-8). The Flora of the Presidency of the Bombay Vol. I, II, III (Repr. ed), Botanical Survey of India.
5. Cronquist, A. (1968). The Evolution and Classification of Flowering Plants. Thomas Nel and Sons Ltd. London.
6. Datta S.C. (1988). Systematic Botany. New Age Publ.
7. Davis P.H and V.H Heywood (1963). Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
8. Heywood V.H. (1967). Plant Taxonomy, Hodder & Stoughton Educational, London.
9. Judd Walter S., Campbell, C. S., Kellogg, E. A., Stevens, P.F. and M. J. Donoghue. (2008). Plant Systematics- A Phylogenetic Approach. Sinauer Associates, INC, Publishers.Sunderland, Massachusetts, USA.
10. Kormondy Edward (1995). Concepts of Ecology, Pearson Publ.
11. Lawrence G.H.M. (1955). An Introduction to Plant Taxonomy. McMillan, New York.
12. Lawrence, G.H.M. (1951). Taxonomy of Vascular Plants. McMillan, New York.
13. Michael P. (1984). Ecological Methods for field and Laboratory investigations TMH Co. ltd. Bombay.
14. Mondol A.K. (2016) Advanced Plant Taxonomy, New Central Book Agency (NCBA)
15. Naik V.N. (1988) Taxonomy of Angiosperms. Oxford and IBH
16. Odum E.P., (2004). Fundamentals of Ecology, Publ. Cengage Learning, Australia
17. Pande B.P. (1997). Taxonomy of Angiosperms. S. Chand.
18. Pande B.P. (2001) Taxonomy of Angiosperms. S. Chand.
19. Radford A.E. 1986. Fundamentals of Plant Systematics, Harper and Row N Y.

Semester II

BOUT 122: Botany Theory Paper II- Molecular Biology (4 Credit- 60 Lectures)

Credit I (1 Cr): Techniques and Tools in Molecular Biology **15 Lectures**

1. Introduction, Scope and Applications 1 L
2. Enzymes in molecular Biology 3 L

1.1: DNA Degrading Enzymes: Nucleases- Endo-nucleaes and Exo-nucleases
1.2: DNA modifying enzymes: Polymerases, Ligases, Phosphatases and polynucleotide kinases, Phosphorylase, Methylase

3. Minor equipments: 2 L

Vortex, magnetic stirrer, Micropipettes, Incubator, Microfuge, microwave oven, pouch sealer and refrigerator. 5 L

4. Major equipments:

PCR - Thermal Cycler, Gel Documentation System, ELISA reader, Millipore Distillation Apparatus, Lyophilizer, Refractometer, Liquid handling system and Gene sequencer 4 L

5. Molecular Techniques:

5.1. Polymerase Chain Reaction: quality of template DNA and overall reaction conditions

5.2 Sequencing Techniques: DNA sequencing 1. Sanger's dideoxy chain termination sequencing method and 2.Maxam –Gilbert sequencing method

5.3 Blotting techniques- Southern, Northern and Western blotting

Credit –II (1 Cr): DNA – Structure, Functions and Damage **15 Lectures**

1. DNA Structure, Forms of DNA (A, B, Z), Properties of DNA: chemical, physical, spectroscopic and thermal properties of DNA (e. g. Buoyant density, effect of acid and alkali, UV- absorption, hyperchromicity and hypochromicity),Dissociation and association kinetics, Cot – curve, C-value paradox. 4 L
2. Packaging of (DNA) genome e.g. Viruses, prokaryotic, eukaryotic, Organelles genome (Mitochondria and Chloroplast), structure of Nucleosome . 4 L
3. Replication: General factors of DNA replication, Replication apparatus, structure of DNA polymerases, Mechanism of replication in Prokaryotes and Eukaryotes, Regulation of replication and fidelity. 4 L
4. DNA damage and repair: Types of DNA damages, multiple repair pathway- Nucleotide excision repair, Base excision repair and Mismatch repair system. 3 L

Credit- III (1 Cr) Gene structure and Function **15 Lectures**

1. Gene Structure
   a. Organization and structure of Prokaryotic and Eukaryotic gene: 3 L
   b. Promotor, Inititiater, Enhancer, Terminater, Classes of Promoter
2. Transcription
   a. Transcription apparatus, Enzymes and factors involved in transcription 6 L
   b. Transcription in Prokaryotes and Eukaryotes
   c. RNA processing - m-RNA, r-RNA and t-RNA editing
   d. Post – transcriptional events : Capping, Methylation, Polyadenylation, Splicing, Structure of spliceosome and Fidelity
3. Translation
   a. Structure of m-RNA, r-RNA and t-RNA, Ribosomal assembly, Genetic code – Concept and Properties 6 L
   b. Coenzymes and factors involved in translation
   c. Mechanism of protein synthesis: Initiation, elongation and termination
   d. Post – translational control, Protein folding and processing, Protein targeting, Chaperons and Post – translational modifications

Credit- IV (1 Cr):

15 Lectures

1. Gene Regulation: Concept and importance , Positive and Negative regulation,Mechanism of regulation and concept: Lactose, Tryptophan and Arabinose 5 L
2. Transposable elements: Concept of Mobile DNA elements: Prokaryotes and Eukaryotes, Transposons, IS elements, SINES and LINES, Ac-Ds system in Maize, Examples of transposable elements, Importance of Transposons in Transposons mediated gene tagging. 5 L
3. Genomics and Proteomics: The human genome project: Clone by clone Strategy and Shotgun sequencing and applications of genomics, Objectives of Proteomics and Methodologies of proteomics (2D Gel Electrophoresis). 5 L

References

1. Pal Jayanta and Saroj S. Ghaskadabi Fundamentals of Molecular Biology, Oxford Higher Education.
2. Lewin B. (2000). Genes VII. Oxford University Press, New York.
3. Alberts, B., Bray, D Lewis, J., Raff, M., Roberts, K and Walter (1999). Molecular Biology of the Cell.Garland Publishing, Inc., New York.
4. Wolfe S.L (1993) Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA.
5. Buchanan B.B, Gruissm W. and Jones R.L (2000). Biochemistry and Molecular Biology of Plant.American Society of Plant Physiologist, Maryland, USA.
6. Kleinsmith L.J and Kish V.M (1995).Principles of Cell and Molecular Biology (Second Edition).Happer Collins College Publishers, New York, USA.
7. Lodish H., Berk A., Zipursky, S.L Matsudaira P., Baltimore D. and Darnell J. (2000). Molecular Cell Biology (Fourth Edition). W.H. Freeman and Company, New USA.

8. David Freifelder (1996). Essentials of Molecular Biology, Panima Publishing Company, New Delhi.
9. Malacinski G.M (2006) (Fourth Edition).Freifelders Essentials of Molecular Biology, Narosa Publishing House, New Delhi.
10. Rastogi V.B Concepts in Molecular Biology.
11. Twyman R.M (2003) (Third Reprint).Advanced Molecular Biology. Viva Books Pvt. Ltd., New Delhi.
12. Watson J.D. et al. Molecular Biology of Gene. Forth Edition, Benjamin and Cummings Publishing Co., California.

Semester II

BOUT 123: Botany Theory Paper III- Biochemistry
(4 Credit- 60 Lectures)

15 Lectures

Credit-I (1 Cr): Fundamental aspects

1. Water: Properties of water, Ionization of water 3 L
2. Buffers: pH, weak acids and weak bases, Handerson - Hasselback equation, buffers, buffer concentration & Biological Buffers. 5 L
3. Solutions: Molarity, Normality, Molality 2 L
4. Bioenergetics:Laws of Thermodynamics, free energy, energy changes, Redox reactions, chemical bonds. 5 L

15Lectures

Credit- II (1 Cr): Biomolecules

1. Carbohydrates: General classification, structure and properties of carbohydrates, synthesis and breakdown of glucose, starch and glycogen. 5 L
2. Lipids: General classification, structure and properties of lipids, types of lipids, biosynthesis and oxidation of lipids. 4 L
3. Nucleic acids: Structure and biosynthesis of purines and pyrimidines, structure of DNA and RNA 6 L

15Lectures

Credit III (1 Cr): Protein Biochemistry

1. Amino Acids: Classification, structure and properties of amino acids. 2 L
2. Proteins – Structure and Function, General classification, primary, secondary, tertiary and quaternary structures, Structure and function of myoglobin, keratin, haemoglobin, Ramchandran plot. 5L
3. Enzymology: General classification, mechanism of action, factors affecting enzyme activity, enzyme kinetics, Michaelis-Menton equation, competitive, non-competative, uncompetitive inhibition. 4L
4. Nitrogen Metabolism: Nitrate and ammonium assimilation, nitrogen uptake, biological nitrogen fixation, NOD factors, *nif* genes, root nodulation and nitrogen fixation, leg heamoglobin. 4L

Credit-IV (1 Cr): Phytochemistry and Metablomics **15Lectures**

1. Metabolomics: Overview of primary and secondary metabolites, integration of metabolism. 5L
2. Phytochemistry: Primary metabolites as precursors of secondary metabolites, study of secondary metabolites – structure, classification, properties and therapeutic plant sources, biosynthetic pathways - alkaloids, phenols, terpenes, glycosides, pigments. 6L
3. Phytochemical investigation: Extraction methods, qualitative and quantitative analysis of alkaloids, glycosides, terpenes, phenols, pigments. 4L

References:

1. Buchanan B. B., Gruissem W. and Jones R. L. (2000), Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, Maryland, USA.
2. Dennis D. T., Turpin D. H., Lefebvre D. D. and Layzell D. B. (eds) (1997), Plant Metabolism (second edition), Longman, Essex, England.
3. Galstone A. W. (1989), Life Processes in Plants, Scientific American Library, Springer - Verlag, New York, USA.
4. Moore T. C. (1989), Biochemistry and Physiology of Plant Hormones, Springer – Verlag, New York, USA.
5. Nobel P. S.(1998), Physiochemical and Environmental Plant Physiology (Second Edition), Academic Press, San Diego, USA.
6. Salisbury F.B. and Ross C. W. (1992), Plant Physiology (Fourth Edition), Wadsworth Publishing Company, California, USA.
7. Singhal G. S., Renger G., Sopory S.K., Irrgang K.D. and Govindjee (1999), Concept in Photobiology; Photosynthesis and Photomorphogenesis, Narosa Publishing House, New Delhi.
8. Taiz L. and Zeiger E. (2010), Plant Physiology (Fourth Edition), Sinauer Associates Inc. Publishers, Massachusetts, USA.
9. Thomas B. and Vince – Preu D. (1997), Photoperiodism in Plants (Second Edition), Academic Press, San Diego, USA.
10. Verma S. K. and VermaMohit (2007), A Textbook of Plant Physiology, Biochemistry and Biotechnology, S Chand Publications.
11. Lehninger A. L. (1987), Principles of Biochemistry, CBS Publishers and Distributors (Indian Reprint).
12. Hapse and Acharya (1999), Treaties on AgroElectronics and Agrophysics, VSI.

Semester II

BODT 124: Botany Theory paper 4- Floriculture and Nursery Management

(2 Credits- 30 Lectures) **15 Lectures**

Credit-I (Cr 1): Floriculture

1. Floriculture : Concept, definition, Scope and Importance of floriculture, global scenario of flowers, scope of floriculture in India 2L
2. Pre-requisites of commercial floriculture: soil and climate requirements, field preparation, systems of planting, water and nutrient management, weed management, rationing, training and pruning, pinching and disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies 3L
3. Harvesting and processing of flowers: harvesting indices, harvesting techniques, postharvest handling and grading, pre cooling, packing and storage, value addition, concrete and essential oil extraction, transportation and marketing, export potential, agri-export zones 5L
4. Commercial production of flowers: varietal wealth and diversity, climate, soil preparation, aftercare and manuring, pruning and training, harvesting, yield, important pests and diseases, control measures, harvesting, grading, packing and marketing , storage and transport, export potential of cut flowers: Chrysanthemum, Gerbera, Tuberose, Anthurium; Loose flowers- Scented Rose and Jasmine 5L

15 Lectures

Credit II (Cr 1): Nursery Management

1. Introduction 1 L
2. Nursery Site: Types of Nurseries, Water, Location, Topography, Size of Nursery, Soil 2 L
3. Preparation of the Site: Clearing of surface, Removal of Top Soil, Erosion Control and Wind Damage, Surface Dressing, Shape, Fencing. 2 L
4. Design and Layout of Nursery: Administration Area, Operations Area, Production Areas, Germination Section, Transplanting Area. 2 L
5. Producing Plants from Seed: Seed Handling, Seed Procurement and Storage, Seed Dormancy and Pre-Treatment, Germination Process, Time of Sowing, Method of Sowing, Care of Seed Bed and Direct Sown Container, Transplanting the Young Seedlings, Light and Shade, Transplanting Natural Regeneration Seedlings, Tending the Seedlings, Watering, Germination Beds and Transplants, Weed Control. 4 L
6. Producing Plants Vegetatively: Cuttings, Air Layering, Grafting and Budding, Cleft or V Grafting, Shield or Inverted T-budding. 2 L
7. Growing Media: Growing Media for Propagation and Germination Beds, Growing Media for Transplant Beds, Growing Media for Container Seedlings, Organic Material, Compost, Mixing the Growing Media, Media Compaction in Pots, Mulching. 2 L

References:

1. Arora JS. 2006. Introductory Ornamental horticulture. Kalyani.
2. Bhattacharjee SK. 2006. Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ.

3. Bose TK & Yadav LP. 1989. Commercial Flowers. NayaProkash.
4. Bose TK, Maiti RG, Dhua RS & Das P. 1999. Floriculture and Landscaping. NayaProkash.
5. Chadha KL & Choudhury B.1992. Ornamental Horticulture in India. ICAR.
6. Chadha KL. 1995. Advances in Horticulture. Vol. XII. Malhotra Publ. House.
7. Chaudhary RC. 1993. Introduction to Plant Breeding. Oxford & IBH.
8. Singh BD. 1990. Plant Breeding. Kalyani.
9. Lauria A &Ries VH. 2001. Floriculture – Fundamentals and Practices. Agrobios.
10. Prasad S & Kumar U. 2003. Commercial Floriculture. Agrobios
11. Keats C. Hall 2012. Manual onNursery Practices, Forestry Department, 173 Constant Spring Road, Kingston 8, Jamaica
12. Evans Julian1992. Plantation Forestry in the Tropics, Ch 10. Clarendon Press. Oxford.
13. Jacnicke, H. 1999.Practical Guidelines for Research Nurseries. International Centre for Research in Agroforestry. Nairobi, Kenya.
14. Mc.Donald, B. 1986. Practical Plant Propagation for Nursery Growers.
15. Schmidt, L. 2000.Guide to Handling of Tropical and Subtropical Forest Seed. DANIDA Forest Seed Centre.

Semester II

BODT 124: Botany Theory paper 4- Mushroom cultivation and Bio-pesticides

(2 Credits- 30 Lectures)

Credit-I (1 Cr): Mushroom culture

15 Lectures

1. History of mushroom cultivation — 1 L
2. Present status of mushroom cultivation in India and abroad — 1L
3. Edible and Poisonous mushrooms — 1L
4. Nutritional and medicinal values of mushrooms — 2L
5. Mushrooms spawn- spawning, running and cropping — 1L
6. Cultivation of paddy straw mushroom- *Volvariella* and wood mushroom-Lentinus. — 2L
7. Cultivation of Wheat straw mushroom- *Pleurotus* — 1L
8. Cultivation of Button mushroom- *Agaricus* — 2L
9. Management of pest in mushroom cultivation — 1 L
10. Recipes of edible mushrooms — 1 L
11. World commerce of mushrooms — 2 L

Credit-II (1 Cr): Bio-pesticides

15 Lectures

1. Biological control of plant pathogens- concept and brief history — 2 L
2. Antagonism- Mechanism of biocontrol- Amensalism, Predation, Parasitism — 2 L
3. Applications of biological control in field- Crop rotation, irrigation, alteration of soil pH, Organic amendments, Introduction of Antagonists, Seed inoculation, Use of Mycorrhizal fungi and biofertilizers — 3 L

4. Bacterial pesticides, Viral pesticides, Mycopesticides, Mycoherbicides, Mycoweedicides, Myconematicides, Insects as biocontrol agents — 3 L
5. Botanical pesticides- Pyrethrum, Nicotine, Rotenone, Neem, Karanja — 3 L
6. Commercialization of biopesticides — 2 L

References

1. A Textbook of Biotechnology - R.C. Dubey
2. Biopesticides and pest management - Dhaliwal and Kaul
3. Introduction to mushroom science - T. N. Kaul
4. Benificial fungi and their utilization - M. C. Nair
5. Benificial fungi - S. K. Sharma
6. Mushroom cultivation - Nita Bahl

Semester II

BODP 124: Practical based on BODT 124 Floriculture and Nursery Management

Practical (2 Credits):

1. Study of methods of post harvest technology for flowers (cut flowers) — 1P
2. Study of different protective structures with respect to design, components, orientation and construction for cut flower production — 1P
3. Study of special cultural practices for flower crops under protected structure — 1P
4. Gerbera–identification and description of species/varieties – propagation and planting –pruning management — 1P
5. Study of response of micronutrients and macronutrients on growth of cut flowers. — 1P
6. Preparation of project on Cut flower production including diseases and Pests management. — 1P
7. Preparation of Bed for nursery — 2P
8. Study of different method of seed germination — 1P
9. Preparation of growing media — 1P
10. Study of Grafting and budding method — 1P
11. Study of Air Layering and cutting method

Note: Visit to any Local Nursery and Preparation of report is compulsory

BODP 124: Practical based on BODT 124 Mushroom cultivation and bio-pesticides Practical (2 Credits):

1. Morphology of any six mushrooms — 1 P
2. Preparation of spawn for mushroom cultivation — 2 P
3. Cultivation of Dhingri mushroom — 3 P
4. Any six recipes of mushroom — 2 P
5. Visit to mushroom industry and report preparation — 1 P
6. Any six botanical pesticides — 2 P
7. Mycoherbicides- *Aspergillus, Penicillium* to control *Alternanthera, Fusarium* to control water hyacinth. — 2 P
8. Mycofungicides- Mycorrhizal fungi to control soil borne pathogens-*Trichoderma* to control soil borne pathogens. — 2 P

Semester II

BOUP 125: Botany practical paper based on BOUT 121, BOUT 122, and BOUT 123

Practical based on BOUT 121: Plant Systematics II **(4 Cr)**

1. Studies on the families as per Bentham and Hooker's system of classification– any one example from each series available locally and their identification up to Genus and species level with the help of Regional Flora — 4P
   Dicotyledonae:
   a) Polypetalae: Thalamiflorae, Disciflorae, Calyciflorae
   b) Gamopetalae: Inferae, Heteromerae, Bicarpellatae
   c) Monochlamydae: Curvembryae, Microembryae, Unisexuales
   Monocotyledonae:
   Epigynae, Coronariae, Calycinae, Glumaceae
2. Morphological, anatomical and reproductive studies of the following with the help of live material/or herbarium specimens and/or museum specimens and/or permanent slides of the following orders: — 2P
   i) Cycadales
   ii) Coniferales
   iii) Gnetales
3. Morphological, anatomical and reproductive studies of the following *Psilotum, Lycopodium, Selaginella, Equisetum, Pteris, Adiantum,* and *Marsilea* — 2P
4. Study of available fossils - At least 5 specimens from Gymnosperms and Pteridophytes. — 1P

Practical Based on BOUT 122: Molecular Biology

1. Isolation and quantification of plant genomic DNA — 2 P
2. Effect of temperature and alkali on absorption of DNA : hyperchromicity — 1 P

3. Separation of seed storage proteins from legumes and its quantitative study and qualitative study by SDS-PAGE. 1 P
4. Electrophoretic separation of plasmid isoforms 1 P
5. Restriction digestion study of plasmid DNA and separation by Electrophoresis 2 P
6. Study of instruments or equipment's used in Molecular Biology techniques (by photographs / by power point / by Animation): PCR thermal cycler, Gel documentation system, ELISA reader, Millipore distillation apparatus, Lyophilizer, Refractometer 1 P

Practical Based on BOUT 123: Biochemistry

1. Preparation of solutions and buffers. 1P
2. Thin Layer chromatography- sugars, amino acids. 1P
3. Spectrophotometry: Absorption spectra of protein and nucleic acid. 1P
4. Effect of pH and enzyme concentration on enzyme activity. 1P
5. Defatting and dialysis of proteins 1P
6. Separation of seed storage proteins by SDS PAGE 2P
7. Estimation of proteins by Lowry and Bradford Method 1P

BOUT 231 Computational Botany (60 L)

Credit I-Basic Biostatistics (15 L)

1. Introduction to Statistics : Measures of central tendency – mean, mode, median and their properties Measures of dispersion – variance, standard deviation, coefficient of variance Symmetry and skewness, measures of skewness, kurtosis Sampling and sampling distributions – concept of sample and population, statistic, standard error, methods of sampling 9L
2. Correlation and regression Bivariate correlation, positive correlation, negative correlation Measures of correlation – Scatter diagram, Karl-Pearson's coefficient of correlation, Spearman's rank correlation coefficient Regression – Equations of regression lines using least square method, regression estimate and its standard error 6L

Experimental Statistics (15 L)

1.1 Statistics using R, SPSS and Excel : Introduction , features, installation, starting and ending of the sessions, R commands and case sensitivity (08L)

a. Data types: Logical and Numerical
b. Vectors and vector arithmetic
c. Data frames: Creation using data, frame, subset and transform commands
d. Statistical methods using R : Sampling methods, Diagrams, graphs: : Measures of central tendency, Dispersion, Skewness and Kurtosis
e. Probability Distributions: Hypergeomertric distribution, Binomial. Normal and poison distribution
f. Correlation and Regression

1.2. SPPS (Statistical Package for the Social Sciences) Software: Concept and applications in Means, t – test, ANOVA and Correlation and linear regression

1.3 Excel : concept and applications on Biology

2. Testing of Hypothesis : critical difference for pairs of treatments Tukey's test for pairwise comparison of treatments Dunnet's test for comparison of treatment means with control Duncan's multiple range test Mann–Whitney U test 7L

3. Testing of hypothesis Hypothesis, statistical hypothesis, critical region, level of significance, p-value, normal distribution T-test: t-test for mean, equality of two means, paired t-test, unpaired t-test, chi-square test: chi square test for goodness of fit, independence of attributes, non-parametric test

Credit III – Scientific Communication (15 L)

1. Importance of scientific communication Types of scientific communications Logical organization of scientific data and documentation
2. Different modes of scientific communication Details of – Steps involved in Proposal writing, Research paper writing, Thesis writing
3. Oral forms of scientific communication Popular and Scientific talks, Poster presentations
4. Legal forms of communication of science 4 Ethics in scientific communication IPR, patent submissions

Credit IV: Bio-analytical techniques & Bioinformatics (15L)

1. Making solutions – moles and molarity, stock solutions and dilutions, making media and reaction mixtures

2. pH measurements and preparation of buffers (4 L)

3. Measuring concentrations using spectrophotometry, Cell counting using serial dilutions, haemocytometry (2L)

4. Bioinformatics: What is Bioinformatics, What is database, Classification of database, Sequences and nomenclature, IUPAC symbols, Types of sequences used in Bioinformatics, Information sources: NCBI, the GDP, MGD. (2L)

5. Data Retrieval tools – ENTREZ, OMIM, PubMed, Taxonomy Browsers, LocusLink, SRS. Database Similarity Searching – BLAST, FASTA, Resources for Gene Level Seqoences, Use of Bioinformatics tools in analysis (4L)

NOTE – Emphasis be given on methodology and numerical problem solving rather than derivations and proofs. (3L)

Suggested Reading:

1. P.N. Arora and P.K. Malhan (2002) Biostatistics, Himalaya publishing House.
2. Rama Krishnan, P. (1995) Biostatics, Saras publication A.R.P. camp Road, Periavilai, Kottar, po. Nagercoil, Kanyakumari- Dist. Pin- 629 002.
3. Banerjee, P.K. (2005) Introduction to Biostatics' S. Chand and Company Ltd. Ram Nagar, New Delhi- 110 055.
4. Norman T.J. Bailey (2004), Statistical methods in biology (Third Edition) Cambridge University press (Low price Editions).
5. Dr. Mungikar A.N. (1997) an introduction to Biometry, Saraswati publication, Aurangabad.
6. Mungikar, A. M. (2003) Biostatistial Analysis. Saraswati Printing Press. Aurangabad.
7. Lab Math – Adams, D.S. I.K. InternationsPvt Ltd. New Delhi, 2004
8. T. M. Apostol: Mathematical Analysis (Narosa publishing house)

BOUT 232 Botany Theory paper 2

BOUT 232 Developmental Botany (4 Cr - 60 L)

Credit I: Basic concepts of Plant development (15L)

1. Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development, 7L

2. Polarity & Symmetry 2L

3. Difference between Plant and Animal development 2L

4. Factors for development- intrinsic and extrinsic 2L

5. Juvenility -Characteristics,Transition to Adult phase. 2L

Credit II: Embryology (15L)

1. Reproductive structure in plant 1L

2. Gametophyte development- Stamen and Microsporogenesis, Male gametophyte or male germ unit development, Carpel and Megasporogenesis, Female gametophyte or female germ unit development 4L

3. Fertilization-Pollen tube growth and its path,it sentry into embryo sac, gametic fusion, significance of double fertilization, abnormalities in fertilization. 2L

4. Development of embryo in dicots and monocot 2L

5. Development of Endosperm 2L

6. Polyembryony- concept and classification of polyembryony, special cases and causes of polyembryony. 2L

7. Apomixis - concept, categories- agamospermy and vegetative reproduction apospory, parthenogenesis 2L

Credit III: Physiological & Molecular Basis of Plant Development (15L)

S.Y.B.A.(G 2)

द्वितीय वर्ष कला (सामान्य स्तर २)

आधुनिक मराठी साहित्य आणि उपयोजित मराठी

उद्दिष्टे :

१ शुद्धलेखनाची ओळख करून देणे.

२ पारिभाषिक संज्ञांची ओळख करून देणे.

३ चरित्र-आत्मचरित्र या साहित्यप्रकारांच्या तात्त्विक घटकांचे ज्ञान करून देणे.

४ आधुनिक मराठी साहित्यातील निवडक चरित्र-आत्मचरित्रात्मक वेच्यांचे आकलन, आस्वाद आणि मूल्यमापन करण्याची क्षमता विद्यार्थ्यांमध्ये निर्माण करणे.

प्रथम सत्र

एकूण तास: ४८ **गुण: ६०**

१. उपयोजित मराठी

तास : १२ **गुण १५**

१ अर्जलेखन ५

२ अशुद्ध शब्द शुद्ध करून लिहिणे १०

२. 'चरित्र' या साहित्यप्रकाराची तात्त्विक मीमांसा

तास : १२ **गुण १५**

१ चरित्र : संकल्पना

२ चरित्र : साहित्यप्रकाराचे स्वरूप

३ चरित्र : साहित्यप्रकाराची वाटचाल

३. पाठ्यपुस्तक

तास : २४ गुण ३०

जीवनवेध

संपादक : प्रा. डॉ.स्नेहल तावरे

प्रा. डॉ.शिरीष लांडगे

द्वितीय सत्र

एकूणतास: ४८ गुण : ६०

१) व्यावहारिक मराठी

तास : १२ गुण १५

१ सारांश लेखन ५

२ पारिभाषिक संज्ञा १०

२) 'आत्मचरित्र' या साहित्यप्रकाराची तात्त्विक मीमांसा

तास : १२ गुण १५

१ आत्मचरित्र : संकल्पना

२ आत्मचरित्र व आत्मकथन : साम्य-भेद

३ आत्मचरित्र : साहित्यप्रकाराची वाटचाल

३) पाठ्यपुस्तक

तास : २४ गुण ३०

माझी जडणघडण

संपादक : प्रा.डॉ. स्नेहल तावरे

प्राचार्य डॉ. उज्ज्वला देवरे

द्वितीय सत्र

कादंबरी

एकूण तास: ४८ सत्रांत परीक्षा गुण: ६०

१) तात्त्विक मीमांसा

तास : १२ गुण १५

१ : कादंबरी या साहित्यप्रकाराची तात्त्विक मीमांसा

१ कादंबरी या साहित्यप्रकाराची संकल्पना

२ कादंबरीचे घटक

३ कादंबरीचे प्रकार

४ कादंबरी या साहित्यप्रकाराची वाटचाल

२) कादंबरी संहिता

तास : ३६ गुण ४५

फकिरा -अण्णा भाऊ साठे

संदर्भ ग्रंथ

१ अण्णा भाऊ साठे साहित्य समीक्षा - (संपा.) प्रा. रणधीर शिंदे

२ अण्णा भाऊ साठे - बजरंग कोरडे

३ अण्णा भाऊ साठे समाजविचार आणि साहित्य विवेचन - डॉ. बाबुराव गुरव

४ लोकशाहीर अण्णा भाऊ साठे निवडक वाङ्मय - (संपा.) अर्जुन डांगळे

५ ग्रामीण दलित कादंबरी : तुलना (संपा.) डॉ. भास्कर शेळके

६ ग्रामीण दलित साहित्य : डॉ. मधुकर मोकाशी

७ दलित साहित्य : डॉ. नीला पांढरे

८ चरित्र आणि आत्मचरित्र वाङ्मयप्रकारांचे विवेचन - सदा कऱ्हाडे

S. Y. B. A. (S 1)

द्वितीय वर्ष कला (विशेषस्तर १)

मराठी साहित्यातील विविध साहित्यप्रकार

उद्दिष्टे :

१ मराठी साहित्यप्रकारांच्या तात्त्विक घटकांचे ज्ञान देणे.

२ वेगवेगळ्या कालखंडातील मराठीतील अभिजात साहित्यकृतींचा संस्कार घडविणे. साहित्याविषयीची अभिरुची निर्माण करणे.

३ साहित्यकृतीला मुक्त प्रतिसाद देण्याची क्षमता विकसित करणे.

४ साहित्यकृतीचे आकलन, आस्वाद आणि मूल्यमापन करण्याची दृष्टी निर्माण करणे.

५ साहित्याचा सूक्ष्म पातळीवर अभ्यास करण्याची क्षमता विकसित करणे.

६ पदव्युत्तर अभ्यास करण्याची पूर्वतयारी करणे.

सत्र पहिले

नाटक

एकूण तास: ४८ सत्रांत परीक्षा गुण: ६०

१) तात्त्विक मीमांसा

तास : १२ गुण १५

१ : नाटक या साहित्यप्रकाराची तात्त्विक मीमांसा

१ नाटक साहित्यप्रकाराची संकल्पना

२ नाटकाचे घटक

३ नाटकाचे प्रकार

४ नाटक या साहित्यप्रकाराची वाटचाल

२) नाटक संहिता

तास : ३६ गुण ४५

S. Y. B. A. (S 2)

द्वितीय वर्ष कला (विशेषस्तर २)

अर्वाचीन मराठी वाङ्मयाचा इतिहास (इ. स. १८१८ ते १९६०)

उद्दिष्टे :

१ विशेषस्तरावर अभ्यासाचा प्रारंभ होत असताना, मराठी साहित्याच्या ऐतिहासिक परंपरेचे स्थूल ज्ञान करून देणे.

२ विशिष्ट कालखंडाच्या पार्श्वभूमीवर साहित्यामागील प्रेरणा, प्रवृत्तींचे ज्ञान करून देणे.

३ साहित्यप्रकारांच्या विकसनशील परंपरेचे स्थूल ज्ञान करून देणे.

४ पदव्युत्तर अभ्यास करण्याची पूर्वतयारी करणे.

सत्र पहिले

अर्वाचीन मराठी वाङ्मयाचा इतिहास (इ. स. १८१८ ते १९२०)

एकूणतास: ४८ सत्रांत परीक्षा गुण: ६०

१) कालखंड : इ.स. १८१८ ते १८७४

तास : १२ गुण ३०

१ या कालखंडातील सामाजिक, धार्मिक, राजकीय, सांस्कृतिक आणि वाङ्मयीन पार्श्वभूमी.

२ या कालखंडातील साहित्य निर्मिती मागील प्रेरणा आणि प्रवृत्ती.

३ या कालखंडातील निबंध, कविता, कथा, कादंबरी, नाटक, चरित्र, आत्मचरित्र या निवडक वाङ्मयप्रकारांचा स्थूल आढावा.

२) कालखंड : इ.स. १८७५ ते १९२०

तास : १२ गुण ३०

१ या कालखंडातील सामाजिक, धार्मिक, राजकीय, सांस्कृतिक आणि वाङ्मयीन पार्श्वभूमी.

२ या कालखंडातील साहित्य निर्मिती मागील प्रेरणा आणि प्रवृत्ती.

३ या कालखंडातील निबंध, कविता, कथा, कादंबरी, नाटक, चरित्र, आत्मचरित्र या निवडक वाङ्मयप्रकारांचा स्थूल आढावा.

द्वितीय सत्र

अर्वाचीन मराठी वाङ्मयाचा इतिहास (इ. स. १९२१ ते १९६०)

एकूणतास: ४८ सत्रांत परीक्षा गुण: ६०

१) कालखंड : इ.स. १९२१ ते १९४५

तास : १२ गुण ३०

१ या कालखंडातील सामाजिक, धार्मिक, राजकीय, सांस्कृतिक आणि वाङ्मयीन पार्श्वभूमी.

२ या कालखंडातील साहित्यनिर्मिती मागील प्रेरणा आणि प्रवृत्ती.

३ या कालखंडातील निबंध, कविता, कथा, कादंबरी, नाटक, चरित्र, आत्मचरित्र, ललितगद्य इ. या निवडक वाङ्मयप्रकारांचा स्थूल आढावा.

२) कालखंड : इ.स. १९४६ ते १९६०

तास : १२ गुण ३०

१ या कालखंडातील सामाजिक, धार्मिक, राजकीय, सांस्कृतिक आणि वाङ्मयीन पार्श्वभूमी.

२ या कालखंडातील साहित्य निर्मिती मागील प्रेरणा आणि प्रवृत्ती.

३ या कालखंडातील निबंध, कविता, कथा, कादंबरी, नाटक, चरित्र, आत्मचरित्र, ललितगद्य इ. या निवडक वाङ्मयप्रकारांचा स्थूल आढावा.

संदर्भ ग्रंथ

१ मराठी वाङ्मयाचा इतिहास खंड ४,५,६, म.सा.प. पुणे.

२ अर्वाचीन मराठी गद्याची पूर्वपीठिका- गं.बा. सरदार

३ महाराष्ट्र जीवन खंड १ व खंड २ गं. बा. सरदार

तृतीय वर्ष कला (T.Y.B.A)

मराठी (सामान्यस्तर पेपर —३)

प्रथम सत्र

एकूण तासिका— ४८ एकूण गुण — ६०

घटक अ — ग्रंथ परीक्षण

गुण — १५
तासिका — १२

- ग्रंथ परीक्षणाचे स्वरूप स्पष्ट करून ग्रंथ परीक्षणाच्या घटकांचे विवेचन करणे.
- विविध साहित्यप्रकारातील साहित्यकृतींचे परीक्षण कसे करावे ते विद्यार्थ्यांना समजावून सांगणे.
- ग्रंथ परीक्षणांच्या तात्त्विक विवेचनासाठी एकूण ८ गुण असतील तर प्रत्यक्ष साहित्यकृतीच्या परीक्षणासाठी एकूण ७ गुण असतील.

सूचना :—

१. विविध साहित्यप्रकारांतील पुस्तकांचे परीक्षण कसे करावे, यासंबधी सप्रमाण विवेचन वर्गात केले जावे अशी अपेक्षा आहे.

२. विद्यार्थ्यांनी पदवी पर्यंतच्या विद्यापीठीय अभ्यासक्रमात समाविष्ट असलेल्या साहित्यकृतीं व्यतिरिक्त पुस्तकाचे परीक्षण करावे.

घटक ब — निबंध : तात्त्विक विवेचन

गुण — १५
तासिका — १२

- निबंध या साहित्यप्रकाराचे स्वरूप व व्याख्या
- मराठीतील इतर साहित्यप्रकारांच्या तुलनेत निबंधाचे वेगळेपण
- निबंधाचे प्रकार
- निबंध या साहित्यप्रकारामागील प्रेरणा व प्रयोजने

घटक क — निबंधसंग्रह

गुण — ३०
तासिका — २४

'विचारधारा' — संपा— डॉ. स्नेहल तावरे
डॉ. भास्कर शेळके

तृतीय वर्ष कला (T.Y.B.A)

मराठी (सामान्यस्तर पेपर — ३)

द्वितीय सत्र

एकूण तासिका— ४८

घटक अ — प्रवासवर्णन : तात्त्विक विवेचन

गुण — १५
तासिका — १२

- प्रवासवर्णन या साहित्यप्रकाराचे स्वरूप व व्याख्या
- इतर साहित्यप्रकारांच्या तुलनेत प्रवासवर्णनाचे वेगळेपण
- प्रवासवर्णन या साहित्य प्रकारामागील प्रेरणा व प्रयोजने

घटक ब — प्रवासवर्णन साहित्यप्रकाराची वैशिष्टये, व्याप्ती आणि वाटचाल

गुण — १५
तासिका — १२

घटक क — प्रवासवर्णनसंग्रह

गुण — ३०
तासिका — २४

'देशविदेश' — संपा— डॉ. स्नेहल तावरे
डॉ. अशोक शिंदे
डॉ. अरुण कोळेकर

तृतीय वर्ष कला (T.Y.B.A.)
मराठी (विशेषान्तर पेपर - ३) (S-३)
पुनर्रचित अभ्यासक्रम अमलात
२०१५-१६ पासून

साहित्यविचार S-३

प्रथम सत्र

एकूण तासिका— ४८

१. साहित्याचे स्वरूप:—

१) शास्त्रीय साहित्य आणि ललित साहित्य यांमधील भेद

२) साहित्याचे शब्दरूप

३) साहित्यातून व्यक्त होणाऱ्या अनुभवांचे विशेष — वास्तव आणि कल्पित यांचा संबंध, संवेदनात्मकता — भावनात्मकता — वैचारिकता, सेंद्रियत्व, सूचकता, विशिष्ट आणि विश्वात्मकता.

२. साहित्याचे प्रयोजन:—

१) प्रयोजन म्हणजे काय?

२) प्रयोजन आणि परिणाम यांमधील भेद.

३) साहित्याची प्रयोजने —

अ) मम्मटाची प्रयोजने

ब)पाश्चात्यांचीप्रयोजने:— इच्छापूर्ती — जिज्ञासातृप्ती — विरेचन — आत्माविष्कार अनुभवविश्वाची समृद्धी — स्वप्नरंजन—उद्‌बोधन—प्रचार—मनोरंजन—आनंद.

४) या प्रयोजनांचा लेखक व वाचक तसेच कलावादी, जीवनवादी या दृष्टीने विचार.

३. साहित्याची निर्मितीप्रक्रिया:—

१) साहित्याच्या निर्मितीचे स्वरूप

२) साहित्यनिर्मितीच्या शक्ती—१) प्रतिभा २) कल्पनाशक्ती ३) स्फूर्ती

३) प्रतिभाव्यापार व स्वप्नव्यापार

४) साहित्याची निर्मिती प्रक्रिया आणि साहित्यिकाचे व्यक्तिमत्त्व — १) संवेदनक्षमता

२) शैशववृत्ती ३) अनुभव समृद्धी ४) विद्वत्ता ५)लेखकाचा जीवनविषयक दृष्टिकोण. ६) लेखकाचा साहित्यविषयक दृष्टिकोण.

४. साहित्याची भाषा:—

१) व्यवहारभाषा, शास्त्रीय साहित्याची भाषा व साहित्याची भाषा यांच्यातील भेद.

२) शब्दार्थांचा वक्रव्यापार

३) भाषेचे नादरूप

४) अलंकार

५) रूपक

६) प्रतिमा

७) प्रतीक

८) प्राक्कथा

९) शैली विचार — १) लेखक तशी शैली २) आशय तशी शैली ३) साहित्यप्रकार तशी शैली.

द्वितीय सत्र

एकूण तासिका— ४८

५. साहित्याचा आस्वाद:—

१) आस्वाद म्हणजे काय ?

२) आस्वाद प्रक्रिया

३) आस्वादकाला आवश्यक असणारे गुण

४) आस्वादातील अडथळे

६. साहित्याची सामाजिकता:—

१) साहित्य आणि समाज यांचे परस्परसंबंध

२) लेखकाची सामाजिकता

३) भाषेची सामाजिकता

४) कलात्मक अनुभवातील सामाजिकता

५) वाचकाची सामाजिकता

६) साहित्यातील सामाजिकतेला वैश्विक रूप प्राप्त होते काय?

७) बांधीलकीची संकल्पना व साहित्यिकाची बांधीलकी.

७. साहित्यिक अभिरुची

१) अभिरुची म्हणजे काय?

२) अभिरुची आणि सौदर्यदृष्टी.

३) अभिरुची आणि औचित्य.

४) अभिरुची भिन्नतेची कारणे.

५) अभिरुची नियत करणारे घटक — सांस्कृतिक पर्यावरण, आर्थिक पर्यावरण, वाङ्मयीन पर्यावरण.

८. साहित्यप्रकाराची संकल्पना:—

१) साहित्याच्या वर्गीकरणाची शक्याशक्यता

२) साहित्याच्या वर्गीकरणाची आवश्यकता

३) साहित्याच्या वर्गीकरणाची तत्त्वे— माध्यमभिन्नता, प्रस्तुतीकरणाची पद्धती, प्रस्तुतीकर्त्यांचा दृष्टिकोण व प्रस्तुतीकरणाचा काळ

४) साहित्याचे ठळक प्रकार — कथा, कादंबरी, काव्य, नाटक.

संदर्भ साहित्य

१) साहित्यविचार — डॉ. अ. वा कुलकर्णी

२) साहित्यविचार (संपा.) डॉ. द.दि.पुंडे, डॉ.स्नेहल तावरे

३) काव्यशास्त्र प्रदीप — डॉ. स.रा.गाडगीळ

४) वाङ्मयीन शैली आणि तंत्र — म.द.हातकणंगलेकर,

५) साहित्यविचार — भालचंद्र खांडेकर

तृतीय वर्ष कला (T.Y.B.A)

मराठी (विशेषस्तर पेपर —४)

भाषाविज्ञान — S_4

पुनर्रचित अभ्यासक्रम आराखडा

सन २०१५—२०१६ पासून

भाषाविज्ञान— वर्णनात्मक आणि ऐतिहासिक

❖ **अभ्यासक्रमाची उद्दिष्टये:—**

१) भाषेचे स्वरूप व कार्य, भाषेच्या अभ्यासाचे महत्त्व, भाषेच्या अभ्यासाची प्रमुख अंगे जाणून घेणे.

२) भाषा म्हणजे काय व तिचे मानवी जीवनातील कार्य व महत्त्व जाणून घेणे.

३) वेगवेगळ्या भाषाअभ्यासपद्धतींचे वेगळेपण व महत्त्व जाणून घेणे.

४) स्वननिर्मितीची प्रक्रिया समजावून घेणे.

५) वागिंद्रियांची रचना व कार्ये समजावून घेणे.

६) स्वनविज्ञान, स्वनिम संकल्पना आणि मराठीची स्वनिम व्यवस्था जाणून घेणे.

७) मराठीची रूपिमव्यवस्था समजावून घेणे.

८) वाक्यविन्यास व अर्थविन्यास या भाषावैज्ञानिक संकल्पनांचा मराठीच्या संदर्भात स्थूल परिचय.

९) ऐतिहासिक भाषाभ्यासपद्धतीचे स्वरूप व महत्त्व लक्षात घेणे.

१०) भाषाकुलाची संकल्पना जाणून घेवून मराठी भाषेच्या उत्पत्तीचा अभ्यास करणे.

११) मराठी भाषेचा उत्पत्तीकाळ जाणून घेवून तत्कालीन भाषिक स्थित्यंतरांचा आढावा घेणे.

१२) टप्याटप्याने भाषा म्हणून मराठीच्या वाटचालीचा ऐतिहासिक आढावा घेणे.

प्रथम सत्र

एकूण तासिका– ४८

१. **भाषेचे स्वरूप व कार्य :–**भाषा एक सहज क्रिया – भाषा : एक अर्जित वस्तू – संज्ञापन : भाषेचे मुख्य कार्य – संकेत : भाषेचा आधार – शारीरिक आणि मानसिक क्रियांचा संयोग – ध्वनिसंकेत : चिन्ह आणि चिन्हित – संज्ञापनाची अन्य साधने: शरीरस्थित – संज्ञापनाची साधने: शरीरबाहय – भाषा हे सर्वश्रेष्ठ संज्ञापन साधन – संज्ञापनातील क्रिया प्रतिक्रिया – मानवेतर प्राण्यांची भाषा – भाषा : एक सामाजिक संस्था – भाषा आणि व्यक्तिस्वातंत्र्य – भाषेच्या अभ्यासाची आवश्यकता. भाषाअभ्यासाची अंगे, भाषाभ्यास पद्धती –वर्णनात्मक भाषाभ्यासपद्धती, **ऐतिहासिक** भाषाभ्यासपद्धती, तौलनिक भाषाभ्यासपद्धती, समाजभाषाभ्यासपद्धती.

२. **स्वनविज्ञान आणि स्वननिर्मिती :–** वागिंद्रियाची रचना व कार्ये स्वनविज्ञानाचे स्वरूप–स्वन निर्माण करणारी इंद्रिये–जिभेचे महत्त्व–स्वननिर्मितीची प्रक्रिया–मुखमार्ग, नासिकामार्ग आणि पडजीभ– दात आणि ओठ यांचे कार्य–तालुपटाची रचना व कार्य–स्वरांचे स्वरूप, लक्षणे व प्रकार–व्यंजनांचे स्वरूप लक्षणे व प्रकार–स्वरांच्या वर्गीकरणाची तत्त्वे– स्वननिर्मितीमधील 'प्रयत्ना'चे स्वरूप.

३. **स्वनिम विचार :–** स्वनिम निश्चितीचे तत्त्वे, विनियोग संकल्पनेचा स्थूल परिचय, स्वन, स्वनिम व स्वनांतर यामधील परस्परसंबंध, मराठी स्वनिमव्यवस्थेची रूपरेषा, स्वरस्वनिम, अर्धस्वरस्वनिम, व्यंजनस्वनिम यांचे वर्गीकरण.

४. **रूपिम विचार :–** रूपिमचे तत्त्व, रूपिका–रूपिम आणि रूपिकांतर यांमधील परस्परसंबंध, रूपिकांचे प्रकार प्रकृति (धातू) आणि प्रत्यय यांचे वर्गीकरण (आशयबोधक रूपिम व कार्यकारी रूपिम)

द्वितीय सत्र

एकूण तासिका— ४८

५. **वाक्य**विचार — वाक्यविन्यास संकल्पना आणि मराठीतील वाक्यविन्यास व्यवस्था, वाक्याचे घटक

६. **अर्थविचार** — अर्थविन्यास व मराठीतील त्याचे स्वरूप, अर्थ ही संकल्पना, अर्थाचे विविध प्रकार

७. **ऐतिहासिक भाषाभ्यासपध्दती** — सर विल्यम जोन्स यांचा सिद्धांत — ऐतिहासिक भाषाविज्ञानाचे स्वरूप — कार्य, **भाषाकुलाची संकल्पना** — भाषांचे वर्गीकरण — जगातील प्रमुख भाषाकुले — इंडो युरोपियन भाषाकुल — आर्य भाषाकुल व मराठी भाषा — होर्न्ले यांचा अंतर् बहिर् वर्तुळ सिध्दांत.

८. **मराठी भाषेची उत्पत्ती** :— मराठी भाषेची उत्पत्ती व त्यासंबंधीची साधने — मराठी भाषेच्या उत्पत्ती संबंधी विविध सिध्दांत — वैद्य—गुणे वाद, मराठीचे कालिक भेद

S.Y. B. Sc.

द्वितीय वर्ष विज्ञान

मराठी विज्ञानसाहित्य आणि व्यावहारिक मराठी

उद्दिष्टे :

१ विद्यार्थ्यांमध्ये मराठी विज्ञानसाहित्याविषयी आवड निर्माण करणे.

२ विद्यार्थ्यांमध्ये वैज्ञानिक जाणिवा निर्माण करून देणे.

३ विद्यार्थ्यांना विज्ञान, उद्योगातील विविध प्रवाह, संधी यांचा परिचय करून देणे.

४ विद्यार्थ्यांमध्ये लेखन, वाचन, आकलन आणि संभाषण ही भाषिक कौशल्ये अधिकाधिक विकसित करणे.

५ भाषिक कौशल्यांचे विविध आविष्कार आणि प्रसारमाध्यमे यांच्या परस्परसंबंधाचे ज्ञान विद्यार्थ्यांना करून देणे.

६ वैज्ञानिक, कार्यालयीन, व्यावसायिक आदी कामकाजात मराठीच्या होणाऱ्या वापराची माहिती देत पारिभाषिक संज्ञांची ओळख विद्यार्थ्यांना करून देणे.

प्रथम सत्र

एकूण तास : ४८ गुण : ४०

१. निबंधलेखन

तास : ०८ गुण १०

विज्ञान, सामाजिक व वैचारिक विषयावर निबंधाचे लेखन करणे.

२. पाठ्यपुस्तक

तास : ४० गुण ३०

विज्ञानसृष्टी

संपादक : प्रा. डॉ. स्नेहल तावरे

प्रा. डॉ. बाळासाहेब गुंजाळ

F.Y.B.A. (प्रथम वर्ष कला)

निवड आधारित श्रेयांक पद्धत (Choice Based Credit System)

पहिले सत्र

विषयाचे नाव : मराठी साहित्य : कथा आणि भाषिक कौशल्यविकास [CC-1 A]

अभ्यासक्रमाची उद्दिष्टे :

१. कथा या साहित्यप्रकाराची ओळख करून देणे.
२. कथा या साहित्यप्रकाराचे स्वरूप, घटक आणि प्रकार यांची ओळख करून देणे.
३. विविध साहित्यप्रवाहांमधील कथा या साहित्यप्रकारातील निवडक कथांचे अध्ययन करणे.
४. भाषिक कौशल्यविकास करणे.

पहिले सत्र :

घटक	तपशील	श्रेयांक	तासिका
१	कथा : स्वरूप आणि वाटचाल कथा : घटक कथा : प्रकार (रचनाप्रकार आणि प्रवाह)	१	१५
२	अभ्यासपुस्तक : समकालीन मराठी कथा अक्षरबंध प्रकाशन, पुणे संपादक : प्रा. डॉ. शिरीष लांडगे, प्रा. डॉ. दिलीप पवार, प्रा. डॉ. संदीप सांगळे	१	१५
३	भाषिक कौशल्यविकास नैसर्गिक : आकलनासह श्रवण अर्जित : संभाषण, वाचन, लेखन, इ-संवाद कौशल्य प्रगत : सारग्रहण, सारांशलेखन	१	१५

संदर्भ ग्रंथ

१. मराठी साहित्य : प्रेरणा आणि स्वरूप, संपादक डॉ. गो. मा. पवार, डॉ. म. द. हातकणंगलेकर

२. साहित्यमूल्य आणि अभिरुची, डॉ. गो. मा. पवार

३. काही साहित्यिक : काही साहित्यकृती, डॉ. भीमराव कुलकर्णी

४. साहित्य अध्यापन आणि प्रकार, वा. ल. कुलकर्णी गौरव ग्रंथ, संपादक श्री. पु. भागवत, डॉ. सुधीर रसाळ

५. कथा : संकल्पना आणि समीक्षा, सुधा जोशी, मौज प्रकाशन

६. मराठी कथा : विसावे शतक, संपादक के. ज. पुरोहित, सुधा जोशी

University of Pune

S. Y. B. Sc. [Botany]

Class – S.Y. B .Sc. (To be implemented From June 2014)		
Paper	Semester - I	Semester – II
I	Taxonomy of Angiosperms and Plant community	Plant Anatomy and Embryology
II	Plant Physiology	Plant Biotechnology
III	Practicals based on Theory courses (Paper I and II)	

Equivalence of previous syllabus at S.Y.B.Sc. Botany

Paper	2008 Pattern (Implemented from 2009)	2013 Pattern (To be implemented from 2014)
Paper I Semester I	BO-211: Fundamentals of Plant Systematics and Plant Ecology	BO-211: Taxonomy of Angiosperms and Plant community
Paper II Semester I	BO-212:Fundamentals of Plant Physiology	BO-212:Plant Physiology
Paper I Semester I	BO-221: Structural Botany(Anatomy, Embryology and Palynology)	BO-221: Plant Anatomy and Embryology
Paper II Semester I	BO-222: Fundamentals of Plant Biotechnology	BO-222: Plant Biotechnology
Practical Course	Practical based on theory courses (Paper I and Paper II)	Practical based on theory courses (Paper I and Paper II)

S.Y.B.Sc. Botany

(Semester I, Paper I)

Taxonomy of Angiosperms and Plant Community (48 Lectures)

1. Introduction to Plant Taxonomy **3L**

1.1 Definition, scope, objectives and importance

1.2 Identification, classification, nomenclature

1.3 Concept of Systematics

2. Systems of classification **6L**

2.1 Types of systems with their merits and limitations- a)Artificial system- Carl Linnaeus , b)Natural system -Bentham and Hooker, c) Phylogenetic system- Engler and Prantl

3. Taxonomic literature **2L**

Flora, monograph, revisions, manuals, journals, periodicals and references books.

4. Sources of data for Systematics **6L**

4.1 Morphology

4.2 Anatomy

4.3 Cytology

4.4 Embryology

4.5 Phytochemistry

4.6 Molecular biology

5. Botanical Nomenclature **6L**

5.1 History

5.2 Binomial nomenclature

5.3 ICBN- principles

5.4 Rules of nomenclature

5.5 Coining of generic names and specific epithets.

5.6 Ranks and endings of taxa names

5.7 Principle of priority

5.8 Effective and valid publications

5.9 Single and double authority citation

5.10 *Nomina conservanda*

6. Study of Plant Families **11L**

Study of following families with reference to systematic position, salient features, floral formula, floral diagram and any five examples with their economic importance – Annonaceae, Meliaceae, Myrtaceae, Rubiaceae, Solanaceae, Asclepiadaceae, Euphorbiaceae and Amaryllidaceae

7. Computer in taxonomy **4L**

7.1 Concept of herbarium their advantages and limitations

7.2 Digital /e-herbarium and their advantages

7.3 Data bases: concept and needs.

7.4 Use of computer in plant classification

8. Introduction to ecology **5L**

8.1 Definition

8.2 Concept

8.3 Autecology and synecology

8.4 Ecosystem and its components: biotic and abiotic.

8.5 Food chain

8.6 Food web

8.7 Ecological pyramids

9. Ecological grouping of the plants **5L**

Ecological grouping of the plants with reference to their significance of adaptive external and internal features: a) Hydrophytes, b) Mesophytes c)Xerophytes d) Halophytes with examples.

References-

1. Chopra G.L.- Angiosperms
2. Cronquist, A. 1968. The Evolution and Classification of Flowering Plants. Thomas Nel and Sons Ltd. London.
3. Datta S.C.- A Hand Book of Systematic Botany
4. Davis P.H and V.H Heywood 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd London.
5. Gurucharan Singh 2005- Systematics theory and practice (Oxford IBH)
6. Heywood V.H 1967. Plant Taxonomy, London.
7. Lawrence, G.H.M 1951. Taxonomy of Vascular Plants. N.Y.

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(Semester I, Paper II)

Plant Physiology (48 Lectures)

1. Introduction to Plant Physiology **2L**

Brief history,Scope and applications of plant physiology

2. Plant – water relations **8L**

2.1 Physico-chemical properties of water

2.2 Membrane structure, permeability and aquaporin

2.3 Diffusion – Definition, factors affecting diffusion, importance of diffusion in plants

2.4 Osmosis – Definition, types of solutions – hypotonic, hypertonic and isotonic, endosmosis and exosmosis, concept of osmotic pressure (OP), turgor pressure (TP), wall pressure (WP), Diffusion pressure deficit (DPD), relation between OP, TP and DPD, role of osmosis in plants.

2.5 Plasmolysis – Definition, mechanism, deplasmolysis, significance of plasmolysis

2.6 Imbibition – Concept, mechanism and significance

3. Absorption of water **3L**

3.1 Role of water in plants

3.2 Concept of water potential and capillary water

3.3 Mechanisms of water absorption

3.4 Factors affecting rate of water absorption

4. Ascent of sap **4L**

4.1 Introduction and definition.

4.2 Theories of ascent of sap

4.3 Vital theories: Jamin – Chame theory and Bose theory

4.3.1 Physical force theories: a) Capillary theory, b) Imbibitional theory, c) Atmospheric pressure theory,

4.3.2 Transpiration pull or cohesion-tension theory, evidences and objections

4.4 Factors affecting ascent of sap

5. Transpiration **6L**

5.1 Definition

5.2 Types of transpiration – cuticular, lenticular and stomatal

5.3 Structure of stomata

5.4 Mechanism of opening and closing of stomata –Steward's hypothesis, active K^+ transport mechanism

5.5 Factors affecting the rate of transpiration

5.6 Significance of transpiration

5.7 Antitranspirants

5.8 Guttation

5.9 Exudation

6. Plant growth and plant growth regulators **6L**

6.1 Introduction

6.2 Phases of growth

6.3 Measurement of growth- Arc auxanometer, Bose crescograph, fresh and dry weight method

6.4 Factors affecting growth

6.5 Plant Growth Regulators- Introduction and definition

6.6 Properties and practical applications of auxins, cytokinins, gibberellins, ethylene and abscisic acid

7. Nitrogen metabolism **8L**

7.1 Introduction

7.2 Biological nitrogen fixation

7.2.1 Symbiotic nitrogen fixation, nitrogenase enzyme- structure and function

7.2.2 Non-symbiotic nitrogen fixation

7.3 Denitrification, ammonification and nitrification

7.4 Reductive amination and transamination

7.5 Role of nitrogen in plants

8. Seed dormancy and germination **4L**

8.1 Definition and types of seed dormancy

8.2 Methods to break seed dormancy

8.3 Metabolic changes during seed germination

9. Physiology of flowering **7L**

9.1 Photoperiodism – Concept, definition, short day plants, long day plants and day neutral plants, photoperiodic induction, phytochrome and flowering

9.2 Phytohormones and initiation of flowering

9.3 Applications of photoperiodism

S. Y. B. Sc. [Botany]

(Semester II, Paper I)

Plant Anatomy and Embryology (48 Lectures)

Plant anatomy:

1. Introduction 2L

Definition, scope of plant anatomy and types of tissues

2. Epidermal tissue system 4L

Structure and function of epidermal tissue system, uniseriate and multiseriate epidermis, stomata: structure, types and functions, epidermal outgrowth: glandular and non-glandular

3. Mechanical tissue system 4L

Principles involved in distribution of mechanical tissues – inflexibility, incompressibility, inextensibility and shearing stress, tissues providing mechanical support, their distribution in leaf, stem and root of dicots and monocots.

4. Vascular tissue system 4L

Structure and function of xylem, phloem and cambium

5. Normal secondary growth 5L

Introduction, cambium and its role, process in stems of *Helianthus annus* and *Annona sqamosa*, extrastelar and intrastelar secondary growth, annual rings, periderm, bark, tylosis and lenticel

6. Anomalous secondary growth 5L

Introduction, causes, anomalous secondary growth in dicot stem (*Bignonia*) dicot root (*Raphanus*) and monocot stem (*Dracaena*).

Plant Embryology

7. Introduction 1L

Definition and scope of plant embryology

8. Microsporangium and male gametophyte 5L

a. Microsporangium: structure of tetrasporangiate anther, types of tapetum, sporogenous tissue.

b. Microsporogenesis: process and its types, types of microspore tetrad.

c. Male gametophyte: structure and development of male gametophyte.

10. Megasporangium and female gametophyte: 7L

a. Megasporangium: structure, types of ovules – anatropous, orthotropous, amphitropous, campylotropous, circinotropous.

b. Megasporogenesis: tenuinucellate and crassinucellate ovules, types of megaspore tetrads.

c. Female gametophyte: structure of typical embryo sac, types of embryo sacs with examples – monosporic, bisporic and tetrasporic.

11. Fertilization: 5L

Mechanism of pollination- entomophily, anemophily, hydrophily, zoophily, germination of pollen grain, double fertilization (syngamy and triple fusion) and its significance.

12. Endosperm and embryo 6L

a. Endosperm: Types – nuclear, helobial and cellular.

b. Embryogeny: structure of dicot and monocot embryo and seed formation.

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3. Greulach V A and Adams J E Plant- An introduction to Modern Biology, Toppen Co. Ltd, Tokyo,
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5. Adriance S Foster Practical Plant Anatomy, D Van Nostrand Co. INC, Newyork
6. Esau, Plant Anatomy, Wiley Toppan Co. California, USA
7. Pijush Roy, Plant Anatomy,New Central Book Agency Ltd, Kolkata
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9. Bhojwani S S and Bhatnagar S P, An Embryology of Angiosperms
10. Maheshwari P, An introduction to Embryology of Angiosperm
11. Nair P K K Essentials of Palynology.

S. Y. B. Sc. [Botany]

(Semester II, Paper II)

Plant Biotechnology (48 Lectures)

1. Introduction 2L

1.1 Biotechnology- Definition, concept and scope

1.2 Interdisciplinary nature of biotechnology

2 . Enzyme Technology 7L

2.1 Introduction, definition and properties of enzymes.

2.2 Classification of enzymes

2.3 Industrial applications of enzymes.

2.4 Production of amylase, proteases and lipase enzyme

2.5 Enzymes immobilization - concept and techniques of immobilization

3. Fermentation Technology. 7L

3.1 Introduction.

3.2 Liquid and solid state fermentations

3.3 Principles of microbial growth

3.4 Bioreactors used in fermentations- stirred tank and tubular tower and digestive tank fermenters

3.5 Media composition for liquid and solid state fermentations

3.6 Industrial applications of fermentation

3.7 Downstream processing- citric acid production.

4. Single cell protein 5L

4.1 Introduction

4.2 Need of proteins in diet

4.4 Production of SCP from algae (*Spirulina*) and fungi (Yeast)

4.5 The economic implications of SCP

4.6 Acceptability of SCP

5. Environmental Biotechnology 6L

5.1 Introduction

5.2 Phytoremediation- definition and concept

5.3 Methods of phytoremediation- Rhizofilteration, phytoextraction, phytostabilization, phytovolatization, phytodegradation,

5.4 Environmental sustainability

6 . Basics of plant genetic engineering 7L

6.1 Introduction and structure of DNA

6.2 Structure of gene in prokaryots and eukaryots- Promoter, coding region and terminator

6.3 General method of gene isolation from the plants-DNA isolation, restriction enzymes, restriction digestion of DNA, DNA electrophoresis, southern hybridization, lygation of DNA fragments

6.4 Gene cloning- vectors used for gene cloning

7. Methods of gene transfer in plants 8L

7.1 Direct gene transfer methods- Electroporation, biolystic gene transfer, liposome mediated transfer.

7.2 Vector mediated gene transfer- *Agrobacterium* mediated gene transfer in plants, Ti-plasmid: structure and functions, Ti plasmid based vectors, advantages.

8. Application of plant genetic engineering in crop improvement. 4L

8.1 Introduction

8.2 Insect pest resistance, abiotic stress tolerance, herbicide resistance, storage protein quality

9. Nano-biotechnology 2L

9.1 Definition and concept

9.2 Applications of nanotechnology in agriculture (fertilizers and pesticides).

REFERENCES:

1. Nanobiotechnology, Concepts, Applications and perspectives, C.M. Niemeyer and C.A. Mirkin ; 2004; WILEY-VCH,.
2. Bionanotechnology: concepts, Lessons from Nature", David.S. Goodsell, 2004 Wiley-Liss
3. Nanobiotechnology Protocols; Sandra J Rosenthal, David W Wright 2005, Humana Press Inc
4. Nanoscale Technology in Biological Systems; R.S. Greco, F.B.Prinz and R.L.Smith 2005 CRC press,.
5. Fundamental Molecular Biology ; Allison LA; 2007
6. Recombinant DNA, Watson et al ; 5th Ed; 2006
7. Techniques for Engineering Genes ; Curell BR et al;2004
8. Techniques for Molecular Biology ; Tagu D & Moussard C; INRA; 2006
9. Gene Cloning and DNA Analysis ; 5th Ed ; Brown TA ; 2006
10. Analysis of Genes and Genomes ; Reece RJ ; Wiley; 2004
11. Recombinant DNA and Biotechnology ; 2nd Ed ; Kreuzer H and Massey A ;ASM;2006
12. Text book of biotechnology, R.C.Dubey, 2009, S.Chand, Delhi

S. Y. B. Sc. [Botany] Paper III

Practicals Based on Theory Paper I and II

a) Taxonomy of Angiosperms and Plant Community

1. Description of flowering plant in botanical terms (01 P)
2. Study of plant families (any four) (03 P)
3. Study of ecological adaptations in Hydrophytes with any two examples (01P)
4. Study of ecological adaptations in Xerophytes with any two examples (01P)
5. Study of vegetation by list count quadrat method. (01P)
6. Study of tools of taxonomy and ecological instruments (any four each) (01P)

b) Plant Physiology

1. Determine water holding capacity (WHC) and pH of soil (pH by pH meter.) (01 P)
2. Study of plasmolysis in suitable plant material (01 P)
3. Determination of Diffusion Pressure Deficit (DPD). (01 P)
4. Determine rate of transpiration under different conditions of Sunlight, Shade and wind (01 P)
5. Demonstration Experiments. (Compulsory Practical) (01 P)
   a. Curling Experiment
   b. Imbibition in seeds
   c. Arc Auxanometer
   d. Effect of auxins on rooting
   e. Transpiration pull
   f. Spectrophotometer
   g. Portable leaf area meter
   h. Conductivity meter
   i. Centrifuge
6. Assessing seed viability by TTC method

c) Plant Anatomy and Embryology (01 P)

1. Study of epidermal tissue system – non-glandular and glandular trichomes, multilayered epidermis, typical stomata (dicot and monocot). (01 P)
2. Study of mechanical tissues and their distribution in root, stem and leaves. (01 P)
3. Study of normal secondary growth in dicot stem – *Annona* /*Moringa*. (Double stained temporary preparation). (01 P)

4. Study of anomalous secondary growth in *Bignonia* and *Dracaena* stem. (Double stained temporary preparation). (01 P)
5. Study of tetrasporangiate anther and types of ovules. (01 P)
6. Study of dicot and monocot embryo. (01 P)

b) Plant Biotechnology

1. Production of citric acid by *Aspergillus niger* and estimation of citric acid by titration method. (02 P)
2. Production of single cell protein production i.e. *Spirulina* / yeast and study of commercial products (01 P)
3. Demonstration of fermentation and fermentation products (01 P)
4. Demonstration of separation of plasmid DNA by agarose gel electrophoresis (01 P)
5. Demonstration of enzyme immobilization (01 P)

N.B. Botanical excursion tour and submission of at least five correctly identified wild plant photographs is compulsory.

Proposed Syllabus from 2015-2016 in Botany
T. Y. B. Sc. Semester III
Paper- I: BO : 331 Cryptogamic Botany
(Algae, Fungi, Bryophytes and Pteridophytes)

1. Introduction: Cryptogams- meaning. Types- Lower Cryptogams and Higher Cryptogams, brief review with examples. **02L.**

Algae: **(11L)**

2. Algae: General characters, economic importance and Classification (Chapman and Chapman, 1973) up to classes. **03L.**

3. Study of life cycle of algae with reference to taxonomic position, occurrence, thallus structure, and reproduction of *Nostoc, Chara, Sargassum* and *Batrachospermum*. **08 L.**

Fungi:

(11L)

4. Fungi: General characters, economic importance and Classification. (Alexopoulos, 1979) up to classes.

5. Study of life cycle of fungi with reference to taxonomic position, thallus structure, and reproduction of *Rhizopus, Saccharomyces, Puccinia* and *Cercospora*. **03L.**

Bryophytes: **08 L.**

6. Bryophytes: General characters, economic importance and Classification. (G.M. Smith, 1955) up to classes. **(12L)**

03L.

7. Study of life cycle of Bryophytes with reference to taxonomic position, thallus structure (Morphology and anatomy), reproduction and sporophyte structure of *Marchantia, Anthoceros* and *Polytrichum*. **09 L.**

Pteridophytes:

8. Pteridophytes: General characters and economic importance and Classification. (K.R. Sporne, 1975) up to classes. **(12L)**

9. Study of life cycle of Pteridophytes with reference to taxonomic position, Morphology, anatomy, reproduction, gametophytes and sporophyte of *Psilotum, Selaginella* and *Marsilea*. **03L**

(Development of sex organs and sporophyte is not expected.) **09 L.**

Reference Books :

1. **Vashistha B. R. et al.,** Botany for degree students-Algae
2. **Das, Datta and Gangulee**-College Botany Vol I
3. **Sharma, O.P.** -Algae
4. **Vashishta B.R. et al.,** Botany for degree students- Fungi
5. **Sharma, P.D.**-The Fungi
6. **Sharma, O.P.**-Fungi
7. **Chopra G.L. and Yadav D.L.** A Text book of Bryophytes.
8. **Parihar, N.S.** An introduction to Embryophyta: Bryophyte-I
9. **Puri Prem.** Brayophytes, Atmaram and Sons. Delhi.
10. **Vashishta B.R.** Botany for degree students Bryophytes- Vol-III
11. **Parihar N.S.** 1991. Bryophyta. Central Book Depot, Allahabad.
12. **Puri P.** 1980. Bryophytes. Atma Ram and Sons, Delhi.
13. **Alexopoulus C.J , Mims C.W. and Blacwel M.I** 1996. Introductory Mycology. John Wiley and Sons Inc.
14. **Kumar H.D.** 1988. Introductory Phycology. Affiliated East-West Press Ltd., New Delhi.
15. **Sporne K.R.** 1991. The Morphology of Pteridophytes. B.I Publishing Pvt. Ltd. Bombay.

Practicals - 06

(Finalize the practicals after discussion in workshop).

1. Study of **Algae** with respect to systematic position thallus structure and reproduction of *Nosotc, Chara, Sargassum and Batrachospermum.*
2. Study of **Fungi** respect to systematic position thallus structure and reproduction of *Rhizopus, Saccharomyces* and *Puccinia.*
3. Study of **Bryophytes** with respect to systematic position thallus structure and reproduction of of *Marchantia, Anthoceros and Polytrichum.*
4. Study of **Pteridophytes** with respect to systematic position, sporophyte - morphology and anatomy, reproductive structures of *Psilotum, Selaginella* and *Marsilea.*
5. Excursion tour.

Paper II: BO.332: CELL AND MOLECULAR BIOLOGY

Chapter 1 Cell Biology: An Introduction **2L**

1. Definition and brief history
2. Units of measurement of cell
3. Prokaryotic and Eukaryotic Cell
4. Cell biology and other Biological Sciences

Chapter 2 Cytoplasmic Matrix **2L**

1. Physical nature of cytoplasmic matrix
2. Chemical organisation- organic and inorganic compounds of cytoplasmic matrix

Chapter 3 Plant Cell- Cytoplasmic Constituents

15L

Morphology, Ultrastructure, Chemical composition, Functions of Cell wall, Plasma membrane, Endoplasmic Reticulum, Golgi apparatus, Lysosomes, Microbodies, Mitochondria, Plastids, Vacuoles, Ribosomes

Chapter 4 Plant Cell- Nucleus and Chromosomes

5L

Nucleus- Morphology, Ultrastructure, Nucleoplasm, Nucleolus, Functions

Chromosome- Number, Morphology, Structure, Karyotype and ideogram, Chemical composition, Euchromatin and Heterochromatin, Giant chromosomes

Chapter 5 Molecular Biology

1L

Definition, History, Scope and Importance, Central Dogma of Molecular Biology

Chapter 6 Nature of Genetic Material

5L

Characteristics of genetic material, Physical and Biological evidences to prove DNA as genetic material, Chargoff's Law, Franklin and Wilkion's Work, Watson and Cricks Model of DNA, Forms of DNA- A, B and Z, C-Value Parodox, RNA as genetic material-TMV

Chapter 7 DNA Replication

3L

Introduction and types, Messelson and Stahl's Experiment, Molecular mechanism of DNA replication

Chapter 8 DNA Damage and Repair

2L

Introduction, Causes and types, DNA repair system- Photoreactivation, Dark excision repair,

Chapter 9 Gene Organization

3L

Promoter-structure and function in prokaryotes and eukaryotes, Terminators, Units of Gene, Enhancers, Split genes, jumping genes

Chapter 10 Transcription

3L

Structure and role of m-RNA, r-RNA, t-RNA, Transcription apparatus, Mechanism of Transcription in Prokaryotes,

Chapter 11 Genetic Code and Translation

4L

Genetic Code- Definition, Concept, Work of Nirenburg and Khorana, Properties of Genetic code, Translation- Definition, Mechanism of translation- Initiation, Elongation and Termination

Chapter 12 Gene Action and Regulation

3L

Relation of Gene and Enzymes- One gene one enzyme hypothesis, regulation of metabolism, Inducible and Repressible enzymes, Gene regulation- in prokaryotes (Lac Operon Model) and eukaryotes (Britten and Davidson's Model)

Practicals:

1. Cytological techniques-preparation of Fixatives, preparation of stains (Aceto-carmine and Aceto-orcein).
2. Study of various stages of mitosis and meiosis
3. Study of Chromosomes Morphology (from colchicines pretreated Onion root tip cells)
4. Maceration technique for study of plant tissues
5. Study of polytene chromosome from Chironomus larvae
6. Plant Genomic DNA extraction from Cauliflower
7. Estimation of Plant DNA by DPA Method
8. Extraction and estimation of RNA by Orcinol Method

References:

1. Cell and Molecular Biology , S. C. Rastogi
2. Cytology, T. S. Verma and V. K. Agarwal

3. Cell Biology, C. B. Pawar
4. Cell and Molecular Biology, P. K. Gupta
5. Fundamentals of Molecular Biology, Veer Bala Rastogi
6. Fundamentals of Molecular Biology, G. K. Pal and Ghaskadabi
7. Cell Biology, Molecular Biology, Genetic, Evolution and Ecology, Verma and Agarwal
8. Cell and Molecular Biology, Robertis and DeRobertis
9. Molecular Cell Biology, 4th Edition, Lodish S. Baltimore
10. Molecular Biology of Gene, Watson J. D.
11. Biochemistry and Molecular Biology of Plants, Buchanan B. B.
12. Molecular and Cell Biology, Wolfe S.L.

Paper III: BO: 333: Genetics and Evolution

1. **Genetics- Introduction**

Definition, Concept of heredity and variations, Branches and Applications of Genetics **1L**

2. **Mendelism**

Genetical terminology, Selection of experimental material , Monohybrid cross, Law of dominance, Incomplete dominance, Law of segregation/law of purity of gametes, Dihybrid cross, Law of independent assortment, Back cross and Test cross **4L**

3. **Interactions of genes**

Non-epistatic genetic interactions- complementary genes (9:7), Duplicate Genes (15:1), Epistatic genetic interactions- Masking genes (12:3:1), Supplementary genes (Recessive epistasis) (9:3:4), Inhibitory genes(13:3), Lethal genes (2:1)-Concept, Inheritance of coat colour in mice, Inheritance of sickle cell anemia **6L**

4. **Multiple alleles**

Definition, Concept, Characters of multiple alleles, Examples of multiple alleles – inheritance of blood group in human, self-incompatibility in **Nicotiana and** eye colour in **Drosophila** **2L**

5. **Linkage and Crossing over**

Linkage- Definition and Types, Crossing over: Definition and Types, Construction of a linkage map by two point test cross and three point test cross **4L**

6. **Quantitative and Cytoplasmic Inheritance**

Concept of quantitative inheritance, Difference between qualitative and quantitative traits, Inheritance of quantitative trait in Maize (Cob length), Cytoplasmic inheritance – Definition and concept, Chloroplast- Varigation in Four O'clock plants, Mitochondria- Petite mutants in yeast **5L**

7. **Sex linked inheritance**

Concept of Sex chromosomes and autosomes, Inheritance of X- linked genes - eye colour in **Drosophila**, Inheritance of colour blindness in humans, Inheritance of Y-linked genes - Holandric genes in humans, Sex influenced genes – baldness in humans Sex-limited genes - feathering in domestic fowl **5L**

8. **Euploidy and Aneuploidy**

Numerical changes in chromosomes- Euploidy and Aneuploidy, Euploidy- Monoploidy, Origin and production, morphology and uses. Polyploidy -Concept and Characteristics of polyploids, Autopolyploidy- Origin and production, effects of autopolyploidy, uses. Allopolyploidy- Concept, synthesized allopolyploidy (wheat and cotton) Evolutionary significance of polyploidy –Aneuploidy, Monosomy and nullisomy- origin and cytology, Trisomy in **Datura** and humans **5L**

9. **Chromosomal Abberations**

Types of structural changes in chromosomes, Deletion: types, cytology and genetic effects, Duplication: types and cytology, position effect and bar eye phenotype in **Drosophila**, Inversion: types and their cytology, Translocation: types, translocation complexes, Variation in chromosome morphology: Isochromosomes, ring chromosomes and Robertsonian translocation

10. **Evolution – Introduction and Theories of Evolution** **4L**

The concept of organic evolution, Theories of Evolution, Pre-Darwinian period- Theory of Inheritance of acquired characters (Lamark's), Darwinism- Theory of Natural Selection, Post-Darwinian period- Modern synthetic theory

11. Evidences of Evolution **3L**

Direct evidences and conclusions from fossil records, Indirect evidences, Evidences from Genetics, Evidences from bio-geographical relations

12. Population Genetics and Evolution **5L**

Concept of Mendelian population, Gene pool and its models, Hardy-Weinberg law of gene frequencies, Factors affecting allelic frequency, Genetic polymorphism

Practicals based on Genetics

1. Study of structural heterozygotes (multiple translocations) in **Rhoeo** 1P
2. Induction of tetraploidy in onion root cells and preparation of squash for observation of tetraploid cells 1P
3. Preparation of salivary gland chromosomes in **Chironomous** larvae 1P
4. Estimation of frequency of PTC taste sensitivity, earlobe and rolling tongue in known population 1P
5. Genetic problems on gene mapping using three point test cross data 1P

Paper IV: BO.334: SPERMATOPHYTA AND PALAEOBOTANY)

GYMNOSPERMS: (12L)

1. Introduction, general characters, economic importance and classification according to Chamberlain (1934). **(2L)**
2. Study of life cycle of *Pinus* and *Gnetum* with reference to distribution, morphology, anatomy, reproduction, gametophyte, sporophyte, seed structure and alternation of generations. **(10 L)**

(Developmental stages of sex organs are not expected)

ANGIOSPERMS (24L)

1) Origin of angiosperms:

Origin with reference to time, place and ancestry-

1) Pteridosperms theory 2) Bennettitalean theory 3) Gnetalean theory **(3 L)**

2. Classification

Review of artificial, natural and phylogenetic systems (general account), **(4 L)** Hutchinson systems with reference to outline and assumptions, merits and limitations, Advanced Phylogenetic Group system-III (APG-III).

3) Study of following families according to Bentham and Hooker's System: (14 L)

With reference to systematic position, distinguishing characters, economic importance, general floral formula, floral diagram of following families: Magnoliaceae, Capparidaceae, Rhamnaceae, Leguminosae (Fabaceae), Asteraceae, Acanthaceae, Apocynaceae, Lamiaceae, Nyctaginaceae, Orchidaceae and Cannaceae

4) Plant identification **(3 L)**

Latin diagnosis and recent trends, use of flora, Practicing indented and bracketed keys, Preparation of artificial keys, Plant authentication.

PALAEOBOTANY : (12 L)

1. Geological time scale, Form genera concept. **(1L)**
2. **Fossil-** Definition, process of fossil formation, types of fossils.-Impression, Compression, Petrifaction, Pith cast and Coal ball. **(3L)**
3. **Study of following fossil groups.** **(08 L)**

a) **Psilopsida-** Salient features of order Psilophytales, external and internal morphology of *Rhynia*.

b) **Lycopsida-** Salient features of order Lepidodendrales, external and internal morphology of *Lepidodendron*,

c) **Sphenopsida-** Salient features of Calamitales, external and internal morphology of *Calamites*

d) **Pteridosperms-** External and internal morphology of *Lyginopteris oldhamia*.

e) **Pentoxylae-** Salient feature, external and internal morphology of stem [*Pentoxylon*], Leaf [*Nipaniophyllum*].

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2. **Stewart W.N. and Rathwell** G.W. 1993. Paleobotany and the Evolution of plants. Cambridge University Press.
3. **Bhatnagar S.P and Moitra Alok** 1996. Gymnosperms. New Age International Pvt. Ltd. Publishers, New Delhi, 470 pp.
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5. **Sporne K.R** 1965. The Morphology of Gymnosperms London, pp. 216.
6. **Bierhorst D.W.** 1971. Morphology of Vascular Plants. New York and London.
7. **Chamberlain C.J** 1934. Gymnosperms-Structure and Evolution, Chicago.
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15. **Parihar N.S.** 1996. Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
16. **Arnold C.R.**-An Introduction to Palaeobotany
17. **E.H.N.Andrews**-Studies in Palaeobotany (Botany for Degree Students Vol.-V)
18. **Shukla A.C.** and **Mishra S.P.**- Essentials of Palaeobotany.

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22. **Heywood V.H** 1967. Plant Taxonomy, London.
23. **Lawrence, G.H.M** 1951. Taxonomy of Vascular Plants.
24. **Lawrence G. H. M** 1955. An Introduction to Plant Taxonomy
25. **Rendle A.B.** 1925. The Classification of flowering plants. 2 Vols. London.
26. **Santapau H.** 1953. The Flora of Khandala on the Western Ghats of India.
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29. **Takhtajan A.** 1969. Flowering Plants; Origin and Disposal.
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31. **Gurucharan Singh 2005-** Plant systematics
32. **Naik V.N. -** Taxonomy of Angiosperms.
33. **Yadav S.R. and Sardesai M.R.-** Flora of Kolhapur District.
34. **Bhagat R.B., Shimpale V.B. and Deshmukh R.B.** Flora of Baramati
35. **Shivrajan V.V.** -Introduction to Principles plant taxonomy
36. **V. V. Sivarajan, N. K. P. Robson** 1991. Introduction to the Principles of Plant Taxonomy II[nd] Edi.
37. **Theodore Cooke (1903)-** The flora of The Presidency of Bombay Vol. I, II, III
38. **Chopra G.L.-** Angiosperms
39. **Datta S.C.-** A Hand Book of Systematic Botany
40. **Priti Shukla** and **Shital Mishra-** An introduction to Taxonomy of angiosperms.
41. **Sharma O.P.** Plant Taxonomy Tata McGraw-Hill Education
42. **Singh, N.P. and S.Karthikeyn** (2000) B.S.I. Calcutta. Flora of Maharashtra State, Dicotyledons. Vol. I and II
43. **Sharma B.D.. Karthikeyan. S. and N P. Singh** (1996) B.S.I., Calcutta Flora of Maharashtra State, Monocotyledons -
44. *Botanical Journal of the Linnean Society*, 2009, 161, 105–121.
45. http://www.mobot.org/MOBOT/research/APweb/

Practical based Gymnosperm Paper IV: BO.334 (1P)

1. Study of *Pinus* with the help of permanent slides and plant material.
i) External morphology, ii) T. S. of stem(Temporary double stained preparation), iii) T. S. of needle(Temporary double stained preparation), iv) Morphology of male cone – T. S. & L. S. Permanent slide, mounting of pollen grains.
v) Morphology of female cone – T. S. & L. S. Permanent slide, vi) Mounting of pollen grains.
vii) V. S. of mature ovule(Permanent slide)
2. Study of *Gnetum* with the help of permanent slides and plant material.
i) External morphology, ii) T. S. of stem
iii) T. S. of leaf (permanent slide), iv) Morphology of male cone
vi) Morphology of female cone
vii) V. S. of mature ovule
3. Study of at least any eight families as per theory course (3P)
4. Identification of plants with the help of regional/local/suitable flora. (1 P)
5. Preparation of an artificial key based on multiple characters/ androecium/gynoecium/ vegetative characters (at least two keys) (1P)
6. Study of the following with the help of slides and/ or specimens.
i) Impression ii) Compression iii) Petrifaction iv) Coal ball v) *Rhynia*
vii)*Lyginopteris viii*) *Pentoxylon* ix) *Nipaniophyllum* x) *Lepidodendron*

Paper –IV BO.335: HORTICULTURE AND FLORICULTURE

Chapter 1 Horticulture- Introduction 4L

Definition, branches, scope and economic importance of horticultural crops, export and import potential of horticultural crops, Horticultural zones of India and Maharashtra, Global and national scenario of horticulture

Chapter 2 Horticultural Plants 4L

Nutritive value of fruits and vegetables, Classification of horticultural crops, Classification of Vegetables, Fruits, Ornamental plants, Spices and Flowers

Chapter 3 Horticulture- Methods of Plant Propagation 6L

A. Sexual propagation- importance, seed viability and treatments
B. Artificial Vegetative Propagation – Importance, Methods- cutting. Layering, grafting and budding.
C. Physiological and Anatomical basis of rooting
D. Role of growth regulators in horticulture

Chapter 4 Special Practices in Horticulture 6L

Training and Pruning- objectives, types, systems of trainings
Fruit crops- Special practices like Bahar treatment, Girdling, Notching, Ringing, Bending, Vegetable crops special practices- Earthing up, Staking, Blanching

Chapter 5 Fruits and Vegetables Production Technology 8L

Introduction, soil and climate requirements, commercial varieties, special practices- harvesting and post harvest management, plant protection methods of following

Fruits- Banana, Mango, Vegetables- Tomato, peas, Beans

Chapter 6 Ornamental Horticulture **5L**

Introduction, Origin and History of Gardens, Famous Indian Gardens, Gardening styles- English garden, Italian Garden, Mughal Garden, Japanese garden, Landscape gardening

Chapter 7 Floriculture **8L**

Introduction, Concept, Definition, Scope and Importance of floriculture, Important floriculture crops and methods of cultivation for cultivation of Aster, Gladiolus, Orchids, Tagetus

Chapter 8 Flower Industry **7L**

A- **Dry Flowers** - Introduction, Indian market of dry flowers, Selection of material, Techniques of drying- Air drying, sun drying, press drying, dessicants, oven and microwave drying methods. Preservation methods, bleaching, dyeing and painting, storage , care of dried flowers, etc.

B- **Cut Flowers** – Introduction, Species and cultivars of Orchids, **Anthuriums** and **Heliconias**, Harvesting - Techniques, mode of harvesting, post harvest handling- conditioning , precooling, pulsing and impregnation, grading, bunching, wrapping packing and cold storage of cut flowers, Indian market of Cut flowers

Practicals

1. Phenology of any two of each: fruit, vegetables and flowering crops
2. Study of garden tools and implements- Sprayer, Duster, Pruning knife, Sprinkler, Micro-irrigation system,
3. Study of garden containers and filling of pots and pits and plantation any one plants of each fruit, vegetable and flowering crops
4. Study of cutting, layering, budding and grafting
5. Study of technique of training and pruning
6. Methods of harvesting of cut flowers and their preservation methods
7. Methods of making dry flowers

- **Visit to any one Nursery unit, Commercial Orchards, fruit market, floriculture Industry and submission of report in Practical Examination**

Reference Books-

1. Horticulture: V. L Sheela, MJP Publications
2. Plant Propagation, Principles and Practices: Hartmann and Koster's
3. Principles of Horticulture and Fruit Growing by Y. N Kunte, M.P Kawathalkar and K.S Yawalkar (Agri- Horticultural Publication House, Nagpur)
4. Arora J. S *Introductory Ornamental Horticulture* Kalyani Publications
5. Bose T. K & Yadav L. P *Commercial Flowers* Naya Prokash
6. Singh B. D *Plant Breeding* Kalyani Publications
7. Chadha K. L & Pareek O. P *Advances in Horticulture* Vol. IV Malhotra Publications
8. Sudheer K. P and Indira V *Post Harvest Technology of Horticultural Crops* New Delhi Publications
9. Adams C. R. Principles of Horticulture, 4th Edt. Elsevier Publication, 2004

PAPER V: BO 336 - COMPUTATIONAL BOTANY

13. Introduction to Biostatistics **3L**

a. Definition
b. Statistical terms : Population, sample, primary and secondary data, qualitative and quantitative data, parameter and statistics, attributes, variables, discrete and continuous variables, statistical error, linear and non-linear functions of statistics, frequency, and its distribution
c. Scope, applications and uses of biostatistics

14. Sample and sampling **4L**

a. Definition
b. Sampling unit, sample and population
c. Types of sampling
   i. Random sampling – with replicates, without replicates, systematic sampling, stratified sampling
   ii. Non-random sampling- Purpose, quota sampling
d. Need of randomness
e. Achieving randomness
   i. Lottery methods
   ii. Use of random number table
f. Merits and limitations of sampling

15. Collection and representation of data **5L**

a. Classification of data
   i. Meaning and need of classification
   ii. Objectives of classification

iii. Classification according to class interval
iv. Overlapping and non-overlapping frequency table

b. Methods of representation of statistical data
   i. Essential features of tabular presentation
   ii. Advantages of tabular presentation
   iii. Graphic representation of data and its advantages
   iv. Types of graphic representation
      1. Histogram
      2. Frequency polygon
      3. Frequency curve
      4. Scatter or dot diagram
   v. Merits and limitations of graphic representation
   vi. Diagrammatic representation of data
      1. Line diagram
      2. Bar diagram
      3. Pie diagram

16. Measures of central tendency of grouped and ungrouped data **4L**

a. Simple arithmetic mean, its merits and limitations
b. Averages of position: Median and mode, their merits and limitations

17. Measures of dispersion

a. Meaning of dispersion **4L**
   i. Range: Computation in individual, discrete and continuous series, coefficient of range, merits and limitations
   ii. Mean deviation and standard deviation: computation for grouped and ungrouped data, merits and limitation
   iii. Variance: Definition, coefficient of variance

18. Correlation and regression

a. Definition and types of correlation **4L**
b. Coefficient of correlation and its properties
c. Methods of studying correlation: Scatter diagram and Karl Pearson's coefficient of correlation
d. Coefficient of determination (r^2)
e. Regression analysis
   i. Definition and types of regression
   ii. Linear regression

19. Probability and types of theoretical probability distribution **4L**

a. Concept of probability
b. Binomial distribution
c. Poisson distribution
d. Normal distribution
   i. Normal distribution curve
   ii. Relationship between normal curve area and standard deviation
   iii. Properties of normal distribution curve

20. Tests of significance of mean **4L**

a. Introduction
b. Statistic and its standard error
c. Meaning of statistical hypothesis, level of significance, null hypothesis and alternative hypothesis
d. Student's 't' test: unpaired and paired test
e. χ^2 test as a test of goodness of fit and its significance

21. Computation of seed testing and plant growth indices **10L**

a. Seed germination and early seedling growth.
   i. Germination percentage
   ii. Mean germination time (MGT)
   iii. Germination index (GI)
   iv. Germination speed (GS)
   v. Vigor index (VI)

b. Seed germination and early seedling growth under stress
   i. Promptness index (PI)
   ii. Germination stress tolerance index (GSI),
   iii. Plant height stress tolerance index (PHSI)
   iv. Root length stress tolerance index (RLSI)
   v. Dry matter stress tolerance index (DMSI)

c. Plant growth indices
   i. Absolute Growth Rate (AGR)
   ii. Crop Growth Rate (CGR)
   iii. Relative Growth Rate (RGR)
   iv. Leaf Area Index (LAI)

10. Analysis of data on vegetation studies **6L**

a. Data obtained from quadrates and transects methods
   i. Frequency
   ii. Percent frequency
   iii. Relative frequency

iv. Density
v. Relative density
vi. Abundance
vii. Dominance

b. Computation of crop/vegetation biomass using satellite data
i. Simple Ratio (SR) or Ratio Vegetation Index (RVI)
ii. Difference Vegetation Index (DVI),
iii. Normalised Difference Vegetation index (NDVI) or greenness index

NOTE – For Biostatistics, emphasis be given on methodology and numerical problem solving rather than derivations and proofs.

Practicals

1. Computation of mean, mode, median, variance and standard deviation from the given data
2. Representation of data by various graphical methods 1P
3. Statistical problem solving based on Student's 't' test and χ^2 test 1P
4. Statistical problem solving based on data for correlation and regression 2P
5. Germination of various seed lots and analysis of data with various seed germination indices 2P
6. Analysis of vegetation data obtained from list count quadrat method for frequency, density, abundance, relative dominance and importance value index. 1P
7. Analysis of satellite data collected on biomass for RVI, DVI, NDVI, TNDVI, and PVI. 1P

OR

Projects (Equivalent to 6 practicals)

1. Study effect of agrochemicals/ mutagens/ plant extracts/ fertilizers/etc/ on seed germination and early seedling growth, analyze data statistically. **OR**
2. Study varietal variation to abiotic stress based on seed germination and early seedling growth analyze data statistically. **OR**
3. Study vegetation by list count quadrat / line/belt transect method and analyze data statistically. **OR**
4. Collect satellite data on vegetation/biomass and compute RVI, DVI, NDVI, TNDVI, and PVI.

References:

1. Introduction to biostatistics, Pranab Kumar Banerjee.
2. Fundamentals of biostatistics, Khan and Khanum
3. Methods in Biostatistics for medical students and research workers, B K Mahajan
4. ABC of Research Methodology and Applied Biostatistics, M N Parikh and Nithya Gogtay
5. Biostatistics in brief, K Viswesara Rao
6. Introduction to Biometry, S G Purohit, V D Ranade and A V Dusane
7. Biostatistics-Basic Concepts and Methodology for the Health Sciences, Wayne W Daniel
8. Basic statistics, B L Agarwal
9. Biostatistics – Principle and Practice, B Antonisamy, Soloman Chrostopher and P Prasanna Samuel
10. Introduction to biostatistics and research methods, PSS Sundar Rao and J Richards
11. Drought stress in peanut, Lambert Publication , Laware And Shinde

SEMESTER IV

Paper I: BO. 341: PLANT PHYSIOLOGY AND BIOCHEMISTRY

Plant Physiology

1) **Photosynthesis:** Structure of a chloroplast, photosynthetic pigments and their role, Photosystems, Light reaction, electron transport chain, Cyclic and Non-cyclic photophosphorylation, Path of carbon in photosynthesis - Calvin cycle, HSK pathway: Salient features of C4 plants, metabolic pathway, CAM pathway, Photo-respiration, Significance of photosynthesis. **(10)**

2) **Respiration:** Structure of a mitochondrion, Respiratory substrates, Types of respiration, Mechanism of aerobic respiration – Glycolysis, TCA cycle. Electron transport system, Chemi-osmotic hypothesis of ATP synthesis, Balance sheet of ATP generation in respiration. Significance of respiration. **(7)**

3) **Translocation of organic solutes:** Definition, Path of translocation, Evidences for phloem transport, Mechanism of translocation – Pressure flow theory, Diffusion, Source to sink relationship, Phloem loading and unloading. **(4)**

4) **Stress Physiology :** Concept of abiotic , biotic and xenobiotic stresses. Types of stresses – Salinity, drought. Effect of stresses on the plant growth. **(3)**

Biochemistry

1) **Carbohydrates:** Definition and classification Properties and functions of carbohydrates. Synthesis and breakdown of starch. **(4)**

2) **Amino acids and proteins:** Definition, synthesis and properties of amino acids. Role of amino acids. Classification of proteins on the basis of structure, properties and functions of proteins. **(5)**

3) **Lipids:** Definition , classification, properties and functions of lipids. Synthesis of lipids, β-oxidation. **(4)**

4) **Enzymology:** Definition and nature of enzymes, active site, Classification (IUB) and properties of enzymes, Co-enzymes. Mechanism of enzyme action- Lock and key hypothesis, Induced fit theory. Factors affecting enzyme activity – pH, temperature, substrate concentration, enzyme concentration. Enzyme inhibitors – Competitive, uncompitative, non-competitive. **(6)**

5) **Secondary Metabolites:** Definition, Types, Metabolic pool and biosynthesis of secondary metabolites through – malonic, mevalonic and shikkimic acid pathways. Role of secondary metabolites. **(5)**

References: -

S. N. Pandey and B. K. Sinha (2014). Plant Physiology, Vikas Publishing House Pvt. Ltd., India.

Buchanan B.B, Gruissem W. and Jones R.L (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists Maryland, USA.

Salisbury F.B and Ross C.W (1992). Plant physiology (Fourth Edition) Wadsworth Publishing Company, California,USA.

William G. Hopkins (1995) Introduction to Plant Physiology, Published by – John Wiley and Sons, Inc.

Lincoln Taiz and Eduardo Zeiger (2003). Plant Physiology (3rd edition), Published by – Panima Publishing Corporation

R. G. S. Bidwell (revised edn.)-Plant Physiology

Verma S.K. and Verma Mohit (2007). A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.

Leninger A.C (1987). Principles of Biochmistry, CBS Publishers and Distributers (Indian Reprint)

Dennis D.T., Turpin, D.H. Lefebvre D.D. and Layzell D.B. (eds) 1997. Plant Metabolism (Second Edition) Longman, Essex, England.

Galstone A.W. 1989. Life processes in Plants. Scientific American Library, Springer Verlag, New York, USA..

Moore T.C. 1989. Biochemistry and Physiology of Plant Hormones Springer – Verlag, New York, USA.

Singhal G.S., Renger G., Sopory, S.K. Irrgang K.D and Govindjee 1999. Concept in Photobiology; Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi

Taiz L. and Zeiger E. 1998. Plant Physiology (Second Edition). Sinauer Associates, Inc. Publishes, Massachusetts, USA.

Verma S.K. and Mohit Verma 2007. A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.

Practicals based on Paper I: BO. 341: Plant Physiology and Biochemistry:-

1. Estimation of chlorophyll-a and chlorophyll-b by spectrometric or colorimetric method.
2. Separation of photosynthetic pigments by TLC/Paper chromatography.
3. To determine diurnal fluctuation in TAN values of CAM plants.
4. Estimation of soluble proteins by Lowery *et. al.* method.
5. Separation of amino acids by paper chromatography.
6. Demonstration of
   a. Ringing experiment for path of solute translocation.
   b. Hill reaction

c. Qualitative tests for alkaloids, tannins, glycosides, starch, lipids and proteins.

d. Enzyme activity: catalase

Paper II: BO.342: PLANT ECOLOGY AND BIODIVERSITY

Plant Ecology (24L)

1. Ecology

Introduction, Interrelationship between the living world and the environment, components and dynamism of Ecosystem, homeostasis. **(8L)**

Impact of human activities on environment – Causes, Prevention and control of – Air, water and Soil Pollution

Brief account of environmental toxicology – Eutrophication, bioaccumulation and biomagnifications

2. Environmental Crisis

Desertification, Ozone depletion and Global warming **(3L)**

3. Environmental Impact Assessment

Process, objectives of EIA, Hierarchy in EIA, Historical Review of EIA, Concepts related to EIA, Basic data collection for EIA **(3L)**

4. Environmental Audit

Meaning, need, Audit Protocol, Proccessing, Certification, personnel environmental Audit. **(3L)**

5. Ecology and Economics

Man and Biosphere concept.

Relation between ecology and economics **(3L)**

6. Remote Sensing

Definition, basic principles,

Process of data acquisition and interpretation, **(4L)**

Global positioning System

Application of Remote Sensing in ecology.

Biodiversity (24L)

Introduction to Biodiversity **(02 L)**

Introduction, Concept, Aims and objectives,

Scope and values of Biodiversity. **(05 L)**

Characterization of Biodiversity:

Introduction, need for characterization, various disciplines of Biodiversity- Genetics, Species and Ecosystem. Concept of endemism and phytogeography. **(03 L)**

Biodiversity Loss:

Loss of Species and Genetic Diversity: Introduction, Factors causing loss of species and genetic diversity, Founder Effects, Genetic Drift, Inbreeding Depression, IUCN Categories (RET plants) **03 L)**

Inventorying and Monitoring of Biodiversity:

Introduction, Necessity, planning and approaches to inventorying and monitoring, capacity building. **(11L)**

Conservation of Biodiversity:

Current Practices in Conservation,

In-situ Conservation: International efforts and Indian initiatives; protected areas in India, Concept of Biosphere Reserves and National Parks.

Ex-situ Conservation: Germplasm Collections, Botanical Gardens, Seed Banks, Gene Banks, Pollen Banks, DNA Banks, Wetlands, mangroves and coral reefs.Enlist national agencies playing role in conservation (BSI, NBPGR, ICAR, CSIR, DBT),

Social Approach to Biodiversity Conservation: Sacred Groves, Sthalavrikshas, Chipko Movement, Role of Universities and other Educational Institutions in Biodiversity Conservation

References:

1. **M. Anji Reddy** Textbook of Remote sensing and GIS (Third edition, 2006) by BS Publication,Hyderabad

2. **George Joseph** Fundamentals of remote sensing (Second edition, 2005) by Universities press (India) Private Ltd., Hyderabad.
3. **John R. Jensen** Remote sensing of the environment (2000), Dorling Kindersley India Pvt. Ltd,
4. Current sciences special issue remote sensing for national development Volume 61 numbers 3 and 4 August 1991
5. **Larry W. Canter**," Environment Impact Assessment", McGraw-Hill Book Company, New York
6. **G.J. Rau and C.D**. Weeten, "Environmental Impact Analysis Hand book, McGraw Hill, 1980.
7. **E.P. Odum. 1996**. Fundamentals of Ecology. Natraj Publishing, Dehradun.
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11. **Kumar.H.D. 1997**. General Ecology. Vikas Publishing Pvt. Ltd., Delhi.
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15. **Smith L.R. and Mith T.M. 1998**. Elements of Ecology. (4th edition). An imprint of Addison Wesley, Longman ink., California.

1. **K.V. Krishnamurthy** (2003). An Advanced Textbook on Biodiversity- Principles and Practice, Oxfordand IBH Publ. New Delhi
2. **Michael J. Jeffries** (2005). Biodiversity and Conservation, Routledge, London
3. **ShailajaRavindranath and SudhaPremnath** (1997). Biomass Studies – Field Methods for Monitoring Biomass Oxford and IBH, New Delhi.
4. **William J. Sutherland**(1997). Ecological Census Techniques – A Handbook Cambridge Uni. Press.
5. **Magurran Anne** (1988). Ecological Diversity and Its Measuremcnt Chapman and Hall India
6. **Michael P.** (1984). Ecological Methods for field and Laboratory investigations TMH Co. ltd. Bombay.
7. **Uma Shaanker, R. Ganeshiah, KN. and Bawa KS** (2001), (Eds). Forest Genetic Resources: Status, Threats and Conservation Strategies Oxford and IBH, New Delhi
8. **Heywood and Watson** (1995), Edt. Global Biodiversity Assessment UNEP, Cambridge UniversityPress.
9. **Global Biodiversity: Status of the Worlds Living Resources** (1992); WCMC; Chapman and Hall,London
10. **David Hill, Matthew Fasham, Graham Tucker, Michael Shewry and Philip Shaw** (2004) Edt. Handbook of Biodiversity Methods – Survey, Evaluation and Monitoring; Cambridge
11. **Handbook of the Convention on Biological Diversity** (2001), Secretariat of the Convention onBiological Diversity. Earthscan publ., London
12. **Avise J.C.** (1994),Molecular Markers, Natural History and Evolution; Chapman and Hall, London
13. **Barbier E.B., Burgess J.C. and Folke C.** (1994). Paradise Lost? The Ecological Economics of Biodiversity; Earthscan, London
14. **Hajra P.K. and V. Mudgal** (1997) Edt. Plant Diversity Hotspots in India – An Overview, BSI
15. **John E.Weaver and F.E. Clement** (1938). Plant Ecology McGraw-Hill.
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19. **Gadgil M. and Guha R** (1992). This Fissured Land: An Ecological History of India Oxford UniversityPress, New Delhi
20. **Ashish Kothari** (1997)Understanding Biodiversity- Life, sustainability and Equity; Orient Longman

Practicals-Plant Ecology

1. Study of polluted water body with ref. to BOD.
2. Study of physicochemical properties of water body by using Sacchi disc, pH meter and electric conductivity meter.
3. Acquisition of ecological data of particular locality by using GPS/ altimeter/geographicloa maps etc
4. Study of suitable ecosystem by line/belt transect method/ nested quadrate method.
5. Visit to near by locality to study biodiversity and submission of report

Practicals-Biodiversity

1. Study and application of diversity indices to suitable ecosystem/ area.
2. To measure the latitude, longitude and altitude by using GPS

3. Visit to near by conservation institutes/sacred groove and report writing.

PAPER III BO.343:: PLANT PATHOLOGY

1 Fundamentals of plant pathology **5 L**

Introduction, Important terminology- Incitants, Host, Parasite, Pathogen, Inoculum, Penetration, Infection, Incubation, Disease, Disease development, Symptoms, Sign, Endophyte, Predisposition, Suscept, Resistance, Epidemic, Etiology. Economic importance of plant diseases, History of plant pathology, Introduction to Indian Agricultural Research Institute (IARI), International Crop Research Institute for Semi Arid Tropics (ICRISAT), Contribution of Anton DeBary and Prof. B.B. Mundkur.

2 Disease Development **6 L**

Concept of disease cycle, Inoculation, Prepenetration, Penetration, Infection, Dissemination. Epidemics- Forms, Decline,, Exponential model. Disease forecasting, Measurement of plant disease and yield loss.

3 Defence Mechanisms **3 L**

Concept and Definition, Types- Preexisting- Structural and chemical, Induced- Structural and Biochemical

4 Methods of Studying Plant Diseases **5 L**

Macroscopic study, Microscopic study, Koch"s postulates. Culture technique, Media Types and Preparation, Pure culture methods- streak plate, Pour plate, spread plate, Serial dilution.

5 Fungal Plant Diseases **5**
L

Introduction to fungi as plant pathogens. Study of Diseases- Club root of Crucifers, Downy mildew of Grapes, Head smut of Jowar, Leaf spot of Turmeric, Tikka disease of Groundnut with reference to causal organism, symptoms and signs, disease cycle and control measures.

6 Bacterial Plant Diseases **3**
L

Introduction to bacteria as plant pathogens, Study of Diseases- Citrus Canker, Black arm of Cotton with reference to causal organism, symptoms and signs, control measures.

7 Mycoplasma Plant Diseases **3**
L

Introduction to Mycoplasma as plant pathogens, Study of Diseases- Grassy shoot disease of sugarcane, Little leaf of brinjal with reference to symptoms and signs, control measures.

8 Nematodal Plant Diseases **2**
L

Introduction to Nematodes as plant pathogens. Study of Diseases- Root knot disease of vegetables, Ear cockle of Wheat with reference to causal organism, symptoms and signs, control measures.

9 Viral Plant Diseases **3**
L

Introduction to Viruses as plant pathogens. Study of Diseases- Tobacco Mosaic Disease, Bunchy top of Banana with reference to causal organism, symptoms and signs, control measures.

10 Non Parasitic Diseases **4**
L

The impact and abiotic causes- Temperature, Soil moisture and relative humidity, Poor oxygen, Poor light, Air pollutants, mineral deficiencies. Herbicide injury, Study of Tip burn of Paddy, Mango necrosis, Black Heart of Potato, Khaira disease of rice.

11 Principles of Plant Disease Control **5**
L

General account, Quarantine, Eradication, cultural control practices, Biological control, Curative measures, Chemical control, Use of Effective Microorganism Solution (EMS), Microbial Pesticides, IPM

12 Molecular Diagnostics and Transgenic in Crop Protection
4 L

Introduction, Classical approaches, Use of antibodies, Pathogen derived resistance against bacterial and fungal diseases, Expression of vaccines in plants.

Practicals

1. Preparation of any one culture media for isolation of plant pathogens.
2. Study of Koch's Postulates
3. Culture technique - Streak plate methods, Pour plate methods, Spread plate and Serial dilution method for preparation of pure culture.

4. Study of any two of each fungal, bacterial and mycoplasma diseases.
5. Study of any two viral and non-parasitic diseases of plants.
6. Study of any two of each fungicides and microbial pesticides

- Visit to any Agricultural Research Institute and Plant Pathology Laboratory and submission of report

References:

1. Fungi and Plant Diseases by B. B. Mundkur
2. Plant Pathology, R. S. Mehrotra
3. Principles of Plant Pathology, R. S. Singh
4. Plant Pathology, P. D. Sharma
5. Plant Disease, R. S. Singh
6. Plant Pathology, Mandal and Dasgupta
7. Plant Pathology, G. N. Agrios
8. Agricultural Microbiology, Rangaswamy and Bhagyaraj
9. Fundamentals of Plant Pathology by Ravi Chandra
10. Methods of Microbial and Plant Biotechnology, L. N. Nair
11. Molecular Plant Pathology, 2003. Dickinson, Bios Scientific Publication, London, New York

Paper IV: BO.344: MEDICINAL AND ECONOMIC BOTANY

Medicinal Botany (36L)

1. Introduction to Pharmacognosy

1.1. Origin, history, definition and scope of Pharmacognosy, **(3L)**

1.2. Methods of classification and their significance in the study of drugs of natural origin (alphabetical, biological, chemical, taxonomical, chemotaxonomical and pharmacological)

2. Ayurvedic Pharmacy

2.1 Introduction

2.2 Tridosha concept, Humoral, Indigenous Systems of medicine (Ayurveda, Siddha, Unani,Tibi, Chinese etc.) **(8L)**

2.3 Ayurvedic principles- Ras. Guna, Vipaka, Virya, Prabhava,

2.4 Ayurvedic formulations –Asava, Arishta, Kvatha, Churna, Ksharas, Leha, Vatika, Taila, Bhasma,

3. Analytical Medicinal botany **(6L)**

3.1 Drug adulteration

3.2 Methods of extraction (percolation, maceration, soxchlet extraction etc.) of different classes of phytochemicals from crude drugs.

3.3 Methods of drug evaluation- Morphological, Microscopic, Chemical and Physical methods.

4. Cultivation, collection and processing of herbal drugs from Mentha and Eucalyptus. **(3L)**

4.1 Cultivation- Methods, Factors affecting cultivation

4.2 Collection and Processing- Collection, harvesting, drying, garbling, packing, storage of crude drugs. **(6L)**

5. Study of medicinally important drugs

Study of drugs w.r.t. occurrence, distribution cultivation, microscopic characters, constituents and uses of the following.

Root Rhizome drugs :- *Glycyrrhiza,*
Stem drugs: - *Ephedra,*
Leaf drugs: - *Adhatod,*
Flower drugs: - Clove,
Fruit drugs: - Amla,
Unorganized drugs :- Shilajit and *Acacia* gum,
Contraceptive drugs: - *Dioscorea.* **(8L)**

6. Applied Medicinal Botany

6.1 Study of drugs with respect to Biological source, Geographical distribution, common varieties, macro and microscopic characters, chemical constituents and therapeutic uses, adulterants of the following plants/drugs *Strychnosnux vomica*-Seeds, *Tinospora cordifolia*-Stem

6.2 Concept of active principle, and major metabolic Pathway (Carbohydrates and Proteins) leading to the Production of therapeutically active Chemical Constituents

6.3 Concept, definition and introduction to Biopharmaceutics, Pharmacodynamics and clinical Pharmacokinetics with applications **(2L)**

7. Ethnobotany : Definition, principles, scope and ethnic societies in India. **(2L)**

Economic Botany (12L)

1. Introduction to economic botany and its scope

2. Important Botanical resources- meaning and Mention of only botanical resources any five for non-wood forest products (NWFPs) such as **(4L)**

2.1Paper making and 2.2 Gums

3. Origin, evolution, source & uses of Rice, *Curcma longa,* Safflower, Sugarcane, *Butea monosperma/Samanea saman/ Scleichera oleosa and* Rose. **(6L)**

References:-

1. A Pharmacognosy and Pharmacobiotechnology. New Age international (P)Limited, Publishers (formerly wileyEasterm Limited)
2. **Bruncton J.**: Pharmacognosy, Phytochemistry, Medicinal Plants: Intercept Limited.

3. **Harborne, J. B.** (1973): Phytochemical Methods: A guide to Modern Techniques of plant Analysis. Chapman A ad Hal, London
4. **Khandelwal K. R.**(2008): Practical Pharmacognosy Techniques and Experiments; NiraliPrakashan, Pune.
1. **Kokate C.K. (2014)**Practical Pharmacognosy, Vallabhprakashan, New Delhi, 5th edition
2. **Kokate C.K. Purohit A.P. and Gokhale S.B.** Pharmacognosy, NiraliPrakashanpune
3. **Trease G.E. and Evans. W.C.** Pharmacognosy ELBS Twelfth Edition
4. **Tyler V.E Brady L. R and Robbers J.E. (1976).**Pharmacognosy Lea and Febiger. Philadelphia.8th edition KM Varghese and Co.Mumbai,
5. **Vaidya S.S. and Dole.V.A.** Bhaishyajakalpana, AnmolPrakashan, pune
6. **Wallis,T.E. (2003)**Test books of pharmacognosy CBS publishers and distributors New Delhi (Latest Edition)
7. **T. E. Wallis, J. & A. Churchill** Ltd., London, 1960. Textbook of Pharmacognosy
8. **Annonymus** The AyurvedicPharmacopia of India Volume-I and IV, Govt. of India, Ministry of Health and Family Welfare, Department of Ayush Page 41.
9. **P.L. Kochhar(1987)** Tropical Crops: A Textbook of Economic Botany (Macmillan international college edition)
10. **Albert F. Hill. (1952)** Economic Botany: A Textbook of Useful Plants and Plant Products McGraw-Hill
11. **Vernma V (2009)**. Textbook of Economic botany
12. **N.D. Prajapati (2010)**A Handbook of Medicinal Plants: A Complete Source Book
13. **Himadri Panda(2002)** The Complete Technology Book On Natural Products (Forest Based)
14. **Pharmacognosy and Phytochemistry** -- Vinod Rangari.

Practicals based Paper VI: BO:346: Medicinal and Economic Botany

1. Study of any six drug plants from theory syllabus (Macroscopic and Microscopic). (2P)
2. Demonstration of Plant extraction methods -Cold and Soxhlet extraction and TLC of any one drug studied in theory. (1P)
3. Study and preparation of ayurvedic formulations - Asav, Arishtha, Churna (1P)
4. Qualitative analysis of Alkaloid, Glycoside and Tannin (1P)
5. Study of stomatal index and vein islet number using suitable plant material using micrometer and camera Lucida. (1P)
6. Survey of local flora with respect their medicinal and economic importance and submission of 10 dry specimens.

Paper V: BO. 345 PLANT BIOTECHNOLOGY

1. Introduction to Biotechnology **5L**

Introduction and History of plant Biotechnology

Pioneering work and significant achievements in Indian plant Biotechnology

Global Impact and Current excitements of plant Biotechnology - Plant Health care and plant protection. **15L**

2. Plant Tissue Culture

Brief History, Importance of plant tissue culture

Types of culture, basic technique of plant tissue culture, Concept, technique and applications of callus culture, cell suspension culture, protoplast culture, somatic hybridization and cybrids, Haploid production, Micropropagation, embryo culture-and embryo rescue **4L**

3. Germplasm and Cryopreservation

In situ and **Ex situ** conservation, techniques of cryopreservation, cold storage, low pressure and low oxygen storage, applications **6L**

4. Transgenic Plants as Bioreactors

Metabolic engineering of starch, cyclodextrins, fructans, Bioplastics, Genetically engineered plants as protein factories, Production of therapeutic proteins from plants. **6L**

5. Biotechnology of Biological Nitrogen Fixation

Non symbiotic Nitrogen Fixation-Diazotrophs and their ecology, special features,

Mechanism of N_2 Fixation

Nitrogenase and Hydrogenase

Symbiotic N2 Fixation- establishment of symbiosis,

Factors affecting and mechanism of symbiotic N2 Fixation

Genetics of Diazotrophs- Nod genes, Nif gene

Biofertilizers- algal, fungal, phosphate solubilising and organic fertilizers

6. Biotechnology and Society **4L**

Biotechnology- Benefits, GM foods and its safety, patenting of biotechnological inventions, Biotechnology and developing countries, Recombinant foods and religious beliefs, recombinant therapeutic product for human health care, Intellectual property rights

7. Bioinformatics

Introduction, Database and its classification, NCBI, Data retrieval tools, INTREZ, OMIN, BLAST, FASTA, Applications of Bioinformatics **4L**

8. Genomics and Proteomics

Genomics- methods, types and applications, Proteomics- Concept, types and importance **4L**

Practicals

1. Preparation of MS Medium
2. Callus Induction using maize embryo
3. Study of application of biofertilizers- Algal, Fungal, Bacterial, Phosphate Solubilizers and Organic Fertilizers
4. Estimation of Nitrate Reductase enzyme from Legume nodules
5. Study of Transgenic plants- Bt Cotton, Bt Brinjal, Bt Tomato, Golden Rice

- Visit to NCBI and Report preparation

Reference Books:

1. R. C. Dube (2008)- A Text Book of Biotechnology, S. Chand
2. P.K. Gupta-Elements of Biotechnology
3. Satyanarayana-Biotechnology
4. Kalyan Kumar De-Plant tissue culture
5. Pal J.K. and Ghaskadabi S.S. (2008) Fundamentals of Molecular Biology.
6. Verma and Agrawal- Molecular Biology
7. Devi P.2008-Principle and Methods of plant Molecular Biology, Biochemistry and Genetics Agrobios, Jodhpur, India.
8. Glick B.R. and Tompson J.E. 1993 Methods in Plant Molecular Biology and Biotechnology CRC Press Boca Raton, Florida.
9. Hall R.D. (Ed.) 1999 Plant cell culture Protocol human press Inc., New Jersey, USA
10. Kumar H.D. 2002 A Text Book of Biotechnology 2nd Edn. Affiliated Easyt-West Press Private Ltd New Delhi.
11. Ramawat K.G. 2003 Plant Biotechnology, S. Chand & Co. Ltd . Ramnagar New Delhi. 110055
12. Trivedi P.C.2000 Plant Biotechnology, Panima Publishing Carpation, New Delhi.
13. Rajdan- Plant tissue culture.

Paper VI: BO346: PLANT BREEDING AND SEED TECHNOLOGY **(24 L)**

PLANT BREEDING **(2 L)**

1. Introduction, scope and importance **(10 L)**

2. Conventional techniques, methods and practices of breeding

(a) Plant introduction and acclimatization

i. Concept, objectives
ii. Types of plant introduction
iii. Advantage, limitations/ Disadvantages and achievements.

(b) Selection methods

i. Concept,
ii. Types of selections –mass selection, pure line selection and clonal selection.
iii. Advantage and disadvantages/limitations, achievements.

(c) Hybridization
i. Definition and Concept,
ii. Difficulties in crop hybridization and precaution to be taken during hybridization
iii. General procedure of hybridization
iv. Parent selection in a breeding program
v. Criteria for selecting parents

Breeding Methodology
i. Pedigree method
ii. Bulk method
iii. Single-seed descent method
iv. Backcross method, Achievements

(d) Heterosis and hybrid vigour
i. Concept
ii. Causes of heterosis- dominance hypothesis
iii. Applications

3. Alternative breeding techniques

(a) Mutation breeding **(08 L)**
Introduction and concept
Types of Mutation
induced mutagenesis
mutagens used -Chemical and physical mutagens
methods of working
Gamma gardens, concept and design
Applications

(b) **Importance of Polyploidy and aneuploidy in crop improvement**
Properties of polyploids,
Methods of obtaining polyploids
Methods used in obtaining haploids
Production of triploids in plant breeding
Applications and achievements

4. **Breeding for stress tolerance**
Mechanisms and genetic bases of resistance/tolerance to biotic and abiotic stresses in plants, **(4L)**
Breeding for resistance/tolerance.
Molecular Approaches
Characteristics evaluated for drought tolerance
Characteristics evaluated for insect/pest tolerance
Achievements

SEED TECHNOLOGY **(24L)**

1. Introduction: **(2 L)**
Definition of seed,
Stages of Seed Production,
Classes of Seed (nucleus seed, breeders seed, foundation seed, certified seed and truthful seed),
Role of seed technology.

2. Seed certification: **(2 L)**
General procedure of seed certification,
field inspection,
observation during inspection,
field count,
Duties of seed inspector.

3. Seed processing: **(2 L)**
Concept
Principle and techniques of processing of seeds

4. Seed sampling, storage and packaging **(6 L)**
Seed sampling,
Types of seed samples,
Sampling equipments.
Factor affecting seed storage and need of seed storage,
Methods of protection and control,
Air conditioning and dehumidification,
Sanitation and fumigation of seed stores.
Seed sorting and bagging, bag weighing, bag closing, type of bag closer,
Labelling and maintaining lot identify, lot numbers, seed pellets,
Handling and stacking,
Maintenance of seed processing record.

5. Physical purity analysis **(3L)**
Definition of purity components
Procedure
ODV test
Reporting and results.

6. Seed Testing

A. Moisture Testing

By air oven method (3L)
Moisture meters.

B. Germination testing

Definition and objectives, (3L)
General principles and requirements,
Procedure and methods (Paper, Sand and Soil)
Seedling evaluation.

7. Seed Marketing:

(3L)

Marketing- Basic concepts, supply & demand, price equilibrium, seed transportation, storage, cost & returns, cost processing, packing and marketing, Organization for seed marketing, seed markets in India, structure & working.

Practicals based on Plant Breeding and Seed technology

1. Demonstration of Hybridization Techniques.
2. Effect of chemical mutagens on seed germination and seedling growth.
3. Demonstration of chlorophyll mutation in M2 generation. (Photographs)
4. Polypolidy induction in *Allium cepa* by colchicine.
5. Seed moisture testing by hot air oven method.
6. Demonstration of seed sampling equipments with the help of photographs.
7. Visit to seed processing unit / Seed marketing organization.

References:-

1. **Sadova David** – 2004 (First Indian Edition). Cell Biology, New Delhi.
2. **Giese Arthur** 1979 (Fifth Edition). Cell Physiology, Toppan company Ltd., Tokyo, Japan.
3. **Roy S.C and KKDe** 2005 (Second Edition). Cell Biology, New central Book Agency Private Ltd., Kolkata.
4. **Verma P.S and Agarwal V.K** 2006 Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S.Chand and Company, New Delhi.
5. **Gerald Karp** 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and Scne Ine., USA.
6. **Verma and Agarwal** – Seed Technology Demand forecasting, Seed pricing, projection of supply and demand for different kind of seeds
7. **Gardner and Simmons Snustad** 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.

Kopargaon Taluka Education Society's
K.J. Somaiya College of Arts, Commerce & Science,
Kopargaon, Dist. Ahmednagar.
B.C.A (Science) Department.

List of Courses addresses crosscutting issues as per Syllabus (2019 Pattern)

Sr. No.	Programme Name	Course code	Name of Course	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	BCA(SCI)	BCA 111	Fundamentals of Computer	Professional Ethics
2	BCA(SCI)	BCA 112	Problem Solving and C Programming	Professional Ethics
3	BCA(SCI)	BCA 113	Applied Mathematics	Professional Ethics
4	BCA(SCI)	BCA 114	Business Communication	Professional Ethics
5	BCA(SCI)	BCA 115	Fundamentals of Computer Laboratory	Professional Ethics
6	BCA(SCI)	BCA 116	C Programming Laboratory	Professional Ethics
7	BCA(SCI)	BCA 117	Applied Mathematics Laboratory	Professional Ethics
8	BCA(SCI)	BCA118	Business Communication Laboratory	Professional Ethics
9	BCA(SCI)	BCA121	Computer Organization	Professional Ethics
10	BCA(SCI)	BCA122	Advanced C Programming	Professional Ethics
11	BCA(SCI)	BCA123	Operating Systems Concepts	Professional Ethics
12	BCA(SCI)	BCA124	Database Management Systems – I	Professional Ethics
13	BCA(SCI)	BCA125	Computer Organization Laboratory	Professional Ethics
14	BCA(SCI)	BCA126	Advanced C Programming Laboratory	Professional Ethics
15	BCA(SCI)	BCA127	Operating Systems Laboratory	Professional Ethics
16	BCA(SCI)	BCA128	Database Management Systems -I Laboratory	Professional Ethics
17	BCA(SCI)	BCA231	Data Structures	Professional Ethics
18	BCA(SCI)	BCA232	Database Management Systems – II	Professional Ethics
19	BCA(SCI)	BCA233	Computer Networks	Professional Ethics
20	BCA(SCI)	BCA234	Data Structures Laboratory	Professional Ethics
21	BCA(SCI)	BCA235	Database Management Systems - II Laboratory	Professional Ethics
22	BCA(SCI)	BCA236	Computer Networks and Web Programming Laboratory	
23	BCA(SCI)	307	AECC-I Environmental Sciencel	Professional Ethics
24	BCA(SCI)	308	AECC-II Language Communication - I	Professional Ethics
25	BCA(SCI)	BCA241	Object Oriented Programming and C++	Professional Ethics
26	BCA(SCI)	BCA242	Web Technology	Professional Ethics
27	BCA(SCI)	BCA243	Software Engineering	Professional Ethics
28	BCA(SCI)	BCA244	C++ Programming Laboratory	Professional Ethics
29	BCA(SCI)	BCA245	Web Technology Laboratory	Professional Ethics
30	BCA(SCI)	BCA246	Python Programming Laboratory	Professional Ethics
31	BCA(SCI)	407	AECC-III Environmental Science-II	Professional Ethics
32	BCA(SCI)	408	AECC-IV Language Communication – II	Professional Ethics
33	BCA(SCI)	BCA351	DSE I (Programming in Java)	Professional Ethics

34	BCA(SCI)	BCA352	DSE II (Data Mining and Data Science)	Professional Ethics
35	BCA(SCI)	BCA353	DSE III (Principles of Operating Systems)	Professional Ethics
36	BCA(SCI)	BCA354	SEC I (Artificial Intelligence)	Professional Ethics
37	BCA(SCI)	BCA355	SEC II (Cloud Computing)	Professional Ethics
38	BCA(SCI)	BCA356	DSE I Lab (Programming in Java)	Professional Ethics
39	BCA(SCI)	BCA357	DSE II Lab (Data Mining)	Professional Ethics
40	BCA(SCI)	BCA358	DSE III Lab (Operating Systems and AI)	Professional Ethics
41	BCA(SCI)	BCA361	DSE IV Android Programming	Professional Ethics
42	BCA(SCI)	BCA362	DSE V Programming in GO	Professional Ethics
43	BCA(SCI)	BCA363	DSE VI Software Project Management	Professional Ethics
44	BCA(SCI)	BCA364	SEC III Management Information Systems	Professional Ethics
45	BCA(SCI)	BCA365	SEC IV Internet of Things (IoT)	Professional Ethics
46	BCA(SCI)	BCA366	DSE IV Lab (Android Programming)	Professional Ethics
47	BCA(SCI)	BCA367	DSE V Lab (Programming in GO and IoT)	Professional Ethics
48	BCA(SCI)	BCA368	DSE VI Project Lab	Professional Ethics

List of Add-on/Value Added/ Certificate Courses

Sr. No.	Department	Name of Certificate Course	Course Code	Year of Offering	Addressed issue(Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	BCA(SCI)	Web Programming	CC.004	2019-20	Professional Ethics

Head of Dept.
HOD
Dept.of BCA(Science)
K.J.Somaiya College,Kopargaon

IQAC coordinator
Co ordinator
IQAC, K. J. Somaiya College
Kopargaon, Dist. A.Nagar

Principal
Principal
K. J. Somaiya College of Arts
Commerce & Science, Kopargaon

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA111: Fundamentals of Computer

Teaching Scheme:	Credits	Examination Scheme:
Theory: 04 Hrs/Week	04	Continuous Evaluation: 30 Marks End-Semester : 70 Marks

Pre-requisite Course: None

Companion Course: BCA115: Fundamentals of Computer Laboratory

Course Objectives:

- To study the basics of Computer System
- To learn how to configure computer devices
- To Learn Basic Commands of Operating system and application software
- To understand Open Source Software

Course Outcomes:

At the end of the course, students will be able to

- Define working of computers and peripherals, types of software and languages
- Troubleshoot the computer systems and use utility software
- Choose commands and features of operating systems and application software
- Use open source software

Course Contents

Unit I **Introduction to Computer System** **08 Hrs**

Introduction– Characteristics of Computers, Basic structure and operation of a computer, functional units and their interaction, Types of computers and features- Mini Computers, Micro Computers, Mainframe Computers, Super Computers, Laptops and Tablets,
Types of Programming Languages- Machine Languages, Assembly Languages, High Level Languages
Translators- Assembler, Compiler, Interpreter
Data Organization- Drives, Directories and Files
Number Systems - Introduction to Binary, Octal, Hexadecimal system, Conversion, Addition, Subtraction, Multiplication, Division

Unit II **Computer Peripherals** **08 Hrs**

Primary storage devices – RAM, ROM, PROM, EPROM

Secondary Storage Devices – HDD, CD, DVD, Pen drive

I/O Devices- Keyboards, Scanners, Digitizers, Plotters, LCD, Plasma Display,

Pointing Devices –Mouse, Joystick, Touch Screens

Introduction to Network devices – Hubs, Switches, Routers, NAS, MODEM, Access Points

Unit III **Computer Software** **08 Hrs**

Types of software: System Software, Application Software.

System Software: Operating System. Types of O.S., Basic Commands in Linux – ls, pwd

Introduction to GUI: Desktop Icons, File and Directory structure, Menu Items, Control Panel, File and Directory Search
Utility programs: Anti-plagiarism software, Anti-virus, Disk Cleaning, Defragmentation, Compression/Decompression of files.
Application software: Examples of commercial software with brief introduction

Unit IV **Editors, Word Processors, Spreadsheets & Presentation Tools** **08 Hrs**

Editors and Word Processors: Features and functionalities, examples of basic and advanced editors like notepad, vi and Emacs, Introduction to desktop publishing – Features and functionalities
Spreadsheets: Features and functionalities, Spreadsheet Applications
Introduction to Google Apps: Google Docs, Sheets and Forms and its applications
Presentation Tools: Design Slides (using Text, images, charts, clipart), Slide Animation, Template and theme creation

Unit V **Open Source Software** **08 Hrs**

Introduction: Open Source, Free Software, Free Software vs. Open Source software, Public Domain Software, Problems with traditional commercial software, Open Source Development Model and Licenses, History, Initiatives, Principles, methodologies and Philosophy
Open Source Operating Systems: GNU/Linux, Android, Free BSD, Open Solaris. Technologies, Development tools, IDEs, LAMP
Example Open Source Projects: Apache web server, GNU/Linux, Android, Mozilla (Firefox), Wikipedia, Drupal, Wordpress, GCC, github, Open Office.

Unit VI **PC Hardware & Trouble Shooting** **08 Hrs**

Introduction to Computer Hardware - Motherboard, CPU, Basic Input and Output Setting (BIOS), Network Interface Card (NIC), Graphics card
Logical Fault Isolation – ADJUST method, Common Networking Problems, Tools for gathering information, Troubleshooting PC hardware

Reference Books:

1. P.K. Sinha &Priti Sinha, "Computer Fundamentals", 3rd edition, BPB pub.
2. Sumitabha Das, "Unix Concepts and Applications", Tata McGraw Hill Education
3. Join Josh, "PC/HARDWARE" O'Reilly Publication.
4. Open Source Initiative: https://opensource.org/
5. Wikipedia: https://en.wikipedia.org/
6. Github: https://help.github.com/

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA112: Problem Solving and C Programming

Teaching Scheme:	Credits	Examination Scheme:
Theory: 04 Hrs/Week	04	Continuous Evaluation: 30 Marks End-Semester : 70 Marks

Pre-requisite Course: None

Companion Course: BCA116 C Programming Laboratory

Course Objectives:

- To provide a broad overview of problem solving techniques
- To learn C programming to solve problems

Course Outcomes:

At the end of the course, students will be able to

- Define algorithms and explain their characteristics
- Formulate algorithm and draw flow chart to solve a given problem
- Explain use of appropriate data types, control statements
- Demonstrate ability to use top-down program design

Course Contents

Unit I	Problem solving, algorithms and flowcharts	08 Hrs

Types of Problems, Problem solving using computer, Difficulties with problem solving, Problem solving aspects.
Definition & Characteristics of algorithm, Examples of algorithms, Flow charts with examples, Top-down design
Problem solving using Arithmetic Statements, Conditional Statement & Iterative Statements such as Addition/Multiplication, check number is positive/negative, Maximum of 2 numbers & 3 numbers, sum of first n numbers, sum of given n numbers, reverse digits of a number, check whether the number is palindrome, check number is prime, factorial of number, factors of number, GCD, LCM of numbers etc.

Unit II	C Fundamentals	08 Hrs

Introduction to C, Features of C, Structure of C Program, C Character Set, Identifiers and Keywords, Variables and constants
Data types- Basic data types, Enumerated types, Type casting, Declarations,
Operators and Expressions Unary and Binary arithmetic operators, Increment Decrement operators
Relational and logical operators, Bit wise operators, Assignment operators, Comma operator, size of operator, Ternary conditional operator, Precedence and associativity

Unit III	Input Output Statements	08 Hrs

printf, scanf functions, getchar, putchar, getch functions, gets, puts functions, Escape sequence characters, Format specifiers

Unit IV	Control & Iterative Structures	08 Hrs

If, If- Else Statements, Nested If Statements, Conditional Branching – switch statement, Loop (while, do…while, for), break, continue, goto statements

Unit V	Functions	08 Hrs

Introduction to Functions, Function Arguments, Library & User defined functions, Methods for parameter passing, Recursion, Storage Classes – Auto, Static, Global and Register

Unit VI	Arrays	08 Hrs

Introduction, Array Declarations, Bounds Checking, Single dimension Arrays, Two dimension Arrays, Arrays & Function

Reference Books:

1. Cormen, Leiserson, Rivest, Stein, "Introduction to algorithms"
2. Brian W. Kernighan, Dennis M. Ritchie , "The C Programming Language", ISBN:9788120305960, PHI Learning
3. R.G. Dromey, "How to Solve it by Computer", ISBN: 9788131705629, Pearson Education
4. Behrouz A. Forouzan, RichardF. Gilberg, "A Structured Programming Approach Using C", ISBN:9788131500941, Cengage Learning India
5. E. Balaguruswamy, "Programming in ANSI C", ISBN: 9781259004612, Tata Mc-Graw Hill Publishing Co Ltd.-New Delhi
6. Maureen Spankle, "Problem Solving and Programming Concepts", ISBN: 81-317-0711-3
7. Y S Kanetkar, "Let Us C", BPB Publications

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA113: Applied Mathematics

Teaching Scheme:	Credits	Examination Scheme:
Theory: 04 Hrs/Week	04	Continuous Evaluation: 30 Marks End-Semester : 70 Marks

Pre-requisite Course: Basic Mathematics

Companion Course: BCA117 Applied Mathematics Laboratory

Course Objectives:

- Learn basic terminology formal logic, proofs, sets, relations, functions and perform the operations associated with same
- Use formal logic proof and logical reasoning to solve problems
- To understand significance of statistical measures
- To study Correlation, Probability and sampling theory

Course Outcomes:

On completion of the course, students will be able to–

- Relate and apply techniques for constructing mathematical proofs and make use of appropriate set operations, propositional logic to solve problems
- Use function or relation models to interpret associated relationships
- Apply basic counting techniques and use principles of probability
- Given a data, compute various statistical measures of central tendency
- Use appropriate Sampling techniques

Course Contents

Unit I **Set Theory and Logic** **08 Hrs**

Sets– Set Theory, Need for Sets, Representation of Sets, Set Operations, cardinality of set, **Types of Sets** – Bounded and Unbounded Sets, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, power set, **Propositional Logic-** logic, Propositional Equivalences, Application of Propositional Logic-Translating English Sentences, Proof by Mathematical Induction and Strong Mathematical Induction.

Unit II **Relations and Functions** **08 Hrs**

Relations: Properties, n-ary Relations and Applications, Representing Relations , Closures of Relations, Equivalence Relations, Partial Orderings, partitions, Hasse Diagram, Lattices, Chains and Anti-Chains, Transitive Closure and Warshall's Algorithm

Functions- Surjective, Injective and Bijective functions, Inverse Functions and Compositions of Functions.

Unit III **Counting** **08 Hrs**

The Basics of Counting, rule of Sum and Product, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, The Pigeonhole Principle.

Unit IV **Data Presentation and Aggregation** **08 Hrs**

Data Types: attribute, variable, discrete and continuous variable, **Data presentation:** frequency distribution, histogram, ogive, box-plot, bar plots

Mean, Median, Mode, and Other Measures of Central Tendency: Arithmetic Mean (AM), Weighted Arithmetic Mean, Arithmetic Mean Computed from Grouped Data, Concept of Median, Mode, Geometric Mean (GM), Harmonic Mean (HM), Quartiles, Deciles, and Percentiles

Standard Deviation and Other Measures of Dispersion: Standard Deviation, Root Mean Square, Variance, Absolute and Relative Dispersion

Unit V **Correlation Theory and Sampling** **08 Hrs**

Moments, Skewness and Kurtosis: Moments, Computation of Moments for Grouped Data, Skewness, Kurtosis, Computation of Skewness and Kurtosis.

Correlation: Bivariate data, scatter plots, Linear Correlation, Correlation of Attributes, Coefficient of correlation

Linear regression: Concept, The Least-Squares Method, Regression Lines

Elementary Sampling Theory : Sampling Theory, Random Samples and Random Numbers, Sampling With and Without Replacement, Stratified Sampling

Unit VI **Probability & Hypothesis Testing** **08 Hrs**

Probability : Random experiment, sample space, events types and operations of events, Probability definition, Axioms (The four Elementary Theorems) of probability (without proof), Conditional probability, 'Bayes' theorem (without proof), Examples, Mathematical Expectations

Standard Distributions: Continuous and discrete, PDF/PMF, Introduction and properties (without proof) for binomial, normal, Standard Normal, chi-square, t, F distributions.

Introduction to Hypothesis testing

Reference Books:

1. Kenneth H. Rosen, Discrete Mathematics And Its Applications, Tata Mcgraw-Hill, Isbn 978-0-07-288008-3, 7th Edition.
2. Trivedi, K.S., " Probability, Statistics, Design Of Experiments And Queuing Theory, With Applications Of Computer Science", Prentice Hall Of India, New Delhi
3. C L Liu, "Elements Of Discrete Mathematics", Tata Mcgraw-Hill, Isbn 10:0-07-066913-9.
4. Kulkarni, M.B., Ghatpande, S.B. And Gore, S.D., "Common Statistical Tests" Satyajeet Prakashan, Pune
5. J.N. Kapur And H.C. Saxena, "Mathematical Statistics", S. Chand Publications, 20th Ed.
6. John P. D'angelo & Douglas B. West, "Mathematical Thinking–Problem Solving And Proofs" Prentice Hall, 2nd Ed.

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA114: Business Communication

Teaching Scheme:	Credits	Examination Scheme:
Theory: 04 Hrs/Week	04	Continuous Evaluation: 30 Marks End-Semester : 70 Marks

Pre-requisite Course: Basic writing Skills including grammar

Companion Course: BCA118 Business Communication Laboratory

Course Objectives:

- To understand the concept, process and importance of communication.
- To develop an integrative approach where reading, writing, presentation skills are used together to enhance ability to communicate and write effectively.
- To create awareness about Methods and Media of communication.
- To improve job seeking skills.

Course Outcomes:

On completion of the course, students will be able to–

- Apply business communication strategies and principles to prepare effective communication for domestic and international business situations
- Identify ethical, legal, cultural, and global issues affecting business communication.
- Participate in team activities using collaborative work skills.
- Communicate via electronic mail, Internet, and other technologies.
- Deliver an effective oral business presentation

Course Contents

Unit I	Introduction to Communication	08 Hrs

Introduction to Communication, Meaning and Definition, Process of communication and importance, Principles of effective communication, Types of Communication, Scope of Business communication - Internal & External, Barriers to Communication, Linguistic Barriers, Psychological Barriers, Interpersonal Barriers, Cultural Barriers, Physical Barriers, Organizational Barriers , Overcoming the barriers

Verbal Communication - Written Communication-Advantages & Limitations (writing a Cover Letter, Memo, Agenda, Notice & Minutes), Oral Communication - Principles of effective oral communication - Techniques of effective speech, Media of oral communication (Face-to-face conversation - Teleconferences - Press Conference - Demonstration - Radio Recording - Dictaphone - Meetings - Demonstration and Dramatization - Public address system - Grapevine - Group Discussion - Oral report – Advantages and Limitations

Non-Verbal Communication - Body Language (Positive & Negative Gestures)handshakes, gazes, smiles, hand movements, styles of working, voice modulations, body sport for interviews; business etiquettes; business dining, business manners of people of different cultures, managing customer care

Unit II	Listening Skills	08 Hrs

Importance, Types of Listening, Barriers to Effective listening, Difference between listening and hearing – active listening, academic listening, listening for details - listening and note-taking, listening for sound contents of videos, listening to talks and descriptions, listening for meaning - listening to announcements (railway/ bus stations/ airport / stadium announcement etc.) ,Listening to Radio and Television, listening to news programmes, Tips for effective listening, 10 Commandments of listening

Unit III	Speaking and Presentation Skills	08 Hrs

Interactive nature of communication, importance of context ,formal and informal –set Expressions in different situations ,greeting – introducing - making requests - asking for /giving permission - giving instructions and directions – agreeing / disagreeing - seeking and giving advice - inviting and apologizing telephonic skills - conversational manners

Presentation as a skill - prerequisites of effective presentation, format of presentation; Assertiveness – indicators of assertive behaviour, strategies of assertive behavior; elements of presentation strategies – audience – objectives medium- key ideas - structuring the material - organizing content - audio-visual aids - hand-outs - use of power point - clarity of presentation - non-verbal communication -seminar paper presentation and discussion

Communication skills for group discussion and interviews

Unit IV	Business Correspondence	08 Hrs

Need of Business Correspondence , Components and layout of Business letter, Drafting of letters: Enquiry, Quotation, order , Complaints and follow up , Recovery , Email etiquette, notices, circulars, memos

Preparing agenda and writing minutes of meetings, Making notes on Business conversations

Effective use of SMS and Case writing and Documentation, Persuasive letter, Proposal, Report Writing

Preparing Press Release and Press Notes, Job application letter , Essentials of an impressive Resume

Unit V	Creativity and Capacity Building	08 Hrs

Creativity at Workplace: Introduction, Current Workplaces, Creativity, Motivation, Nurturing Hobbies at Work, The Six Thinking Hat Method Ethical Values: Ethics and Society, Theories of Ethics, Correlation between Values and Behavior, Nurturing Ethics, Importance of Work Ethics, Problems in the Absence of Work Ethics

Capacity Building: Learn, Unlearn and Relearn: Capacity Building, Elements of Capacity Building, Zones of Learning, Ideas for Learning, Strategies for Capacity Building

Unit VI	Soft Skills	08 Hrs

Leadership and Team Building: Leader and Leadership, Leadership Traits, Culture and Leadership, Leadership Styles and Trends, Team Building, Types of Teams,

Decision Making and Negotiation: Introduction to Decision Making, Steps for Decision Making, Decision Making Techniques, Negotiation Fundamentals, Negotiation Styles, Major Negotiation Concepts

Stress and Time Management: Stress, Sources of Stress, Ways to Cope with Stress

Reference Books:

1. McGrath, E.H., "Basic Managerial Skills for All", PHI, New Delhi
2. Gajendra S. Chauhan, Sangeeta Sharma, "Soft Skills: an Integrated Approach to Maximise Personality", Wiley India
3. Hamp-Lyons and etal, "Study Writing", 2nd Edition, Cambridge University Press, 2008.
4. Barun K. Mitra , "Personality Development and Soft Skills", Oxford Press
5. S.A. Sherlekar , "Modern Business Organization", Himalaya Publishing"

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA115: Fundamentals of Computers Laboratory

Teaching Scheme:	Credits	Examination Scheme:
Practical: 03 Hrs/Week	1.5	Continuous Evaluation: 15 Marks End-Semester :35 Marks

Companion Course: BCA111: Fundamentals of Computers

Course Objectives:

- To understand installation process to install operating system and applications
- To learn various features of application software

Course Outcomes:

On completion of the course, students will be able to–

- Install operating system and execute various commands
- Effectively use various features of application software
- Create and use spreadsheets effectively
- Prepare effective Presentation

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include University syllabus, conduction & Assessment guidelines.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign
Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of student. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Topics for Laboratory Assignments

Sr. No.	Assignment
1	Operating System Commands
2	Spreadsheet
3	Presentation Tool
4	Utility programs, anti-plagiarism software etc
5	Word Processing using Open Office
6	Google Apps, Wordpress, Drupal, Wiki, Github etc

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA116: C Programming Laboratory

Teaching Scheme:	Credits	Examination Scheme:
Practical: 03 Hrs/Week	1.5	Continuous Evaluation: 15 Marks
		End-Semester :35 Marks

Companion Course: BCA112 Problem Solving & C Programming

Course Objectives:

- To learn formulation of algorithm for a given problem
- To study various data types, arrays and functions in C
- To understand input-output and, control and iterative statements in C

Course Outcomes:

On completion of the course, students will be able to–

- Formulate an algorithm and draw flowchart for the given problem
- Implement the given algorithm in C
- Write programs using appropriate data types and control structures in C

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include University syllabus, conduction & Assessment guidelines.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign
Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of student. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Sr. No.	Assignment
1	Assignment on use of data types, simple operators (expressions)
2	Assignment on decision making statements (if and if-else, nested structures)
3	Assignment on decision making statements (switch case)
4	Assignment on use of while loops
5	Assignment on use of for loops
6	Assignment on nested loops
7	Assignment on exit, goto, continue, break
8	Assignment on menu driven programs.
9	Assignment on writing C programs in modular way (use of user defined functions)
10	Assignment on call by value
11	Assignment on call by reference
12	Assignment on recursive functions
13	Assignment on use of arrays (1-D array) and functions
14	Assignment on use of multidimensional array (2-D arrays) and functions
15	Assignment on Standard Library Function

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA117: Applied Mathematics Laboratory

Teaching Scheme:	Credits	Examination Scheme:
Practical: 03 Hrs/Week	1.5	Continuous Evaluation: 15 Marks
		End-Semester: 35 Marks

Companion Course: BCA113 Applied Mathematics

Course Objectives:

- To provide knowledge about applying theoretical concepts of applied mathematics and statistics to solve problems
- To provide hands-on experience on statistical package

Course Outcomes:

On completion of the course, student will be able to

- Apply mathematical and statistical concepts to solve problems
- Use R to perform statistical operations and data visualization

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include University syllabus, conduction & Assessment guidelines.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign

Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of student. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Suggested List of Laboratory Assignments

Applied Mathematics: 2 Assignments each based on following topics

1	Set Theory
2	Logic, Mathematical Induction
3	Relations
4	Functions
5	Counting

Statistics (Assignments may be performed using R)

1	Download and Install R, understand IDE
2	Using R execute the basic commands, array, list and frames.
3	Create a Matrix using R and Perform the operations addition, inverse, transpose and multiplication operations.
4	Using R Execute the statistical functions: mean, median, mode, quartiles, range, inter quartile range histogram
5	Using R, drawing scatter Plots, Line Plots, Bar Plots etc
6	Using R import the data from Excel / .CSV file and Perform operations
7	Using R import the data from Excel / .CSV file and Calculate the standard deviation,
8	Using R import the data from Excel / .CSV file and draw the skewness
9	Import the data from Excel / .CSV and perform the Chi-squared Test.

References:

- Richard Cotton, "Learning R", SPD O'Reilly Publications

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA118: Business Communication Laboratory

Teaching Scheme:	Credits	Examination Scheme:
Practical: 03 Hrs/Week	1.5	Continuous Evaluation: 15 Marks
		End-Semester: 35 Marks

Companion Course: BCA114 Business Communications

Course Objectives:

- To study different ways for effective listening, writing, reading and presentation
- To learn tools used in business communication

Course Outcomes:

On completion of the course, student will be able to

- Effectively listen to lectures, public announcements and news on TV and radio.
- Engage in telephonic conversation.
- Communicate effectively and accurately in English
- Use spoken language for various purposes
- Demonstrate ability to prepare documents used in business correspondence

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include University syllabus, conduction & Assessment guidelines.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of student. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Suggested List of Laboratory Assignments

1	Listening Comprehension Exercise
2	Reading Comprehension & Vocabulary Exercise
3	Role Play I
4	Telephone Conversation
5	Face to Face Conversation
6	Introducing Yourself
7	Thumbnail Portrait
8	Writing Skills - Covering Letter, Resume , Application letter, Report Writing, Proposal Writing ,Email Communication
9	Presentation Skills
10	Group Discussions
11	Mock Interviews
12	Public Speaking activity
13	Leadership Skills and Team Building Activity

References:

- D. Sudha Rani , "Business Communication and Soft Skills Laboratory Manual"

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA121: Computer Organization

Teaching Scheme:	Credits	Examination Scheme:
Theory: 04 Hrs/Week	04	Continuous Evaluation: 30 Marks End-Semester : 70 Marks

Pre-requisite Course: BCA111 Fundamentals Of Computer

Companion Course: BCA125: Computer Organization Laboratory

Course Objectives:

- To study number system, logic gates
- To understand combinational and sequential circuits
- To provide a broad overview of architecture and functioning of computer systems
- To learn the basic concepts behind the architecture and organization of computers.

Course Outcomes:

On completion of the course, student will be able to–

- Design of combinational circuits
- Design of sequential circuits
- Explain block diagram of CPU, Memory and types of I/O transfers

Course Contents

Unit I	Data representation and Computers Arithmetic	08 Hrs

Review of Decimal, Binary, Octal, Hexadecimal Number system and their inter-conversion, BCD code, Gray code, Excess-3 code, ASCII , EBCDIC, Unicode, Concept of parity code. Signed and Unsigned numbers, 1's and 2's complement of binary numbers, Binary arithmetic (Addition, subtraction and subtraction using1's complement and 2's complement).

Unit II	Boolean Algebra & Logic Gates	08 Hrs

Introduction, Logic (AND OR NOT), Boolean theorems, Boolean Laws, De Morgan's Theorem, Reduction of Logic expression using Boolean Algebra, Deriving Boolean expression from given circuit, exclusive OR and Exclusive NOR gates, Universal Logic gates, Implementation of other gates using universal gates

Minterm, Maxterm and Karnaugh Maps:

Introduction, minterms and sum of minterm form, maxterm and Product of maxterm form, Reduction technique using Karnaugh maps – 2/3/4 variable K-maps, Grouping of variables in K-maps, K-maps for product of sum form, minimize Boolean expression using K-map and obtain K-map from Boolean expression

Unit III	Combinational Circuits	08 Hrs

Introduction - Multi-input, multi-output Combinational circuits, Code converters design and implementations

Arithmetic Circuits: Introduction, Adder, BCD Adder, Excess – 3 Adder, Binary Subtractors, BCD Subtractor, Multiplier, Comparator

Multiplexer, Demultiplexer, ALU, Encoder and Decoder: Introduction, Multiplexer, De-multiplexer, Decoder, ALU, Encoders

Unit IV	Sequential circuits	08 Hrs

Introduction, Terminologies used, S-R flip-flop, D flip-flop, JK flip-flop, Race-around condition, Master – slave JK flip-flop, T flip-flop, conversion from one type of flip-flop to another, Application of flip-flops.

Counters:

Introduction, Asynchronous counter, Terms related to counters, IC7493 (4-bit binary counter), Synchronous counter, Bushing, Type T Design, Type JK Design, Pre-settable counter, IC 7490, IC 7492,

Synchronous counter ICs, Analysis of counter circuits.

Shift Register:

Introduction, parallel and shift registers, Ring counter, Johnson counter

Unit V	CPU, Memory and I/O Organization	08 Hrs

Block diagram of CPU, functions of CPU, general register organization, flags, Concept of RISC and CISC, Introduction to hardwired and micro-programmed CPU.

Memory System hierarchy, Cache Memory, Internal Memory, External Memory, Concept of Virtual Memory.

Input/ Output: types of I/O data transfers - CPU initiated, Interrupt initiated and DMA, Need of I/O interfaces, Parallel and serial communication (asynchronous and synchronous data transfer).

Unit VI	Introduction to Microprocessors and Microcontrollers	10 Hours

Block diagram of Pentium, Functional units, Concept of pipeline and parallelism, Programmers model

Introduction to Microcontroller Intel 8051 – Functional block diagram, Introduction to multi-core processors.

Reference Books:

1. R.P. Jain, "Modern Digital Electronics", McGraw-Hill Publications
2. Flod and Jain, "Digital Fundamentals", Pearson Publication.
3. Morris Mano, "Computer System Architecture" Prentice-Hall.

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA122: Advanced C Programming

Teaching Scheme:	Credits	Examination Scheme:
Theory: 04 Hrs/Week	04	Continuous Evaluation: 30 Marks End-Semester : 70 Marks

Pre-requisite Course: BCA112: Problem Solving and C Programming

Companion Course: BCA126: Advanced C Programming Laboratory

Course Objectives:

- To learn advanced features in C Programming
- To study advanced data types
- To understand built-in library functions

Course Outcomes:

On completion of the course, student will be able to–

- Write programs using pointers, structures and unions
- Use Pre-processor directives
- Manipulate strings using library functions
- Write programs to perform operations on Files

Course Contents

Unit I	Preprocessor	08 Hrs

Concept, Format of preprocessor directives, File inclusion directives (#include), Macro substitution directives (#define), nested macros, parameterized macros,

Macros versus functions, #error / #pragma directives, Conditional compilation (#if/#ifdef/#else/#elif/#endif), Predefined macros (_DATE_ / _TIME_ /_FILE_ /_LINE_ /_STDC_)

Unit II	Pointers	08 Hrs

Concept – reference & dereference, Declaration, definition, initialization & use, Types of pointers,

Pointer Arithmetic, Multiple indirection,

parameter passing – call by value and call by reference

Arrays & Pointers - Pointer to array, Array of pointers,

Functions & pointers - Passing pointer to function, Returning pointer from function, Function pointer, Pointers &const

Dynamic memory management, Allocation, Resizing, Releasing, Memory leak / dangling pointers

Unit III	Strings	08 Hrs

Concept, Declaration, definition, initialization, format specifiers, String literals/ constants & variables – reading & writing from & to console, Importance of terminating NULL character, Strings & pointers

Array of strings & array of character pointers, User defined functions, predefined functions in string.h - strlen , strcpy , strcat , strcmp , strcmpi , strrev , strlwr , strupr , strset , strchr , strrchr , strstr , strncpy , strncat , strncmp , strncmpi , strnset , strtok, Command line arguments – argc and argv

Unit IV	Structures	08 Hrs

Concept, Declaration, definition, initialization, accessing structure members (. operator), Array of structures, Pointers to structures, Declaring pointer to structure
Accessing structure members via pointer to structure, Structures & functions,
Passing each member of structure as a separate argument, Passing structure by value / address
Nested structures, typedef & structures,

Unit V	Advanced Features	08 Hrs

Unions - Concept, Declaration, definition, accessing union members, Difference between Structures & unions, structures within union, union within structures, pointers and unions, nested unions, enumerated data types, Bit fields, Concept, need, use, multi-file programs

Unit VI	File Handling	08 Hrs

Concept of streams, need, Types of files, Operations on text & binary files, Random access file, library functions for file handling – fopen, fclose, fgetc, fseek, fgets, fputc etc

Reference Books:

1. The C Programming Language (Second Edition) – By B. W. Kerninghan& D. M. Ritchie
2. Programming in C – A Practical Approach – By Ajay Mittal (Pearson Publications)
3. Programming with C – By Byron S Gottfried (Schaum's Outlines)
4. A structural Programming Approach using C – By BehrouzForouzan& Richard Gilberg
5. Y S Kanetkar, "Let Us C", BPB Publications

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA123: Operating Systems Concepts

Teaching Scheme:	Credits	Examination Scheme:
Theory: 04 Hrs/Week	04	Continuous Evaluation: 30 Marks End-Semester : 70 Marks

Pre-requisite Course: BCA111 Fundamentals of Computers

Companion Course: BCA127 Operating Systems Laboratory

Course Objectives:

- To Understand the basic concepts of operating system
- To study Architecture, File systems and basic operating system commands
- To Use of editors and Networking commands.
- To learn Shell Programming and shell scripts.

Course Outcomes:

On completion of the course, student will be able to–

- explain basic concepts of operating system
- use basic Linux commands and Linux documentation
- write shell scripts

Course Contents

Unit I	Introduction	08 Hrs

Introduction to Operating Systems, Different services provided by Operating System to Users.

Introduce the concept of Process, Process States, Process Control Block, User Interface, System Calls.

Introduction to Linux Operating System - Features of Linux, Architecture of the Linux, Introduction to File System and Process Environment.

Working with Linux - The login prompt, General features of commands/ command structure, Command arguments and options.

Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, Combining commands

Unit II	Commands & Processes	08 Hrs

What is a Command?, Meaning of Internal and external commands, The type command: knowing the type of a command and locating it, The man command knowing more about commands and using Linux online manual pages. The man with keyword option and whatis

Operating system Processes - Concept, Mechanism of process creation, Parent and child process, The ps command with its options, Executing a command at a specified point of time: at command.

The nice command, Background processes. The bg and fg commands, The kill command, The find command with illustrative example.

Unit III	File System	08 Hrs

Linux files - Naming files. Basic file types, Organization of files. Standard directories, Parent child relationship, The home directory and the HOME variable.

The PATH variable, manipulating the PATH, Relative and absolute pathnames, Directory commands – pwd, cd, mkdir, rmdir commands, The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names

File related commands – cat, mv, rm, cp, wc and od commands, File attributes and permissions and knowing them, The ls command with options, Changing file permissions: the relative and absolute permissions changing methods

Unit IV	Using Shells and Vi Editor	08 Hrs

What is Shell? Different types of shells, The shells interpretive cycle, Wild cards and file name generation, Removing the special meanings of wild cards, Three standard files and redirection,

Connecting commands: Pipe, The grep, egrep commands. .

Vi Editor - Introduction to the Vi editor, Different ways of invoking and quitting vi, Different modes of vi, Input mode commands, Command mode commands, The ex mode commands, Illustrative examples Navigation commands

Unit V	Security & Networking	08 Hrs

Security Understanding Linux Security, Uses of root, pseudo command, working with passwords, Bypassing user authentication, Understanding ssh

Networking Basic introduction to Networking, Network protocols: http, ftp etc., IP address, DNS

Unit VI	Shell Scripts	08 Hrs

Shell programming - Ordinary and environment variables, The .profile. Read and read only commands, Command line arguments, exit and exit status of a command, Logical operators for conditional execution, The test command and its shortcut.

The if, while, for and case control statements, The set and shift commands and handling positional parameters, The here (<<) document and trap command, Simple shell program examples.

File inodes and the inode structure, File links – hard and soft links. Filters, Head and tail commands.

Cut and paste commands, The sort command and its usage with different options

Reference Books:

1. Unix Concepts and Applications by Sumitabha Das.
2. Operating System Concepts - Siberchatz, Galvin, Gagne (8th Edition)
3. UNIX and Shell Programming, Behrouz A. Forouzan, Richard F. Gilberg : Cengage Learning – India Edition. 2009.
4. Linux Command Line and Shell Scripting Bible, Richard Blum , Christine Bresnahan, 2ndEdition , Wiley,2011

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA124: Database Management Systems – I

Teaching Scheme:	Credits	Examination Scheme:
Theory: 04 Hours/Week	04	Continuous Evaluation: 30 Marks End-Semester : 70 Marks

Pre-requisite Course: BCA113 Applied Mathematics

Companion Course: BCA128: Database Management Systems – I Laboratory

Course Objectives:

- To understand the fundamental concepts of database management such as database design, database languages, and database-system implementation
- To study and understand systematic database design approaches
- To learn SQL – the database Query language

Course Outcomes:

On completion of the course, student will be able to–

- Design E-R Model for given requirements and convert the same into database tables.
- Formulate database queries using SQL
- Design a database in appropriate normal form

Course Contents

Unit I	File Organization	08 Hrs

Introduction, Physical / logical files, Record organization (fixed, variable length) Types of file organization(heap, sorted, indexed, hashed)

Unit II	Introduction of DBMS	08 Hrs

Overview, File system Vs. DBMS, Describing & storing data (Data models - relational, hierarchical, network), Levels of abstraction, Data independence, Structure of DBMS, Users of DBMS, Advantages of DBMS

Unit III	Conceptual Design (E-R model)	08 Hrs

Overview of DB design
ER data model (entities, attributes, entity sets, relations, relationship sets)
Additional constraints (key constraints, participation constraints, weak entities, aggregation / generalization), Case studies

Unit IV	Structure of Relational Databases	08 Hrs

Concepts of a table, a row, a relation, a tuple and a key in a relational database
Conversion of ER to Relational model
Integrity constraints (primary key, referential integrity, Null constraint, unique constraint, check constraint)

Unit V	SQL	08 Hrs

Introduction, DDL commands (create, drop, alter) with examples, Basic structure of SQL query, Set operations, Aggregate functions, Null values, Nested Sub-queries, Modifications to Database (insert, delete, update),
SQL mechanisms for joining relations (inner joins, outer joins and their types)
Examples on SQL (case studies)

Unit VI	Relational Database Design	08 Hrs

Pitfalls in Relational-Database Design (undesirable properties of a RDB design like repetition, inability to represent certain information)
Functional dependencies (Basic concepts, Closure of set of functional dependencies, Closure of an Attribute set)
Concept of a Super Key and a primary key (Algorithm to derive a Primary Key for a relation)
Concept of Decomposition, Desirable Properties of Decomposition (Lossless join and Dependency preservation)
Concept of Normalization - Normal forms (only definitions) 1NF, 2NF, 3NF, BCNF
Examples on Normalization

Reference Books:

1. Henry F. Korth, Abraham Silberschatz, S. Sudarshan, "Database System Concepts", Tata McGraw-Hill Education
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", McGraw-Hill

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA125: Computer Organization Laboratory

Teaching Scheme:	Credits	Examination Scheme:
Practical: 03 Hrs/Week	1.5	Continuous Evaluation: 15 Marks End-Semester :35 Marks

Companion Course: BCA121 Computer Organization

Course Objectives:

- To study architecture and functioning of computer systems
- To learn the basic concept behind the architecture and organization of computers

Course Outcomes:

On completion of the course, student will be able to–

- Design and implement combinational circuits
- Design and implement sequential circuits
- Translate real world problems into digital logic formulations

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include University syllabus, conduction & Assessment guidelines.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign
Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of student. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Suggested Topics for Laboratory Assignments

1	Study of Logic gates and their ICs and universal gates
2	Implement code converters
3	Implement Adder and Subtractor Arithmetic circuits
4	Design and implement combinational circuit based on the problem given and minimizing using K-maps
5	Implement Encoder and Decoder and Multiplexer and De-multiplexers
6	Study of flip-flops and counters Memory Organization
7	Study of counter ICs and designing Mod-N counters

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA126: Advanced C Programming Laboratory

Teaching Scheme:	Credits	Examination Scheme:
Practical: 03 Hrs/Week	1.5	Continuous Evaluation: 15 Marks End-Semester :35 Marks

Companion Course: BCA122 Advanced C Programming

Course Objectives:

- To learn advanced features in C Programming
- To study advanced data types
- To understand built-in library functions

Course Outcomes:

On completion of the course, student will be able to–

- Write programs using pointers, structures and unions
- Use Pre-processor directives
- Manipulate strings using library functions
- Write programs to perform operations on Files

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include University syllabus, conduction & Assessment guidelines.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign
Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of student. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Sr. No.	Assignment
1	To demonstrate use of preprocessor directives
2	To demonstrate use of pointers
3	To demonstrate advanced use of pointers
4	To demonstrate concept of strings, array of strings
5	To demonstrate string operations using pointers
6	To demonstrate command line arguments
7	To demonstrate structures (using array and functions)
8	To demonstrate nested structures and Unions
9	To demonstrate use of bitwise operators.
10	To demonstrate file handling

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA127: Operating Systems Laboratory

Teaching Scheme:	Credits	Examination Scheme:
Practical: 03 Hrs/Week	1.5	Continuous Evaluation: 15 Marks End-Semester :35 Marks

Companion Course: BCA123 Operating Systems Concepts

Course Objectives:

- To provide hands-on knowledge for
  - Installation of Linux and Packages
  - Setting environment, use documentation, commands and editors
  - Configure Security and Network environment

Course Outcomes:

On completion of the course, student will be able to–

- Install Linux and packages, configure environment
- Use commands and editors and use documentation
- Configure Security and network environment

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include University syllabus, conduction & Assessment guidelines.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign
Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of student. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Suggested List of Laboratory Assignments

1 Linux Installation:
a. Install your choice of Linux distribution e.g. Ubuntu, Fedora, Debian.
b. Try different installation media like CD/DVD, USB Drive to install.
c. Customize desktop environment by changing different default options like changing default background, themes, screensavers.

2 a. Screen Resolution: Ascertain the current screen resolution for your desktop.
b. Networking: Get the current networking configuration for your desktop. Are you on a wired or a wireless connection? What wireless networks are available, if any?
c. Time Settings Change the time zone of your system. After noting the time change, change the time zone back to your local time zone

3 Installing and Removing Software:
a. Install gcc package, run the package and remove it.

4 Documentations:
a. Finding Info Documentation: From the command line: bring up the info page for say "sed" command. Study the usage section.
b. Finding man pages From the command line: Bring up the man page for the 'ls' command. Study the EXAMPLES section.
c. Finding man pages by the given Topic, by the given Section
d. From the command line, bring up the man page for the given library function
e. Study of Command-Line Help

5 Command line operations:
a. Find the passwd file in / using find command
b. Create a symbolic link to the file you found
e. Create a file say, xyz.txt and move it in /tmp directory using relative pathname.
f. Delete the file moved to /tmp in previous step using absolute path.
g. Find the location of ls. ps. bash commands.

6 File Operations:
a. Explore mounted file systems on your system using different ways
b. Archive and backup your home directory using tar, gzip commands.
d. Use dd command to create files and explore different options to dd.
e. Use diff command to create diff of two files.
f. Use patch command to patch a file. Analyze the patch using diff command again.

7 User environment
a. Find in which account are you logged in?
b. Display /etc/shadow file using cat and understand the importance of shadow file. How it's different than passwd file?
c. Get you current working directory.
d. Explore different ways of getting command history, how to run previously executed command without typing it?
e. Create alias to most commonly used commands

8. Using Linux Editors: vim/emacs
a. Create, modify, search, navigate a file in editor.
b. Learn all essential commands such as search, search/replace, highlight, show line

9. Linux Security:
a. Use of sudo to change user privileges to root
b. Identify all operations that require sudo privileges
c. Create a new user and add it to sudo configuration file.
d. Set password for new user.
e. Modify the expiration date for new user using password ageing.
f. Delete newly added user.

10. Network:
    a. Get IP address of your machine using ifconfig.
    b. If IP is not set, then assign an IP address according to your network settings.
    c. Get hostname of your machine.
    d. Use ping to check the network connectivity to remote machines.
    e. Use telnet/ssh to connect to remote machines and learn the difference between the two.
11. Shell Scripting
    a. Searching with grep: Search for your username in the /etc/passwd file.
    b. Parsing files with awk: Display in a column a unique list of all the shells used for users in /etc/passwd. Which field in /etc/passwd holds the shell (user command interpreter in the manual page)? How do you make a list of unique entries, that is, no repeated entries?
    c. Searching and substituting with sed: Search all instances of the user command interpreter (shell) equal to /bin/false in /etc/passwd and substitute with /bin/bash using sed.
    d. Exit status: write a script which does ls to a non existent file. Display an exit status of the previous command. Now create the file and again display the exit status. In each task send the ls output to /dev/null
    e. Working with files: Write a shell script which will ask user for a directory, create that directory and switch to it and tell the user where you are using pwd command. Now use touch to create some new files followed by displaying the filenames.

Savitribai Phule Pune University
First Year of Computer Applications (2019 Course)
BCA128: Database Management Systems – I Laboratory

Teaching Scheme:	Credits	Examination Scheme:
Practical: 03 Hrs/Week	1.5	Continuous Evaluation: 15 Marks End-Semester :35 Marks

Companion Course: BCA124: Database Management Systems – I

Course Objectives:

- To learn design of E-R diagrams
- To prepare and execute database queries

Course Outcomes:

On completion of the course, student will be able to–

- Prepare E-R Diagram for the given problem statement
- Formulate appropriate SQL DDL Queries
- Formulate appropriate SQL DML Queries

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include University syllabus, conduction & Assessment guidelines.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign
Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance of student. For each lab assignment, the instructor will assign grade/marks based on parameters with appropriate weightage. Suggested parameters include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Sr. No.	Assignment
1	Case study – ER diagram
2	Case study – ER diagram (with generalization)
3	Case study – ER diagram (with aggregation)
4	Using PostgreSQL (demo of PostgrSQL)
5	Data Definition queries (Create)
6	Data Definition querie (Alter)
7	Data Definition queries (Drop)
8	SQL DML Select queries

Koparagaon Taluka Education Society's
K. J. Somaiya College Koparagaon.
B. Sc Computer Science 2019 Pattern

List of Courses Addresses Crosscutting Issues (2019 Pattern)

Sr. No.	Programme Name	Coursecode	Name of Course	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1.	B. Sc. Computer Science	CS-111	Problem Solving Using Computer And 'C' Programming	Professional Ethics
2.	B. Sc. Computer Science	CS-112	Database Management Systems	Professional Ethics
3.	B. Sc. Computer Science	CS-113	Practical Course Based On CS101 And CS102	Professional Ethics
4.	B. Sc. Computer Science	CS-121	Advanced 'C' Programming	Professional Ethics
5.	B. Sc. Computer Science	CS-122	Relational Database Management Systems	Professional Ethics
6.	B. Sc. Computer Science	CS-123	Practical Course Based On CS201 And CS202	Professional Ethics
7.	B. Sc. Computer Science	ELC-111	Semiconductor Devices & Basic Electronics System	Professional Ethics
8.	B. Sc. Computer Science	ELC-112	Principle of Digital Electronics	Professional Ethics
9.	B. Sc. Computer Science	ELC-121	Instrumentation System	Professional Ethics
10.	B. Sc. Computer Science	ELC-122	Basics of Computer Organization	Professional Ethics
11.	B. Sc. Computer Science	ELC-113	Electronics Lab IA	Professional Ethics
12.	B. Sc. Computer Science	ELC-123	Electronics Lab IB	Professional Ethics
13.	B. Sc. Computer Science	MTC-111	Mathematics-I	Professional Ethics
14.	B. Sc. Computer Science	MTC-112	Mathematics-II	Professional Ethics
15.	B. Sc. Computer Science	MTC-113	Mathematics Practical	Professional Ethics
16.	B. Sc. Computer Science	MTC-121	Mathematics-I	Professional Ethics
17.	B. Sc. Computer Science	MTC-122	Mathematics-II	Professional Ethics
18.	B. Sc. Computer Science	MTC-123	Mathematics Practical	Professional Ethics
19.	B. Sc. Computer Science	CSST-111	Statistics -I	Professional Ethics

Sr. No.	Programme Name	Coursecode	Name of Course	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1.	B. Sc. Computer Science	CS-111	Problem Solving Using Computer And 'C' Programming	Professional Ethics
20.	B. Sc. Computer Science	CSST-112	Statistics-II	Professional Ethics
21.	B. Sc. Computer Science	CSST-113	Statistics Practical	Professional Ethics
22.	B. Sc. Computer Science	CSST-121	Statistics-I	Professional Ethics
23.	B. Sc. Computer Science	CSST-122	Statistics-II	Professional Ethics
24.	B. Sc. Computer Science	CSST-123	Statistics Practical	Professional Ethics
25.	B. Sc. Computer Science	CS-231	Data Structures And Algorithms – I	Professional Ethics
26.	B. Sc. Computer Science	CS-232	Software Engineering	Professional Ethics
27.	B. Sc. Computer Science	CS-233	Practical Course Based On CS301	Professional Ethics
28.	B. Sc. Computer Science	CS-241	Data Structures And Algorithms – II	Professional Ethics
29.	B. Sc. Computer Science	CS-242	Computer Networks – I	Professional Ethics
30.	B. Sc. Computer Science	CS-243	Practical Course Based On CS401	Professional Ethics
31.	B. Sc. Computer Science	MTC-231	Group & Coding Theory	Professional Ethics
32.	B. Sc. Computer Science	MTC-232	Numerical Technique	Professional Ethics
33.	B. Sc. Computer Science	MTC-233	Mathematics Practical: Python Programming Language-I	Professional Ethics
34.	B. Sc. Computer Science	MTC-241	Computational Geometry	Professional Ethics
35.	B. Sc. Computer Science	MTC-242	Operation Research	Professional Ethics
36.	B. Sc. Computer Science	MTC-243	Mathematics Practical: Python Programming Language-II	Professional Ethics
37.	B. Sc. Computer Science	ELC-231	8051 Microcontroller architecture & Its Programming	Professional Ethics
38.	B. Sc. Computer Science	ELC-232	Digital Communication & Networking	Professional Ethics
39.	B. Sc. Computer Science	ELC-241	Wireless Communication & IoT	Professional Ethics
40.	B. Sc. Computer Science	ELC-242	Advanced Embedded System Design	Professional Ethics
41.	B. Sc. Computer Science	ELC-233	Practical Course I	Professional Ethics
42.	B. Sc. Computer Science	ELC-243	Practical Course II	Professional Ethics
43.	B. Sc. Computer Science	CS-351	Operating Systems –I	Professional Ethics

44.	B. Sc. Computer Science	CS-352	Computer Networks –II	Professional Ethics
45.	B. Sc. Computer Science	CS-357	Practical Course Based On CS501	Professional Ethics
46.	B. Sc. Computer Science	CS-353	Web Technologies – I	Professional Ethics
47.	B. Sc. Computer Science	CS-354	Foundations Of Data Science	Professional Ethics
48.	B. Sc. Computer Science	CS-358	Practical Course Based On CS503	Professional Ethics
49.	B. Sc. Computer Science	CS-355	Object Oriented Programming – I (Core Java)	Professional Ethics
50.	B. Sc. Computer Science	CS-356	Theoretical Computer Science And Compiler Construction – I	Professional Ethics
51.	B. Sc. Computer Science	CS-359	Practical Course Based On CS505	Professional Ethics
52.	B. Sc. Computer Science	CS-3510	Python Programming / R Programming	Professional Ethics
53.	B. Sc. Computer Science	CS-361	Operating Systems – II	Professional Ethics
54.	B. Sc. Computer Science	CS-362	Software Testing	Professional Ethics
55.	B. Sc. Computer Science	CS-367	Practical Course Based On CS601	Professional Ethics
56.	B. Sc. Computer Science	CS-363	Web Technologies – II	Professional Ethics
57.	B. Sc. Computer Science	CS-364	Data Analytics	Professional Ethics
58.	B. Sc. Computer Science	CS-368	Practical Course Based On CS603 And CS604	Professional Ethics
59.	B. Sc. Computer Science	CS-365	Object Oriented Programming – II (Advanced Java)	Professional Ethics
60.	B. Sc. Computer Science	CS-366	Theoretical Computer Science And Compiler Construction - II	Professional Ethics
61.	B. Sc. Computer Science	CS-369	Practical Course Based On CS605	Professional Ethics
62.	B. Sc. Computer Science	CS-3610	Mobile Application Development Or Software Testing Tools	Professional Ethics
63.	B. Sc. Computer Science	CS-3611	Project	Professional Ethics
64.	M. Sc. Computer Science	CSUT111	Paradigm Of Programming Language	Professional Ethics
65.	M. Sc. Computer Science	CSUT 112	Design And Analysis Of Algorithms	Professional Ethics
66.	M. Sc. Computer Science	CSUT 113	Database Technologies	Professional Ethics
67.	M. Sc. Computer Science	CSDT114B	Artificial Intelligence	Professional Ethics

68.	M. Sc. Computer Science	CSDP114B	Artificial Intelligence Practical	Professional Ethics
69.	M. Sc. Computer Science	CSUP115	PPL And Database Technologies Practical	Professional Ethics
70.	M. Sc. Computer Science	CSUT121	Advanced Operating System	Professional Ethics
71.	M. Sc. Computer Science	CSUT122	Mobile Technologies	Professional Ethics
72.	M. Sc. Computer Science	CSUT123	Software Project Management	Professional Ethics
73.	M. Sc. Computer Science	CSDT124A	Project	Professional Ethics
74.	M. Sc. Computer Science	CSDP124A	Project Related Assignments	Professional Ethics
75.	M. Sc. Computer Science	CSUP125	Practical On Advanced OS &Amp; Mobile Technologies	Professional Ethics
76.	M. Sc. Computer Science	CSUT231	Software Architecture And Design Patterns	Professional Ethics
77.	M. Sc. Computer Science	CSUT232	Machine Learning	Professional Ethics
78.	M. Sc. Computer Science	CSUT233	Web Frameworks	Professional Ethics
79.	M. Sc. Computer Science	CSDT234C	Project	Professional Ethics
80.	M. Sc. Computer Science	CSDP234C	Project Related Assignments	Professional Ethics
81.	M. Sc. Computer Science	CSUP235	Practical On CSUT231, CSUT232 And CSUT233	Professional Ethics
82.	M. Sc. Computer Science	CSUIT241	Industrial Training /Institutional Project	Professional Ethics

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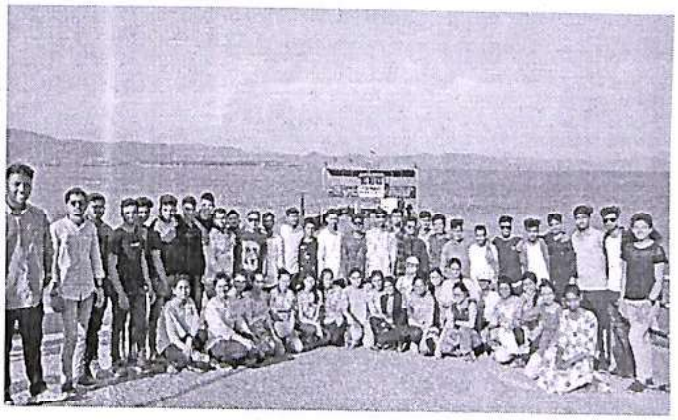
List of Add-on/Value Added/ Certificate Courses

Sr. No.	Department	Name of Certificate Course	Course Code	Year of Offering	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
1	Computer Science	Computer Hardware & Network	CC.918	2019-20	Professional Ethics

List Showing Curricular and Extra Curricular activities to address Crosscutting Issues (Similar/repeated activities are not listed).

Sr. No.	Name of Activity and Date of Implementation	Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)	Representative Photograph
1	Department has organized one day workshop on "Cyber Security & Ethical Hacking" on 24th August 2018.	Professional Ethics, Human Values, Gender,	
2	Department has District level **"Techno-Fest"** event on 19th December 2018. The event includes activities such as paper presentation, poster presentation, technical rangoli competition, Aptitude test, computer Game zone.	Professional Ethics, Gender, Human Values, Environment and Sustainability	
3	Guest lecture by **Mr. Sagar Tarade** from "TCS Pvt. Ltd." was organized On 22nd September 2018 in the Subject **"Web Development & Designing"**	Professional Ethics,	

4	Guest lecture was organized on technology **"Photoshop"** Mr. Ronak Soni & Mr. Abhijeet Kote from "Zyma Pvt. Ltd." on 1st February 2019.	Professional Ethics	
5	**"Welcome Function" and Induction Program** was organized on 3th August 2018	Professional Ethics, Human Values	
6	Department organized a Two Day workshop on **"Python"** on 20th & 21st December 2019.	Professional Ethics	
7	Department organized a guest lecture by Mr. Rahul Wable from "SPARK Pvt. Ltd." on 24th January 2020 in the Subject **"Android".**	Professional Ethics	
8	A One day Webinar on **"E-content development in Covid-19 Pandemic"** was organized on 5th November 2020.	Professional Ethics	
9	A one day webinar on **"Strategies to Crack Interview in I.T. Industries"** was organized on 27th Feb 2021.	Professional Ethics, Human Values	
10	In the academic year 2020-21 the **"Welcome Function"** was organized on 12th July 2020.	Professional Ethics, Human Values	
11	In the academic year 2021-2022, the Welcome function of first year students was organized dated 2nd December in the presence of Hon. Principal Dr. B. S. Yadav.	Professional Ethics, Human Values	

12	In the academic year 2022-23 the **"Welcome Function"** was organized on 30th September. 2022.	Professional Ethics, Human Values	
13	Department of Computer Science organized one day workshop on **C Programming on 6th September 2022**	Professional Ethics	
14	Department of Computer Science has Organized **Two-Days Educational Tour** for S.Y.B.Sc.(CS) and T.Y.B.Sc.(CS) Students. It was held on 14/04-15/04/2023.	Professional Ethics, Gender, Human Values, Environment and Sustainability	

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Sr.No.	Title of the Activity	Period		Addressed issue (Professional Ethics, Gender, Human Values, Environment and Sustainability)
		From	To	
1.	One day workshop on "Cyber Security & Ethical Hacking"	24th August 2018.		Professional Ethics
2.	"Techno-Fest" event	19th December 2018.		Professional Ethics
3.	"Welcome Function"	Every academic Year		Professional Ethics, Human Values,
4.	Short term Course on Computer Hardware & Networking	From academic Year 2019-20		Professional Ethics
5.	A One day Webinar on "E-content development in Covid-19 Pandemic"	5th November 2020.		Professional Ethics, Gender, Human Values, Environment and Sustainability
6.	Two Day workshop on "Python" on 20th & 21st December 2019.	20th to 21st December 2019.		Professional Ethics,
7.	A one day webinar on "Strategies to Crack Interview in I.T. Industries".	27th Feb 2021.		Professional Ethics, Human Values,
8.	One Day workshop on C Programming on	6th September 2022		Professional Ethics

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Detailed Syllabus:

Semester- I
Paper - I
Course Type: Core Credit **Course Code: CS101**
Course Title : Problem Solving Using Computer and 'C' Programming - I

Teaching Scheme	No. of Credits	Examination Scheme
2 Hours / Week	2	IE : 15 Marks UE: 35 Marks

Course Objectives

1. To introduce the foundations of computing, programming and problem- solving using computers.
2. To develop the ability to analyze a problem and devise an algorithm to solve it.
3. To formulate algorithms, pseudocodes and flowcharts for arithmetic and logical problems
4. To understand structured programming approach.
5. To develop the basic concepts and terminology of programming in general.
6. To implement algorithms in the 'C' language.
7. To test, debug and execute programs.

Course Outcomes:- On completion of this course, students will be able to :

1. Explore algorithmic approaches to problem solving.
2. Develop modular programs using control structures and arrays in 'C'.

Course Contents

Chapter 1	**Problem Solving Aspects**	**5 Hours**

1.1. Introduction to problem solving using computers.
1.2. Problem solving steps.
1.3 Algorithms-definition, characteristics , examples ,advantages and limitations.
1.4 Flowcharts - definition, notations , examples , advantages and limitations, Comparison with algorithms.
1.5 Pseudo codes - notations, examples, advantages and limitations.
1.6 Programming Languages as tools, programming paradigms, types of languages
1.7 Converting pseudo-code to programs.
1.8 Compilation process (compilers , interpreters), linking and loading, syntax and semantic errors, testing a program
1.9 Good Programming Practices (naming conventions , documentation, indentation).

Chapter 2	**'C' Fundamentals**	**7 Hours**

2.1 History of 'C' language.
2.2 Application areas.
2.2 Structure of a 'C' program.
2.3 'C' Program development life cycle.

Semester- I
Paper - II

Course Type: Core Credit **Course Code: CS102**

Course Title : Database Management Systems

Teaching Scheme	No. of Credits	Examination Scheme
02 Hours / Week	2	IE : 15 Marks UE: 35 Marks

Prerequisites

- Basic Knowledge of file system; storing data in file system and Operations on sets

Course Objectives

- To understand the fundamental concepts of database.
- To understand user requirements and frame it in data model.
- To understand creations, manipulation and querying of data in databases.

Course Outcomes

On completion of the course, student will be able to–

- Solve real world problems using appropriate set, function, and relational models.
- Design E-R Model for given requirements and convert the same into database tables.
- Use SQL.

Course Contents

Chapter 1	**Introduction to DBMS**	**3 Hours**

1.1. Introduction
1.2. File system Vs DBMS
1.3. Levels of abstraction & data independence
1.4.Structure of DBMS (Roles of DBMS Users)
1.5. Users of DBMS Advantages of DBMS

Chapter 2	**Conceptual Design**	**11 Hours**

2.1. Overview of DB design process
2.2. Introduction to data models (E-R model, Relational model, Network model, Hierarchical model)
2.3. Conceptual design using ER data model (entities, attributes, entity sets, relations, relationship sets)
2.4. Constraints (Key constraints, Integrity constraints, referential integrity, unique constraint, Null/Not Null constraint, Domain, Check constraint, Mapping constraints)
2.5. Extended features – Specialization, Aggregation, Generalization
2.6. Pictorial representation of ER(symbols)
2.7. Structure of Relational Databases (concepts of a table)
2.8. DBMS Versus RDBMS
2.9. Case Studies on ER model

Semester- I
Paper - III

Course Type: Core Credit **Course Code: CS103**

Title : Practical course on Problem Solving using Computer and 'C' programming and Database Management Systems

Teaching Scheme	No. of Credits	Examination Scheme
3 Hrs / week	1.5	IE : 15 Marks UE: 35 Marks

Course Objectives

- To understand the program development life cycle.
- Solve simple computational problems using modular design and basic features of the 'C' language.
- Understand basic database management operations.
- Design E-R Model for given requirements and convert the same into database tables.

Course Outcomes:-

On completion of this course, students will be able to :

- Devise pseudocodes and flowchart for computational problems.
- Write, debug and execute simple programs in 'C'.
- Create database tables in postgreSQL.
- Write and execute simple, nested queries.

Guidelines :

Lab Book: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Submission:

Problem Solving Assignments:

The problem solving assignments are to be submitted by the student in the form of a journal containing individual assignment sheets. Each assignment includes the Assignment Title, Problem statement, Date of submission, Assessment date, Assessment grade and instructors sign.

Programming Assignments:

Programs should be done individually by the student in the respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

DBMS Assignments:

For each problem/case study, the student must design the database model in the form of an E-R

Semester- II
Paper - I

Course Type: Core Credit **Course Code: CS201**
Course Title : Advanced 'C' Programming

Teaching Scheme	No. of Credits	Examination Scheme
2 Hours / Week	2	IE : 15 Marks UE: 35 Marks

Prerequisites

- Problem Solving tools like algorithms, flowcharts and pseudocodes.
- Basic knowledge of 'C' language.

Course Objectives :-

- To study advanced concepts of programming using the 'C' language.
- To understand code organization with complex data types and structures.
- To work with files.

Course Outcomes:- Student will be able to :-

- Develop modular programs using control structures, pointers, arrays, strings and structures
- Design and develop solutions to real world problems using C.

Course Contents

Chapter 1	**Pointers**	**8 Hours**

1.1. Introduction to Pointers.
1.2. Declaration, definition, initialization, dereferencing.
1.3. Pointer arithmetic.
1.4. Relationship between Arrays & Pointers- Pointer to array, Array of pointers.
1.5. Multiple indirection (pointer to pointer).
1.6. Functions and pointers- Passing pointer to function, Returning pointer from function, Function pointer.
1.7. Dynamic memory management- Allocation(malloc(),calloc()), Resizing(realloc()), Releasing(free()).,
1.8. Memory leak, dangling pointers.
1.9. Types of pointers.

Chapter 2	**Strings**	**6 Hours**

2.1 String Literals, string variables, declaration, definition, initialization.
2.2 Syntax and use of predefined string functions
2.3 Array of strings.
2.4. Strings and Pointers
2.5. Command line arguments.

Semester- II
Paper - II

Course Type: Core Credit **Course Code: CS202**
Course Title : Relational Database Management Systems

Teaching Scheme	No. of Credits	Examination Scheme
2 Hours / Week	2	IE : 15 Marks UE: 35 Marks

Prerequisites

- Basic Knowledge of DBMS
- Knowledge of SQL Queries
- Basics of relational design
- Basics of ER model

Course Objectives

- To teach fundamental concepts of RDBMS (PL/PgSQL)
- To teach database management operations
- Be familiar with the basic issues of transaction processing and concurrency control
- To teach data security and its importance

Course Outcomes

On completion of the course, student will be able to–

- Design E-R Model for given requirements and convert the same into database tables.
- Use database techniques such as SQL & PL/SQL.
- Explain transaction Management in relational database System.
- Use advanced database Programming concepts

Course Contents

Chapter 1	**Relational Database Design Using PLSQL**	**8 Hours**

1.1 Introduction to PLSQL
1.2 PL/PgSqL: Datatypes, Language structure
1.3 Controlling the program flow, conditional statements, loops
1.4 Stored Procedures
1.5 Stored Functions
1.6 Handling Errors and Exceptions
1.7 Cursors
1.8 Triggers

Semester- II
Paper - III

Course Type: Core Credit **Course Code:CS203**

Title : Practical Course on Advanced 'C' Programming and Relational Dstabase Management Systems

Teaching Scheme	No. of Credits	Examination Scheme
3 Hours / week	1.5	IE : 15 Marks UE: 35 Marks

Course Objectives

- To solve real world computational problems.
- To perform operations on relational database management systems.

Course Outcomes:-

On completion of this course, students will be able to :

- Write, debug and execute programs using advanced features in 'C'.
- To use SQL & PL/SQL.
- To perform advanced database operations.

Guidelines :

Lab Book: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Submission:

Programming Assignments:

Programs should be done individually by the student in respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

RDBMS Assignments:

For each problem/case study, the student must design the database model in the form of an E-R diagram. Table design should be based on the same and must include proper constraints and integrity checks. The students have to create, populate the tables and then perform the activities specified in each of the assignments. A separate softcopy of the table creation statements and queries must be maintained for each assignment.

Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall

Detail Syllabus:

SEMESTER I

Paper I

ELC-111: Semiconductor Devices and Basic Electronic Systems

(2 Credits, 36 lectures)

Objectives :

1. To study various types of semiconductor devices
2. To study elementary electronic circuits and systems

Term I

Unit 1. Semiconductor Diodes **(6 L)**

Semiconductor, P and N type semiconductors, Formation of PN junction diode, it's working, Forward and Reverse bias characteristics, Zener diode: working principle, breakdown mechanism and characteristics, Working principle of Light emitting diode, photo diode, optocoupler, Solar cell working principle and characteristics

Unit 2. Bipolar Junction Transistor (BJT) **(7 L)**

Bipolar Junction Transistor (BJT) symbol, types, construction, working principle, Transistor amplifier configurations - CB, CC (only concept), CE configuration: input and output characteristics, Definition of α, β and Υ , Concept of Biasing (numerical problems not expected), Potential Divider bias, Transistor as amplifier (Concept of Gain and Bandwidth expected), Transistor as a switch.

Unit 3. MOSFET **(5 L)**

MOSFET types, Working principle, Characteristics, Application of MOSFET as a Switch.

Unit 4. POWER SUPPLY **(6 L)**

Block Diagram of Regulated Power Supply, Rectifiers (half wave, full wave, Bridge), rectifier with capacitor-filter, Use of Zener Diode as a Voltage Regulator, IC 78XX and 79XX as regulator, Block Diagram and explanation of SMPS, Block diagram and explanation of UPS

Unit 5. OSCILLATORS **(6 L)**

Barkhauson Criteria, Low frequency Wein-bridge oscillator, High frequency crystal oscillator, IC 555 as astable multivibrator used as square wave generator / clock

Unit 6. DATA CONVERTERS **(6 L)**

Need of Digital to Analog converters, parameters, weighted resistive network, R-2R ladder network, need of Analog to Digital converters, parameters, Flash ADC, successive approximation ADC.

Text/reference books :

1. Electronic Devices and Circuits I – T. L. Floyd- PHI Fifth Edition
2. Principles of Analog Electronics - A.P.Malvino
3. Sedha R.S., A Text Book Of Applied Electronics, S.Chand& CompanyLtd

SEMESTER I

PAPER II

ELC 112: Principles of Digital Electronics

(2 Credits, 36 lectures)

Objectives:

1. To get familiar with concepts of digital electronics
2. To learn number systems and their representation
3. To understand basic logic gates, Boolean algebra and K-maps
4. To study arithmetic circuits, combinational circuits and sequential circuits

Unit 1: Number Systems and Digital codes **(10 L)**

Introduction to Decimal, Binary and Hexadecimal number systems and their inter-conversions, binary addition and binary subtraction using 2's complement, Binary Coded Decimal number, Gray Codes, Gray to Binary and Binary to Gray conversion, Alphanumeric representation in ASCII codes.

Unit 2: Logic gates and Boolean Algebra **(14)**

Logic gates (NOT, AND, OR, NAND, NOR, XOR gate) with their symbol, Boolean equation and truth table, Universal gates

Introduction of CMOS and TTL logic families, Parameters like voltage levels, propagation delay, noise margin, fan in, fan out, power dissipation (TTL NAND, inverter, CMOS gates etc. not expected)

Rules and laws of Boolean algebra, De Morgan's theorem, simplification of Logic equations using Boolean algebra rules, Min terms, Max terms, Boolean expression in SOP and POS form, conversion of SOP/POS expression to its standard SOP/POS form Introduction to Karnaugh Map, problems based on SOP (upto 4 variables), digital designing using K Map for: Gray to Binary and Binary to Gray conversion,

Unit 3: Combinational Circuits **(12 L)**

Half adder and full adder, 4-Bit Universal adder/ Subtractor, applications of Ex-OR gates as parity checker and generator, study of Multiplexer (4:1) and Demultiplexer (1:4), Encoders - Decimal/BCD to binary, 3X4 matrix keyboard encoder, priority encoder, Decoder- BCD to seven segment decoder, IC 74138 and IC 7447, Digital comparator,

Reference Books:

1. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education
2. Digital Electronics: Jain R.P., Tata McGraw Hill
3. Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill
4. M.Morris Mano, " Digital Design " 3rdEdition, PHI, NewDelhi.
5. Ronald J. Tocci. "Digital Systems-Principles and Applications" 6/e. PHI. New Delhi. 1999.(UNITS I to IV)
6. G.K.Kharate-Digital electronics-Oxford university press
7. S.Salivahana & S.Arivazhagan-Digital circuits and design

SEMESTER I

Paper III

ELC-113: ELECTRONICS LAB IA (1.5 Credits)

The practical course consists of **10 experiments** out of which two will be preparatory experiments. These will be evaluated in an oral examination for 15% marks at internal and external semester examination. **Each Practical batch will have maximum 15 students.**

Preparatory Experiments (Minimum 2/3)

1.Identification of Components (Passive and Active) /Tools

- Minimum 10 different types of components must be given
- Identification based on visual inspection / data sheets be carried out

2.Use of Digital Multimeters

- Measurement of AC/DC voltage and Current – on different ranges
- Measurement of R &C
- Testing of Diodes &Transistors
- Measurement of β.
- Use of Multimeter in measurement of Resistance of LDR and Thermistor

3.Study of Signal Generator & CRO

- Understand how to use Signal Generator, CRO
- Study of front panel controls of both
- Measurement of amplitude and frequency of Sine/Square waveform
- Measurement of Phase with the help of RC circuit
- Demonstration of Lissajous figures
- Demonstrate the use of Component testing facility

Semester I List of Practical's (Minimum 08, 4 from each group)

Group A

1. Study of breakdown characteristics and voltage regulation action of Zener diode, Use of 3 Pin Regulator IC 78XX & 79XX as a regulator.
2. Study of half wave, full wave and bridge rectifier circuit with and without capacitor filters.
3. Study of Opto-coupler using LED and Photodiode (Package may be used here), it's application as burglar alarm.
4. Study of Bipolar Junction Transistor as a Switch.
5. Study of Single stage RC coupled CE transistor Amplifier (Gain/ Bandwidth).
6. Study of output and transfer characteristics of MOSFET.
7. Study of SMPS.
8. Study of IC 555 as an Astable Multivibrator.
9. Study of 4-Bit R-2R Ladder Network type of DAC.
10. Study of 3-bit Flash ADC.

SEMESTER II

PAPER I

ELC 121: Instrumentation Systems
(2 Credits, 36 lectures)

Objectives :

1. To study Instrumentation System
2. To study various blocks of Instrumentation System
3. To study Smart Instrumentation System

Unit 1: Introduction to Instrumentation System **(6 L)**

Block diagram of Instrumentation system, Definition of sensor, transducer and Actuators, Classification of sensors: Active and passive sensors. Specifications of sensors: Accuracy, range, linearity, sensitivity, resolution, reproducibility.

Unit 2: Sensors and Actuators **(12 L)**

Temperature sensor (Thermistor, LM-35), optical sensor (LDR), Passive Infrared sensor (PIR), Tilt Sensor, ultrasonic sensor, Motion sensor, Image Sensor, Actuators: DC Motor, stepper motor

Unit 3: Smart Instrumentation System and Smart Sensors **(6 L)**

Block diagram of Smart Instrumentation system, Concept of smart sensor, Film sensors, Nano sensor

Unit 4: OPAMP as signal Conditioner **(12 L)**

Concept, block diagram of Op amp, basic parameters (ideal and practical): input and output impedance, bandwidth, differential and common mode gain, CMRR, slew rate, IC741/ LM324, Concept of virtual ground, Op amp as inverting and non inverting amplifier, Unity gain follower, Opamp as adder, substractor, Op amp as current to voltage and voltage to current convertor, Voltage to frequency converter, Op amp as comparator, Problems based on above Op Amp applications.

Reference Books:

1. Sensors and Transducers : D. Patranabis, PHI publication, 2nd Edition
2. Sensors and Transducers : Prof A.D.Shaligram
3. Op Amp and Linear Integrated Circuits: Ramakant Gaykwad

SEMESTER II

PAPER II

ELC 122 : Basics of Computer Organisation
(2 Credits, 36 lectures)

Objectives:

1. To get familiar digital sequential circuits
2. To study Basic computer Organization
3. To study Memory architecture

Unit 1: Flip-flops **(5 L)**

RS Flip Flop using NAND gate, clocked RS Flip Flop, D Latch, J K Flip Flop,T Flip Flop

Unit 2: Shift registers and Counters **(9 L)**

Shift registers - SISO, SIPO, PISO, PIPO shift registers, Ring Counter using D Flip flop. Counters -Synchronous and Asynchronous type, 3-bit Up, Down and Up-Down counter, Concept of modulus Counters
(Timing Diagram of all above are expected)

Unit 3: Basics of Computer System **(12 L)**

Basic Computer Organization, Concept of Address Bus, Data Bus, Control Bus. CPU Block Diagram and Explanation of each block, Register based CPU organization, Concept of Stack & its organization, I/O organization: need of interface, block diagram of general I/O interface

Unit 4: Memory Organization **(10 L)**

Memory Architecture, Memory hierarchy, Types of Memories, Data Read/ Write process, Vertical and Horizontal Memory Expansion, Role of Cache memory, Virtual Memory.

Reference Books:

1. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education
2. Digital Electronics: Jain R.P., Tata McGraw Hill
3. Digital Logic and Computer Design : M. Morris Mano, Pearson Education
4. Computer Organization and Architecture, William Stallings, Pearson, 10th Edi.

SEMESTER II

Paper III

ELC-123: Electronics Lab IB

The practical course consists of **10 experiments** out of which one will be activity equivalent to 2 practical sessions.
Activity will carry 15% marks at internal and external semester examination. Activity can be any one of the following :

1.Hobby projects
2.Industrial visit / live work experience
3.PCB Making
4.Market Survey of Electronic Systems
5.Circuit Simulations and CAD tools

GROUP A (Minimum 4/8)

1. To study temperature sensor LM 35
2. Use of LDR to control light intensity
3. Study of PIR and tilt sensor.
4. Study of stepper motor.
5. Use of OPAMP as comparator and its use in DC motor driving.
6. Build and test Inverting and non inverting amplifier using OPAMP.
7. Build and test adder and subtractor circuits using OPAMP.
8. Build and test voltage to frequency converter

GROUP B (Minimum 4/8)

1. Study of RS, JK and D flip flops using NAND gates
2. Study of Four bit ALU
3. Study of asynchronous Up/Down Counter
4. Study of decade counter IC circuit configurations
5. Study of 4-bit SISO Shift register and it's use as Ring Counter
6. Study of read and write action of RAM (using IC 2112/4 or equivalent).
7. Study of Diode Matrix ROM
8. Study of Computer hardware system

Paper II	MTC-102 : Algebra and Calculus	MTC-112 : Discrete Mathematics and MTC-122 : Graph Theory
Paper III	MTC-103 : Mathematics Practical	MTC – 113 : Mathematics Practical and MTC – 113 : Mathematics Practical

Detailed Syllabus:

Semester - I

MTC-111: Matrix Algebra

Unit 1 : Introduction **(4 lectures)**

1.1 Matrix Operations
1.2 The Inverse of a Matrix
1.3 Characterization of invertible matrices

Unit 2 : Linear Equations in Linear Algebra-I **(12 lectures)**

2.1 System of Linear equations
2.2 Row reduction and echelon forms
2.3 Vector equations
2.4 The matrix equation Ax=b
2.5 Solution sets of linear systems

Unit 3 : Linear Equations in Linear Algebra -II **(12 lectures)**

3.1 Partitioned Matrices
3.2 Matrix factorization [Lu decomposition]
3.3 Linear Independence
3.4 Introduction to linear transformation
3.5 The matrix of linear transformation
3.6 Subspaces of R^n
3.7 Dimension and Rank

Unit 4 : Determinants **(8 lectures)**

4.1 Introduction to determinants
4.2 Properties of determinants

4.3 Cramer's rule, Volume and linear transformations

Text Book : Linear Algebra and its Applications, David C Lay, Steven R. Lay, Judi J. MacDonald Pearson Publication,2016, Fifth Edition.

Unit 1: Chapter 2: Sec. 2.1, 2.2, 2.3
Unit 2: Chapter 1: Sec. 1.1, 1.2, 1.3, 1.4, 1.5
Unit 3: Chapter 2: Sec. 2.4, 2.5,2.8, 2.9, Chapter 1: 1.7, 1.8, 1.9
Unit 4: Chapter 3: Sec. 3.1, 3.2, 3.3

Reference Books :

1. Elementary Linear Algebra with supplemental Applications,Howard Anton and others ,Wiley Student Edition.
2. Matrix and Linear Algebra (aided with MATLAB),KantiBhushanDatta, Eastern Economic Edition.

MTC 112: Discrete Mathematics

UNIT 1 : LOGIC (7 Lectures)

1.1 Revision : Propositional Logic, Propositional Equivalences.
1.2 Rules of Inference : Argument in propositional Logic, Validity Argument(Direct and Indirect methods) Rules of Inference for Propositional Logic, Building Arguments.
1.3 Predicates and Quantifiers : Predicate, n-Place Predicate or ,n-ary Predicate, Quantification and Quantifiers, Universal Quantifier, Existential Quantifier, Quantifiers with restricted domains, Logical Equivalences involving Quantifiers.

Unit 2 : Lattices and Boolean Algebra (13 Lectures)

2.1 Relations, types of relations, equivalence relations, Partial ordering relations
2.2 Digraphs of relations, matrix representation and composition of relations.
2.3 Transitive closure and Warshall's Algorithm
2.3 Poset, Hasse diagram.
2.4 Lattices, Complemented lattice, Bounded lattice and Distributive lattice.
2.5 Boolean Functions : Introduction, Boolean variable, Boolean Function of degree n, Boolean identities, Definition of Boolean Algebra.
2.6 Representation of Boolean Functions : Minterm, Maxterm Disjunctive normal form, Conjunctive normal Form.

Unit 3 : Counting Principles (7 Lectures)

3.1 Cardinality of Set : Cardinality of a finite set.
3.2 Basics of Counting : The Product Rule, The Sum Rule, The Inclusion- Exclusion Principle.
3.3 The Pigeonhole Principle: Statement, the Generalized Pigeonhole Principle, Its Applications.

3.4 Generalized Permutations and Combinations : Permutation and
3.5 Combination with Repetitions, Permutations with Indistinguishable Objects

Unit 4: Recurrence Relations **(9 Lectures)**

4.1 Recurrence Relations: Introduction, Formation.
4.2 Linear Recurrence Relations with constant coefficients.
4.3 Homogeneous Solutions.
4.4 Particular Solutions.
4.5 Total Solutions.

TextBooks:
1. Discrete Mathematics and its applications, by Kenneth Rosen, Tata McGraw Hill, Seventh Edition.
2. Discrete Mathematical Structures, by Kolman, Busby, Ross, Rehman, Prentice Hall,
3. Elements of Discrete Mathematics, by C. L. Liu, Tata McGraw Hill,

Unit 1: Text Book 1: Chapter 1: Sec. 1.1, 1.2, 1.3, 1.4, 1.5
Unit 2: Text Book 2: Chapter 6: Sec. 6.1, 6.2, 6.3, 6.4, 6.5
Unit 3: Text Book 1: Chapter 2: Sec. 2.1, Chapter 5: Sec.5.1, 5.2, 5.3
Unit 4: Text Book 3: Chapter 10: Sec. 10.1, 10.2, 10.3, 10.4, 10.5, 10.6

MTC 113: Mathematics Practical

(Practical based on the applications of articles in MTC-111 and MTC - 112)

In Semester-I, we should conduct 3 written practical and 3 practical on maxima software for each paper MTC -111 and MTC -112.

List of Practical

Practical 1 : Problems on Unit 1 and 2 (Written) from MTC-111.
Practical 2 : Problems on Unit 3 (Written) from MTC-111.
Practical 3 : Problems on Unit 4 (Written) from MTC-111.
Practical 4 :Introduction to maxima software for MTC-111.
Practical 5 : Problems on unit 1 and unit 2 from MTC-111using maxima software.
Practical 6 : Problems on Unit 3 and Unit 4 from MTC-111using maxima software.
Practical 7: Problems on Unit 1 and Unit 2(Written) from MTC-112.
Practical 8 : Problems on Unit 3 (Written) from MTC-112.
Practical 9 : Problems on Unit 4(Written) from MTC-112.
Practical 10 :Introduction to maxima software for MTC-112.
Practical 11 : Problems on unit 1 and unit 2 from MTC-112 using maxima software.
Practical 12 : Problems on Unit 3 and Unit 4 from MTC-112 using maxima software.

Note:

1. The soft copy of practical on maxima software will be prepared and provided by the Board of Studies in mathematics.
2. Practical on maxima software can be performed on computer and android mobiles.
3. Android mobiles are allowed for practical examination on maxima software.
4.Practical examination of 25 marks on written problems, 10 marks for problems on maxima software (5 marks for writing syntax and 5 marks to perform the same on android mobile or computer).

Semester -II

MTC-121: Linear Algebra

Unit 1: Vector Spaces **(10 lectures)**

1.1 Vector spaces and subspaces
1.2 Null spaces, column spaces and linear tranformations.
1.3 Linearly independent sets : Bases
1.4 Coordinate systems
1.5 The dimension of a vector space
1.6 Rank

Unit 2: Eigen values and Eigen vectors **(10 lectures)**

2.1 Eigen values and Eigen vectors
2.2 The characteristic equation
2.3 Diagonalization
2.4 Eigen vectors and Linear transformations

Unit 3:Orthogonality and Symmetric Matrices **(10 lectures)**

3.1 Inner product, length and orthogonality
3.2 Orthogonal sets
3.3 Orthogonal Projections
3.4 Diagonalization of Symmetric Matrices
3.5 Quadratic forms

Unit 4: The Geometry of vector spaces **(6lectures)**

4.1 Affine combinations
4.2 Affine independence
4.3 Convex combinations

Text Book :

Linear Algebra and its Applications (5th Edition) David C Lay, Steven R. Lay, Judi J. MacDonaldPearson Publication, Fifth Edition, 2016.

Unit 1:Chapter 4: Sec.4.1, 4.2, 4.3,4.4, 4.5, 4.6
Unit 2: Chapter 5: Sec. 5.1, 5.2, 5.3, 5.4
Unit 3: Chapter 6: Sec. 6.1, 6.2, 6.3, Chapter 7: 7.1,7.2
Unit 4: Chapter 8:Sec. 8.1, 8.2*,8.3
*From section 8.2 omit Barycentric coordinates.

Reference Books:

1. Elementary Linear Algebra with supplemental Applications, by Howard Anton and others,Wiley Student Edition, Fourth edition.
2. Matrix and Linear Algebra (aided with MATLAB), byKantiBhushanDatta, Eastern Economic Edition, Fourth edition.

MTC-122: Graph Theory

Unit 1: An Introduction to graph **(10 lectures)**

1.1. Definitions, Basic terminologies and properties of graph, Graph models.
1.2. Special types of graphs, basic terminologies, properties and examples of directed graphs .Types of diagraphs.
1.3. Some applications of special types of graph.
1.4. Matrix representation and elementary results, Isomorphism of graphs.

Unit 2: Connected graph **(8 lectures)**

2.1. Walk, trail, path, cycle, elementary properties of connectedness. Counting paths between vertices (by Warshall's algorithm).
2.2. Cut edge (Bridge), Cut vertex, cut set, vertex connectivity, edge connectivity, and Properties.
2.3. Shortest path problem, Dijkstra's algorithm.

Unit 3. Euler and Hamilton path. **(8 lectures)**

3.1. The Konigsberg bridge problem, Euler trail, path, circuit and tour, elementary properties and Fleury's algorithm.
3.2. Hamilton path, circuit, elementary properties and examples.
3.3. Introduction of Travelling salesman problem, Chinese postman problem.

Unit 4. Trees **(10 lectures)**

4.1. Definitions, basic terminologies, properties and applications of trees.
4.2. Weighted graph, definition and properties of spanning tree, shortest spanning tree, Kruskal's algorithm, Prim's algorithm.

4.3. M-ary tree, binary tree, definitions and properties, tree traversal: preorder, inorder, postorder, infix, prefix, postfix notations and examples.

Text Book:

Kenneth Rosen, Discrete Mathematics and its applications, Tata McGraw Hill, Seventh Edition.

Unit 1: Chapter 8: Sec. 8.1, 8.2, 8.3
Unit 2: Chapter 8: Sec. 8.4
Unit 3: Chapter 8: Sec. 8.5, 8.6
Unit 4: Chapter 9: Sec. 9.1,9.2,9.3,9.4,9.5.

Reference Books:

1. John Clark and Derek Holton, A first look at Graph theory, Allied Publishers.
2. NarsinghDeo, Graph Theory with applications to computer science and engineering, Prentice Hall.
3. C.L.Liu, Elements of Discrete Mathematics, Tata McGraw Hill, Fourth edition
4. Douglas B. West, Introduction to Graph Theory, Pearson Education, second edition.

MTC 123: Mathematics Practical

(Practical based on the applications of articles in MTC- 121 and MTC- 122)

In Semester- II, we should conduct 4 written practical and 2 practical on maxima software for each paper MTC-121 and MTC-122.

List of Practical

Practical 1 : Problems on Unit 1 (Written) from MTC-121.
Practical 2 : Problems on Unit 2 (Written) from MTC-121.
Practical 3 : Problems on Unit 3(Written) from MTC-121.
Practical 4 :Problems on Unit 4(Written) from MTC-121.
Practical 5 : Problems on unit 1 and unit 2 from MTC-121using maxima software.
Practical 6 : Problems on Unit 3 and Unit 4 from MTC-121using maxima software.
Practical 7: Problems on Unit 1 (Written) from MTC-122.
Practical 8 : Problems on Unit 2 (Written) from MTC-122.
Practical 9 : Problems on Unit 3 (Written) from MTC-122.
Practical 10 :Problems on Unit 4 (Written) from MTC-122.
Practical 11 : Problems on unit 1 and Unit 2 from MTC-122 using maxima software.
Practical 12: Problems on Unit 3 and Unit 4 from MTC-122 using maxima software.

Note:

Semester I

Paper-I

CSST 111 :Descriptive Statistics

No. of Credits :2No. of lectures: 40

TOPICS/CONTENTS:

UNIT1: Data Condensation and Presentation of Data (9L)

1.1 Definition, importance, scope and limitations of statistics.

1.2 Data Condensation: Types of data (Primary and secondary), Attributes and variables, discrete and Continuous variables.

1.3 Graphical Representation: Histogram,Ogive Curves, Steam and leaf chart. [Note: Theory paper will contain only procedures. Problems to be included in practical]

1.4 Numerical problems related to real life situations.

UNIT2: Descriptive Statistics(14L)

2.1 Measures of central tendency:Concept of central tendency, requisites of good measures of central tendency.

2.2 Arithmetic mean: Definition, computation for ungrouped and grouped data, properties of arithmetic mean (without proof) combined mean, weighted mean, merits and demerits.

2.3 Median and Mode: Definition, formula for computation for ungrouped and grouped data, graphical method, merits and demerits. Empirical relation between mean, median and mode (without proof)

2.4 Partition Values: Quartiles, Box Plot.

2.5 Concept of dispersion, requisites of good measures of dispersion, absolute and relative measures of dispersion.

2.6 Measures of dispersion : Range and Quartile Deviation definition for ungrouped and grouped data and their coefficients, merits and demerits,
Variance and Standard deviation: definition for ungrouped and grouped data, coefficient of variation, combined variance & standard deviation, merits and demerits.

2.7 Numerical problems related to real life situations.

Semester I

Paper-II

CSST 112 :Mathematical Statistics

No. of Credits : 2 No. of lectures: 40

TOPICS/CONTENTS:

UNIT 1:Theory of Probability **(10L)**

1.1 Counting Principles, Permutation, and Combination.

1.2 Deterministic and non-determination models.

1.3 Random Experiment, Sample Spaces (Discrete and continuous)

1.4 Events: Types of events, Operations on events.

1.5 Probability - classical definition, probability models, axioms of probability, probability of an event.

1.6 Theorems of probability (without proof)

i) $0 \leq P(A) \leq 1$ ii) $P(A) + P(A') = 1$ iii) $P(\Phi) = 0$ iv)$P(A) \leq P(B)$ when $A \subset B$

iv) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

1.7 Numerical problems related to real life situations.

UNIT 2: Conditional Probability and Independence **(8L)**

2.1Concepts and definitions of conditional probability, multiplication theorem $P(A \cap B)=P(A).P(B|A)$

2.2 Bayes' theorem (without proof). True positive , false positive and sensitivity of test as application of Bayes' theorem.

2.3 Concept of Posterior probability, problems on posterior probability.

2.4 Concept and definition of independence of two events.

2.5 Numerical problems related to real life situations.

UNIT 3: Random Variable **(10L)**

3.1 Definition of random variable (r.v.) , discrete and continuous random variable.

3.2 Definition of probability mass function (p.m.f.) of discrete r.v. and Probability density function of continuous r.v..

3.3 Cumulative distribution function (c.d.f.) of discrete and continuous r.v. and their properties. (Characteristic properties only)

Semester I

Paper-III

CSST113: Statistics Practical

No. of Credits : 1.5

TOPICS/CONTENTS

Pre-requisites: Knowledge of the topics in theory papers I and II

Objectives: At the end of the course students are expected to be able

i) To tabulate and make frequency distribution of the given data.
ii) To use various graphical and diagrammatic techniques and interpret.
iii) To compute various measures of central tendency, dispersion, Skewness and kurtosis.
iv) To fit the Binomial and Poisson distributions.
v) To compute the measures of attributes.
vi) The process of collection of data, its condensation and representation for real life data.
vii) To study free statistical softwares and use them for data analysis in project.

Sr. No.	Title of the practical
1	Tabulation and construction of frequency distribution. (Use of at least two data sets more than 50 observations- each for constructing frequency distribution)
2	Diagrammatic and graphical representation using EXCEL and data interpretation. (problems on the basis of SET and NET examination in Paper I to be taken)
3	Summary statistics for ungrouped data and comparison for consistency using EXCEL.
4	Summary statistics for grouped frequency distribution. (Problems based on central tendency, dispersion, measures of skewness: Karl Pearson's and Quartile measure to be covered)
5	Measure of Skewness and kurtosis based on moments.
6	Fitting of Binomial distribution and computation of expected frequencies. (Use the observed and expected frequencies for the next semester χ^2 test)
7	Fitting of Poisson distribution and computation of expected frequencies. (Use the observed and expected frequencies for the next semester χ^2 for test.) (Give one data set for fitting both Poisson and Binomial distributions.)
8	Measure of attributes. (Two attributes only)
9	Study of free statistical softwares and writing a report on it. (individual activity)
10	Project(Part-I) -Data collection, its condensation and representation.

Notes:

1) For project, a group of maximum 8 students be made.
2) All the students in a group are given equal marks for project.
3) Different data sets from primary or secondary sources may be collected.

Semester II

Paper-I

CSST 121 :Methods of Applied Statistics

No. of Credits: 2 No. of lectures: 40

TOPICS/CONTENTS:

UNIT 1:Correlation (For ungrouped data) (10L)

1.1Concept of bivariate data, scatter diagram, its interpretation, concept of correlation, Positivecorrelation, negative correlation, zero correlation.

1.2 Karl Pearson's coefficient of correlation, properties of correlation coefficient, Interpretation of correlation coefficient, coefficient of determination with interpretation.

1.3 Spearman's rank correlation coefficient (formula with and without ties).

1.4Numerical problems

UNIT 2: Regression (for ungrouped data) (12L)

2.1Concept of linear and nonlinear regression.

2.2 Illustrations, appropriate situations for regression and correlation

2.3 Linear regression :Fitting of both lines of regression using least square method.

2.4 Concept of regression coefficients.

2.5 Properties of regression coefficients : $b_{xy} \cdot b_{yx} = r^2$, $b_{xy} * b_{yx} \leq 1$, $b_{xy} = r\,(\sigma_x / \sigma_y)$ and$b_{yx} = r\,(\sigma_y / \sigma_x)$.

2.6 Nonlinear regression models: Second degree curve, exponential curves of the type $Y=ab^x$ and $Y=ax^b$.

2.7 Numerical problems related to real life situations

UNIT3: Multiple Regression and Multiple, partial Correlation (For Trivariate Data)(10L)

3.1 Concept of multiple regressions, Yule's Notations.

3.2 Fitting of multiple regression planes.[Derivation of equation to the plane of regression of X_1on X_2 and X_3 is expected. Remaining two equations to be written analogously.]

3.3 Concept of partial regression coefficients, interpretations.

3.4 Concept of multiple correlation: Definition of multiple correlation coefficientand its formula..

Semester II

Paper-II

CSST122: Continuous Probability Distributions and Testing of Hypotheses

No. of Credits : 2 No. of lectures: 40

TOPICS/CONTENTS:

UNIT 1:Standard Continuous Probability Distributions (10L)

1.1 Uniform Distribution: statement of p.d.f., mean, variance, nature ofprobability curve. Theorem (without proof): The distribution function of any continuous r.v. if it is invertible follows U(0, 1) distribution

1.2 Exponential Distribution: statement of p.d.f. of the form,$f(x) = (1/\theta)\, e(-x/\theta)$, mean, variance, nature of probability curve, lack ofmemory property.(with proof)

1.3 Paratodistribution :Form of pdf $f(x):\alpha/ x^{(\alpha+1)}$; $x \geq 1$, $\alpha > 0$. Mean, variance, symmetry, applications

1.3 Normal Distribution: statement of p.d.f., identification of parameters,nature of probability density curve, standard normal distribution,symmetry, distribution of aX+b, aX+bY+c where X and Y areindependent normal variables, computations ofprobabilities usingnormal probability table, normal approximation to binomial and Poissondistribution, central limit theorem (statement only), normal probabilityplot. Box Muller transformation

1.4 Numerical problems related to real life situations.

UNIT 2:Concepts and definitions related to testing of hypothesis (4L)

2.1 Concepts of population and sample.

2.2 Definitions: random samplefrom a probability distribution, parameter, statistic, standard error ofestimator.

2.3 Concept of null hypothesis and alternative hypothesis (Research hypothesis), critical region,level of significance, type I and type II error, one sided and two sided tests, Test of hypothesis,p-value.

Semester II

Paper-III

CSST 123: Statistics Practical

No. of Credits : 1.5

Pre-requisites: Knowledge of the topics in theory papers I and II

Objectives: At the end of the course students are expected to be able

i) To understand the relationship between two variables using scatter plot.
ii) To compute coefficient of correlation, coefficient of regression.
iii) To fit various regression models and to find best fit.
iv) To fit the Normal distribution.
v) To understand the trend in time series and how to remove it.
vi) To apply inferential methods for real data sets.
vii) To generate model sample from given distributions.
viii) To understandthe importance and functions of different statistical organizations in the development of nation.

Sr. No.	Title of the Practical
1	Linear correlation and regression (use of scatter plot for explaining the linear relationship between two variables)
2	Fitting of non-linear regression. (use of scatter plot for explaining the non-linear relationship between two variables)
3	Fitting of normal distribution and computation of expected frequencies.
4	Fitting of linear regression model (Simple and Multiple) and non-linear regression models and finding the best fit byusing EXCEL.
5	Modelsampling from continuous uniform, exponential and normal distributions using Excel.
6	Large sample tests.
7	F test, t test, χ^2 test using EXCEL (one problem each with equal and unequal variance)(χ^2 test – for goodness of fit-use fitted problems of Binomial, Poisson and Normal distribution in previous practical problems)
8	Time Series- Estimation of trend by using the method of moving averages
9	Write a report on application of some statistical technique in the field of computers.(individual activity)
10	Project (Part-II) - Analysis of data collected in semester-I

Notes:

i) For project, a group of maximum 8 students be made.
ii) All the students in a group are given equal marks for project.
iii) Students will be asked to use Statistical methods which they have learnt and use of free statistical software for data analysis.

Detailed Syllabus:

Course Code: CSUT111	**Course Name:** Paradigm of Programming Language	**Total Lectures (48 Hours)**
Teaching Scheme : 4 hrs/week	**Examination Scheme:** IA: 30 Marks UE: 70 Marks	**No. of Credits** 4
Course Prerequisites:	Student should have basic knowledge of: • Procedural Language like C • Object-Oriented Languages (C++ and Java) • Concepts of Operating Systems • Basic Data Structures and Algorithms.	
Course Objectives:	To Prepare student to think about programming languages analytically: • Separate syntax from semantics • Compare programming language designs • Understand their strengths and weaknesses • Learn new languages more quickly • Understand basic language implementation techniques • Learn small programs in different programming Languages	
Chapter	**Course Contents**	**No. of Lectures**
1	**Introduction** • The Art of Language Design • The Programming Language Spectrum • Why Study Programming Languages? • Compilation and Interpretation • Programming Environments	2
2	**Names, Scopes, and Bindings** • The Notion of Binding Time • Object Lifetime and Storage Management • Static Allocation, Stack-Based Allocation, Heap-Based Allocation, Garbage Collection Scope Rules • Static Scoping, Nested Subroutines, Declaration Order, Dynamic Scoping The meaning of Names in a Scope • Aliases, Overloading, Polymorphism and Related Concepts, the Binding of Referencing Environments • Subroutine Closures, First-Class Values and Unlimited Extent, Object Closures Macro Expansion •	5

Course Code: CSUT112	Course Name: Design and Analysis of Algorithm	Total Lectures (48 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 30 Marks UE: 70 Marks	No. of Credits 4
Course Prerequisites:	☐ Basic knowledge of algorithms and programming concepts ☐ Data Structures and Advanced Data Structures ☐ Basic Knowledge of Graphs and Algorithms	
Course Objectives:	• To design the algorithms • To select the appropriate algorithm by doing necessary analysis of algorithms • To learn basic Algorithm Analysis techniques and understand the use of asymptotic notation • Understand different design strategies • Understand the use of data structures in improving algorithm performance • Understand classical problem and solutions • Learn a variety of useful algorithms • Understand classification of problems • To provide foundation in algorithm design and analysis • To develop ability to understand and design algorithms in context of space and time complexity.	

Chapter	Course Contents	No. of Lectures
1	**Basics of Algorithms** • Algorithm definition and characteristics • Space complexity • Time complexity, worst case-best case-average case • complexity, asymptotic notation • Recursive and non-recursive algorithms • Sorting algorithms (insertion sort, heap sort, bubble sort) • Sorting in linear time: counting sort, concept of bucket and radix sort • Searching algorithms: Linear, Binary	8
2	**Divide and conquer strategy** • General method, control abstraction • Binary search • Merge sort, Quick sort • Comparison between Traditional Method of Matrix Multiplication vs. Strassen's Matrix Multiplication	5

Course Code: CSUT113	Course Name: Database Technologies	Total Lectures (48 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 30 Marks UE: 70 Marks	No. of Credits 4
Course Prerequisites:	• Knowledge of file system concepts • Strong foundation of Related database Concepts (Basic & Advanced) • A firm foundation of any RDBMS package	
Course Objectives:	• Provide an overview of the concept of NoSQL technology. • Provide an insight to the different types of NoSQL databases • Make the student capable of making a choice of what database technologies to use, based on their application needs.	

Chapter	Course Contents	No. of Lectures
1	**Introduction to NOSQL (Core concepts)**	18
	Why NoSQL	
	Aggregate Data Models	
	Data modeling details	
	Distribution Models	
	Consistency	
	Version stamps	
	Map-Reduce	
2	**Implementation with NOSQL databases**	14
	Key-Value Databases (Riak)	
	Document Databases (Mongodb)	
	Column-Family stores (Cassandra)	
	Graph databases (Neo4j)	
3	**Schema Migrations**	5
4	**Polygot Persistence (Multi model types)**	5
5	**Beyond NoSQL**	3
6	**Choosing your database**	3

References:

Sr. No.	Title of the Book	Author/s	Publication
1	NoSQL Distilled	Pramod Sadalge, Martin Fowler	
2	NoSQL for Dummies	A Willy Brand	
3	http://nosql-database.org		

Note: For Database Technologies implementation of databases/assignments can be done in all, but for university practical examination only MongoDB and Neo4j will be used/considered. Other can be for self learning/demonstration.

Course Code: CSDT114B	Course Name: Artificial Intelligence	Total Lectures (30 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 15 Marks UE: 35 Marks	No. of Credits 02
Course Prerequisites:	☐ Concepts of Data structures and Design and Analysis of algorithms. ☐ Strong data analytics skills. ☐ Strong will to learn machine learning languages.	
Course Objectives:	☐ To learn various types of algorithms useful in Artificial Intelligence (AI). ☐ To convey the ideas in AI research and programming language related to emerging technology. ☐ To understand the numerous applications and huge possibilities in the field of AI that goes beyond the normal human imagination.	

Chapter	Course Contents	No. of Lectures
1	**Introduction to Artificial Intelligence:** Introduction and Intelligent systems, What Is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, Applications of AI, Early work in AI and related fields, AI problems and Techniques.	2
2	**Searching:** -Defining AI problems as a State Space Search: example, Search and Control Strategies, Problem Characteristics, Issues in Design of Search Programs, Production System. Blind Search Techniques : -BFS, DFS, DLS, Iterative Deepening, Search, Bidirectional Search, Uniform cost Search. Heuristic search techniques: -Generate and test ,Hill Climbing, Best First search, Constraint Satisfaction, Mean-End Analysis, A*,AO*.	8

CSDP114B: Artificial Intelligence Practical

Sr. No.	Assignment
1	Subject teacher should conduct first lab practical on basic programs using python for introducing and using python environment such as, a) Program to print multiplication table for given no. b) Program to check whether the given no is prime or not. c) Program to find factorial of the given no and similar programs.
2	Write a program to implement List Operations(Nested list, Length, Concatenation, Membership ,Iteration ,Indexing and Slicing), List Methods(Add, Append, Extend & Delete)
3	Write a program to Illustrate Different Set Operations.
4	Write a program to implement Simple Chatbot.
5	Write a program to implement Breadth First Search Traversal.
6	Write a program to implement Depth First Search Traversal.
7	Write a program to implement Water Jug Problem.
8	Write aprogram to implement K -Nearest Neighbor algorithm.
9	Write a program to implement Regression algorithm.
10	Write a program to implement Random Forest Algorithm.

CSUP115: PPL and Database Technologies Practical

LIST OF SCALA PROGRAMS (PPL)

Control Structures

1. Write a program to calculate average of all numbers between n1 and n2(eg.100 to 300 Read values of n1 and n2 from user)
2. Write a program to calculate factorial of a number.
3. Write a program to read five random numbers and check that random numbers are perfect number or not.
4. Write a program to find second maximum number of four given numbers.
5. Write a program to calculate sum of prime numbers between 1 to 100
6. Write a program to read an integer from user and convert it to binary and octal using user defined functions.

Arrays

1. Write a program to find maximum and minimum of an array
2. Write a program to calculate transpose of a matrix.
3. Write a program to calculate determinant of a matrix,
4. Write a program to check if the matrix is upper triangular or not.
5. Write a program to sort the matrix using insertion sort.
6. Write a program for multiplication of two matrices(Validate number of rows and columns before multiplication and give appropriate message)

String

1. Write a program to count uppercase letters in a string and convert it to lowercase and display the new string.
2. Write a program to read a character from user and count the number of occurrences of that character.
3. Write a program to read two strings. Remove the occurrence of second string in first string.
4. Create array of strings and read a string from user. Display all the elements of array containing given string.

Classes and Objects

1. Define a class CurrentAccount (accNo, name, balance, minBalance). Define appropriate constructors and operations withdraw(), deposit(), viewBalance(). Create an object and perform operations.
2. Define a class Employee (id, name, salary). Define methods accept() and display(). Display details of employee having maximum salary.
3. Create abstract class Order (id, description). Derive two classes PurchaseOrder& SalesOrder with members Vendor and Customer. Create object of each PurchaseOrder and SalesOrder. Display the details of each account.
4. Create abstract class Shape with abstract functions volume() and display(). Extend two classes Cube and Cylinder from it. Calculate volume of each and display it.

Course Code: CSUT121	Course Name: Advanced Operating System	Total Lectures (48 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 30 Marks UE: 70 Marks	No. of Credits 4
Course Prerequisites:	• Working knowledge of C programming. • Basic Computer Architecture concepts. • Basic algorithms and data structure concepts.	
Course Objectives:	This course teaches Advanced Operating Systems Concepts using Unix/Linux. This course strikes a delicate balance between theory and practical applications In fact, most Units start with the theory and then switches focus on how the concepts are implemented in a C program. This course describes the programming interface to the Unix/Linux system - the system call interface. It is intended for anyone writing C programs that run under Unix/Linux. This course provides an understanding of the functions of Operating Systems. It also provides provide an insight into functional modules of Operating Systems. It discusses the concepts underlying in the design and implementation of Operating Systems.	
Chapter	Course Contents	No. of Lectures
1	**Introduction to UNIX/LinuxKernel** • System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System (TextBook-1: Chapter Topics: 1.2, 1.3, 1.5, 2.1) • Concepts of Linux Programming- Files and the Filesystem, Processes, Users and Groups, Permissions, Signals, Interprocess Communication (TextBook-3: Chapter 1- relevant topics)	04
2	**File and Directory I/O** • Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks, inodes, structure of regular file, open, read, write, lseek, close, pipes, dup (TextBook- 1: Chapter Topics: 3.1-3.4, 4.1, 4.2, 5.1-5.3, 5.5-5.7, 5.12, 5.13) • open, creat, file sharing, atomic operations, dup2, sync, fsync, and fdatasync, fcntl, /dev/fd, stat, fstat, lstat, file types, Set-User-ID and Set-Group-ID, file access permissions, ownership of new files and directories, access function, umask function, chmod and fchmod, sticky bit, chown, fchown, and lchown, file size, file truncation, file systems, link, unlink, remove, and rename functions, symbolic links, symlink and readlink functions, file times, utime, mkdir and rmdir, reading directories, chdir, fchdir, and getcwd, device special files (TextBook-2: Chapter Topics: 3.3, 3.4, 3.10-3.14, 3.16, 4.2-4.23)	15

Course Code: CSUT121	Course Name: Advanced Operating System	Total Lectures (48 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 30 Marks UE: 70 Marks	No. of Credits 4
Course Prerequisites:	• Working knowledge of C programming. • Basic Computer Architecture concepts. • Basic algorithms and data structure concepts.	
Course Objectives:	This course teaches Advanced Operating Systems Concepts using Unix/Linux. This course strikes a delicate balance between theory and practical applications In fact, most Units start with the theory and then switches focus on how the concepts are implemented in a C program. This course describes the programming interface to the Unix/Linux system - the system call interface. It is intended for anyone writing C programs that run under Unix/Linux. This course provides an understanding of the functions of Operating Systems. It also provides provide an insight into functional modules of Operating Systems. It discusses the concepts underlying in the design and implementation of Operating Systems.	
Chapter	Course Contents	No. of Lectures
1	**Introduction to UNIX/LinuxKernel** • System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System (TextBook-1: Chapter Topics: 1.2, 1.3, 1.5, 2.1) • Concepts of Linux Programming- Files and the Filesystem, Processes, Users and Groups, Permissions, Signals, Interprocess Communication (TextBook-3: Chapter 1- relevant topics)	04
2	**File and Directory I/O** • Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks, inodes, structure of regular file, open, read, write, lseek, close, pipes, dup (TextBook- 1: Chapter Topics: 3.1-3.4, 4.1, 4.2, 5.1-5.3, 5.5-5.7, 5.12, 5.13) • open, creat, file sharing, atomic operations, dup2, sync, fsync, and fdatasync, fcntl, /dev/fd, stat, fstat, lstat, file types, Set-User-ID and Set-Group-ID, file access permissions, ownership of new files and directories, access function, umask function, chmod and fchmod, sticky bit, chown, fchown, and lchown, file size, file truncation, file systems, link, unlink, remove, and rename functions, symbolic links, symlink and readlink functions, file times, utime, mkdir and rmdir, reading directories, chdir, fchdir, and getcwd, device special files (TextBook-2: Chapter Topics: 3.3, 3.4, 3.10-3.14, 3.16, 4.2-4.23)	15

Course Code: CSUT122	Course Name: Mobile Technologies	Total Lectures (48 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 30 Marks UE: 70 Marks	No. of Credits 4
Course Prerequisites:	☐ Concepts of Networking ☐ Conversant with OS internals ☐ Familiar with the network Protocol stack ☐ Gain knowledge about different mobile platform and application development ☐ Brief History of wireless communication	
Course Objectives:	☐ To impart basic understanding of the wireless communication systems. ☐ To expose students to various aspects of mobile and ad-hoc networks. ☐ Understand the issues relating to Wireless applications ☐ Understand the Mobile security	
Chapter	Course Contents	No. of Lectures
1	**Introduction to Mobile Computing** • Introduction and need for Mobile computing • Mobility and portability • Mobile and Wireless devices • Mobile Applications • Mobile Operating system – IOS, BlackBery, Windows phone, Plam OS, Symbian OS,PhoneGap	03
2	**Android Fundamentals** • Introduction to Android - Overview and evolution of Android , Features of Android, Android architecture • Components of an Android Application, Manifest file • Android Activity • Service Lifecycle	07
3	**Android UI Design** • Basic UI Designing (Form widgets ,Text Fields , Layouts ,[dip, dp, sip, sp] versus px) • Intent(in detail) • All components (e.g Button , Slider, Image view, Toast) Event Handling • Adapters and Widgets • Menu	07

Course Code: CSUT123	Course Name: Software Project Management	Total Lectures (48 Hours)
Teaching Scheme : 4 hrs/week	Examination Scheme: IA: 30 Marks UE: 70 Marks	No. of Credits 4
Course Prerequisites:	☐ Software Engineering ☐ Basic testing concepts	
Course Objectives:	• Software Metrics and Project Management covers skills that are required to ensure successful medium and large scale software projects. • It examines Requirements Elicitation, Project Management, Verification &Validation and Management of Large Software Engineering Projects. • Students learn to select and apply project management techniques for process modeling, planning, estimation, process metrics and risk management; perform software verification and validation using inspections, design and execution of system test cases.	

Chapter	Course Contents	No. of Lectures
1	**Introduction to Project Management** ☐ What is a Project? ☐ What is Project management? ☐ Project phases and project life cycle ☐ Organizational structure ☐ Qualities of Project Manager ☐ WBS	4
2	**Project Management Components** ☐ Project Integration Management-Project plan development and execution ☐ Change controls ☐ CCB ☐ Configuration management	6
3	**Scope Management** ☐ Strategic planning ☐ Scope planning, definition ☐ Verification and control	4
4	**Time management** ☐ Activity planning ☐ Schedule development and control ☐ GANTT Chart	2
5	**Cost Management** ☐ Cost estimation and Control ☐ COCOMO model ☐ BASIC COCOMO NUMERICALS	2
6	**Quality Management** • Quality planning and assurance	2

M. Sc. [I]

CSDP124A: Project Related Assignments

Assignment 1

Assignment 2

Assignment 3

Assignment 4