English Language and Foundation Courses B.A/B.Sc/B.Com Career Related 2(a) and 2 (b) Programmes

(2019 Admission onwards)

B.A/ B.Sc Programmes

Semester I to IV- Course Breakup

Sem No	Course No	Course Title	Instructional hours	Credits
1	EN 1111.1	Language Course 1: Language Skills	5	4
1	EN 1121	Foundation Course 1: Writings on Contemporary Issues	4	2
2	EN 1211.1	Language Course 3: Ability Enhancement Compulsory Course: Environmental Studies and Disaster Management	6	4
2	EN 1212.1	Language Course 4: English Grammar, Usage and Writing	4	3
3	EN 1311.1	Language Course 6: English for Career	5	4
4	EN 1411.1	Language Course 8: Readings in Literature	5	4

English Language Courses for B. Com Programmes

Semester I to IV- Course Breakup

Sem No	Course No	Course Title	Instructional hours	Credits
1	EN 1111.2	Language Course 1: Language Skills	5	4
2	EN 1211.2	Language Course 3: English Grammar, Usage and Writing	5	4
3	EN 1311.2	Language Course 4: Business English	3	3
2	EN 1411.2	Language Course 6: Readings in Literature	3	3

English Language Courses for Career Related 2(a) Programmes

Semester I to IV- Course Breakup

Sem No	Course No	Course Title	Instructional hours	Credits
1	EN 1111.3	Language Course 1: Language Skills	5	4
2	EN 1211.3	Language Course 3: English Grammar, Usage and Writing	5	3
3	EN 1311.3	Language Course 5: English for Career	5	4
4	EN 1411.3	Language Course 6: Readings in Literature	5	4

English Language Courses for Career Related 2(b) Programmes

Semester I to II- Course Breakup

Sem No	Course No	Course Title	Instructional hours	Credits
1	EN 1111.4	Language Course 1: Language Skills	3	2
2	EN 1211.4	Language Course 3: English Grammar, Usage and Writing	3	2

Semester I

Language Course 1- EN 1111.1 (B A/ B. Sc), EN 1111.2 (B.Com), EN 1111.3 [Career Related 2(a)] Programme and EN 1111.4 [Career Related 2(b) Programme]

Course Title: LANGUAGE SKILLS

Credits: 4

Hours: 5/week (90 hrs)

Learning Objectives:

1. Mastering the language for personal and professional growth.
2. Basic language skills are to be acquired through interactive classroom sessions
3. Connecting literature with language learning

Learning Outcomes:

English as an acquired language for undergraduate students is to be mastered with focus on learning the basic skills of listening, speaking, reading and writing the language proficiently. This course aims to impart these skills in an interactive manner along with classroom activities and using the text as a resource for self study as well. Discursive Practice as the learning and teaching method for this course, will encourage teachers to localise and personalise learning of English for students in undergraduate classrooms. The course will equip the students with basic language skills along with improved non-verbal skills thereby improving their employability quotient.

Course Description

Module I: Basics of Communication

UNIT I

Theories of communication - Types of communication - Effective communication - barriers to effective communication - English as a language for communication - Micro-skills and macro-skills

Module II: Listening

Unit I

Listening skills - Barriers to effective listening - Conducting interviews - Enhancing listening skills

Unit II

1. Short Story: "The Night Train at Deoli" by Ruskin Bond - Comprehension questions
2. Poem: "Lines Addressed to a Warrior" by Meena Kandasamy - Comprehension questions

Unit III

Strengthening Vocabulary - Summarising passages - conducting interviews

Unit 1V

Phonetics: A Ready Reckoner

Standard English - Phonetics - symbols - syllables - stress - pitch and intonation

Unit V

1. Speech by Chimamanda Ngozi Adichie - Comprehension Questions
2. *Rhinoceros* Act I (Excerpt) by Eugene Ionesco - Comprehension Questions

Unit VI

Strengthening vocabulary - identifying sounds - marking stress - creating conversations

Module III: Speaking

Unit I

Speaking Skills - enhancing speaking skills - public speaking - telephonic conversations - podcasting - anchoring

Unit II

1. Speech by Steve Jobs - Comprehension Questions
2. Poem - "Still I Rise" by Maya Angelou - Comprehension Questions

Unit III

Vocabulary building exercises - self introduction - telephonic conversation

Unit IV

1. Poem - "The Art of Losing" by Tishani Doshi - Comprehension Questions
2. Essay - "Tsunami" by Amitav Ghosh - Comprehension Questions

Unit V

Vocabulary building exercises - marking stress - creating conversations - making a speech - script for anchoring

Module IV: Reading

Unit I

Reading skills - four types of reading - barriers to reading effectively - basics of editing

Unit II

1. *Autobiography* (Excerpt) Nelson Mandela - Comprehension Questions
2. "Toba Tek Singh" by Sadat Hasan Manto - Comprehension Questions

Unit III

Vocabulary building exercises - identifying meanings - building conversations - narrating stories - editing passages

Unit IV

The Ivory Throne (Excerpt) by Manu S Pillai - Comprehension Questions

1. Excerpt from a Play *Chitra* by Rabindranath Tagore - Comprehension Questions

Unit V

Vocabulary Exercises - Identifying diphthongs and vowels - describing people - conducting interviews and conversations - writing food blogs

Module V: Writing

Unit I

Four types of writing - writing for special purposes - academic writing – plagiarism

Unit II

1. Essay "The Great Indian Paradox" by Shashi Tharoor - Comprehension Questions
2. Poem "A Dog has Died" by Pablo Neruda - Comprehension Questions

Unit III

Paragraph writing - subjective style - objective style - writing stories - newspaper reports

Unit IV

1. Writing letters - writing emails - writing reports - writing memos - writing minutes - self-introduction - resume - biodata - curriculum vitae - blogging

Unit V

1. **Extract** from *India Psychedelic: The Story of a Rocking Generation* by Sidharth Bhatia - Comprehension Questions
2. Blog on Kabir by Anuradha Goyal - Comprehension Questions

Unit VI

Writing letters - writing emails - writing minutes - writing reports - note taking

Module VI: Soft Skills

Unit I

Posture - gestures - eye contact - telephone etiquette - netiquette - interpersonal skills

Text Book Prescribed:

Language Skills: A Course on Communication Skills in English

By Dr. Swapna Gopinath, Associate Professor, Department of English, S.N College, Chempazhanthy and Sangeetha Hariharan, Assistant Professor, Department of English, S.N Women's College, Kollam

Publishers: Emerald

Suggested Reading

S .P. Dhanvel. *English and Softskills*. Orient Blackswan, 2010.

Dr M. Farook. *English for Communication*, Emerald Publishers, 2015.

Dr Mathew Joseph. *Fine-tune your English*. Orient Blackswan, 2010.

E. Suresh Kumar, B Yadava Raju and C Muralikrishna. *Skills in English*. Orient Blackswan, 2013.

Bill Bryson. *The Mother Tongue: English and How it Got it that Way*. Harper Collins, 1990.

Web sources

www.englishclub.com

http://www.bbc.co.uk/learningenglish/

https://www.eslfast.com/

https://www.myenglishpages.com/
http://www.examenglish.com/
http://learnenglishteens.britishcouncil.org/exams/listening-exams
https://www.cambridgeenglish.org/learning-english/
https://www.pearson.com/us/

Model Question Paper

Question Paper

Question paper setter, please note that questions are NOT to be asked from the passages and poems given in this text. They are meant to help in learning the basic language skills. Internal exams should focus on listening and speaking skills. Writing and reading skills will be tested as part of University Examinations

No questions should be asked from Additional/ Suggested Reading

Hours: 3 **80 marks**

Section A

Answer in a word or a sentence. All Questions carry One mark each

Questions 1 to 10 will be on suprasegmental features and will focus on words and simple sentences. **(10 x 1 = 10 marks)**

Section B

Questions based on the theories of communication

Attempt Eight out of Twelve Short answers picked from first and sixth module

(8 x 2 = 16 marks)

Section C

Attempt Six out of nine questions to be answered in around 100 words

Questions based on the activities from all the modules except Module I and Module II

(6 x 4 = 24 marks)

Create a dialogue
Write a script for anchoring
Write a speech
Write a telephone conversation
Write a blog
Write a script for a podcast
Write a formal/informal letter
Edit the passage given below
Write an email
Write minutes for a meeting
Write a report
Edit the passage

Section D

Questions based on the activities from all the modules except Module I and Module II

Attempt any two out of four questions in about 300 words

(15 x2 = 30 marks)

Write an essay on any one of the topics
Write a paragraph on two of the following

Semester I

Foundation Course 1- EN 1121 (B A/ B. Sc) and CG 1121.3 [Career Related 2 (a) Programme]

Course Title: WRITINGS ON CONTEMPORARY ISSUES

Credits: 2

Hours: 4/week (72 hrs)

Learning Objectives:

1. To sensitize students to the major issues in the society and the world.
2. To provide students with a variety of perspectives on contemporary issues.
3. To encourage them to read literary pieces critically.

Learning Outcomes:

On completion of the course, the students should be able to

1. Have an overall understanding of some of the major issues in the contemporary world
2. Respond empathetically to the issues of the society
3. Read literary texts critically

Course Description

1. Living in the Planet of the Apps by Khyrunnisa A.
2. Ageing in India: Some Social Challenges to Elderly India by Abhay B. Mane
3. India's Women: The Mixed Truth by Amartya Sen
4. Drug Abuse: Causes and Solutions by Samudranil Mukherjee
5. Artificial Intelligence by Gareth Southwell
6. Universal Declaration of Human Rights by Leah Levin
7. What Secularism is and is not by Romila Thapar
8. The Globalisation of Inequality by P. Sainath

Textbook Prescribed:

Thoughts of Our Times

Edited by Dr. C.A. Lal, Associate Professor of English, School of Distance Education, University of Kerala and Vishnu Narayanan, Assistant Professor, Institute of English, University of Kerala

Publishers: Orient Blackswan

Additional Reading

1. Janaki Lenin, *My Husband & Other Animals*

2. Mark Tully, *No Fullstops in India*

3. Shashi Tharoor, *An Era of Darkness: The British Empire in India*

4. Alexander Frater, *Chasing The Monsoon: A Modern Pilgrimage Through India*

5. Bill Bryson, *A Short History of Nearly Everything*

Web sources

1. https://storycorps.org/stories/

2.https://www.fullspate.digitalcounterrevolution.co.uk/english-articles-advanced/

3. https://www.thehindu.com/

4. https://www.theguardian.com/international

5. http://epaper.indianexpress.com/

6. https://www.nytimes.com/

7. https://www.telegraph.co.uk/

8.https://ia601601.us.archive.org/26/items/in.ernet.dli.2015.460612/2015.460612.Jawaharlal-Nehrus-Speeches-Vol-2_text.pdf

Question Pattern

No questions should be asked from Additional/ Suggested Reading

Max. Marks: 80 **Time: 3 hours**

Part One

10 questions to be answered, each in a word or sentence. (10 x 1=10marks)

Part Two

Eight questions to be answered from a total of 12 and to be written in not more than 50 words. (8 x 2= 16marks)

Part Three

Six questions to be answered from a total of 9 and to be written in around 100words. (6 x 4 = 24marks)

Part Four

Two questions to be answered out of four and to be written in not less than 300 words. (2 x 15= 30marks)

Semester II

EN 1211.1

Language Course 3: Ability Enhancement Compulsory Course – EN 1211.1 (B.A / B.Sc)

Course Title: ABILITY ENHANCEMENT COMPULSORY COURSE: ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

Credits: 5

Hours: 5/week (90 hrs)

Learning Objectives:

To enable the student:

- to engage with a wide range of issues in environmental studies and disaster management.
- to acquire a set of values for environmental protection and conservation
- to recognize the ecological basis for regional and global environmental issues
- to manage natural disasters and other emergency situations
- to develop a critical vocabulary related to environmental studies and disaster management

Learning Outcomes:

The student will be able to:

- understand environmental crises and disaster management situations
- take lead in spreading environmental values and creating awareness among the public
- understand local environmental issues better
- respond in a better way to a natural calamity or disaster
- articulate environmental concerns using appropriate vocabulary

Course Description

Module 1

Understanding the Environment

Introduction: Environment-its importance-types of ecosystems

- "Chief Seattle's Speech"
- "The Religion of Forest" (An Essay by Rabindranath Tagore)
- "Trophic Cascade" (A poem by Camille T. Dungy)

A Glossary of relevant **key concepts** with examples

Comprehension Questions

Module 2

Resources and their Conservation

Introduction: Natural Resources-biodiversity- conservation

- An extract from *The Silent Spring*(A book by Rachel Carson)
- *On Killing a Tree* (A poem by Gieve Patel)
- *The Inheritors of the Earth* (A translation of Short Story by Vaikom Muhammed Basheer)

A Glossary of related **Key Concepts** with **examples**

Comprehension **Questions**

Module 3

Environmental Pollution

Introduction: Types-Causes-Effects-Waste management-Policies and practices

- *Beat Plastic Pollution* (An article from unenvironment.org)
- "Memory of Hiroshima" (A poem by K. Satchidanandan)
- *E is for E-waste* (Ellen Banda-Aaku)

A Glossary of Related **Key Concepts** with **examples**

Comprehension **Questions**

Module 4

Disaster Management

Introduction: Natural and Man-made- health emergency- handling hazardous materials- managing personal disasters- bomb threats- disasterpreparedness-management-rehabilitation

- An introductory essay on Disaster Management
- *The Truth about the Floods* (A poem by Nissim Ezekiel)
- An extract from Chapter 1 of *Patna Blues* by Abdullah Khan (Juggernaut Books)
- A newsletter on Bhopal Gas Tragedy

- Laboratory safety manual
- 'Relief Standard Operating Procedure for Natural & Man-made disaster,' an essay.

A Glossary of related **Key Concepts** with interesting **examples**

Comprehension Questions

Project report (10 Marks)

Students are expected to prepare a project report based on any one of the activities suggested below. General guidelines will be provided for preparing the Project Report.

1. Visit to a local area to document environmental assets: River/Forest/Grassland/Hill
2. Visit to a local polluted site: Urban/Rural/Industrial/Agricultural
3. Study of simple ecosystems: Pond/River/Hill slopes
4. Mock drill organized in their college by the local disaster management agencies

Model Question Paper
No questions should be asked from Additional/ Suggested Reading

Total marks: 80 Time: 3 hours

Part One
10 questions to be answered, each in a word or sentence.(10 x 1=10marks)

Part Two
Eight questions to be answered from a total of 12 and to be written in not more than 50 words. (8 x 2= 16marks)

Part Three
Six questions to be answered from a total of 9 and to be written in around 100 words. (6 x 4 = 24marks)

Part Four
Two questions to be answered out of four and to be written in not less than 300 words.
(2 x 15= 30marks)

Text Book Prescribed:

Ecoscapes

Edited by Dr Kishore Ram, Assistant Professor, Department of English, N.S.S College, Kottiyam, Dr Gireesh J., Assistant Professor, Department of English, Govt. Arts College, Thiruvananthapuram, Ranjith Krishnan K.R., Assistant Professor, Department of English, N.S.S College, Kottiyam and Dr Deepa Prasad L. Assistant Professor, Research Centre and Department of English, University College, Thiruvananthapuram

Publishers: Emerald

Suggested Reading

1. Bharucha, Erach.*The Biodiversity of India*. Mapin Publishing Pvt. Ltd. Ahmedabad, 2003.

2. Brunner, R C. *Hazardous Waste Incineration*. McGraw Hill Inc,1989.

3. Clark, R S. *Marine Pollution*. Clanderson Press, Oxford, 2008.

4. Cunningham, W P. *Environmental Encyclopaedia.* Jaico Publishing House, Mumbai, 2001.

5. Hawkins, R. E .*Encyclopedia of Indian Natural History*, Bombay Natural History Society, Bombay, 2005.

6. Heywood V.H. and Watson RT, *Global Biodiversity Assessment*. Cambridge University Press.1995.

7. Jadhav H and Bhosale V.M. *Environmental Protection and Laws*. Himalaya Publishing House, Delhi, 1995.

8. Odum EP. *Fundamentals of Ecology.* WB Saunders Co. USA, 1971.

9. Bumgarner, Jeffrey B. *Emergency Management: A Reference Handbook*. ABC-Clio, 2008.

10. Birkland, Thomas A. *Lessons of Disaster: Policy Change after Catastrophic Events.*Georgetown University Press, 2006.

11. Cahill, Kevin M. *Emergency Relief Operations*. FordhamUP, 2003.

Semester II

Language Course 4 -EN 1212.1 (BA/B. Sc), Language Course 3 - EN 1211.2 (B.Com) and Language Course 3 - EN 1211.3 [Career related 2(a) Programme]

Course Title: ENGLISH GRAMMAR, USAGE AND WRITING

Credits: 4

Hours: 5/week (90 hrs)

Learning Objectives:

1. To help students have a good understanding of modern English grammar.
2. To enable them produce grammatically and idiomatically correct language.
3. To help them improve their verbal communication skills.
4. To help them minimise mother tongue influence.

Learning Outcomes:

On completion of the course, the students should be able to

1. Have an appreciable understanding of English grammar.
2. Produce grammatically and idiomatically correct spoken and written discourse.
3. Spot language errors and correct them.

Course Description

Module I:

Form Class Words – Noun, Verb, Adjective, Adverb

Function Class Words – Determiner, Pronoun, Auxiliary, Conjunction, Qualifier, Interrogative, Preposition, Interjection

Types of Sentences – Declarative, Interrogative and Tag Questions, Imperative, Exclamatory Punctuation, Capitalisation

Module II:

Tenses

Concord

Comparisons

Module III:

Active and Passive Voice

Direct and Indirect Speech

Clauses – Simple, Complex and Compound

Module IV:

Dialogue Construction

Outline Story

Preparing Questionnaire

Module V:

Expansion of Proverbs

Report Writing

Short Essay Writing

Textbook Prescribed:

Language in Use

Edited by Dr. Neeta Sasidharan, Assistant Professor, Department of English, Govt. Women's College, Thiruvananthapuram, Dr. Sarita G., Assistant Professor, Department of English, Govt. Women's College, Thiruvananthapuram and Kukku Xavier, Assistant Professor, Research Centre and Department of English, All Saints' College, Thiruvananthapuram

Publishers: Cambridge University Press

Additional Reading:

Eastwood, John. *Oxford Practice Grammar.* Oxford UP, 2002.

Murphy, Raymond. *English Grammar in Use with Answers: Reference and Practice for Intermediate Students.* Cambridge UP, 1994.

Swan, Michael. *Practical English Usage*. Oxford UP, 2001.

Web sources

https://www.englishgrammar.org/exercises/
https://www.perfect-english-grammar.com/grammar-exercises.html

https://web2.uvcs.uvic.ca/elc/studyzone/grammar.htm

Model Question Paper Pattern

No questions should be asked from Additional/ Suggested Reading

English Grammar, Usage and Writing

Total marks: 80 Time: 3 hours

Part One
10 questions to be answered, each in a word or sentence following the directions given. (10 x 1=10marks)

Part Two
Eight questions to be answered from a total of 12 and to be written in not more than 50 words or according to directions given (8 x 2= 16marks)

Part Three
Six questions to be answered from a total of 9 and to be written in around 100 words or as directions given. (6 x 4 = 24marks)

Part Four
Two questions to be answered out of four and to be written in not less than 300 words or as directions given. (2 x 15= 30marks)

Semester III

Language Course 6 - EN 1311.1 (BA/B. Sc), Language Course 5 - EN 1311.3 [Career related 2(a) Programme] and Language Course 1 - EN 1211.4 [Career related 2(b) Programme]

Course Title: English for Career

Credits: 4

Hours: 5 hours/ week (90 hrs)

Learning Objectives

- To introduce students to the language skills required for appearing in career oriented competitive examinations
- To frame modules of study that would develop the cognitive, logical, verbal and analytical skills necessary to succeed in competitive examinations.
- To provide the pattern of questions based on common models of competitive tests
- To provide sufficient practice in Vocabulary, Grammar, Comprehension and Remedial English from the perspective of career oriented tests.
- To help students to prepare for and appear in competitive examinations.

Learning Outcomes

The student will

- Acquire the necessary language skills required in the competitive job market.
- Acquire the cognitive, logical, analytical and verbal skills necessary to succeed in competitive examinations
- Become familiar with the pattern of questions usually asked in the competitive examinations

- Get sufficient practice in Vocabulary, Grammar, Comprehension and Remedial English
- Be able to prepare for and be successful in competitive examinations.

Course Description

Module 1

Vocabulary

Ten passages with two sets of exercises - Passage based exercises (10) and general exercises (10) Identifying words from passages- meanings -synonyms-antonyms- one word substitutions- phrasal verbs- common errors in usage- common phrases and idioms- technical/professional/official usages- formal and informal registers in use – words to be used in sentences- confusing words- misspelt words. Key has been provided

Module 2

Grammar

Fifteen units that cover all the major areas of grammar - Passage based exercises(5) and five sets of practice exercises (25) – Exercises in different question models – Fill in the blanks – Choose the right option – Match the following – Remedial exercises- Correction of errors in sentences

Exercises in statement- negative - question transformations- statement- imperative- exclamatory transformations - question tags- nouns- pronouns- adjectives and adverbs- usage and comparative and superlative degrees - verbs - correct usage of tenses- concord- sequence of tenses , gerund, participle - correct usage of articles, prepositions and phrasal verbs- direct and indirect speech- active and passive voice. Key has been provided

Module 3

Reading Comprehension

Comprehension of ten passages, with twelve questions each – Passages from different subject areas and different levels of complexity - Questions based on reading for information, understanding, learning, summarizing - Exercises to test comprehension, analytical and logical thinking, vocabulary skills and critical thinking.

Module 4

Remedial English

Set of hundred questions for correction of errors if/wherever necessary, with questions from all areas of Vocabulary, Usage and Grammar familiarized in the earlier sections. Key has been provided.

Note: The book is in the format of a workbook. Teachers can ask the students to write the answers in the spaces provided, or follow the directions given in the book.

Model Question Paper

Total Marks: 80

Time: 3 Hours

Part One

10 questions, based on errors in vocabulary and grammar (10 x 1 = 10)

Part Two

Eight sets of questions, two in each set , from a total o 12. Fill in the blanks (8 x 2=16)

Part Three

Six sets of questions, four in each set, from a total of nine. (6 x 4=24)

Part Four

Two sets of questions, with fifteen (three sets of five each) in each set, from a total of our sets. (15 x 2=30)

Textbook Prescribed:

English for Success in Career: A Workbook

Edited by Dr. Bindu Nair, Associate Professor, Department of English, S.D College, Alappuzha, Dr. Sarita G., Assistant Professor, Department of English, Govt. Women's College, Thiruvananthapuram, R. Karthika, Assistant Professor, Department of English, S.D College, Alappuzha and M. Saritha, Assistant Professor, Department of English, S.D College, Alappuzha.

Publishers: Orient Blackswan

Additional Reading:

Oxford English Language Reference. *Compact Oxford Dictionary, Thesaurus and Wordpower Guide*. OUP.

N.D.Turton and J.B. Heaton. *Dictionary of Common Errors*. Longman Ltd. 1998.

Jennifer Seidl and W. McMordie. *English Idioms and How to Use Them*. OUP 1978.

McCarthy, Michael and Felicity O' Dell. *English Vocabulary in Use*. Cambridge UP, 1994.

Roger Gower. *Grammar in Practice 1-6*. Cambridge UP. 2005, 2008.

Raymond Murphy. *Intermediate English Grammar*. CambridgeUP. 2005

Bridger, Nick and Alison Pohl. *Technical English: Vocabulary and Grammar.* Summertown Publishing, 2007.

Julie Moore. *Common Mistakes at Proficiency and How to Avoid Them*. Cambridge UP, 2005.

Rachel Roberts, *Practical English Grammar*. Viva Books, New Delhi.

V.K. Moothathu, *Concise English Grammar*. OUP 2013, 2014

F.T.Wood, *Remedial English Grammar*. Macmillan, 1979.

Michael A. Pyle and Mary Ellen Munoz. *Cliff's TOEFL Preparation Guide*. BPB Publications. 1992.

Bhatnagar, Mahesh et al. *General English – For All Competitive Exams.* Source Books, 2017.

Richa Dwivedi, *The Ultimate Guide to 21st Century Careers*. Hachette India, 2017.

Sangeeta Sharma, Gajendra Singh Chauhan. *Soft Skills: An Integrated Approach to Maximise Personality*. Wiley India. 2016.

Web sources:

https://www.educationforever.in

ttps://owl.purdue.edu/

https://www.pinterest.com/

www.naukri.com

Semester III

Language Course 4 - EN 1311.2 (B.Com)

Course Title: BUSINESS ENGLISH

Credits: 3

Hours: 3 hours/ week (54 hrs)

Learning Objectives

1. To impart knowledge and understanding of the principles of business communication with special emphasis on the different forms of transactional writing.
2. To familiarize students with various business situations thereby tapping their creative quotient.
3. To enable students to employ the English language in habitual situations and thus gain an insight into its global popularity.
4. To instill interest in the students to read and enjoy narratives using texts drawn from a wide range of literary traditions and genres.

Learning Outcomes

On completion of the course, the students should be able to:

1. Understand the basic concepts of business communication

2. Employ the English language in everyday situations and business transactions

3. Communicate fluently and to reach across boundaries of personal and cultural differences

Course Description

Module 1

Transactional writing – business letters – letters of complaint – drafting e-mails – short reports - activities

Module 2

English in business transactions – agenda – minutes – short notes – language of advertising

Module 3

Job applications-*résumés*–cover letters – preparing for interviews

Module 4 - Business Prose

Course Material

1. ‘On the Education of a Man of Business’ – Arthur Helps
2. ‘Appro JRD’ – Sudha Murty
3. A Speech by N.R. Narayana Murthy
4. ‘Facebook is Making us Miserable’ – Daniel Gulati

Textbook Prescribed:

Effective Business Communication

Edited by Susan Alexander, Assistant Professor and Head, Department of English, St. Cyril’s College, Adoor, and Sowmya Mary Thomas, Assistant Professor, Department of English, St. Cyril’s College, Adoor,

Content created by Dr. Samson Thomas, Professor, Department of Literature, School of Literary Studies, EFLU, Hyderabad.

Publishers: Cambridge University Press

Further reading

1. Smith, Jenny. *The Complete Business English Master*

2. Abrams, M. H. *A Glossary of Literary Terms.*

3. Talbot, Fiona. *How to Write Effective Business English*

4.Owen, Roger. *BBC Business English*

Web sources

https://learnenglish.britishcouncil.org/business-english

https://www.skillsyouneed.com/ips/interview-skills.html

Question Pattern

No questions should be asked from Additional/ Suggested Reading

Max Marks: 80 **Time: 3 hours**

Part One

10 questions to be answered, each in a word or sentence. (10 x 1=10marks)

Part Two

Eight questions to be answered from a total of 12 and to be written in not more than 50 words. (8 x 2= 16marks)

Part Three

Six questions to be answered from a total of 9 and to be written in around 100words. (6 x 4 = 24marks)

Part Four

Two questions to be answered out of four and to be written in not less than 300 words. (2 x 15= 30marks)

Semester IV

Language Course 8 -EN 1411.1 (BA/B. Sc), Language Course 4 - EN 1411.2 (B.Com) and Language Course 6 - EN 1411.3 [Career related 2(a) Programme]

Course Title: READINGS IN LITERATURE

Credits: 4

Hours: 5/week (90 hrs)

Learning Objectives

1. To introduce students to Global Literatures and familiarize the writers

2. To sensitize students to the aesthetic, cultural and social aspects of literature originating from all over the world

3. To help them analyze and appreciate literary texts and the various cultures they embody.

4. Motivate further reading outside the class for enjoyment and pleasure

Learning Outcomes

On completion of the course, the students should be able to:

1. Understand and appreciate literary discourse.

2. Look at the best pieces of literary writing critically.

3. Analyze literature as a cultural and interactive phenomenon.

4. Understand the use of the target language and make use of it in daily life.

Course Material

Module 1 - Poetry

1. P.B. Shelley: "Song to the Men of England"

2. Robert Frost: "The Gift Outright"

3. Wole Soyinka: "Telephone Conversation"

5. Oodgeroo Noonuccal: "We are Going"

6. S. Joseph: "Identity Card."

7. Anil Gharai: "Agony"

8. Margaret Atwood: "Journey to the Interior"

9. Meena Alexander: "House of a Thousand Doors"

Module 2 - Short Stories

1. C. Ayyappan : Madness
2. Kottarathil Sankunni: The Power of Faith
3. Chandrika Balan: You are Under Surveillance
4. Jerome K. Jerome: The Man who was a Hospital
5. Rabindranath Tagore: The Exercise Book

Module 3 - Essays

1. Malcolm X : Nightmare
2. Arundhati Roy. The End of Imagination (upto Bomb and I)

Module 4 - One Act Play

1. Anton Chekhov: A Marriage Proposal

Textbook Prescribed:

Global Voices and Cultures

Eds. Susan Alexander, Assistant Professor and Head, Department of English, St. Cyril's College, Adoor, Amith David, Assistant Professor, Department of English, Bishop Moore College, Mavelikkara, Nisha Mathew, Assistant Professor, Department of English, St. Cyril's College, Adoor and Shafana Shaffi, Assistant Professor, Department of English, T.K.M Arts and Science College, Kollam

Publishers: Oxford University Press

Further reading:

1. *A Concise Companion to Literary Forms*. Emerald, 2013.
2. Abrams, M. H. *A Glossary of Literary Terms.* 1971
3. Klarer, Mario. *An Introduction to Literary Studies*. Second edition. Routledge, 2009.

Books for Reference:

Andrew Taylor. *Reading Australian Poetry*. Queensland: U of Queensland P, 1987.

Direction to Teachers:

The introduction to various genres is intended for providing basic information and no conceptual analysis is intended

Question Pattern

No questions should be asked from Additional/ Suggested Reading

Max. Marks: 80 **Time: 3 hours**

Part One

10 questions to be answered, each in a word or sentence.(Synonyms, antonyms, sentence making) (10 x 1=10marks)

Part Two

Eight questions to be answered from a total of 12 and to be written in not more than 50 words. (8 x 2= 16marks)

Part Three

Six questions to be answered from a total of 9 and to be written in around 100words. (6 x 4 = 24marks)

Part Four

Two questions to be answered out of four and to be written in not less than 300 words. (2 x 15= 30marks)

UNIVERSITY OF KERALA

Scheme & Syllabi

For First Degree Programme in Hindi (Other than General English)

(Faculty of Oriental Studies)

Under the Choice based Credit and Semester system (CBCSS)

2020 admission onwards

Preface

The proposed revised syllabus to be implemented with effect from 2020 admission onwards has been prepared by Board of Studies in Hindi (Pass) of the University of Kerala as 'outcome based as per the instructions of University Grants Commission, the Kerala State Higher Education Council and Kerala University. The aim of each course is identified and the syllabus of each course is divided accordingly, into different modules. The outcome of each module and the course outcome of each of the 36 courses is outlined in the syllabus. The outcome of the programme is that the students who pass this programme (FDP in Hindi under CBCSS) will have comprehensive knowledge of Hindi literature both prose and poetry from the Ancient period to contemporary period. They will be proficient in grammer. The programme will kindle their aspiration for a career as translator/Hindi Officer/Journalist in Hindi.

I extend my sincere thanks to Prof. Dr. Devendra Kumar Chowbey, Professor of Hindi, JNU, Deshi for being the Resource person in the workshop conducted as part of revising the syllabus and for his valuable suggestions. I thank Dr. R. Jayachandran Dean, Faculty of Oriental studies and Head, Dept. of Hindi, University of Kerala, Chairman, BOS in Hindi (P.G) for his guidance. I thank all members of the Board of studies in Hindi (pass) for helping me in preparing study materials, compiling study materials, editing text books. I thank all the participants of the workshop especially Dr. N.Shaji, member academic council, Kerala University for their valuable suggestions. My special gratitude to Dr. Suma.S, Member BOS Hindi (pass) for her selfless service throughout the preparation of the syllabus. Hope the students will find the syllabus interesting and helpful.

Trivandrum
12.2.2020

Dr. R.I. Santhi
Chairman, BOS Hindi (Pass)

Board of Studies in Hindi (Pass)

Chairman

Dr. R. I.Santhi
Associate Prof. and Head (Rtd.)
Dept. of Hindi, Govt. College for Women
Trivandrum

Members

1. **Dr.Sasikala Namboothiri**
   Associate Prof. & Head, Dept. of Hindi
   SD College, Alappuzha

2. **Dr. Deepak K.R**
   Asst. Prof. of Hindi
   SDE, University of Kerala

3. **Dr. Satheesh Kumar.G** Associate Professor of Hindi FMN College, Kollam

4. **Dr. R. Sethunath** Associate Prof. of Hindi University of Calicut

5. **Dr. S.R. Jayasree**
   Asst. Prof. of Hindi
   MG College, Trivandrum

6. **Dr. T. Sheela.T. Nair**
   Asst. Prof. of Hindi, NSS College Pandalam

7. **Dr. Suma.S**
   Asst. Prof. of Hindi
   Govt. College for Women, Tvpm

8. **Dr. V. John Panicker**
   Asst. Prof. of Hindi
   St. Gregorios College, Kottarakara

9. **Dr. Reshmi Krishnan**
   Asst. Prof. of Hindi
   Govt. College, Ambalappuzha

10. **Dr. R. Jayachandran**
    Chairman, BOS Hindi (PG)

Resource Person

Prof. Dr. Devendra Kumar Chowbey
Professor of Hindi, JNU, Delhi

Special Invitee

Dr. N.Shaji, Member, Academic Council (Kerala University) Asst. Prof. of Hindi
SN College, Kollam

Syllabi in detail
Common course Hindi for BA/BSc Programmes

Semester I

Common Course I: HN1111.1 **Hindi Katha Sahitya-** **Contact Hrs. 4/week** **Credits:3**

Aim of the Course:

1. To familiarize the students with the world of fiction
2. To develop their faculty of appreciation of fiction
3. To develop creativity in the students

Module 1: Short stories- 6 representative short stories to be studied in detail from Premchand yug to Samkaleen yug.

Outcome of the module: 1) Remembers main works of the representative writers 2) understands the craft of the representative writers 3) analyses the stories 4) Evaluates the contribution of the representative writers 5) Elucidates key sentences with reference to context.

Module 2: A modern novel in Hindi for nondetailed study

Outcome of the study. 1) Remembers the names of main works of the prescribed writer 2) understands the craft of the prescribed writer 3) Analyses the novel on the basis of the subject of the novel, its relevance, its place among contemporary Hindi novels 4)Critically evaluates the place of the novel & the novelist among contemporary Hindi novels & novelists.

Prescribed text books

1. **Kahani Sarovar (**कहानी सरोवर **):** Edited by Sheela.T. Nair

(Detailed study) published by Rajkamal prakashan 1-B, Netaji Subhash Marg, Daryaganj, New Delhi-110002.

i. Sadgati-Premchand
ii. Saranagat – Jayashankar Prasad
iii. Sahaj aur Subh-Markandey
iv. Domin kaki- Chitra Mudgal
v. Panchwa Beta-Nasira Sharma
vi. Ma Rasoyi Mem rahiti hai-Kumar ambud

vii. Amrood ka ped- Gyan ranjan
viii. Salaam- OM Prakash Valmiki

Except Lessons : 'Sahaj aur Subh'- Markandey and 'Panchwa Beta'- Nasira Sharma

2. 'Mobile' (Novel) by Kshama Sharma published by Rajkamal Prakashan, Daryaganj, New Delhi-110002.

Outcome of course±É:

1) Recollect the main works of the representative fiction writers
2) Understand the craft of the fiction writers
3) Analyse and evaluate the works of the fiction writers they studied
4) Understand how the resource language is used as a medium in creative writing.

Hours distribution: 2 hours each for each text.

Reference :

1.Hindi kahani Antharang Pahachan by Ramdaras Mishra,Vani Prakashan,New Delhi

2.Hindi kahani kaa vikas by Madhuresh ,Lokbharati Prakashan ,New Delhi

Semester II

Common Course-II HN 1211.1- Hindi Nibandh aur anya Gadya Vidhayem – credits-3, lecture hrs. 4/week

Aim of the course: (1) to acquaint the students with the different forms of prose in Hindi (2) To develop their faculty of appreciation of prose. (3) to develop the skill of evaluating prose writing of representative prose writer in Hindi

Module1: Two essays to be studied in detail

Outcome: (1) Remembers the main works of the prescribed writers (2) understand the craft of the prescribed writers (3) Analyse the prescribed prose (4) Elucidate key sentences with reference to context.

Module 2: Other prose forms – Biography, Autobiography, sketch, Reportage, Satire. **Outcome**: (1) understand the different forms of prose (2) Recollect the main works of prescribed writers of prose (3) Analyse the prose form in accordance with the craft (4) Elucidate key sentences with reference to context.

Prescribed text books- Gadya Garima (detailed study). Editors, Dr. N. Mohanan, Dr. Deepak.K.R. Publishers- Rajpal and Sons, 1590, Madrasa Road, Kashmiri Gate, Delhi-110006.

(i) Devdaru- Hazari Prasad Dwivedi (Essay)
(ii) Beti ka vivaah- Amrit Rai (Biography)
(iii) Badauda ka Anubhav – Ambedkar (Autobiography)

(iv) Mera Hamdum Mera Dost: Kamleshwar- Rajendra Yadav (Sketch)
(v) Sookhe Sarovar ka Bhoogol- Mani madhukar (Reportage)
(vi) Nindaras- Hari Shankar Parsayi (Satire)
(vii) Aap- Pratap narayan Misr (Essay)
(viii) Gehu banam gulaab – Ram Vrksh Beni puri (Essay)

Except Lesson: 'Aap' Pratap Narayan Misr.

Outcome of the course:

i) Recollect the main works of the prescribed writers
ii) Understand the forms of various prose writing in Hindi
iii) Analyse & evaluate the prose forms prescribed, with respect to the craft and the relevance

Reference :

1.Hindi mein Nibandh saahity by Janardan swaroop Agarwal , Saahitybhavan Ltd,Prayag
2.Nibandhmala by Gulabray by E-pustakalay
3.Hindi Nibandh kaa udbhav aur vikas : hindikunj.com

Semester III

Common Course III HN 1311.1 Hindi Natak, vyakaran tatha Anuvad credits: 4, Lecture hours: 5/week

Aim of the course:

1. To familiarize the students with the development of plays in Hindi
2. To learn to appreciate play
3. To use Hindi language correctly by understanding grammar
4. To facilitate the use of translation as a tool for communicating in Hindi and English
5. To motivate the students for a career as translator

Module 1: To study a play in Hindi

Outcome: (1) Remember and recollect the major works of the playwright (2) Appreciate and evaluate the play with respect to craft, subject, relevance of it in the modern world. (3) Elucidate Key sentences with reference to context

Module 2: A text to study basic grammar of Hindi language & Translation from English to Hindi

Module1: Varna vichar, Sandhi, Sabd vichar, Sagya, Sagyamem roopantar-1, Sagya men roopantar-2

Outcome: (1) understands and recollects all 44 Hindi varnas (2) Classifies the 44 varnas (3) splits a word on the basis of Sandhi & names the sandhi (4) identifies a noun and states the type of noun in a given sentence (5) Elaborates the changes in a noun with respect to gender, number and cases (5) Defines sagya and elaborates its Subdivisions.

Module 2: Sarvnaam, visheshan, kriya, kriyamem roopantar

Outcome: (1) Defines all three parts of speeches and elaborates upon its subdivisions (2) Identifies sarvanam, visheshan and kriya and states their type in a given sentence (3) Elaborates on the changes in kriya with respect to kaal, vachya (4) elaborates 'ne' rule

Module 3: Krident, Avyay, Sabd rachna, Vakya vichar

Outcome: (1) Defines krident and Avyay and subdivisions (2) Identifies major prefixes, suffixes and samas (3) elaborates upon the types of samas and splits a word on the basis of samas (4) Defines phrase, clause its types (5) Defines a sentence, its different types (6) understands the importance of padkram and Anvay in sentence.

Module 4: Translation – from English to Hindi, Common grammatical mistakes made while writing in Hindi.

Outcomes: (1) Translates simple passages from English to Hindi (2) identifies common grammatical mistakes made while writing in Hindi.

Prescribed text books:

1. Sakubai (Play in Hindi) – Nadira Zaheer Babbar published by Vani Prakashan, 21- a, Daryaganj, New Delhi-110002.
2. Vyavaharik Hindi vyakaran, Anuvad tatha Rachna- Dr. H. Parameswaran, Published by Radhakrishna Prakashan, Ansari Marg, Daryaganj, New Delhi-110002.

Except Lessons : Bhasha aur vyakaran, Hindi ucharan aur vartini, Rachna Abhyaas.

Distribution of hours- 2 hrs for play, 2 hrs for grammar 1 hr for translation.

Outcome of the course: (1) critically appreciates play (2) Understands difference between spoken Hindi and written Hindi (3) Writes grammatically correct sentences in Hindi (4) Defines different parts of speech and identifies them in a given sentence (5) Translates simple passages from English to Hindi

Reference :

1.Hindi naatak :udbhav aur vikaas by Dasarath Ojhaa ,Rajpaal &sons
2.Hindi natak kaa udbhav aur vikaas : hindikunj.com
3.vyaakaran pradeep by Ramdev M A ,Hindi Bhavan

Semester IV

Common Course IV- HN 1411.1 Hindi Kavita Evam Ekanki credits 4, Teaching hr: 5hr/week.

Aim of the course: (1) To understand development of Hindi poetry through selected poems (2) to develop the faculty of appreciation of Hindi poems. (3) To familiarize the students with the development to one act plays in Hindi (4) learn to appreciate Hindi- one act play.

Module1: Ancient Hindi poetry- collection of poems of Kabirdas, Soordas, tulsidas, Raheem

Outcome: (1) understands the aesthetics of ancient poetry through the couplets of Kabirdas, Raheem & Soordas (2) understands the history of Bhakti poetry (3) appreciates the creativity of ancient poets (4) critically evaluates the contribution of poets of Bhakti period.

Module 2: Modern Hindi poetry: collection of 10 poems representing modern period with different styles and themes.

Outcome: (1) understands the development of modern poetry from early 20th century to 21st century (2) remembers & recollects the major works of prescribed poets (3) appreciates the different styles of poetry (4) critically evaluates the contribution of prescribed poets to the development of modern Hindi poetry (5) Elucidates given lines of poems with reference to context.

Module 3: Collection of five one act plays
Outcome: (1) Remembers & recollects major works of the prescribed one-act play wrights (2) Appreciates and evaluates the one-act plays with respect to craft, subject (3) elucidates key sentences of the one act plays with reference to context (4) critically evaluates the contribution of prescribed one-act play wrights to the development of one- act plays.

Prescribed text books (1) kavya deepthi- Edited by Dr. Reshmi Krishnan, Dr. Shiny Mathew and Dr. Preetha Remani T.E published by Vani Prakashan, 21-A, Danyaganj, New Delhi-110002 detailed study. 2) Saral Ekanki edited by Dr. John Panicker published by Aman Prakashan, Kanpur. **Except Ekanki** 'Hari ghas par ghante Bhar' by Surendra Verma.

Except the following portions in kavita : 7,8,9,10 dohas of Kabirdas, 7,8,9,10 dohas of Tulsidas, 7,8,9.10 dohas of Raheem, 'Samar shesh' of Dinkar, 'choolha of Pavan karan.

Distribution of hours: 3 hours for 'Kavya Deepthi' and 2 hrs for 'Saral ekanki'.

Reference:

1.Hindi Ekaanki :udbhav aur Vikaas by Ramcharan Mahendr ,Saahitya prakaashan
2.Hindi saahity kaa Itihaas ny Shyaam chandr kapoor ,Prabhaat prakaashan
3.Aadhunik Hindi padya saahity kee pramukh pravruttiyaan : Youtube link uploaded by Hindi Bhashaavaani ,June 12 ,2018

Course outcome: (1) Appreciates ancient and modern Hindi poems. (2) Critically evaluates the contribution of Ancient & modern poets to the development of Hindi poetry (3) Elucidates key lines of poetry with reference to context (4) Appreciates and evaluates one act play with respect to craft and subject.

UNIVERSITY OF KERALA

FIRST DEGREE PROGRAMME IN MALAYALAM

Under the Choice Based Credit and Semester
(CBCS) System for the Academic year

2021 Admission onwards

പ്രോഗ്രാം - മലയാളം: ഭാഷയും സംസ്കാരവും സാഹിത്യവും

(Programme- Malayalam: Language Culture and Literature)

Course Structure & Syllabus

Course Structure of Additional Language
Malayalam for BA/B.Sc Degree Programmes

Semester I	ML 1111.1 Lang. Course II (Addl. lang.I)	- മലയാളകവിത
Semester II	ML 1211.1 Lang. Course V (Addl. lang.II)	- ഗദ്യസാഹിത്യം
Semester III	ML 1311.1 Lang. Course VII (Addl. lang.III)	- ഭാഷാവബോധവും സർഗ്ഗാത്മകയും
Semester IV	ML 1411.1 Lang. Course IX (Adl. lang.IV)	- ദൃശ്യകലാസാഹിത്യം

Course Structure of Additional Language
Malayalam for B.Com Degree Programmes

Semester I	ML 1111.2 Addl. Lang. Course I	- സാഹിത്യപഠനം 1
Semester II	ML 1211.2 Addl. Lang. Course II	- സാഹിത്യപഠനം 2

Course Structure of Additional Language - Malayalam for Career related first Degree Programme and all new generation programmes under CBCS system Group - 2A

Semester I	ML 1111.3 Addl. Lang. Course I	- ഗദ്യസാഹിത്യം
Semester II	ML 1211.3 Addl. Lang. Course II	- ദൃശ്യകലാസാഹിത്യം

ആമുഖം

ഭാഷാസാഹിത്യപഠനത്തെ സമകാലികമായി വിപുലീകരിക്കുന്നതിനുള്ള കാഴ്ചപ്പാടിന്റെ ഭാഗമാണ് 'മലയാളം ; ഭാഷയും സംസ്കാരവും സാഹിത്യവും' എന്ന ഈ പ്രോഗ്രാം. മലയാളസാഹിത്യത്തെ ചരിത്രപരമായി പരിചയപ്പെടുത്തുന്നതോടൊപ്പം സാംസ്കാരിക പഠനമേഖലയെക്കൂടി പഠനപരിധിയിൽ ഉൾപ്പെടുത്തിയിട്ടുണ്ട്. ഈ പ്രോഗ്രാമിന്റെ ഭാഗമായി മലയാള ഭാഷ, സാഹിത്യം, സംസ്കാരം എന്നീ പഠനമേഖലകളുമായി ബന്ധപ്പെട്ട അടിസ്ഥാനകാര്യങ്ങൾ വിവിധ കോഴ്സുകളിലൂടെ വിദ്യാർത്ഥിസമൂഹത്തിന്റെ ശ്രദ്ധയിലേക്ക് കൊണ്ടുവരാൻ ശ്രമിച്ചിട്ടുണ്ട്. അതോടൊപ്പം കലയെയും സാഹിത്യത്തെയും സംസ്കാരത്തെയും ജീവിതത്തെയും വ്യത്യസ്തമായ കാഴ്ചപ്പാടുകളിലൂടെ സമീപിക്കാനുള്ള സാദ്ധ്യതകൾ വിദ്യാർത്ഥികൾക്കു മുന്നിൽ തുറന്നുവയ്ക്കുകയും ചെയ്യുന്നു. ഇതെല്ലാം ഇനി മുന്നോട്ടുകൊണ്ടുപോകേണ്ടത് അദ്ധ്യാപകരും വിദ്യാർത്ഥികളും ചേർന്ന കൂട്ടായ്മയാണ്.

ക്ലാസ്റൂം പഠനം എന്നത് അദ്ധ്യാപകന്റെ ഏകപക്ഷീയമായ പ്രഭാഷണങ്ങളുടെ തലത്തിൽ നിന്ന് സംവാദാത്മകമായ ഇടപെടലുകളുടെ തലത്തിലേക്ക് പരിവർത്തനപ്പെട്ട കാലമാണിത്. വിദ്യാർത്ഥികളുടെ മനോഭാവങ്ങളിൽ നിന്നും ചിന്താവേഗങ്ങളിൽ നിന്നും അന്വേഷണങ്ങളിൽ നിന്നും പുത്തൻ ആശയങ്ങളും കാഴ്ചപ്പാടുകളും പുറത്തുവരേണ്ടതുണ്ട്. വിദ്യാർത്ഥികേന്ദ്രിതമായ ഒരു പഠനക്രമത്തിലേക്ക് പഠനപ്രക്രിയയെ പുനസ്സംവിധാനം ചെയ്തുകൊണ്ടു മാത്രമേ ഇതു സാധ്യമാക്കാനാവുകയുള്ളൂ. പക്ഷേ അത്തരമൊരു സമീപനം ഏട്ടിലെ പശു മാത്രമായി മാറിപ്പോകാതിരിക്കാൻ പ്രത്യേക ജാഗ്രത ആവശ്യമാണ്. അത്തരത്തിൽ ക്രിയാത്മകമായ മാറ്റം ലക്ഷ്യമാക്കിക്കൊണ്ടാണ് ഈ പ്രോഗ്രാമിലെ ഓരോ കോഴ്സും രൂപപ്പെടുത്തിയിട്ടുള്ളത്. പ്രോഗ്രാം, കോഴ്സ്, മൊഡ്യൂൾ എന്നീ തലങ്ങളിൽ ഉൾക്കൊള്ളിച്ചിട്ടുള്ള പഠനഫലപ്രാപ്തികൾ അതിന്റെ ദിശാസൂചിയാണ്. കേവലമായ ആശയഗ്രഹണത്തിന്റെയും അറിവിന്റെയും തലത്തിൽ നിന്ന് വിശകലനബുദ്ധിയോടെയും അപഗ്രഥനവൈഭവത്തോടെയും സാഹിത്യാദിവിഷയങ്ങളെ സമീപിക്കാൻ വിദ്യാർത്ഥികൾ പ്രാപ്തരാകേണ്ടതുണ്ട്. പുത്തൻ സാഹിത്യനിർമ്മിതികളുടെ ലോകം സ്വയം രൂപപ്പെടുത്തിയെടുക്കാനും അവർക്ക് സാധിക്കണം. ജീവിതത്തിന്റെ സമഗ്രമേഖലകളെയും സ്പർശിച്ചു നിൽക്കുന്ന വിഷയം എന്ന നിലയിൽ ഭാഷാസാഹിത്യപഠനത്തിന് ഇന്ന് മുമ്പൊന്നുമില്ലാത്ത പ്രസക്തിയുണ്ട്. പ്രത്യേകിച്ചും മലയാളത്തിനു കൈവന്നിട്ടുള്ള സവിശേഷപദവിയുടെ പശ്ചാത്തലത്തിൽ. അധ്യാപകർ ജാഗരൂകതയുള്ള മാർഗദർശികളായി വിദ്യാർത്ഥികളോടൊപ്പം പങ്കാളികളായി പഠനപ്രക്രിയയെ സുഗമമാക്കണം. എഴുത്തിന്റെയും വായനയുടെയും മേഖലകളെ വിശാലമാക്കാൻ അവരെ സഹായിക്കണം. അതുവഴി ഭാഷാസാഹിത്യവിഷയങ്ങളോട് ആത്മാർത്ഥമായ താത്പര്യവും അന്വേഷണവ്യഗ്രതയുമുള്ളവരായി അവർ മാറട്ടെ. ഈ പ്രോഗ്രാമിലെ ഓരോ കോഴ്സും ഈ ലക്ഷ്യം പ്രാപ്തമാക്കാൻ പര്യാപ്തമാണെന്ന് കരുതുന്നു.

വ്യത്യസ്ത സെമസ്റ്ററുകളിൽ ഉൾപ്പെടുത്തിയിട്ടുള്ള ഓരോ കോഴ്സിനെയും അവയുടെ ഉള്ളടക്കത്തിന്റെ സ്വഭാവം അനുസരിച്ചാണ് പല മൊഡ്യൂളുകളായി വിഭജിച്ചിട്ടുള്ളത്. ഓരോ മൊഡ്യൂളിന്റെയും പഠനത്തിനാവശ്യമായ സമയക്രമവും അവിടവിടെ സൂചിപ്പിച്ചിട്ടുണ്ട്. ആ സമയപരിധിക്കുള്ളിൽ സാധ്യമാകുന്ന തരത്തിൽ മാത്രം വിശദമായിട്ടാണ് ഓരോ മൊഡ്യൂളിന്റെ പഠനവും പൂർത്തിയാക്കേണ്ടത്. വ്യത്യസ്ത സമയക്രമം നൽകിയിട്ടുള്ള ഓരോ കോഴ്സും അതിനുള്ളിൽ സെമിനാർ, അസൈൻമെന്റ്, ടെസ്റ്റ്പേപ്പറുകൾ, പരീക്ഷ പ്രായോഗികപരിശീലനം എന്നിവ ഉൾപ്പെടെയുള്ള പഠനപ്രക്രിയകളിലൂടെ പൂർത്തിയാക്കേണ്ടതുണ്ട്.

പൊതുനിർദ്ദേശങ്ങൾ

1. സാഹിത്യപഠനത്തോടൊപ്പം പഠിതാവിന്റെ ഭാഷാനൈപുണിയും വികസിക്കുന്നുണ്ടെന്ന് ഉറപ്പുവരുത്താനാവണം.

2. പഠനാനുഭവങ്ങളുമായി ബന്ധപ്പെട്ട് യാത്രകൾ സംഘടിപ്പിക്കുകയും അനുബന്ധമായ റിപ്പോർട്ടുകൾ, പഠനക്കുറിപ്പുകൾ, പട്ടികപ്പെടുത്തലുകൾ തുടങ്ങിയവ തയ്യാറാക്കുവാൻ വിദ്യാർത്ഥികൾക്ക് നിർദ്ദേശം നൽകുകയും വേണം.

3. വിശദപഠനത്തിനു നിർദേശിച്ചിട്ടുള്ള പാഠഭാഗത്തിനു പുറമേ അധികവായനയ്ക്കുതകുന്ന ധാരാളം പുസ്തകങ്ങൾ ഓരോ കോഴ്സിലും സഹായകഗ്രന്ഥങ്ങളായി പട്ടികപ്പെടുത്തിയിട്ടുണ്ട്. ഈ ഗ്രന്ഥങ്ങളെല്ലാം തന്നെ കോളേജ്/ഡിപ്പാർട്ട്മെന്റ് ലൈബ്രറിയിൽ ലഭ്യമാണെന്ന് ഉറപ്പു വരുത്തണം.

4. ആധുനിക സാങ്കേതികവിദ്യയുമായി ബന്ധപ്പെട്ട പാഠഭാഗങ്ങൾ പലതും ഈ പ്രോഗ്രാമിന്റെ ഭാഗമായുണ്ട്. മാധ്യമപഠനം, ചലച്ചിത്രപഠനം, ഇൻഫൊർമാറ്റിക്സ് തുടങ്ങിയ വിഷയങ്ങളിൽ പ്രായോഗികപരിശീലനവും ആവശ്യമാണ്. ഇതിനു സഹായകമായ വിധത്തിൽ ഇന്റർനെറ്റ്, ഡിജിറ്റൽ ലൈബ്രറി സൗകര്യങ്ങൾ ഡിപ്പാർട്ട്മെന്റിനോടു ചേർത്ത് സജ്ജമാക്കേണ്ടതുണ്ട്. ഭാഷാസാഹിത്യ പഠനത്തിന് കാലോചിതമായ പരിഷ്കാരം തീർച്ചയായും അനിവാര്യമാണ്. കോളേജുകളിൽ നിലവിലുള്ള ലാംഗ്വേജ് ലാബ് സൗകര്യം ഭാഷാശാസ്ത്രം പോലെയുള്ള വിഷയങ്ങളുടെ പഠനത്തിന് കുട്ടികൾക്ക് ഏറെ പ്രയോജനപ്പെടും.

5. പഠനഫലപ്രാപ്തിയിൽ അധിഷ്ഠിതമായ ഈ കോഴ്സുകളെക്കുറിച്ച് പൊതുവെയും ആധുനികസാങ്കേതികവിദ്യാപഠനത്തിനു സവിശേഷമായും അധ്യാപകർക്ക് പരിശീലനം നൽകണമെന്ന് സർവ്വകലാശാലയോട് ശിപാർശ ചെയ്യുന്നു.

6. പഠനപ്രക്രിയ ഓരോ വിദ്യാർത്ഥിയെ സംബന്ധിച്ചും പ്രാധാന്യമുള്ളതാണ്. ഈ പ്രോഗ്രാമിന്റെ ഭാഗമായി എല്ലാ വിദ്യാർത്ഥികളും വ്യക്തിഗതമായി ഓരോ പ്രോജക്ട് തയ്യാറാക്കേണ്ടതുണ്ട്. ഗവേഷണരീതിശാസ്ത്രത്തെക്കുറിച്ചുള്ള സാമാന്യധാരണ ബിരുദതലത്തിൽ തന്നെ സിദ്ധിക്കുന്നത് ഉപരിപഠന വേളയിൽ അവർക്ക് ഏറെ പ്രയോജനപ്രദമാകും . അഞ്ചാം സെമസ്റ്ററിൽ പ്രോജക്ടിന്റെ പ്രവർത്തനങ്ങൾ ആരംഭിക്കുകയും ആറാം സെമസ്റ്ററിൽ മാർഗ്ഗദർശിയായ അദ്ധ്യാപകന്റെ സാക്ഷ്യപത്രത്തോടുകൂടി ഡിപ്പാർട്ടുമെന്റിൽ സമർപ്പിക്കുകയും വേണം. 25 പേജിൽ കുറയാതെയും 35 പേജിൽ കവിയാതെയുമുള്ള ഡി.റ്റി.പി. ചെയ്ത പ്രോജക്ടിന്റെ രണ്ടു കോപ്പികളാണ് സമർപ്പിക്കേണ്ടത്.

7. പ്രോജക്ട് റിപ്പോർട്ടിന് നിശ്ചിതമായ ഒരു ഘടന ഉണ്ടായിരിക്കണം. വ്യക്തമായ ആമുഖം, ഉള്ളടക്കത്തിന്റെ സ്വഭാവം അനുസരിച്ചു വേർതിരിയുന്ന ഭാഗങ്ങൾ/അദ്ധ്യായങ്ങൾ, കണ്ടെത്തലുകളുടെയും നിഗമനങ്ങളുടെയും അടിസ്ഥാനത്തിലുള്ള ഉപദർശനങ്ങൾ, അടിക്കുറിപ്പുകൾ, ഗ്രന്ഥസൂചി എന്നീ ഘടകങ്ങൾ ചേർന്നതായിരിക്കണം റിപ്പോർട്ട്.

പ്രോഗ്രാമിന്റെ പഠനഫലപ്രാപ്തികൾ

1. മലയാളഭാഷ, സംസ്കാരം, സാഹിത്യം എന്നീ മേഖലകളുമായി ബന്ധപ്പെട്ട അടിസ്ഥാനകാര്യങ്ങൾ വിവിധ കോഴ്സുകളിലൂടെ സ്വാംശീകരിക്കുന്നു.
2. മനോഭാവങ്ങളിലൂടെയും ചിന്തയിലൂടെയും അന്വേഷണാത്മകമായ വായനയിലൂടെയും പുത്തൻ ആശയങ്ങളും കാഴ്ചപ്പാടുകളും രൂപപ്പെടുന്നു.
3. ഉപരിപഠനസാധ്യതയും പഠനവിഷയങ്ങളിലെ വൈപുല്യവും കണ്ടെത്താൻ പ്രാപ്തിനേടുന്നു.
4. സാഹിത്യകൃതികൾ കണ്ടെത്തി വായിച്ച് നിരൂപണം ചെയ്യാനുള്ള ശേഷി വർദ്ധിക്കുന്നു.
5. സാഹിത്യത്തിന്റെ വളർച്ചയുടെ വ്യത്യസ്ത ഘട്ടങ്ങൾ പരിചയപ്പെടുന്നു.
6. വ്യത്യസ്ത സാഹിത്യരൂപങ്ങളെക്കുറിച്ച് അറിവു നേടുകയും നിലവിലുണ്ടായിരുന്ന ധാരണകൾ നവീകരിക്കുകയും ചെയ്യുന്നു.
7. സാഹിത്യസമീപനത്തിൽ താരതമ്യാത്മകമായ വിശകലനശേഷി കൈവരിക്കുന്നു.
8. സാഹിത്യസിദ്ധാന്തം, സാഹിത്യവിമർശനം, സാഹിത്യചരിത്രവിജ്ഞാനീയം എന്നീ മേഖലകളിൽ ഗവേഷണതാൽപര്യം വളരുന്നു.
9. മലയാളഭാഷയുടെ വൈജ്ഞാനികപദവിയെക്കുറിച്ച് അറിവ് നേടുന്നു.
10. ഭാഷയുടെ വ്യവഹാരപരമായ വൈവിധ്യം, സൗന്ദര്യപരമായ പ്രയോഗം എന്നിവയിൽ സൂക്ഷ്മജ്ഞാനം കൈവരിക്കുന്നു.
11. ഭാഷാജ്ഞാനം, ഭാഷാപ്രയോഗജ്ഞാനം എന്നിവയിലുള്ള ധാരണ ഉറയ്ക്കുന്നു.
12. സാഹിത്യത്തിലും സാംസ്കാരിക പഠനമേഖലയിലും ഉൾക്കാഴ്ച രൂപപ്പെടുന്നു.
13. മൗലികമായ ചിന്തയും ലോകവീക്ഷണവും രൂപപ്പെടുത്തുന്നതിനുള്ള ആത്മവിശ്വാസം നേടിയെടുക്കുന്നു.
14. വിജ്ഞാനമേഖലകളുടെ വൈവിധ്യങ്ങളെ താല്പര്യത്തോടെ സമീപിക്കുന്നതിനും അന്തർവൈജ്ഞാനികമായ വിശകലനബുദ്ധി സ്വരൂപിക്കുന്നതിനും കഴിയുന്നു.
15. ഗവേഷണജേർണലുകളിൽ പ്രബന്ധരചനകൾ പ്രസിദ്ധീകരിക്കുന്നതിനുള്ള നൈപുണി കൈവരിക്കുന്നു.
16. സാംസ്കാരിക സദസ്സുകൾ, സംവാദങ്ങൾ എന്നിവയിൽ പങ്കാളിയാകുന്നു.
17. ധൈഷണികവും സൗന്ദര്യശാസ്ത്രപരവുമായ കാഴ്ചപ്പാടുകൾ രൂപപ്പെടുന്നു
18. ദേശീയതലത്തിലുള്ള സിവിൽ സർവീസ് പരീക്ഷയുൾപ്പെടെയുള്ള മത്സരപ്പരീക്ഷകളിൽ പങ്കെടുക്കുന്നതിനുള്ള ശേഷി കൈവരിക്കുന്നു.

സെമസ്റ്റർ : ഒന്ന്

സെമസ്റ്റർ	:	I
കോഴ്സ് കോഡ്	:	ML 1111.1
ലാംഗ്വേജ് കോഴ്സ്	:	II (അഡീഷണൽ ലാംഗ്വേജ് : 1)
സമയക്രമം	:	ആഴ്ചയിൽ 4 മണിക്കൂർ (18 ആഴ്ചയിൽ 72 മണിക്കൂർ)
ക്രെഡിറ്റ്	:	3

മലയാള കവിത

പുസ്തകം : കാവ്യകൗമുദി
(കേരളസർവകലാശാലാ പ്രസിദ്ധീകരണം)

പഠനഫലപ്രാപ്തി

1. മലയാളകവിതയുടെ ചരിത്രപരമായ വികാസത്തെക്കുറിച്ചുള്ള അവബോധം നേടുന്നു.
2. കാവ്യാഭിരുചിയും കാവ്യാസ്വാദന താല്പര്യവും വികസിക്കുന്നു.
3. കാവ്യഘടകങ്ങളെക്കുറിച്ചുള്ള സൂക്ഷ്മധാരണയുണ്ടാകുന്നു.
4. കവിതകളെ സൂക്ഷ്മമായി വിശകലനം ചെയ്യാനുള്ള പ്രാപ്തി കൈവരിക്കുന്നു.
5. രചനാരീതികളെ താരതമ്യാത്മകമായി നിർദ്ധാരണം ചെയ്യുന്നു.
6. കവിതാനിരൂപണം തയ്യാറാക്കുന്നു.

മൊഡ്യൂൾ : ഒന്ന് (18 മണിക്കൂർ)
പ്രാചീനകവിത

പഠനഫലപ്രാപ്തി

1. ആദ്യകാലകവിതയുടെ സവിശേഷതകൾ വിവരിക്കാനാവുന്നു.
2. കാവ്യഭാഷയുടെ പ്രത്യേകതകൾ ചൂണ്ടിക്കാണിക്കുന്നു.
3. നാടൻ പാട്ടുമാതൃകകൾക്ക് ഉദാഹരണങ്ങൾ കണ്ടെത്തി നൽകുന്നു.
4. ആദ്യകാല കാവ്യരൂപങ്ങളെ ദൃഷ്ടാന്തപ്പെടുത്തുന്നു.
5. വ്യത്യസ്ത ഈണങ്ങളെക്കുറിച്ചു മനസ്സിലാക്കാനും ഉദാഹരണങ്ങൾ കണ്ടെത്താനും ശ്രമിക്കുന്നു.
6. ആദ്യകാലകവിതകളെ വിമർശനാത്മകമായി വിലയിരുത്തുന്നു.

കവിതയുടെ വാമൊഴി പാരമ്പര്യം- നാടൻപാട്ടുകൾ- വീരകഥാഗാനങ്ങൾ, ചരിത്രകഥാഗാനങ്ങൾ, കൃഷിപ്പാട്ടുകൾ, വിനോദഗാനങ്ങൾ- വരമൊഴിസാഹിത്യം- പ്രാചീനകൃതികളും കവികളും- കാവ്യഭാഷ-പാട്ട്, മണിപ്രവാളം സാമാന്യപരിചയം-ചെറുശ്ശേരി, കൃഷ്ണഗാഥ.

വിശദപഠനം

1. നാടൻപാട്ട്- ഒരു സ്വപ്നം (ഇന്നലെയേനൊരു ചൊപ്പനം കണ്ടേ...)
2. കഥാഗാനം- വടക്കൻ പാട്ട് - ഉണ്ണിയാർച്ച കൂത്ത് കാണാൻ പോയ കഥ('ആറ്റുംമണമ്മേലെ ഉണ്ണിയാർച്ച....' എന്നു തുടങ്ങി 'വേഗത്തിൽ പോകുന്നു ഉണ്ണിയാർച്ച....' വരെ)
3. ചെറുശ്ശേരി- വർഷകാലം'കൃഷ്ണഗാഥ പ്രാവ്യഡ് വർണന("പാൽക്കടൽ മാനിനി തന്നുടെ.. "എന്നു തുടങ്ങി "മേഘങ്ങളെല്ലാം തളർന്നു നിന്നു" എന്നതു വരെ 70 വരി)

മൊഡ്യൂൾ : രണ്ട് (18 മണിക്കൂർ)
മധ്യകാലകവിത

പഠനഫലപ്രാപ്തി

1. കവിതയുടെ വികാസഘട്ടങ്ങളെ ചിട്ടപ്പെടുത്തുന്നു.
2. പ്രാചീനകവിത്രയകവിത, എഴുത്തച്ഛൻ കാവ്യഭാഷയിൽ വരുത്തിയ നവീകരണം ഇവ പാഠ്യഭാഗത്തിലൂടെ സ്പഷ്ടമാക്കാനാവുന്നു.
3. ഭക്തിപ്രസ്ഥാനം കവിതയിൽ പ്രായോഗികമായതെങ്ങനെയെന്ന് കണ്ടെത്താനാവുന്നു.
4. കിളിപ്പാട്ട് കീർത്തനസാഹിത്യം ചമ്പു തുടങ്ങിയ കാവ്യരൂപങ്ങളെ താരതമ്യാത്മകമായി വിലയിരുത്തുന്നു.
5. കവിത ചൊല്ലി വ്യത്യസ്ത ഈണങ്ങളെയും താളങ്ങളെയും അറിയുന്നു.
6. കാവ്യഭാഗങ്ങൾ ഹൃദിസ്ഥമാക്കുകയും അവതരിപ്പിക്കുകയും ചെയ്യുന്നു.

കാവ്യഭാഷയുടെ പരിണാമം- ഭക്തിയും നവോത്ഥാനവും- എഴുത്തച്ഛൻ, കിളിപ്പാട്ടുപ്രസ്ഥാനം- പൂന്താനം, കീർത്തനസാഹിത്യം- രാമപുരത്തുവാര്യർ, വഞ്ചിപ്പാട്ട്- കുഞ്ചൻ നമ്പ്യാർ തുള്ളൽസാഹിത്യം-കവിതയുടെ സാമൂഹികബന്ധം.

വിശദപഠനം

1. എഴുത്തച്ഛൻ -മഹാഭാരതം മൗസലപർവ്വം- കലികാലവർണന-34 വരി ("ഇനിയുള്ളകാലം....." എന്നതു മുതൽ ".....നിജനിലയപ്രാപ്തിയും" എന്നതു വരെ.
2. പൂന്താനം -ജ്ഞാനപ്പാന ("അർത്ഥാശയ്ക്കു വിരുതു....." എന്നു തുടങ്ങി "ചത്തു പോകുന്നു പാവം ശിവ ശിവ" എന്നതു വരെ)
3. മഴമംഗലം - നൈഷധം ചമ്പു- വനത്തിലെ രാത്രി ("അസ്തഗിരീശ്വര മസ്തകസീമനി" എന്നുതുടങ്ങി "നിഷസാദൈഷാമഹിതായോഷാ"എന്നതു വരെ.)

മൊഡ്യൂൾ : മൂന്ന് (18 മണിക്കൂർ)
കാല്പനിക പൂർവ്വ - കാല്പനികകവിത

പഠനഫലപ്രാപ്തി

1. കവിതയുടെ വികാസത്തിന്റെ കൈവഴികൾ തിരയുന്നു.
2. ആധുനികകവിത്രയകവിതയുടെ പ്രധാന പ്രത്യേകതകൾ അപഗ്രഥിക്കുന്നു.
3. കവിതയുടെ ഭാവതലം, കല്പനാവൈവിധ്യം ഇവയെക്കുറിച്ച് അന്വേഷിക്കുന്നു.
4. കാല്പനിക കവിതയും ഇടപ്പള്ളിക്കവികളും മലയാളകവിതയെ സ്വാധീനിച്ചത് എങ്ങനെയെന്ന് കണ്ടെത്തി വിവരിക്കുന്നു.

5. ആഖ്യാനകവിതയെ ഉദാഹരിക്കുന്നു.
6. കാവ്യഭാഗങ്ങൾ ഹൃദിസ്ഥമാക്കുന്നു. ഒപ്പം ചൊല്ലി രസിക്കുന്നു.
7. രചനാപരിശ്രമങ്ങളിൽ ഏർപ്പെടുന്നു.

കവിതയുടെ രൂപഭാവതലങ്ങളിൽ വന്ന മാറ്റം- കാല്പനിക പൂർവ്വ കവിത-നിയോ ക്ലാസ്സിക് പ്രവണതകൾ-കാല്പനികതയുടെ തിരനോട്ടം- ആധുനിക കവിത്രയകവികൾ- മഹാകാവ്യം, ഖണ്ഡകാവ്യം, വിലാപകാവ്യം, ഭാവഗീതം- ആഖ്യാനകവിത

വിശദപഠനം

1. കുമാരനാശാൻ - കരുണ 'അവസാനത്തെ വഴിയമ്പലം'- ചുടുകാടിന്റെ വർണ്ണന ("അഴകോടന്നഗരത്തിൻ..."എന്നതു മുതൽ "കിടക്കുന്നു പുതച്ചു മൂടി..." വരെ)
2. ചങ്ങമ്പുഴ - സൗന്ദര്യലഹരി
3. പി.കുഞ്ഞിരാമൻ നായർ- കാടിന്റെ മടിയിൽ
4. വൈലോപ്പിള്ളി - വിഷുക്കണി
5. ജി.ശങ്കരക്കുറുപ്പ് - പെരുന്തച്ചൻ
6. ബാലാമണിയമ്മ - കുളക്കടവിൽ

മൊഡ്യൂൾ : നാല് (18 മണിക്കൂർ)

ആധുനികപൂർവ്വ - ആധുനിക-ആധുനികാനന്തര കവിത

പഠനഫലപ്രാപ്തി

1. കവിത കാല്പനികതയിൽ നിന്ന് ആധുനികതയിലേക്ക് മാറുന്നത് നിർദ്ധാരണം ചെയ്യുന്നു.
2. ആധുനികതയുടെ ഭാവവും ഭാഷയും മൂല്യനിർണയത്തിനു വിധേയമാക്കുന്നു.
3. പുതിയ കാവ്യസങ്കേതങ്ങളുടെ പ്രയോഗസവിശേഷതകൾ ബോധ്യപ്പെടുന്നു.
4. സാമൂഹിക വിഷയങ്ങളെ കവിതയിൽ കോർത്തിണക്കുന്നത് സൂക്ഷ്മവിശകലനത്തിലൂടെ കണ്ടെത്തുന്നു.
5. താളാത്മകതയുടെ സൗന്ദര്യം മനസ്സിലാക്കി കവിത ചൊല്ലി രസിക്കുന്നു.
6. ആധുനികാനന്തരകവിതയുടെ അടയാളങ്ങൾ തിരിച്ചറിയുന്നു.
7. കവിതാരചനാപരിശ്രമങ്ങളിൽ ഏർപ്പെടുന്നു.

കാല്പനികതയിൽ നിന്ന് ആധുനികതയിലേക്ക്- ആധുനികതയുടെ ഭാവവും ഭാഷയും- എൻ.വി, അക്കിത്തം, എൻ.എൻ.കക്കാട്, എം,ഗോവിന്ദൻ, മാധവൻ അയ്യപ്പത്ത്, അയ്യപ്പപ്പണിക്കർ, കടമ്മനിട്ട- ആധുനികാനന്തരകവിത- കവികൾ കവിതകൾ- സൂക്ഷ്മരാഷ്ട്രീയം, ബഹുസ്വരത.

വിശദപഠനം

1. എൻ.വി.കൃഷ്ണവാര്യർ- മഴവില്ലും ചൂരൽവടിയും
2. സുഗതകുമാരി - പെൺകുഞ്ഞ് 90
3. അയ്യപ്പപ്പണിക്കർ - മോഷണം
4. ഡി.വിനയചന്ദ്രൻ - വിരാമം
5. മനോജ് കുറൂർ - എഴുത്ത്
6. ആര്യാംബിക - കാട്ടിലോടുന്ന തീവണ്ടി

സഹായകഗ്രന്ഥങ്ങൾ

1. കൈരളിയുടെ കഥ – പ്രൊഫ. എൻ. കൃഷ്ണപിള്ള
2. മലയാള കവിതാസാഹിത്യചരിത്രം – ഡോ. എം. ലീലാവതി
3. വർണ്ണരാജി – ഡോ. എം. ലീലാവതി
4. തെരഞ്ഞെടുത്ത പ്രബന്ധങ്ങൾ – പ്രൊഫ. എം. അച്യുതൻ
5. മുഹൂർത്തങ്ങൾ – സച്ചിദാനന്ദൻ
6. നവോത്ഥാനാനന്തര കവിത – എസ്. രാജശേഖരൻ
7. വടക്കൻപാട്ടുകളുടെ പണിയാല – എം. ആർ. രാഘവവാര്യർ
8. ആളൊഴിഞ്ഞ അരങ്ങ് – വി. രാജകൃഷ്ണൻ
9. കടലിൽ തങ്ങിയ കാന്തഭൂമി – ഡോ. ബി. വി. ശശികുമാർ
10. ഭാവഗീതത്തിന്റെ അടയാളങ്ങൾ മലയാള കവിതയിൽ – ഡോ. ആർ. എസ്. രാജീവ്
11. പ്രതിബിംബങ്ങൾ പറയാതിരിക്കുന്നത് – ആർ. ശ്രീലതാവർമ്മ.
12. ഹരിതദർശനം ആധുനികാനന്തര മലയാളകവിതയിൽ – ഡോ. സി. ആർ. പ്രസാദ്.
13. മലയാളകവിതയിലെ ഉയർന്ന ശിരസ്സുകൾ – ഡോ. എം. എൻ. രാജൻ.
14. പ്രകടനഗാനങ്ങളുടെ ആഖ്യാന സൗന്ദര്യശാസ്ത്രം – ഡോ. എൻ.അനിൽകുമാർ
15. കടമ്മനിട്ടക്കവിത – പഠനസമാഹരണം – കെ. എസ്. രവികുമാർ.
16. പരിസ്ഥിതിക്കവിതയ്ക്കൊരാമുഖം – പി.പി.കെ. പൊതുവാൾ, ഡി.സി. ബുക്സ്.
17. കീഴാളന്റെ പ്രതിരോധതന്ത്രം – ഡോ. ഷീബ എം. കുര്യൻ.
18. കാവ്യഭാവനയുടെ സ്ത്രീപഠനങ്ങൾ – ഡോ. എ. ഷീലാകുമാരി
19. കവിതയുടെ രഥോത്സവം – ഡോ. അജയപുരം ജ്യോതിഷ് കുമാർ (എഡി.)
20. കവിതയുടെ ജീവചരിത്രം – കല്പറ്റ നാരായണൻ, മാതൃഭൂമി
21. വൈലോപ്പിള്ളി : എഴുത്തും ജീവിതവും – ഡോ. ഇ. ബാനർജി (എഡി.).
22. കവിത – ഡോ.കെ.എസ്.പ്രകാശ്
23. ആധുനികാനന്തരതയുടെ പിന്നാമ്പുറം – പി.പി.രവീന്ദ്രൻ, എൻ.ബി.എസ്.
24. കലിയും കാവ്യൗഷധവും – കെ.എം.വേണുഗോപാൽ, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്
25. ആധുനികകവിതയിലെ കലിയും ചിരിയും – പ്രസന്നരാജൻ
26. സമകാലമലയാളകവിത – എം.ബി.മനോജ്
27. വിത്തും വൃക്ഷവും – സച്ചിദാനന്ദൻ, കേരള സാഹിത്യ അക്കാദമി

സെമസ്റ്റർ : രണ്ട്

സെമസ്റ്റർ	:	II
കോഴ്സ് കോഡ്	:	ML 1211.1
ലാംഗ്വേജ് കോഴ്സ്	:	V (അഡീഷണൽ ലാംഗ്വേജ് : 2)
സമയക്രമം	:	ആഴ്ചയിൽ 4 മണിക്കൂർ (18 ആഴ്ചയിൽ 72 മണിക്കൂർ)
ക്രെഡിറ്റ്	:	3

ഗദ്യസാഹിത്യം

പുസ്തകം : ഗദ്യകൗമുദി
(കേരളസർവകലാശാലാ പ്രസിദ്ധീകരണം)

പഠനഫലപ്രാപ്തി

1. മലയാളഗദ്യത്തിലെ പ്രധാനസാഹിത്യരൂപങ്ങളെക്കുറിച്ച് സാമാന്യാവബോധം പ്രാപ്തമാക്കുന്നു.
2. ഗദ്യരൂപങ്ങളുടെ ഉൽപത്തിവികാസപരിണാമങ്ങൾ അന്വേഷിച്ച് അപഗ്രഥിക്കുന്നു.
3. രചനകളെ വിശകലനം ചെയ്യാനുള്ള ഭാവുകത്വശേഷി വികസിക്കുന്നു.
4. എഴുത്തുകാരുടെ രചനാശൈലിയെ താരതമ്യാത്മകമായി നിരീക്ഷിക്കുന്നു
5. രചനകളിലെ ഉള്ളടക്കം, ഭാഷ. സാമൂഹ്യരാഷ്ട്രീയ പരിപ്രേക്ഷ്യം, സൗന്ദര്യതലം ഇവ വിശകലനം ചെയ്ത് നിരൂപണപഠനങ്ങൾ തയ്യാറാക്കുന്നു.

മൊഡ്യൂൾ : ഒന്ന് (18 മണിക്കൂർ)

നോവൽ

പഠനഫലപ്രാപ്തി

1. നോവൽ എന്ന സാഹിത്യരൂപത്തിന്റെ സവിശേഷതകൾ തിരിച്ചറിയുന്നു.
2. മലയാളനോവലിന്റെ ചരിത്രവും വളർച്ചയുടെ ഘട്ടങ്ങളും രേഖപ്പെടുത്താനാവുന്നു.
3. നോവൽ സമൂഹത്തെ അടയാളപ്പെടുത്തിയതെങ്ങനെയെന്ന് അന്വഷിക്കുന്നു.
4. വിവിധതരം നോവൽരചനാസമ്പ്രദായങ്ങളെക്കുറിച്ചു വിമർശാത്മകമായി വിലയിരുത്തുന്നു.
5. പ്രാതിനിധ്യസ്വഭാവമുള്ള നോവലിന്റെ വിശദപഠനത്തിലൂടെ എഴുത്തുകാരന്റെ ഇതര നോവലുകളും മറ്റെഴുത്തുകാരുടെ നോവലുകളും കണ്ടെത്തി നിരൂപിക്കുന്നു.

നോവൽപ്രസ്ഥാനം- മലയാളനോവൽ- ആവിർഭാവവും വികാസവും- വിവിധതരം നോവലുകൾ- പ്രവണതകൾ- ചന്തുമേനോൻ- സി.വി.രാമൻ പിള്ള- സമൂഹവും നോവലും- നവോത്ഥാനകാല നോവൽ- തകഴി, ദേവ്, ബഷീർ, എസ്.കെ.പൊറ്റെക്കാട്ട്, ഉറൂബ് തുടങ്ങിയവർ- വ്യക്തിമനസ്സും നോവലും- ആധുനികത നോവലിൽ- പ്രധാനഎഴുത്തുകാർ- സാമാന്യപരിചയം- നോവലിലെ ഭാഷ- ആധുനികാനന്തര നോവൽ- സമകാലിക പ്രവണതകൾ

വിശദപഠനം

രണ്ടിടങ്ങഴി – തകഴി

മൊഡ്യൂൾ : രണ്ട് (27 മണിക്കൂർ)

ചെറുകഥ

പഠനഫലപ്രാപ്തി

1. ചെറുകഥയുടെ പൊതുസവിശേഷതകൾ നിർദ്ധാരണം ചെയ്യുന്നു.
2. കഥയിലെ വ്യത്യസ്ത കാലഘട്ടങ്ങളെയും പ്രവണതകളെയും പഠനവിധേയമാക്കുന്നു
3. ചെറുകഥയുടെ സാങ്കേതികതകളെക്കുറിച്ച് മനസ്സിലാക്കി ഉദാഹരിക്കുന്നു.
4. വിവിധതരം ആഖ്യാനസമ്പ്രദായങ്ങളെപ്പറ്റിയും പ്രമേയം, രൂപശില്പം ഇവയിൽ സംഭവിച്ച പരിണാമങ്ങളെപ്പറ്റിയും വിമർശാത്മകമായി വിലയിരുത്തുന്നു.
5. രചനാപരിശ്രമങ്ങളിൽ ഏർപ്പെടുകയും കഥാപരിസരത്തെ ഇതരമാധ്യമങ്ങളിലൂടെ പുനരാവിഷ്കരിക്കുകയും ചെയ്യുന്നു.

ചെറുകഥാപ്രസ്ഥാനം- മലയാള ചെറുകഥ, ആവിർഭാവവും വികാസവും- കഥയിലെ വിവിധ കാലങ്ങൾ, പ്രവണതകൾ- പ്രധാന എഴുത്തുകാർ- പ്രമേയപരിചരണവും ആഖ്യാന വൈവിധ്യവും- സമകാലീന ചെറുകഥ- പ്രാതിനിധ്യസ്വഭാവമുള്ള ചെറുകഥകളുടെ സാമാന്യപരിചയം

വിശദപഠനം

1.	മദിരാശിപ്പിത്തലാട്ടം	–	വേങ്ങയിൽ കുഞ്ഞിരാമൻ നായനാർ
2.	വിശ്വവിഖ്യാതമായ മൂക്ക്	–	വൈക്കം മുഹമ്മദ് ബഷീർ
3.	നെയ്പായസം	–	മാധവിക്കുട്ടി
4.	സ്നേഹത്തിന്റെ ശ്രാദ്ധം	–	ഒ.വി.വിജയൻ
5.	മേജിക് ഷോപ്പ്	–	എം.മുകുന്ദൻ
6.	പാവക്കുട്ടി	–	ഗ്രേസി
7.	എപ്പോഴെത്തുമോ എന്തോ	–	ടി.വി.കൊച്ചുബാവ
8.	ജഡങ്ങളിൽ നല്ലവൻ	–	ബി.മുരളി

മൊഡ്യൂൾ : മൂന്ന് (27 മണിക്കൂർ)

ഉപന്യാസം, പഠനം,അനുഭവം, ഓർമ്മ

പഠനഫലപ്രാപ്തി

1. ഗദ്യസാഹിത്യത്തിന്റെ വിവിധ ജനുസ്സുകളെ പൊതുസാഹിത്യപരിപ്രേക്ഷ്യത്തിൽ വിലയിരുത്താനാവുന്നു.
2. ഉപന്യാസങ്ങൾ പഠനലേഖനങ്ങൾ, സ്മരണകൾ അനുഭവക്കുറിപ്പുകൾ എന്നിവ വായിച്ച് മലയാളഗദ്യത്തിന്റെ വ്യാപ്തി നിർണയിക്കുന്നു.
3. മികച്ച ഗദ്യശൈലി രൂപപ്പെടുത്താനുള്ള പരിശീലനത്തിൽ ഏർപ്പെടുന്നു.
4. ഗദ്യരചനകൾ തയ്യാറാക്കി പ്രസിദ്ധീകരിക്കുന്നു

വിവിധ ഗദ്യരചനാമാതൃകകൾ- സവിശേഷതകൾ- ഉപന്യാസങ്ങളും ഉപന്യാസകാരൻമാരും- പഠനം, നിരൂപണം- അനുഭവക്കുറിപ്പുകളും ഓർമ്മയെഴുത്തും- വിവിധ രചനാശൈലികൾ- വിജ്ഞാനസാഹിത്യം- സാമാന്യപരിചയം.

വിശദപഠനം

1. സ്വാതിയുടെ സന്നിധിയിൽ - പ്രൊഫ. എസ്. ഗുപ്തൻ നായർ
2. ആനയും അല്പം തെലുങ്കും - എ.പി.ഉദയഭാനു
3. വഴി തിരിച്ചു വിട്ട ആചാര്യൻ - ഡോ.എം.ലീലാവതി
4. ചരിത്രത്തെ അഗാധമാക്കിയ ഗുരു - കെ.പി.അപ്പൻ
5. ഇന്ത്യൻ ഭരണഘടനയും അടിസ്ഥാനതത്വങ്ങളും - പ്രൊഫ.വി.കാർത്തികേയൻനായർ
6. കവിതയുടെ സാന്ത്വനചികിത്സ - ശാന്തൻ

സഹായകഗ്രന്ഥങ്ങൾ

1. മലയാളനോവൽസാഹിത്യചരിത്രം- പ്രൊഫ. കെ.എം.തരകൻ
2. മലയാള ചെറുകഥാസാഹിത്യചരിത്രം - ഡോ. എം. എം.ബഷീർ
3. ചെറുകഥ ഇന്നലെ ഇന്ന്- എം.അച്യുതൻ
4. ചെറുകഥയുടെ ഛന്ദസ്സ്- വി.രാജകൃഷ്ണൻ
5. രോഗവും സാഹിത്യഭാവനയും- കെ.പി.അപ്പൻ
6. ആത്മസംവാദം- എം.കൃഷ്ണൻ നമ്പൂതിരി
7. തകഴി പഠനങ്ങൾ- പത്മന രാമചന്ദ്രൻ നായർ (എഡി)
8. കലഹവും വിശ്വാസവും കെ.പി.അപ്പൻ
9. നോവൽ സി.വി.മുതൽ ബഷീർ വരെ- ഡോ.ജോർജ് ഇരുമ്പയം
10. നോവൽ സാഹിത്യം- എം.പി.പോൾ
11. ആധുനിക നോവൽദർശനം- ഡോ.കെ.എം.തരകൻ
12. നോവൽസ്വരൂപം- കെ.സുരേന്ദ്രൻ
13. തകഴിയും മലയാളനോവലും- ഡോ.വി.എസ്.ശർമ്മ
14. മലയാളനോവലിന്റെ ദേശകാലങ്ങൾ- ഇ.വി.രാമകൃഷ്ണൻ
15. നോവലും ആഖ്യാനകലയും- ഡോ.എം.വിജയൻപിള്ള
16. നോവലും പ്രാദേശികതയും- ഡോ.ജോബിൻ ചാമക്കാല (എഡി)
17. നോവൽ കലയും ദർശനവും- ഡോ.എം.കൃഷ്ണൻ നമ്പൂതിരി
18. അന്ധനായ ദൈവം മലയാളനോവലിന്റെ 100 വർഷങ്ങൾ- പി.കെ.രാജശേഖരൻ
19. നോവൽ വായനകൾ- വി.സി.ശ്രീജൻ
20. ആഖ്യാനത്തിന്റെ അടരുകൾ- കെ.എസ്.രവികുമാർ
21. മലയാളനോവൽ ഭാവനയുടെ രാഷ്ട്രീയം- ഷാജി ജേക്കബ്
22. കാഥികന്റെ പണിപ്പുര- എം.ടി.വാസുദേവൻ നായർ
23. ചെറുകഥ വാക്കും വഴിയും- കെ.എസ്.രവികുമാർ
24. മൂന്നാം ലോക സങ്കടങ്ങൾ- സാബു കോട്ടുക്കൽ
25. കഥാപഠനങ്ങൾ- പി.കെ.പരമേശ്വരൻ നായർ ട്രസ്റ്റ്
26. നിശ്ശബ്ദതയും നിർമ്മാണവും- ഇ.പി.രാജഗോപാലൻ

സെമസ്റ്റർ : മൂന്ന്

സെമസ്റ്റർ	:	III
കോഴ്സ് കോഡ്	:	ML 1311.1
ലാംഗ്വേജ് കോഴ്സ്	:	VII (അഡീഷണൽ ലാംഗ്വേജ് : 3)
സമയക്രമം	:	ആഴ്ചയിൽ 5 മണിക്കൂർ (18 ആഴ്ചയിൽ 90 മണിക്കൂർ)
ക്രെഡിറ്റ്	:	4

ഭാഷാവബോധവും സർഗാത്മകതയും

പഠനഫലപ്രാപ്തി

1. മലയാളഭാഷയുടെ പ്രയോഗരീതികളെക്കുറിച്ച് മനസ്സിലാക്കുന്നു.
2. തെറ്റില്ലാത്ത രീതിയിൽ ഭാഷ പ്രയോഗിക്കാനുള്ള നൈപുണി നേടുന്നു.
3. വ്യാകരണത്തിന്റെ പ്രാഥമികപാഠങ്ങളിൽ പ്രാഗത്ഭ്യം കരസ്ഥമാക്കുകയും സ്വയം വിലയിരുത്തുകയും ചെയ്യുന്നു.
4. വിവർത്തനത്തിൽ പ്രായോഗികപരിശീലനം നേടുകയും വിവർത്തനരചനകൾ നടത്തി വിലയിരുത്തുകയും ചെയ്യുന്നു.
5. എഴുത്തുകാരുടെ സർഗജീവിതത്തെക്കുറിച്ച് അവബോധം നേടുകയും താരതമ്യാത്മകമായി നിരീക്ഷിക്കുകയും ചെയ്യുന്നു.
6. പുതുരചനകൾ സൃഷ്ടിക്കുന്നു.

മൊഡ്യൂൾ : ഒന്ന് (36 മണിക്കൂർ)

ഭാഷ-സ്വരൂപവും പ്രയോഗവും

പഠനഫലപ്രാപ്തി

1. മലയാളഭാഷയുടെ വ്യാകരണ നിയമങ്ങളെക്കുറിച്ച് സാമാന്യ പരിജ്ഞാനം നേടുന്നു.
2. ഭാഷയിലെ വിവിധ വ്യവഹാരരൂപങ്ങളെ വേർതിരിച്ചു മനസ്സിലാക്കുകയും അവയുടെ രചനയിൽ പ്രാപ്തി കൈവരുകയും ചെയ്യുന്നു.

ഭാഷയും പ്രയോഗവും- ഭാഷാശബ്ദങ്ങൾ- ശബ്ദവിഭജനരീതികൾ(നാമം, ക്രിയ, വിശേഷണം- സാമാന്യധാരണ)- പദരൂപീകരണം- വാക്യം, സന്ധി, സമാസം, പ്രയോഗം - സാമാന്യധാരണ- വിവിധ വ്യവഹാരരൂപങ്ങൾ- (ഉപന്യാസം, കത്തെഴുത്ത്, നിവേദനം തയ്യാറാക്കൽ തുടങ്ങിയവ) ചൊല്ലുകൾ, ശൈലികൾ-വിവർത്തനം- മാധ്യമഭാഷ- ഭരണഭാഷ.

വിശദപഠനം

1. ഭാഷാസഹവർത്തിത്വം(ലേഖനം) - ഡോ.നടുവട്ടം ഗോപാലകൃഷ്ണൻ
2. ഭാഷ ചീത്തയാക്കുന്നത് ആരാണ്(ലേഖനം) - എം.എൻ. കാരശ്ശേരി

മൊഡ്യൂൾ : രണ്ട് (9 മണിക്കൂർ)
പ്രായോഗികപരിശീലനം

പദശുദ്ധി, വാക്യശുദ്ധി, ഉപന്യാസരചന, കത്തെഴുത്ത്, നിവേദനം തയ്യാറാക്കൽ, ആശയസംഗ്രഹം, ആശയവിപുലനം തുടങ്ങിയവയിൽ പ്രായോഗിക പരിശീലനം. (പരീക്ഷയിൽ മേൽപ്പറഞ്ഞ ഭാഗങ്ങളിൽ നിന്ന് നിർബന്ധമായും ചോദ്യങ്ങൾ ഉൾക്കൊള്ളിക്കേണ്ടതാണ്.)

മൊഡ്യൂൾ : മൂന്ന് (18 മണിക്കൂർ)
വിവർത്തനം

പഠനഫലപ്രാപ്തി

1. വിവർത്തനത്തിന്റെ ചരിത്രം മനസ്സിലാക്കുന്നു.
2. വിവിധതരം വിവർത്തനരീതികൾ പരിചയിക്കുകയും വിവർത്തനം ചെയ്യാനുള്ള ശേഷി കൈവരിക്കുകയും ചെയ്യുന്നു.

വിവർത്തനം എന്നാലെന്ത്- വിവർത്തനചരിത്രം- വിവർത്തനരീതികൾ- സാമാന്യ പരിചയം

വിശദപഠനം

2. തർജമയിൽ വരാവുന്ന അപാകതകൾ- പ്രൊഫ.വിഷ്ണുനാരായണൻ നമ്പൂതിരി

മൊഡ്യൂൾ : നാല് (9 മണിക്കൂർ)
വിവർത്തനപരിശീലനം

മലയാളത്തിൽ നിന്ന് ഇംഗ്ലീഷിലേക്കും തിരിച്ചും വിവർത്തനം നടത്താനുള്ള പരിശീലനം. (പരീക്ഷയിൽ മേൽപ്പറഞ്ഞ ഭാഗങ്ങളിൽ നിന്ന് നിർബന്ധമായും ചോദ്യങ്ങൾ ഉൾക്കൊള്ളിക്കേണ്ടതാണ്.)

മൊഡ്യൂൾ : അഞ്ച് (18 മണിക്കൂർ)
സർഗാത്മകത

1. കലാസൃഷ്ടിയുടെ പിന്നിലെ പ്രേരണയും പരിശ്രമവും തിരിച്ചറിയാനാകുന്നു
2. പ്രശസ്തരായ എഴുത്തുകാരുടെ സർഗ്ഗ പ്രക്രിയയുടെ അനുഭവങ്ങൾ മനസ്സിലാക്കുന്നു.
3. മൗലികമായ രചനകൾ നടത്തുന്നതിന് ശ്രമിക്കുന്നു.

സർഗാത്മകതയെക്കുറിച്ചുള്ള പാശ്ചാത്യവും പൗരസ്ത്യവുമായ കാഴ്ചപ്പാടുകൾ സാമാന്യപരിചയം- രചനയുടെ വിവിധ ഘട്ടങ്ങൾ- അനുഭവവും രചനയും- വിവിധ സാഹിത്യരൂപങ്ങൾ- എഴുത്തുകാരും രചനാനുഭവങ്ങളും.

വിശദപഠനം

1. നാലിതൾപ്പൂവ് – ഇടശ്ശേരി
2. ഒരു കവിതയുടെ കഥ – അക്കിത്തം
3. എന്തിന് എങ്ങനെ കഥയെഴുതണം – പി.കേശവദേവ്

സഹായക ഗ്രന്ഥങ്ങൾ

1. കേരളപാണിനീയം – എ.ആർ.രാജരാജവർമ്മ
2. മലയാളശൈലി – കുട്ടികൃഷ്ണമാരാർ, മാരാർ സാഹിത്യപ്രകാശം, കോഴിക്കോട്.
3. ഗദ്യശില്പം – സി. വി. വാസുദേവഭട്ടതിരി, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്,.
4. തെറ്റും ശരിയും – പ്രൊഫ. പന്മന രാമചന്ദ്രൻ നായർ, കറന്റ് ബുക്സ്, കോട്ടയം.
5. തെറ്റില്ലാത്ത മലയാളം – പ്രൊഫ. പന്മന രാമചന്ദ്രൻ നായർ,
6. മലയാളവും മലയാളികളും– പ്രൊഫ. പന്മന രാമചന്ദ്രൻ നായർ, കറന്റ് ബുക്സ്, കോട്ടയം.
7. നല്ല ഭാഷ – പ്രൊഫ. പന്മന രാമചന്ദ്രൻ നായർ,കറന്റ് ബുക്സ്, കോട്ടയം.
8. ഭാഷാശുദ്ധി – സംശയപരിഹാരങ്ങൾ – പ്രൊഫ. പന്മന രാമചന്ദ്രൻ നായർ, കറന്റ് ബുക്സ്, കോട്ടയം.
9. ഭാഷയും ഭരണഭാഷയും – ഡോ. എഴുമറ്റൂർ രാജരാജവർമ്മ, ഇൻഫർമേഷൻ ആന്റ് പബ്ലിക്കേഷൻ വകുപ്പ്, കേരള സർക്കാർ.
10. ഭരണ ശബ്ദാവലി, കേരളഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്,
11. ലിറിക്കൽ ബാലഡ്സിന്റെ ആമുഖം – വില്യം വേർഡ്സ്വർത്ത്, വിവ: ഡോ. തോന്നയ്ക്കൽ വാസുദേവൻ, എം. എൻ. വിജയൻ സാംസ്ക്കാരികവേദി.
12. ഭാഷാശുദ്ധിയും ഭരണഭാഷയും – ഡോ. വിളക്കുടി രാജേന്ദ്രൻ, പ്രിയദർശിനി പബ്ലിക്കേഷൻസ്.
13. തായ്മൊഴി – എം. എൻ. കാരശ്ശേരി, ഡി. സി. ബുക്സ്.
14. ഭരണഭാഷാപ്രശ്നങ്ങൾ എം. വി. തോമസ്, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
15. നല്ലമലയാളം – സി.വി.വാസുദേവഭട്ടതിരി, ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
16. തെളിമലയാളം – എം. എൻ. കാരശ്ശേരി.
17. വിവർത്തനവിചാരം – ഡോ. എൻ. ഇ. വിശ്വനാഥ അയ്യർ, കേരളഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
18. വിവർത്തനം– ഒരു സംഘം ലേഖകർ, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്,
19. വിവർത്തനചിന്തകൾ– എഡി. ഡോ.വി. ആർ പ്രബോധചന്ദ്രൻ നായർ, ഡി. സി. ബുക്സ്.
20. പ്രായോഗിക വിവർത്തനവിചിന്തനം– –ഡോ.വിജയകുമാരൻ സി.പി.വി
21. വിവർത്തനവിചിന്തനം– –ഡോ.കെ.വി.തോമസ്, ഡോ.മാത്യു.ജെ.മുട്ടത്ത്
22. തർജ്ജമയുടെ താക്കോൽ – സി. വി. വാസുദേവ ഭട്ടതിരി, സ്കൈ ബുക്സ് പബ്ലിഷേഴ്സ്.
23. ഭാരതീയകാവ്യശാസ്ത്രം– ഡോ.ടി.ഭാസ്കരൻ, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
24. ഭാരതീയസാഹിത്യദർശനം– ചാത്തനാത്ത് അച്യുതനുണ്ണി, വള്ളത്തോൾ വിദ്യാപീഠം
25. കാവ്യമീമാംസ, ഡോ.കെ.സുകുമാര പിള്ള, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
26. സൗന്ദര്യശാസ്ത്രം,– –ഡോ.സി. രാജേന്ദ്രൻ, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
27. പാശ്ചാത്യസാഹിത്യദർശനം– പ്രൊഫ. എം.അച്യുതൻ, കറന്റ് ബുക്സ് തൃശൂർ
28. പാശ്ചാത്യസാഹിത്യ തത്ത്വശാസ്ത്രം– പ്രൊഫ.കെ.എം.തരകൻ, എൻ.ബി.എസ്
29. സാഹിത്യതത്ത്വം– പ്രൊഫ.പി.ടി.ചാക്കോ, സാംസ്കാരിക പ്രസിദ്ധീകരണ വകുപ്പ്
30. സർഗസമീക്ഷ– അക്ബർ കക്കട്ടിൽ, ഡി.സി.ബുക്സ്
31. കാഥികന്റെ പണിപ്പുര– എം.ടി.വാസുദേവൻ നായർ
32. രമണീയം ഒരു കാലം– എം.ടി.വാസുദേവൻ നായർ, മാളൂബെൻ
33. ഇതിഹാസത്തിന്റെ ഇതിഹാസം – ഒ.വി.വിജയൻ
34. കാവ്യലോകസ്മരണകൾ– വൈലോപ്പിള്ളി
35. കവിയുടെ കാൽപ്പാടുകൾ– പി.കുഞ്ഞിരാമൻ നായർ, ഡി.സി.ബുക്സ്
36. ഉപനയനവും സമാവർത്തനവും– അക്കിത്തം, കൈരളി ബുക്സ്
37. കവിതയുടെ ജീവചരിത്രം–കൽപ്പറ്റ നാരായണൻ, മാതൃഭൂമി ബുക്സ്

സെമസ്റ്റർ : നാല്

സെമസ്റ്റർ	:	IV
കോഴ്സ് കോഡ്	:	ML 1411.1
ലാംഗ്വേജ് കോഴ്സ്	:	IX (അഡീഷണൽ ലാംഗ്വേജ് : IV)
സമയക്രമം	:	ആഴ്ചയിൽ 5 മണിക്കൂർ (18 ആഴ്ചയിൽ 90 മണിക്കൂർ)
ക്രെഡിറ്റ്	:	4

ദൃശ്യകലാസാഹിത്യം

(പാഠപുസ്തകം: ദൃശ്യകൗമുദി- കേരളസർവ്വകലാശാലാ പ്രസിദ്ധീകരണം)

പഠനഫലപ്രാപ്തി

1. കേരളത്തിലെ ദൃശ്യകലാസംസ്കാരത്തിന്റെ സമ്പന്നതയും വൈവിധ്യവും കണ്ടെത്തി വിവരിക്കുന്നു.
2. രചനയിൽ നിന്ന് പ്രയോഗത്തിലേക്കുള്ള പരിണാമത്തെക്കുറിച്ച് പരിശോധന നടത്തുന്നു.
3. കഥകളി, തുള്ളൽ, നാടകം, സിനിമ എന്നീ കലാരൂപങ്ങളെയും അവയ്ക്ക് ആധാരമായ സാഹിത്യകൃതികളെയും ചേർത്തുവച്ച് നിരൂപിക്കുന്നു.
4. ദൃശ്യകലകളെ വിമർശാത്മകമായി ആസ്വദിക്കുന്നു.
5. നാടകം, തിരക്കഥ എന്നിവ രചിക്കുന്നു.
6. അഭിനയം, തിരക്കഥാരചന, നാടകരചന, തുടങ്ങി കലകളുടെ ക്രിയാത്മകാവിഷ്കാരത്തിന് നേതൃത്വം നൽകുന്നു.

മൊഡ്യൂൾ : ഒന്ന് (36 മണിക്കൂർ)

ആട്ടക്കഥ, തുള്ളൽസാഹിത്യം

കഥകളിയുടെ ഉത്ഭവവികാസപരിണാമങ്ങൾ - സവിശേഷതകൾ- ആട്ടക്കഥാസാഹിത്യം - പ്രധാന ആട്ടക്കഥാകൃത്തുക്കൾ - തുള്ളൽപ്രസ്ഥാനം - ചരിത്രം - വികാസപരിണാമങ്ങൾ - കുഞ്ചൻനമ്പ്യാർ- തുള്ളൽസാഹിത്യം - സാമാന്യപരിചയം.

വിശദപഠനം

1. നളചരിതം മൂന്നാം ദിവസം (ഒന്നു മുതൽ നാലു വരെ രംഗങ്ങൾ)- ഉണ്ണായിവാരിയർ
2. കിരാതം (ഓട്ടൻതുള്ളൽ) - കുഞ്ചൻ നമ്പ്യാർ.
   ('ഗിരിവരമകളുടെ കളവചനം' മുതൽ 'തുള്ളിയലഞ്ഞു വലഞ്ഞു കിരീടി' വരെ).

മൊഡ്യൂൾ : രണ്ട് (36 മണിക്കൂർ)

നാടകസാഹിത്യം

നാടകം എന്ന ദൃശ്യകല - സാഹിത്യരൂപം - മലയാള നാടകപ്രസ്ഥാനം - ആരംഭ വികാസചരിത്രം സാമാന്യാവലോകനം- ആദ്യകാലനാടകപരിഭാഷകൾ- സംസ്കൃതനാടക സ്വാധീനം- ഗദ്യനാടകങ്ങളുടെ ആരംഭം- യഥാതഥ നാടകം- ആധുനികനാടകം- സമകാലിക നാടകങ്ങൾ

വിശദപഠനത്തിന്

1. സ്വപ്നവാസവദത്തം (ഗദ്യപരിഭാഷ)- പ്രൊഫ.പന്മന രാമചന്ദ്രൻ നായർ
2. അടുക്കള - എൻ.ശശിധരൻ

മൊഡ്യൂൾ : മൂന്ന് (18 മണിക്കൂർ)
തിരക്കഥാപഠനം

പഠനഫലപ്രാപ്തി

1. മലയാളസിനിമയുടെ ചരിത്രത്തെക്കുറിച്ച് സാമാന്യമായ അറിവുനേടുന്നു.
2. സാങ്കേതികത്തികവും കലാമേന്മയുമുള്ള ചലച്ചിത്രങ്ങളെ ഗൗരവത്തോടെ സമീപിക്കാൻ പ്രേരണയുണ്ടാകുന്നു.
3. മികച്ച ചലച്ചിത്രസൃഷ്ടികൾ കാണുന്നു. അവയുടെ തിരക്കഥ സൂക്ഷ്മമായി വായിക്കുന്നു.
4. സ്വന്തം അഭിരുചിക്കനുസരിച്ച് അഭിനയം തിരക്കഥാരചന, സംവിധാനം തുടങ്ങിയ കാര്യങ്ങൾ പരിശീലിക്കാനുള്ള താൽപര്യമുണ്ടാകുന്നു.

ചലച്ചിത്രനിർമ്മിതിയിൽ തിരക്കഥയ്ക്കുള്ള പ്രാധാന്യം- ലോകപ്രസിദ്ധ തിരക്കഥകൾ- തിരക്കഥാരചനയുടെ ഘട്ടങ്ങൾ- സ്വതന്ത്രതിരക്കഥയും അനുവർത്തനവും- മലയാളത്തിലെ പ്രമുഖ തിരക്കഥാകൃത്തുക്കൾ- എം.ടി- പത്മരാജൻ- അടൂർ ഗോപാലകൃഷ്ണൻ- ലോഹിതദാസ്- തിരക്കഥ സാഹിത്യരൂപം എന്ന നിലയിൽ.

വിശദപഠനത്തിന്

മഴ - ലെനിൻ രാജേന്ദ്രൻ

സഹായകഗ്രന്ഥങ്ങൾ

1. കൈരളിയുടെ കഥ - പ്രൊഫ. എൻ. കൃഷ്ണപിള്ള.
2. ആധുനിക സാഹിത്യചരിത്രം പ്രസ്ഥാനങ്ങളിലൂടെ - കെ. എം. ജോർജ് (എഡി.)
3. ആട്ടക്കഥാസാഹിത്യം- പ്രൊഫ.അയ്മനം കൃഷ്ണക്കൈമൾ
4. കഥകളിപ്രവേശിക - പ്രൊഫ.വട്ടപ്പറമ്പിൽ ഗോപിനാഥപിള്ള
3. നളചരിതം ആട്ടക്കഥ - കൈരളീവ്യാഖ്യാനം - പ്രൊഫ. പന്മന രാമചന്ദ്രൻനായർ
4. ഉയരുന്ന യവനിക - സി.ജെ. തോമസ്, മാളുബൻ പബ്ലിക്കേഷൻസ്, തിരുവനന്തപുരം.
5. മലയാള നാടകസാഹിത്യചരിത്രം - ജി. ശങ്കരപ്പിള്ള.
6. മലയാളനാടകസാഹിത്യചരിത്രം - ഡോ. വയലാ വാസുദേവൻ പിള്ള.
7. സിനിമയുടെ വ്യാകരണം - ഡോ. ടി. ജിതേഷ്.
8. അരങ്ങിലെ ആധുനികീകരണം - ഡോ. സീമ ജെറോം.
9. തിരക്കഥാരചന : കലയും സിദ്ധാന്തവും - ജോസ് കെ. മാനുവൽ.
10. കഥയും തിരക്കഥയും - ആർ. വി. എം. ദിവാകരൻ.
11. സുവർണ ചകോരത്തിന്റെ കഥ - ശാന്തൻ (കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.)
12. വിശ്വോത്തര തിരക്കഥകൾ- വിജയകൃഷ്ണൻ
13. മലയാളസിനിമയുടെ കഥ- വിജയകൃഷ്ണൻ
14. ചലച്ചിത്രത്തിന്റെ പൊരുൾ - വിജയകൃഷ്ണൻ
15. എം.ടി.യുടെ തിരക്കഥകൾ- എം.ടി.വാസുദേവൻ നായർ
16. സിനിമയുടെ ലോകം - അടൂർ ഗോപാലകൃഷ്ണൻ

Board of Studies in Mathematics (UG)
UNIVERSITY OF KERALA

First Degree Programme in MATHEMATICS under Choice Based Credit and Semester System

SYLLABUS for 2018 admission onwards

Structure of Core Courses

Sem	Course Code	Course title	Instr.hrs. per week	Credit
I	MM 1141	Methods of Mathematics	4	4
II	MM 1221	Foundations of Mathematics	4	3
III	MM 1341	Elementary Number Theory and Calculus – I	5	4
IV	MM 1441	Elementary Number Theory and Calculus – II	5	4
V	MM 1541	Real Analysis – I	5	4
	MM 1542	Complex Analysis – I	4	3
	MM 1543	Abstract Algebra – Group Theory	5	4
	MM 1544	Differential Equations	3	3
	MM 1545	Mathematics Software – LaTeX & SageMath (Practical Examination Only)	4	3
	MM 1551	Open Course	3	2
	——	Project preparation - From selecting the topic to presenting the final report	1	
VI	MM 1641	Real Analysis – II	5	4
	MM 1642	Complex Analysis – II	4	3
	MM 1643	Abstract Algebra – Ring Theory	4	3
	MM 1644	Linear Algebra	5	4
	MM 1645	Integral Transforms	4	3
	MM 1651	Elective Course	3	2
	MM 1646	Project		4

Structure of Open Courses

Sem	Course Code	Course title	Instr.hrs. per week	Credit
V	MM 1551.1	Operations Research	3	2
V	MM 1551.2	Business Mathematics	3	2
V	MM 1551.3	Basic Mathematics	3	2

Structure of Elective Courses

Sem	Course Code	Course title	Instr.hrs. per week	Credit
VI	MM 1661.1	Graph Theory	3	2
VI	MM 1661.2	Linear Programming with SageMath	3	2
VI	MM 1661.3	Numerical Analysis with SageMath	3	2
VI	MM 1661.4	Fuzzy Mathematics	3	2

Structure of the Complementary Courses

Complementary Course in Mathematics for First Degree Programme in Physics

Course Code	Sem.	Title of Course	Contact hrs/week	No. of Credits
MM 1131.1	1	Calculus with applications in Physics – I	4	3
MM 1231.1	2	Calculus with applications in Physics – II	4	3
MM 1331.1	3	Calculus and Linear Algebra	5	4
MM 1431.1	4	Complex Analysis, Special Functions and Probability Theory	5	4

Complementary Course in Mathematics for First Degree Programme in Chemistry

Course Code	Sem.	Title of Course	Contact hrs/week	No. of Credits
MM 1131.2	1	Calculus with applications in Chemistry – I	4	3
MM 1231.2	2	Calculus with applications in Chemistry – II	4	3
MM 1331.2	3	Linear Algebra, Probablity Theory & Numerical Methods	5	4
MM 1431.2	4	Differential Equations, Vector Calculus and Abstsract Algebra	5	4

Complementary Course in Mathematics for First Degree Programme in Geology

Course Code	Sem.	Title of Course	Contact hrs/week	No. of Credits
MM 1131.3	1	Algebra, Geometry and Trigonometry	4	3
MM 1231.3	2	Calculus and Linear Algebra	4	3
MM 1331.3	3	Complex Numbers, Algebra and Calculus	5	4
MM 1431.3	4	Basic Statistics and Differential Equations	5	4

Complementary Course in Mathematics for First Degree Programme in Statistics

Course Code	Sem.	Title of Course	Contact hrs/week	No. of Credits
MM 1131.4	1	Basic Calculus for Statistics	4	3
MM 1231.4	2	Advanced Differential and Integral Calculus	4	3
MM 1331.4	3	Fourier Series, Numerical Methods and ODE	5	4
MM 1431.4	4	Linear Algebra	5	4

Complementary Course in Mathematics for First Degree Programme in Economics

Course Code	Sem.	Title of Course	Contact hrs/week	No. of Credits
MM 1131.5	1	Mathematics for Economics I	3	2
MM 1231.5	2	Mathematics for Economics II	3	3
MM 1331.5	3	Mathematics for Economics III	3	3
MM 1431.5	4	Mathematics for Economics IV	3	3

Syllabus for the First Degree Programme in Mathematics of the University of Kerala

Semester I
Methods of Mathematics

CODE: MM 1141 Instructional hours per week: 4
No.of credits: 4

In this paper, we quickly review the fundamental methods of solving problems viz. the limiting method, finding the rate of changes through differentiation method, and finding the area under a curve through the integration method.

Module I - Methods of Differential Calculus (36 Hours)
In the beginning of this module, the basic concepts of calculus like limit of functions especially infinite limits and limits at infinity, continuity of functions, basic differentiation, derivatives of standard functions, implicit differentiation etc. should be reviewed with examples.
The above topics which can be found in chapter 2 of text [1] **below are not to be included in the end semester examination.** A maximum of 5 hours should be devoted for the review of the above topics. After this quick review, the main topics to discuss in this module are the following:
Differentiating equations to relate rates, how derivatives can be used to approximate non-linear functions by linear functions, error in local linear approximation, differentials;

Increasing and decreasing functions and their analysis, concavity of functions, points of inflections of a function and applications, finding relative maxima and minima of functions and graphing them, critical points, first and second derivative tests, multiplicity of roots and its geometrical interpretation, rational functions and their asymptotes, tangents and cusps on graphs;

Absolute maximum and minimum, their behaviour on various types of intervals, applications of extrema problems in finite and infinite intervals, and in particular, applications to Economics;

Motion along a line, velocity and speed, acceleration, Position - time curve, Rolle's, Mean Value theorems and their consequences;

Indeterminate forms and L'Hôpital's rule;
The topics to be discussed in this module can be found in chapter 2,3 and 6 of text [1] *below.*

Module II - Methods of Integral Calculus (36 Hours)
The module should begin with revising integration techniques, like integration by substitution, fundamental theorem of calculus, integration by parts, integration by partial fractions, integration by substitition and the concept of definite integrals.

The above topics which can be found in chapter 4 and 7 of text [1] **below are not to be included in the end semester examination.** A maximum of 5 hours should be devoted for the review of the above topics.
After this quick review, the main topics to discuss in this module are the following:
Finding position, velocity, displacement, distance travelled of a particle by integration, analysing the distance-velocity curve, position and velocity when the acceleration is constant, analysing the free-fall motion of an object, finding average value of a function and its applications;

Area, volume, length related concepts : Finding area between two curves, finding volumes of some three dimensional solids by various methods like slicing, disks and washers, cylindrical shells, finding length of a plane curve, surface of revolution and its area;

Work done : Work done by a constant force and a variable force, relationship between work and energy;

Relation between density and mass of objects, center of gravity, Pappus theorem and related problems

Fluids, their density and pressure, fluid force on a vertical surface.

Introduction to Hyperbolic functions and their applications in hanging cables;

Improper integrals, their evaluation, applications such as finding arc length and area of surface.

The topics to be discussed in this module can be found in chapter 4, 5, 6 and 7 of text [1] *below.*

Text 1 – H Anton, I Bivens, S Davis. *Calculus*, 10th Edition, John Wiley& Sons

References

Ref. 1 – G B Thomas, R L Finney. *Calculus*, 9th Edition, Addison-Weseley Publishing Company

Ref. 2 – J Stewart. *Calculus with Early Transcendental Functions*, 7th Edition, Cengage India Private Limited

Semester II

Foundations of Mathematics

CODE: MM 1221 Instructional hours per week: 4
No.of credits: 3

The rigorous study of mathematics begins with understanding the concepts of sets and functions. After that, one needs to understand the way in which a mathematician formally makes statements and proves or disproves it. We start this course with an introduction to these fundamental concepts. Apart from that, the basic of vector calculus is to be revised before moving to more advanced topics.

Module I - Foundations of Logic and Proof (36 Hours)
The following are the main topics in this module :
Statements, logical connectives, and truth tables, conditional statements and parts of it, tautology and contradiction, using various quantifiers like universal and existential quantifiers in statements, writing negations, determining truth value of statements;

Proof : Various techniques of proof like inductive reasoning, counter examples, deductive reasoning, hypothesis and conclusion, contrapositive statements, converse statements, contradictions, indirect proofs;

Sets and relations: A review of basic set operations like union, intersection, subset, superset concepts, equality of sets, complements, disjoint sets, indexed family of sets and operations on such families, ordered pairs, relations on sets, cartesian products (finite case only), various types of relations (reflexive, symmetric, transitive, equivalence), partitions of sets;

Functions: domain, codomain, range of functions, one-one, onto, bijective functions, image, preimage of functions, composing functions and the order of composition, inverse functions, cardinality of a set, equinumerous (equipotent) sets
The topics to be discussed in this module can be found in chapter 1 and 2 of text [1] *below.*

Module II - Foundations of co-ordinate geometry (18 Hours)
The following are the main topics in this module :
Parametric equations of a curve, orientation of a curve, expressing ordinary functions parametrically, tangent lines to parametric curves, arc length of parametric curves;

Polar co-ordinate systems, converting between polar and rectangular co-ordinate systems, graphs in the polar co-ordinate system, symmetry tests in the polar co-ordinate system, families of lines, rays, circles, other curves, spirals;

Tangent lines to polar curves, arc length of the curve, area, intersections of polar curves;

Conic sections : definitions and examples, equations at standard positions, sketching them, asymptotes of hyperbolas, translating conics, reflections of conics, applications,

rotation of axes and eliminating the cross product term from the equation of a conic, polar equations of conics, sketching them, applications in astronomy such as Kepler's laws, related problems
The topics to be discussed in this module can be found in chapter 10 of text [2] *below.*

Module III - Foundations of vector calculus (18 Hours)
To begin with, the three dimesional rectangular co-ordinate system should be discussed and how distance is to be calculated between points in this sytem. Basic operations on vectors like their addition, cross and dot products should be introduced next. The concept of projections of vectors and the relation with dot product should be given emphasize. Equations of lines determined by a point and vector, vector equations in lines, equatins of planes using vectors normal to be should be discussed. Quadric surfaces which are three dimensinal analogues of conics should be discussed next. Various co-ordinate systems like cylindrical, spherical should be discussed next with the methods for conversion between various co-ordinate systems.
The topics to be discussed in this module can be found in chapter 11 of text [2] *below.*

Texts

Text 1 – S R Lay. *Analysis with an Introduction to Proof*, 5th Edition, Pearson Education Limited

Text 2 – H Anton, I Bivens, S Davis. *Calculus*, 10th Edition, John Wiley & Sons

References

Ref. 1 – J P D'Angelo, D B West. *Mathematical Thinking - Problem Solving and Proofs*, 2nd Edition, Prentice Hall

Ref. 2 – Daniel J Velleman. *How to Prove it : A Structured Approach*, 2nd Edition, Cambridge University Press

Ref. 3 – Elena Nardi, Paola lannonne. *How to Prove it : A brief guide for teaching Proof to Year 1 mathematics undergraduates*, University of East Anglia, Centre for Applied Research in Education

Ref. 4 – G B Thomas, R L Finney. *Calculus*, 9th Edition, Addison-Weseley Publishing Company

Ref. 5 – J Stewart. *Calculus with Early Transcendental Functions*, 7th Edition, Cengage India Private Limited

Semester III

Elementary Number Theory and Calculus – I

CODE: MM 1341 Instructional hours per week: 5
No.of credits: 4

Towards beginning the study on abstract algebraic structures, this course introduces the fundamental facts in elementary number theory. Apart from that, calculus of vector valued functions and multiple integrals is also discussed.

Module I - Divisibility in integers (18 Hours)
The topic of elementary number theory is introduced for further developing the ideas in abstract algebra. The following are the main topics in this module :
The division algorithm, Pigeonhole principle, divisibility relations, inclusion-exclusion principle, base-b representations of natural numbers, prime and composite numbers, infinitude of primes, GCD, linear combination of integers, pairwise relatively prime integers, the Euclidean algorithm for finding GCD, the fundamental theorem of arithmetic, canonical decomposition of an integer into prime factors, LCM;

Linear Diophantine Equations and existence of solutions, Eulers Method for solving LDE's
The topics to be discussed in this module can be found in chapter 2 and 3 of text [2] *below.*

Module II - Vector valued functions (30 Hours)
Towards going to the calculus of vector valued functions, we define such functions. The other topics in this module are the following :
Parametric curves in the three dimensional space, limits, continuity and derivatives of vector valued functions, geometric interpretation of the derivative, basic rules of differentiation of such functions, derivatives of vector products, integrating vector functions, length of an arc of a parametric curve, change of parameter, arc length parametrizations, various types of vectors that can be associated to a curve such as unit vectors, tangent vectors, binormal vectors, definition and various formulae for curvature, the geometrical interpretation of curvature, motion of a particle along a curve and geometrical interpretation of various vectors associated to it, various laws in astronomy like Kepler's laws and problems
The topics to be discussed in this module can be found in chapter 12 of text [1] *below.*

Module III - Multivariable Calculus (42 Hours)
After introducing the concept of functins of more than one variable, the sketching of them in three dimensinal cases with the help of level curves should be discussed. Countours and level surface plotting also should be discussed. The other topics in this module are the following:
Limits and continuity of Multivariable functions, various results related to finding the limits and establishing continuity, continuity at boundary points, partial derivatives of

functions, partial derivative as a function, its geometrical interpretation, implicit partial differentiation, changing the order of partial differentiation and the equality conditions;

Differentiability of a multivariate function, differentiability of such a function implies its continuity, local linear approximations, chain rules - various versions, directional derivative and differentiability, gradient and its properties, applications of gradients;

Tangent planes and normal vectors to level surfaces, finding tangent lines to intersections of surfaces, extrema of multivariate functions, techniques to find them, critical and saddle points, Lagrange multipliers to solve extremum problems with constrains,
The topics to be discussed in this module can be found in chapter 13 of text [1] *below.*

Texts

Text 1 – H Anton, I Bivens, S Davis. *Calculus*, 10th Edition, John Wiley & Sons

Text 2 – Thomas Koshy. *Elementary Number Theory with Applications*, 2nd Edition, Academic Press

References

Ref. 1 – G B Thomas, R L Finney. *Calculus*, 9th Edition, Addison-Weseley Publishing Company

Ref. 2 – J Stewart. *Calculus with Early Transcendental Functions*, 7th Edition, Cengage India Private Limited

Ref. 3 – G A Jones, J M Jones. *Elementary Number Theory*, Springer

Semester IV

Elementary Number Theory and Calculus – II

CODE: MM 1441 Instructional hours per week: 5
No.of credits: 4

As in the previous semester, towards beginning the study on abstract algebraic structures, this course introduces the fundamental facts in elementary number theory. Apart from that, calculus of vector valued functions and multiple integrals is also discussed.

Module I - Congruence relations in integers (30 Hours)
Towards defining the congruence classes in $\mathbb{Z}$, we begin with defining the congruence relation. Its various properties should be discussed, and then the result that no prime of the form $4n + 3$ is a sum of two squares should be discussed. The other topics in this module are the following:
Defining congruence classes, complete set of residues, modulus exponentiation, finding reminder of big numbers using modular arithmetic, cancellation laws in modular arithmetic, linear congruences and existence of solutions, solving Mahavira's puzzle, modular inverses, Pollard Rho factoring method;

Certain tests for divisibility - The numbers here to test are powers of 2, 3, 5, 7, 9, 10, 11, testing whether a given number is a square;

Linear system of congruence equations, Chinese Remainder Theorem and some applications;

Some classical results like Wilson's theorem, Fermat's little theorem, Pollard $p - 1$ factoring method, Eulers' theorem,
The topics to be discussed in this module can be found in chapter 2 and 3 of text [2] *below.*

Module II - Multiple integrals (30 Hours)
Here we discuss double and triple integrals and their applications. The main topics in this module are the follwing:
Double integrals: Defining and evaluating double integrals, its properties, double integrals over non rectangular regions, determining limits of integration, revising the order of integration, area and double integral, double integral in polar coordinates and their evaluation, finding areas using polar double integrals, conversion between rectangular to polar integrals, finding surface area, surface of revolution in parametric form, vector valued function in two variables, finding surface area of parametric surfaces;

Triple integrals : Properties, evaluation over ordinary and special regions, determining the limits, volume as triple integral, modifying order of evaluation, triple integral in cylindrical co-ordinates, Converting the integral from one co-ordinate system to other;

Change of variable in integration (single, double, and triple), Jacobians in two variables.
The topics to be discussed in this module can be found in chapter 14 of text [1] *below.*

Module III - Vector Calculus (30 Hours)

After the differentiation of vector valued functions in the last semester, here we introduce the concept of integrating vector valued functions. Some important theorems are also to be discussed here. The main topics are the following :

Vector fields and their graphical representation, various type of vector fields (inverse-square, gradient, conservative), potential functions, divergence, curl, the $\bigtriangledown$ operator, Laplacian;

Integrating a function along a curve (line integrals), integrating a vector field along a curve, defining work done as a line integral, line integrals along piecewise-smooth curves, integration of vector fields and independence of path, fundamental theorem of line integrals, line integrals along closed paths, test for conservative vector fields, Green's theorem and applications;

Defining and evaluating surface integrals, their applications, orientation of surfaces, evaluating flux integrals, The divergence theorem, Gauss' Law, Stoke's theorem, applications of these theorems.

The topics to be discussed in this module can be found in chapter 15 of text [1] *below.*

Texts

Text 1 – H Anton, I Bivens, S Davis. *Calculus*, 10th Edition, John Wiley & Sons

Text 2 – Thomas Koshy. *Elementary Number Theory with Applications*, 2nd Edition, Academic Press

References

Ref. 1 – G B Thomas, R L Finney. *Calculus*, 9th Edition, Addison-Weseley Publishing Company

Ref. 2 – J Stewart. *Calculus with Early Transcendental Functions*, 7th Edition, Cengage India Private Limited

Ref. 3 – G A Jones, J M Jones. *Elementary Number Theory*, Springer

Semester V

Real Analysis – I

CODE: MM 1541 Instructional hours per week: 5
No.of credits: 4

In this course, we discuss the notion of real numbers, the ideas of sequence of real numbers and the concept of infinite summation in a formal manner. Many of the topics discussed in the first two modules of this course were introduced somewhat informally in earlier courses, but in this course, the emphasis is on mathematical rigor. A minimal introduction to the metric space structure of $\mathbb{R}$ is also included so as to serve as a stepping stone into the idea of abstract topological spaces. The course is mainly based on Chapters 1–3 of text [1].

All the chapters mentioned above contains a section titled *Discussions* in the beginning of the chapter. This section is intended only for motivating the students, and so should not be made as a part of the examination process.

Module I (25 Hours)

This module introduces the basic concepts about the real number system with some introduction to sets, functions, and proof techniques. The following are the main topics to be discussed: existence of an irrational number, the axiom of completeness, upper lower bounds of sets in $\mathbb{R}$, consequences of completeness like Archimedian property of real numbers, Density of $\mathbb{Q}$ in $\mathbb{R}$, existence of square roots, countability of $\mathbb{Q}$ and uncountability of $\mathbb{R}$, various cardinality results, Cantor's original proof for uncoubtability of $\mathbb{R}$, and Cantor's theorem on power sets.

The topics to be discussed in this module can be found in chapter 1 of text [1] *below. The first section 1.1 may be briefly discussed and is not meant for examination purposes.*

Module II (40 hours)

Students must have already encountered the idea of infinite series through the example of geometric progression. After discussing the rearrangement concept of infinite series, the following topics are to be introduced rigourously : Limit of a sequence, diverging sequences, examples, algebraic operations on limits, and order properties of sequences and limits, the Monotone Convergence Theorem, Cauchy's condensation test for convergence of a series, various other tests for the convergence series, the Bolzano-Weierstrass theorem, the Cauchy criterion for convergence of a sequence, rearrangement of absolutely convergent series.

The topics to be discussed in this module can be found in chapter 2 of text [1] *below. The first section 2.1 may be briefly discussed and is not meant for examination purposes.*

Module III (25 hours)

This module is intended to be a beginner for learning abstract metric spaces. To motivate the students, the Cantor set should be constructed and shown in the beginning. Then move to the topics open and closed sets in $\mathbb{R}$, and what about their complements, Compactness of sets (defined using sequential convergence), open covers and compactness, perfect and connected sets in $\mathbb{R}$, and finally the Baire's theorem.
The topics to be discussed in this module can be found in chapter 3 of text [1] *below. The first section 3.1 may be briefly discussed and is not meant for examination purposes.*

Texts

Text 1 – Stephen Abbot. *Understanding Analysis*, 2nd Edition, Springer

References

Ref. 1 – R G Bartle, D Sherbert. *Introduction to Real Analysis*, 3rd Edition, John Wiley & Sons

Ref. 2 – W. Rudin. *Principles of Mathematical Analysis*, Second Edition, McGraw-Hill

Ref. 3 – Terrence Tao. *Analysis I*, Hindustan Book Agency

Semester V

Complex Analysis – I

CODE: MM 1542 Instructional hours per week: 4
No.of credits: 3

Here we go through the basic complex function theory.

Module I (27 Hours)
Complex numbers : The algebra of Complex Numbers, Point Representation of Complex Numbers, Vectors and Polar forms, The Complex Exponential, Powers and Roots, Planar Sets
Analytic Functions : Functions of a complex variable, Limits and Continuity, Analyticity, The Cauchy Riemann Equations, Harmonic Functions
The topics to be discussed in this module can be found in chapter 1, sections 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 and chapter 2, sections 2.1, 2.2, 2.3, 2.4, 2.5 of text [1] *below.*

Module II (15 hours)
Elementary Functions : Polynomials and rational Functions (Proof of the theorem on partial fraction decomposition need not be discussed), The Exponential, Trigonometric and Hyperbolic Functions, The Logarithmic Function, Complex Powers and Inverse Trigonometric Functions.
The topics to be discussed in this module can be found in chapter 3, sections 3.1, 3.2, 3.3, 3.5 of text [1] *below.*

Module III (30)
Complex Integration : Contours, Contour Integrals, Independence of Path, Cauchy's Integral Theorem (Section 4.4a on deformation of Contours Approach is to be discussed, but section 4.4 b on Vector Analysis Approach need not be discussed), Cauchy's Integral Formula and Its Consequences, Bounds of Analytic Functions
The topics to be discussed in this module can be found in chapter 4, sections 4.1, 4.2, 4.3, 4.4a, 4.5 and 4.6 of text [1] *below.*

Texts

Text 1 – Edward B. Saff, Arthur David Snider. *Fundamentals of complex analysis with applications to engineering and science*, 3rd Edition, Pearson Education India

References

Ref. 1 – John H Mathews, Russel W Howell. *Complex Analysis for Mathematics and Engineering*, Jones and Bartlett Publishers

Ref. 2 – Erwin Kreyszig. *Advanced Engineering Mathematics*, 10th Edition, Wiley-India

Ref. 3 – James Brown, Ruel Churchill. *Complex Variables and Applications*, Eighth Edition, McGraw-Hill

Semester V

Abstract Algebra – Group Theory

CODE: MM 1543 Instructional hours per week: 5
No.of credits: 4

The aim of this course is to provide a very strong foundation in the theory of groups. All the concepts appearing in the course are to be supported by numerous examples mainly from the references provided.

Module I (30 Hours)
The concept of group is to be introduced before rigorously defining it. The symmetries of a square can be a starting point for this. After that, definition of group should be stated and should be clarified with the help of examples. After discussing various properties of groups, finite groups and their examples should be discussed. The concept of subgroups with various characterizations also should be discussed. After introducing the definition of cyclic groups, various examples, and important features of cyclic groups and results on order of elements in such groups should be discussed.
The topics to be discussed in this module can be found in chapter 1, 2 3 and 4 of text [1] *below.*

Module II (24 Hours)
This module starts with defining and analysing various properties permutation groups which forms one of the most important class of examples for non abelian, finite groups. After defining operations on permutations, their properties are to be discussed. To motivate the students, the example of check-digit scheme should be discussed (This section on check-digit scheme is not meant for the examinations). Then we proceed to define the notion of equivalence of groups viz. isomorphisms. Several examples are to be discussed for explaining this notion. The properties of isomorphisms are also to be discussed together with special classes of isomorphisms like automorphisms and inner automorphisms before finishing the module with the classic result of Cayley on finite groups.
The topics to be discussed in this module can be found in chapter 5 and 6 of text [1] *below.*

Module III (18 Hours)
In this module we prove one of the most important results in group theory which is the Langrange's theorem on counting cosets of a finite group. The concept of cosets of a group should be defined giving many examples before proving the Lagrange's theorem. As some of the applications of this theorem, the connection between permutation groups and rotations of cube and soccer ball should be discussed. The section on Rubik's cube and section on internal direct products need not be discussed.
The topics to be discussed in this module can be found in chapter 7 and 9 of text [1] *below.*

Module IV (18 Hours)

Here the concept of group homomorphisms should be defined with sufficient number of examples. After proving the first isomorphism theorem, the fundamental theorem of isomorphism should be introduced and proved. Classifying groups based on the fundamental theorem should be discussed in detail.
The topics to be discussed in this module can be found in chapter 10 and 11 of text [1] *below.*

Texts

Text 1 – Joseph Gallian. *Contemporary Abstract Algebra*, 8th Edition, Cengage Learning

References

Ref. 1 – D S Dummit, R M Foote. *Abstract Algebra*, 3rd Edition, Wiley

Ref. 2 – I N Herstein. *Topics in Algebra*, Vikas Publications

Semester V

Differential Equations

CODE: MM 1544 — Instructional hours per week: 3
No.of credits: 3

In this course, we discuss how differential equations arise in various physical problems and consider some methods to solve first order differential equations and second order linear equations. For introducing the concepts, text [1] may be used, and for strengthening the theoretical aspects, reference [1] may be used.

Module I - First order ODE (18 hours)
In this module we discuss first order equations and various methods to solve them. Sufficient number of exercises also should be done for understanding the concepts thoroughly. The main topics in this module are the following:
Modelling a problem, basic concept of a differential equation, its solution, initial value problems, geometric meaning (direction fields), seperable ODE, reduction to seperable form, exact ODEs and integrating factors, reducing to exact form, homogeneous and non homogeneous linear ODEs, special equations like Bernoulli equation, orthogonal trajectories, understanding the existence and uniqueness of solutions theorem.
The topics to be discussed in this module can be found in chapter 1 of text [1] *below.*

Module II - Second order ODE (18 hours)
As in the first module, we discuss second order equations and various methods to solve them. Sufficient number of exercises also should be done for understanding the concepts thoroughly. The main topics in this module are the following:
homogeneous linear ODE of second order, initial value problem, basis, and general solutions, finding a basis when one solution is known, homogeneous linear ODE with constant coefficients (various cases that arise depending on the characteristic equation), differential operators, Euler-Cauchy Equations, existence and uniqueness of solutions w.r. to wronskian, solving nonhomogeneous ODE via the method of undetermined coefficients, varius applications of techniques, solution by variation of parameters.
The topics to be discussed in this module can be found in chapter 2 of text [1] *below.*

Texts

Text 1 – Erwin Kreyszig. *Advanced Engineering Mathematics*, 10th Edition, Wiley-India

References

Ref. 1 – G. F. Simmons. *Differential Equations with applications and Historical notes*, Tata McGraw-Hill, 2003

Ref. 2 – H Anton, I Bivens, S Davis. *Calculus*, 10th Edition, John Wiley & Sons

Ref. 3 – Peter V. O' Neil. *Advanced Engineering Mathematics*, Thompson Publications, 2007

Semester V

Mathematics Software – LaTeX & SageMath

CODE: MM 1545 Instructional hours per week: 4
No.of credits: 3

Here we introduce two software which are commonly used by people working in Mathematics – a science typesetting software LaTeX, and a mathematical computation and visualization software SageMath. The aim of introducing LaTeX software is to enable students to typeset the project report which is a compulsory requirement for finishing their undergraduate mathematics programme succesfully. The aim of learning SageMath is to enable students to see how the computational techniques they have learned in the previous semesters can be put into action with the help of software so as to reduce human effort. Also, they should be able to use this software for further computations in their own in the forthcoming semester.

Module I - LaTeX for prearing a project report in Mathematics (36 Hours)

Graphical User Interface (GUI)/ Edtitor like Kile or TeXstudio should be used for providing training to the students. The main topics in this module are following:

Typesetting a simple article and compiling it;

How spaces are treated in the document;

Document layout : various options to be included in the `documentclass` command, page styles, splitting files into smaller files, breaking line and page, using boxes (like, `mbox`) to keep text unbroken across lines, dividing document in to parts like frontmatter, mainmatter, backmatter, chapters, sections, etc, cross referencing with and without page number, adding footnotes;

Emphasizing words with `\emph, \texttt, \textsl, \textit, \underline` etc.

Basic environments like `enumerate, itemize, description, flushleft, flusuright, center, quote, quotation`

Controlling enumeration via the `enumerate` package.

Tables : preparing a table and floating it, the longtable environment;

Typesetting mathematics : basic symbols, equations, operators, the `equation` environment and reference to it, the `displaymath` environment, exponents, arrows, basic functions, limits, fractions, spacing in the mathematics environments, matrices, aligning various objects, multi-equation environments, suppressing numbering for one or more equations, handling long equations, phantoms, using normal text in math mode, controlling font size, typesetting theorems, defintions, lemmas, etc, making text bold in math mode, inserting symbols and environments (`array, pmatrix` etc) using the support of GUIs;

Figures : Including JPG, PNG graphics with `graphicx` package, controlling width, height etc, floating figures, adding captions, the wrapfig package;

Adding references/bibliogrpahy and citing them, using the package `hyperref` to add and control hypertext links, creating presentations with `pdfscreen`, creating new commands;

Fonts : changing font size, various fonts, math fonts,

Spacing : changing line spacing, controlling horizontal, vertical spacing, controlling the margins using the geometry package, fullpage package

Preparing a dummy project with `titlepage`, acknowledgement, certificates, table of contents (using `\tableofcontents`), list of tables, table of figures, chapters, sections, bibliography (using the `thebibliography` environment). This dummy project should contain atleast one example from the each of the topic in the syllabus, and should be submitted for internal evaluation before the end semester practical examination.

Module II - Doing Mathematics with SageMath (36 hours)

Starting SageMath using a browser, how to use the sage cell server `https://sagecell.sagemath.org/`, how to use SageMathCloud, creating and saving a sage worksheet, saving the worksheet to an .sws file, moving it and re-opening it in another computer system;

Using sagemath as a calculator, basic functions (square root, logarithm, numeric value, exponential, trigonometric, conversion between degrees and radians, etc.);

Plotting : simple plots of known functions, controlling range of plots, controlling axes, labels, gridlines, drawing multiple plots on a single picture, *adding* plots, polar plotting, plotting implicit functions, contour plots, level sets, parametric 2D plotting, vector fields plotting, gradients;

Matrix Algebra : Adding, multiplying two matrices, row reduced echelon forms to solve linear system of equations, finding inverses of square matrices, determinants, exponentiation of matrices, computing the kernel of a matrix;

Defining own functions and using it, composing functions, multi variate functions;

Polynomials : Defining polynomials, operations on them like multiplication and division, expanding a product, factorizing a polynomial, finding gcd;

Solving single variable equations, declaring multiple variables, solving multi variable equations, solving system of non linear equations, finding the numerical value of roots of equations;

complex number arithmetic, finding complex roots of equations;

Finding derivatives of functions, higher order derivatives, integrating functions, definite and indefinite integrals, numerical integration, partial fractions and integration,

Combinatorcs & Number theory: Permutations, combinations, finding gcd, lcm, prime factorization, prime counting function, n^{th} prime funcion, divisors of a number, counting divisors, modular arithmetic;

Vector calculus : Defining vectors, operations like sum, dot product, cross product, vector valued functions, divergence, curl, multiple integrals;

Computing Taylor, McClaurins polynomials, minimization and Lagrange multipliers, constrained and unconstrained optimization;

Internal Evaluation : A dummy project report prepared in LaTeX should be submitted as assignment for internal evaluation for 5 marks. Another practical record should be submitted the content of which should be problems and their outputs evaluated using SageMath. This record should be awarded a maximum of 10 marks which is earmarked for the internal evaluation examination.

Problems to be included in the examination:

1. Find all local extrema and inflection points of a function
2. Traffic flow optimization
3. Minimum surface area of packaging
4. Newton's method for finding approximate roots
5. Plotting and finding area between curves using integrals
6. Finding the average of a function
7. Finding volume of solid of revolution
8. Finding solution for a system of linear equations
9. Finding divergence and curl of vector valued functions
10. Using differential calculus to analyze a quintic polynomials features, for finding the optimal graphing window
11. Using Pollard's $p - 1$ Method of factoring integers, to try to break the RSA cryptosystem
12. Expressing gcd of two integers as a combination of the integers (Bezout's identity)

References

Ref. 1 – Tobias Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl. *The (Not So) Short Introduction to LaTeX2e*, Samurai Media Limited (or available online at `http://mirrors.ctan.org/info/lshort/english/lshort.pdf`)

Ref. 2 – Leslie Lamport. *LaTeX: A Document Preparation System*, Addison-Wesley, Reading, Massachusetts, second edition, 1994

Ref. 3 – *LaTeX Tutorials—A Primer*, Indian TeX Users Group, available online at `https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf`

Ref. 4 – H. J. Greenberg. *A Simplified introduction to LaTeX*, available online at `https://www.ctan.org/tex-archive/info/simplified-latex/`

Ref. 5 – *Using Kile - KDE Documentation*, `https://docs.kde.org/trunk4/en/extragear-office/kile/quick_using.html`

Ref. 6 – *TeXstudio : user manual*, `http://texstudio.sourceforge.net/manual/current/usermanual_en.html`

Ref. 7 – *The longtable package - TeXdoc.net*, `http://texdoc.net/texmf-dist/doc/latex/tools/longtable.pdf`

Ref. 8 – *wrapfig - TeXdoc.net*, `http://texdoc.net/texmf-dist/doc/latex/wrapfig/wrapfig-doc.pdf`

Ref. 9 – *The geometry package*, `http://texdoc.net/texmf-dist/doc/latex/geometry/geometry.pdf`

Ref. 10 – *The fullpage package*, http://texdoc.net/texmf-dist/doc/latex/preprint/fullpage.pdf

Ref. 11 – *The SageMathCloud*, https://cloud.sagemath.com/

Ref. 12 – Gregory V. Bard. *Sage for Undergraduates*, American Mathematical Society, available online at http://www.gregorybard.com/Sage.html

Ref. 13 – Tuan A. Le and Hieu D. Nguyen. *SageMath Advice For Calculus* available online at http://users.rowan.edu/~nguyen/sage/SageMathAdviceforCalculus.pdf

Semester V

Operations Research (Open Course)

CODE: MM 1551.1 — Instructional hours per week: 3
No. of Credits: 2

Module I – Linear Programming (18 hours)
Formulation of Linear Programming models, Graphical solution of Linear Programs in two variables, Linear Programs in standard form - basic variable - basic solution- basic feasible solution -feasible solution, Solution of a Linear Programming problem using simplex method (Since Big-M method is not included in the syllabus, avoid questions in simplex method with constraints of $\geq$ or $=$ type.)

Module II – Transportation Problems (18 hours)
Linear programming formulation - Initial basic feasible solution (Vogel'sapproximation method/North-west corner rule) - degeneracy in basic feasible solution - Modified distribution method - optimalitytest.

ASSIGNMENT PROBLEMS: Standard assignment problems - Hungarian method for solving an assignment problem.

Module III – Project Management (18 hours)
Activity -dummy activity - event - project network, CPM (solution by network analysis only), PERT.

The topics to be discussed in this course can be found in text [1].

Texts

Text 1 – Ravindran, Philps, Solberg. *Operations Research- Principles and Practice*, 2nd Edition, Wiley India Pvt Ltd

References

Ref. 1 – Hamdy A. Taha. *Operations Research : An Introduction*, 9th Edition, Pearson

Semester V

Business Mathematics (Open Course)

CODE: MM 1551.2 — Instructional hours per week: 3
No. of Credits: 2

Module I – Basic Mathematics of Finance (18 hours)
Nominal rate of Interest and effective rate of interest, Continuous Compounding, force of interest, compound interest calculations at varying rate of interest, present value, interest and discount, Nominal rate of discount, effective rate of discount, force of discount, Depreciation.
(Chapter 8 of Unit I of text [1] - Sections: 8.1, 8.2, 8.3, 8.4. 8.5, 8.6, 8.7, 8.9)

Module II – Differentiation and their applications to Business and Economics (18 hours)
Meaning of derivatives, rules of differentiation, standard results (basics only for doing problems of chapter 5 of Unit 1)
(Chapter 4 of unit I of text [1] - Sections: 4.3, 4.4, 4.5, 4.6)
Maxima and Minima, concavity, convexity and points of inflection, elasticity of demand, Price elasticity of demand
(Chapter 5 of Unit I of text [1] - Sections: 5.1, 5.2, 5.3, 5.4, 5.5. 5.6, 5.7)
Integration and their applications to Business and Economics: Meaning, rules of integration, standard results, Integration by parts, definite integration (basics only for doing problems of chapter 7 of Unit 1 of text)
(Chapter 6 of unit I of text [1] - Sections: 6.1, 6.2, 6.4, 6.10, 6.11)
Marginal cost, marginal revenue, Consumer's surplus, producer's surplus, consumer's surplus under pure competition, consumer's surplus under monopoly
(Chapter 7 of unit I of text [1] - Sections: 7.1, 7.2, 7.3, 7.4, 7.5)

Module III – Index Numbers (18 hours)
Definition, types of index numbers, methods of construction of price index numbers, Laspeyer's price index number, Paasche's price index number, Fisher ideal index number, advantages of index numbers, limitations of index numbers
(Chapter 6 of Unit II of text [1] - Sections: 6.1, 6.3, 6.4, 6.5, 6.6, 6.8, 6.16, 6.17)
Time series: Definition, Components of time series, Measurement of Trend
(Chapter 7 of Unit II of text [1] - Sections: 7.1, 7.2, 7.4)

Texts

Text 1 – B M Agarwal. *Business Mathematics and Statistics*, Vikas Publishing House, New Delhi, 2009

References

Ref. 1 – Qazi Zameeruddin, et al . *Business Mathematics*, Vikas Publishing House, New Delhi, 2009

Ref. 2 – Alpha C Chicny, Kevin Wainwright. *Fundamental methods of Mathematical Economics*, 4th Edition, Mc-Graw Hill

Semester V

Basic Mathematics (Open Course)

CODE: MM 1551.3 Instructional hours per week: 3
No. of Credits: 2

This course is specifically designed for those students who might have not undergone a mathematics course beyond their secondary school curriculum. The structure of the course is so as to give an exposure to the basic mathematics tools which found a use in day today life, say in the fields general finance and basic sciences.

Module I : Basic arithmetic of whole numbers, fractions and decimals (24 hours)

Place Value of numbers, standard Notation and Expanded Notation, Operations on whole numbers : exponentiation, square roots, order of operations, computing averages, rounding, estimation, applications of estimation, estimating product of numbers by rounding, exponents, square roots, order of operations, computing averages;

Fractions: multiplication and division of fractions, applications, primes and composites, factorization, simplifying fractions to lowest terms, multiplication of fractions, reciprocal of fractions, division of fractions, operations of mixed fractions, LCM,

Decimal notation and rounding of numbers, fractions to decimals, multiplication of decimals, division of decimals, order of operations involving decimals,

Scientific notation of numbers, operations in scientific notations, square and cube roots of numbers, laws of exponents and logarithms

The topics to be discussed in this module can be found in chapters 1–3 of text [1] *and chapters 1 and 2 of* text [2] *below.*

Module II - Ratios, proportions, percents and the relation among them (15 hours)

Ratio and proportions : Simplifying ratios to lowest terms, ratios of mixed numbers, unit rates and cost, ratios and proportion, similar figures;

Percents: Fractions - decimals - percents, converting between these three relation with proportions, equations involving percents, increase and decrease in percent, finding simple and compound interests

The topics to be discussed in this module can be found in chapters 4, 5 of text [1] *below.*

Module III – Basic Statistics, Simple Equations (15 hours)

Basic Statistics : Data and tables, various graphs like bar graphs, pictographs, line graphs, frequency distributions and histograms, circle graphs (pie charts), interpreting them, circle graphs and percents, mean, median, mode, weighted mean

Solving simple equations, quadratic equations (real roots only), cubic equations, arithmetic geometric series, systems of two and three equations, matrices and system of equations

The topics to be discussed in this module can be found in chapters 9 of text [1] *and chapters 2, 3 of* text [2] *below.*

Texts

Text 1 – J Miller, M O'Neil, N Hyde. *Basic College Mathematics*, 2nd Edition, McGraw Hill Higher Education

Text 2 – Steven T Karris. *Mathematics for Business, Science and Technology*, 2nd Edition, Orchard Publications

References

Ref. 1 – Charles P McKeague. *Basic Mathematics*, 7th Edition, Cengage Learning

Semester V

Project preparation - From selecting the topic to presenting the final report

Instructional hours per week: 1

To complete the undergraduate programme, the students should undertake a project and prepare and submit a project report on a topic of their choice in the subject mathematics or allied subjects. The work on the project should start in the beginning of the 5th semester itself, and should end towards the middle of the 6th semester. This course (without any examination in the 5th semester, with a project report submissin and project viva in the 6th semester) is introduced for making the students understand various concepts behind undertaking such a project and preparing the final report. Towards the end of this course the students should be able to choose and prepare topics in their own and they should understand the layout of a project report.

To quickly get into the business, the first chapter of text [1] may be completely discussed. Apart from that, for detailed information, the other chapters in this book may be used in association with the other references given below. The main topics to discuss in this course are the following:

Quick overview : The structure of Dissertation, creating a plan for the Dissertation, planning the results section, planning the introduction, planning and writing the abstract, composing the title, figures, tables, and appendices, references, making good presentations, handling resources like notebooks, library, computers etc., preparing an interim report.

Topics in detail : Planning and Writing the Introduction, Planning and Writing the Results, Figures and Tables, Planning and Writing the Discussion, Planning and Writing the References, Deciding On a Title and Planning and Writing the Other Bits, Proofreading, Printing, Binding and Submission, oral examinations, preparing for viva, Taking the Dissertation to the Viva

Layout : Fonts and Line Spacing, Margins, Headers, and Footers, Alignment of Text, Titles and Headings, Separating Sections and Chapters

Texts

Text 1 – Daniel Holtom, Elizabeth Fisher. *Enjoy Writing Your Science Thesis or Dissertation – A step by step guide to planning and writing dissertations and theses for undergraduate and graduate science students*, Imperial College Press

References

Ref. 1 – Kathleen McMillan, Jonathan Weyers. *How to write Dissertations & Project Reports*, Pearson Education Limited

Ref. 2 – Peg Boyle Single. *Demystifying dissertation writing : a streamlined process from choice of topic to final text*, Stylus Publishing, Virginia

Semester VI

Real Analysis – II

CODE: MM 1641 Instructional hours per week: 5
No.of credits: 4

In the second part of the Real Analysis course, we focus on functions on $\mathbb{R}$, their continuity, existence of derivatives, and integrability. The course is mainly based on Chapters 4,5 and 7 of text [1].

All the chapters mentioned above contains a section titled *Discussions* in the beginning of the chapter. These sections are intended only for motivating the students, and so should not be made a part of the examination process.

Module I (35 Hours)

Here we move towards the basic notion of limits of functions and their continuity. Various version of definition of limits are to be discussed here. The algebra of limits of functions and the divergence criterion for functional limits are to be discussed next. The other topics to be discussed in this module are the discontinuity criterion, composition of functions and continuity, continuity and compct sets, results on uniform continuity, the intermediate value theorem, Monotone functions and their continuity.

The topics to be discussed in this module can be found in chapter 4 of text [1] *below. The first section 4.1 may be briefly discussed and is not meant for examination purposes.*

Module II (25 hours)

Here we discuss the derivative concept more rigorously than what was done in the previous calculus courses. After (re)introducing the definition of differentiability of functions, we verify that differentiability implies continuity. Algebra and composing of differentiable functions should be discussed next. The interior extremum theorem and Darboux's theorem should be discussed after that. The mean value theorems should be discussed and proved, and the module ends with L'Hospitals results. A continuous everywhere but notwhere differentiable function should be discussed, but it is not meant for the examination. It may be infact used for student seminars.

The topics to be discussed in this module can be found in chapter 5 of text [1] *below. The sections 5.1 and 5.4 may be briefly discussed and is not meant for examination purposes.*

Module III (30 hours)

In the last module, the theory of Riemann integration is to be discussed. Main topics to be included in this module are defining the Riemann integral using upper, lower Riemann sums, and the integrability criterion, continuity and the existence of integral, algebraic operations on integrable functions, (The results and examples on convergence of sequence of functions and integrability may be omitted), the fundamental theorem of calculus and its proof, Lebesgue's criterion for Riemann integrability.

The topics to be discussed in this module can be found in chapter 7 of text [1] *below. The first section 7.1 may be briefly discussed and is not meant for examination purposes.*

Texts

Text 1 – Stephen Abbot; *Understanding Analysis*, 2nd Edition, Springer

References

Ref. 1 – R G Bartle, D Sherbert ; *Introduction to real analysis*, 3rd Edition, John Wiley & Sons

Ref. 2 – W. Rudin, *Principles of Mathematical Analysis*, Second Edition, McGraw-Hill

Ref. 3 – Terrence Tao; *Analysis I*, Hindustan Book Agency

Semester VI

Complex Analysis – II

CODE: MM 1642 Instructional hours per week: 4
No.of credits: 3

Module I (32 Hours)
Series Representations for Analytic Functions : Sequences and Series, Taylor Series, Power Series, Mathematical Theory of Convergence, Laurent series, Zeros and Singularities, The point at Infinity. *The topics to be discussed in this module can be found in chapter 5, sections 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7 of* text [1] *below.*

Module II (20 Hours)
Residue Theory : The Residue Theorem, Trigonometric Integrals over $[0, 2\pi]$, Improper integrals of Certain functions over $[-\infty, \infty]$, Improper integrals involving Trigonometric Functions, Indented Contours
The topics to be discussed in this module can be found in chapter 6, sections 6.1, 6.2, 6.3, 6.4, 6.5 of text [1] *below.*

Module III (20 Hours)
Conformal Mapping : Geometric Considerations, Mobius Transformations
The topics to be discussed in this module can be found in chapter 7, sections 7.2, 7.3, 7.4 of text [1] *below.*

Texts

Text 1 – Edward B. Saff, Arthur David Snider. *Fundamentals of complex analysis with applications to engineering and science*, 3rd Edition, Pearson Education India

References

Ref. 1 – John H Mathews, Russel W Howell. *Complex Analysis for Mathematics and Engineering*, 6th Edition, Jones and Bartlett Publishers

Ref. 2 – Murray R Spiegel. *Complex variables: with an introduction to conformal mapping and its applications*, Schaum's outline.

Ref. 3 – Erwin Kreyszig. *Advanced Engineering Mathematics*, 10th Edition, Wiley-India

Ref. 4 – James Brown, Ruel Churchill. *Complex Variables and Applications*, Eighth Edition, McGraw-Hill

Semester VI

Abstract Algebra – Ring Theory

CODE: MM 1643 Instructional hours per week: 4
No.of credits: 3

After discussing the theory of groups thoroughly in the previous semester, we move towards the next higher algebraic structure rings. As in the last semester, all the new concepts appearing in the course is to be supported by numerous examples mainly from the references provided.

Module I (24 Hours)
The concept of rings, subrings with many examples should be discussed here. Next comes the definition and properties of integral domains, fields, and the characteristic of rings. Ideals, how factor rings are defined using ideals, should be explained next. The definition of prime and maximal ideals with examples should be discused after that.
The topics to be discussed in this module can be found in chapter 12, 13 and 14 of text [1] *below.*

Module II (24 Hours)
After introducing the definition of ring homomorphisms, their properties should be discussed. The field of quotients of an integral domain should be discussed next. The next topic is the definition and various properties of polynomial rings over a commutative ring. Various results on operations on polynomials such as division algorithm, factor theorem, remainder theorem etc should be discussed next. The definition and examples of PID's should be discussed next, before moving to the factorization of polynomials. Tests of irreducibility and reducibility and the unique factorization of polynomials over special rings should be discused. .
The topics to be discussed in this module can be found in chapter 15, 16 and 17 of text [1] *below.*

Module III (24 Hours)
In the last module, we introduce more rigorous topics like various type of integral domains. The divisibility properties of integral domains and definition of primes in a general ring should be introduced. Unique factorization domains and the Euclidean domains should be discussed next with examples. Results on these special integral domains are aslo to be discussed.
The topics to be discussed in this module can be found in chapter 18 of text [1] *below.*

Texts

Text 1 – Joseph Gallian; *Contemporary Abstract Algebra*, 8th Edition, Cengage Learning

References

Ref. 1 – D S Dummit, R M Foote; *Abstract Algebra*, 3rd Edition, Wiley

Ref. 2 – I N Herstein, *Topics in Algebra*, Vikas Publications

Semester VI

Linear Algebra

CODE: MM 1644 Instructional hours per week: 5
No.of credits: 4

The main focus of this course is to introduce linear algebra and methods in it for solving practical problems.

Module I (15 Hours)
This module deals with a study on linear equations and their geometry. After introducing the geometrical intrepretation of linear equations, following topics should be discussed: various operations on column vectors, technique of Gaussian elimination, operations involving elementary matrices, interchanging of rows using elementary matrices, triangular factorisation of matrices and finding inverse of matrices by the elimination method.
The topics to be discussed in this module can be found in chapter 1 of text [1] *below. The section 1.7 may be omitted.*

Module II (25 hours)
Towards the study of vector spaces, specifically $\mathbb{R}^n$, we define them with many examples. Subspaces are to be defined next. After discussing the idea of nullspace of a matrix. The solving linear equations (which was one to some extent in the first module) and finding solutions to non-homogeneous systems from the corresponding homogeneous systems. After this, linear independence and dependence of vectors, their spanning, basis for a space, its dimension concepts are to be introduced. The column, row, null, left null spaces of a matrix is to be discussed next. When inverses of a matrix exists related to its column/row rank should be discussed. Towards the end of this module, linear transformations (through matrices) and their properties are to be discussed. Types of transformations like rotations, projections, reflections are to be considered next.
The topics to be discussed in this module can be found in chapter 2 of text [1] *below. The section 2.7 on graphs and networks may be omitted.*

Module III (25 hours)
This module is intended for making the idea and concepts of determinants stronger. Its properties like what happens when rows are interchanged, linearlity of expansion along the first row, etc are to be discussed. Breaking a matrix into triangular, diagonal forms and finding the determinants, expansion in cofactors, their applications like solving system of equations, finding volume etc are to be discussed next.
The topics to be discussed in this module can be found in chapter 4 of text [1] *below.*

Module IV (25 hours)
Here we conclude our analysis of matrices. The problem of finding eigen values a matrix is to be introduced first. Next goal is to diagonalize a matrix. This concept should be

discussed first, and move to the discussion on the use of eigen vectors in diagonalization. Applications of finding the powers of matrices should be discussed next. The applications like the concept of Markov Matrices, Positive Matrices and their applications in Economics should be discussed. Complex matrices and operations on them are to be introduced next. The concept orthoganality of vectors may be required here from one of the previous sections in text [1] and it should be briefly introduced and discussed here. The module ends with similar matrices, and similarity transformation related ideas. How to diagonalize some special matrices like symmetric and Hermitial matrices are also to be discussed in this module.
The topics to be discussed in this module can be found in chapter 5 of text [1] *below. The section 5.4 on applications to differential equations may be omitted*

Texts

Text 1 – Gilbert Strang, *Linear Algebra and Its Applications*, 4th Edition, Cengage Learning

References

Ref. 1 – *Video lectures of Gilber Strang Hosted by MITOpenCourseware* available at `https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/`

Ref. 2 – Thomas Banchoff, John Wermer; *Linear Algebra Through Geometry*, 2nd Edition, Springer

Ref. 3 – T S Blyth, E F Robertson: *Linear Algebra*, Springer, Second Edition.

Ref. 4 – David C Lay: *Linear Algebra*, Pearson

Ref. 5 – K Hoffman and R Kunze: *Linear Algebra*, PHI

Semester VI

Integral Transforms

CODE: MM 1645 Instructional hours per week: 4
No.of credits: 3

After completing courses in ordinary differential equations and basic integral calculus, we see here some of its applications.

Module I (38 Hours)
Laplace Transforms : Laplace Transform. Linearity. First Shifting Theorem (s-Shifting), $s-$ Shifting: Replacing s by $s-a$ in the Transform, Existence and Uniqueness of Laplace Transforms, Transforms of Derivatives and Integrals. ODEs, Laplace Transform of the Integral of a Function, Differential Equations, Initial Value Problems, Unit Step Function (Heaviside Function), Second Shifting Theorem ($t-$Shifting) Time Shifting ($t-$Shifting): Replacing t by $t-a$ in $f(t)$, Short Impulses. Diracs Delta Function. Partial Fractions Convolution , Application to Nonhomogeneous Linear ODEs, Differentiation and Integration of Transforms, ODEs with Variable Coefficients, Integration of Transforms, Special Linear ODEs with Variable Coefficients, Systems of ODEs
The topics to be discussed in this module can be found in sections 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7 of text [1] below.

Module II (34 hours)
Fourier Series, Basic Examples, Derivation of the Euler Formulas, Convergence and Sum of a Fourier Series, Arbitrary Period. Even and Odd Functions. Half-Range Expansions From Period 2π to any Period $P = 2L$, Simplifications: Even and Odd Functions, Half-Range Expansions, Fourier Integral, From Fourier Series to Fourier Integral, Applications of Fourier Integrals, Fourier Cosine Integral and Fourier Sine Integral, Fourier Cosine and Sine Transforms, Linearity, Transforms of Derivatives, Fourier Transform, Complex Form of the Fourier Integral, Fourier Transform and Its Inverse, Linearity. Fourier Transform of Derivatives, Convolution.
The topics to be discussed in this module can be found in Sections 11.1, 11.2, 11.7, 11.8, 11.9 (Excluding Physical Interpretation: Spectrum and Discrete Fourier Transform (DFT),Fast Fourier Transform (FFT)) of text [1] below.

Texts

Text 1 – Erwin Kreyszig. *Advanced Engineering Mathematics*, 10th Edition, Wiley-India

References

Ref. 1 – Peter V. O' Neil, *Advanced Engineering Mathematics*, Thompson Publications, 2007

Ref. 2 – M Greenberg, *Advanced Engineering Mathematics*, 2nd Edition, Prentice Hall

Semester VI

Graph Theory (Elective)

CODE: MM 1661.1 Instructional hours per week: 3
No. of credits: 2

Overview of the Course: The course has been designed to build an awareness of some of the fundamental concepts in Graph Theory and to develop better understanding of the subject so as to use these ideas skillfully in solving real world problems.

Module I (27 Hours)

Basics : The Definition of a Graph, Graphs as Mathematical Models, other basic concepts and definitions, Vertex Degrees, Subgraphs, Paths and Cycles, The Matrix Representation of Graphs, Fusing graphs (The fusion algorithm for connectedness need not be discussed).

Trees and Connectivity : Definitions and Simple Properties of trees, Bridges, Spanning Trees, Cut Vertices and Connectivity *The topics in this module can be found in Chapter 1, Sections 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7 and 1.8, Chapter 2, Sections 2.1, 2.2, 2.3 and 2.6 of* text [1].

Module II (27 Hours)

Euler Tours and Hamiltonian Cycles : Euler Tours (Fleury's algorithm need not be discussed), The Chinese Postman Problem (Only Statement of the problem is to be discussed) , Hamiltonian Graphs, The Travelling Salesman Problem (Only Statement of the problem is to be discussed, The Two-Optimal Algorithm and The Closest Insertion Algorithm need not be discussed)

Planar Graphs : Plane and Planar Graphs, Euler's Formula, The Platonic Bodies, Kuratowski's Theorem (Without proof).

The topics in this module can be found in Chapter 3, Sections 3.1, 3.2, 3.3 and 3.4, Chapter 5, Sections 5.1, 5.2, 5.3 and 5.4 of text [1].

Texts

Text 1 – John Clark, Derek Allan Holton. *A first look at Graph Theory*, World Scientific

References

Ref. 1 – R Balakrishnan, Ranganatahan. *A Text Book of Graph Theory*, 2nd Edition, Springer

Ref. 2 – V Balakrishnan. *Graph Theory*, Schaums Outline

Ref. 3 – J A Body, U S R Murthy. *Graph Theory with Applications*, The Macmillan Press

Ref. 4 – Robin J Wilson. *Introduction to Graph Theory* 5th edition, Prentice Hall

Semester VI

Linear Programming with SageMath (Elective)

CODE: MM 1661.2 Instructional hours per week: 3
No. of credits: 2

This course is aimed at providing an introduction to linear programming and solving problems in it using very basic methods.

Note :

1. There should not be any problems to solve using the SageMath software in the End Semester Examination (ESE). The ESE should be based only on the theory and problems to be solved either manually or using a non programmable scientific calculator.
2. Students may be permitted to use non programmable scientific calculator in the end semester examination.
3. One of the internal evaluation examinations should be done using SageMath Software, as a practical examination.

Module I (18 Hours)

This module is aimed at providing a strong introduction to various type of problems that can be solved via linear programming. Main topics in this module are the following:
Introduction to linear programming through problems, basic underlying assumptions like Proportionality, Divisibility, Additivity, Certainty, more general problems, standard form of a linear program, conversion rules to arrive at such a form like Converting unrestricted variables, Converting inequality constraints, Converting maximization to minimization, their examples, standard linear programming terminology, examples on planning, transportation, assignment, workforce scheduling, portfolio optimization, Minimum Cost Flow Problem, Maximum Flow Problem.
The topics to be discussed in this module can be found in chapter 1 of text [1] *below.*

Module II (18 hours)

This module begins with the geometry of linear programming and later proceeds to the Fundamental Theorem of Linear Programming which is a basis for algorithm development for linear programs. The main topics in this module are the following:
Geometry of the Feasible Set, graphically representing the solution space, hyperplane, polyhedron, polytope, convex sets, geometry of optimal solutions, geometric characterisaion of optimality, extreme points and basic feasible solutions, generating basic feasible solutions, resolution theorem, fundamental theorem linear programming.
The topics to be discussed in this module can be found in chapter 2 of text [1] *below.*

Module III (18 hours)

Here we introduce the simplex method, which is an important method to solve linear programming problems. The main topics in this module are the following:
Introducing the simplex method, examples, adjacent basic feasible solutions, checking optimality of a basic feasible solution, direction-step length theorem, its application in developing the steps of simplex method, examples, finite termination under non-degeneracy, generating an initial basic feasible solution using two phase and Big M method, degeneracy and cycling, anti-cycling rules like Bland's rule, and lexicographic rules.
The topics to be discussed in this module can be found in chapter 3 of text [1] *below.*

All the problems in this course should be computationally also solved using the software SageMath. The references provided below, especially text [2] and chapter 4 of text [3] can be used mainly for this.

Texts

Text 1 – Roy H Kwon. *Introduction to Linear Optimization and extensions with MATLAB*, 4th Edition, CRC Press, New York

Text 2 – *Sage Reference Manual: Numerical Optimization, Release 7.6* by the Sage Development Team available online at `http://doc.sagemath.org/pdf/en/reference/numerical/numerical.pdf`

Text 3 – Gregory V. Bard. *Sage for Undergraduates*, American Mathematical Society, available online at `http://www.gregorybard.com/Sage.html`

References

Ref. 1 – Frederick S Hillier, Gerald J Lieberman. *Introduction to operations research*, 10th Edition, McGraw Hill Education

Ref. 2 – Paul R Thie, G. E. Keough. *An introduction to linear programming and game theory*, 3rd Edition, John Wiley & Sons

Ref. 3 – Wayne L Winston, *Operations Research Applications and Algorithms*, 4th Edition, Cengage Learning

Semester VI

Numerical Analysis with SageMath (Elective)

CODE: MM 1661.3 Instructional hours per week: 3
No. of credits: 2

This course is aimed at providing an introduction to Numerical analysis with particular emphasize to finding approximate solutions to problems like finding roots of equations, numerically evaluating differential and integral equations, finding polynomials from values that approximate a given function, solving systems of linear equations etc. SageMath can be used as the software for supporting computations.

Note :

1. There should not be any problems to solve using the SageMath software in the End Semester Examination (ESE). The ESE should be based only on the theory and problems to be solved either manually or using a non programmable scientific calculator.
2. Students may be permitted to use non programmable scientific calculator in the end semester examination.
3. One of the internal evaluation examinations should be done using SageMath Software, as a practical examination.

Module I (27 Hours)

General concepts in Numerical analysis : Introduction, Floating-Point Form of Numbers, Round off, Loss of Significant Digits, Errors of Numeric Results, Error Propagation, Basic Error Principle, Algorithm Stability.

Solution of Equations by Iteration : Fixed-Point Iteration for Solving Equations $f(x) = 0$, Newton's Method for Solving Equations $f(x) = 0$, Order of an Iteration Method Speed of Convergence, Convergence of Newton's Method, Secant Method for Solving $f(x) = 0$.

Interpolation : Lagrange Interpolation, Newton's Divided Difference Interpolation, Equal Spacing: Newton's Forward Difference Formula, Equal Spacing: Newton's Backward Difference Formula, Spline Interpolation,

The topics to be discussed in this module can be found in chapter 19, sections 19.1, 19.2,19.3,19.4 of text [1] *below.*

Module II (27 hours)

Numerical Integration and Differentiation : Rectangular Rule. Trapezoidal Rule, Simpson's Rule of Integration, Adaptive Integration, Gauss Integration Formulas Maximum Degree of Precision, Numeric Differentiation.

Numerical Methods for Ordinary Differential Equations : Methods for First-Order ODEs, Picard's Iteration Method, Euler's method (Numeric Method) , Improved Euler Method, Runge-Kutta Methods (RK Methods) of fourth order.

Numerical Methods in Linear Algebra : Linear Systems: Gauss Elimination, Linear Systems: LU-Factorization, Matrix Inversion, Cholesky's Method, GaussJordan Elimination. Matrix Inversion. Linear Systems: Solution by Iteration, GaussSeidel Iteration Method, Jacobi Iteration
The topics to be discussed in this module can be found in chapter 19 section 1.2 and Problem set 1.7 CAS PROJECT. 6 , Chapter 19 Sections 19.5, Chapter 20, Sections 20.1, 20.2, 20.3, Chapter 21 Sections 21.1, of text [1] *below.*

All the problems in this course should be computationally also solved using the software SageMath. The references provided below, especially text [2] and chapter 4 of text [3] can be used mainly for this.

Texts

Text 1 – Erwin Kreyszig. *Advanced Engineering Mathematics*, 10th Edition, Wiley-India

Text 2 – *Sage Reference Manual: Numerical Optimization, Release 7.6* by the Sage Development Team available online at `http://doc.sagemath.org/pdf/en/reference/numerical/numerical.pdf`

Text 3 – Gregory V. Bard. *Sage for Undergraduates*, American Mathematical Society, available online at `http://www.gregorybard.com/Sage.html`

References

Ref. 1 – Richard L Burden, J Douglas Faires. *Numerical Analysis*, 9th Edition, Cengate Learning

Ref. 2 – E Isaacson, H B Keller. *Analysis of Numerical Methods*, Dover Publications, New York

Ref. 3 – W. Cheney, D Kincaid. *Numerical Mathematics and Computing*, 6th Edition, Thomson Brooks/Cole

Semester VI

Fuzzy Mathematics (Elective)

CODE: MM 1661.4 — Instructional hours per week: 3
No. of credits: 2

Module I (18 hours)
FROM CRISP SETS TO FUZZY SETS: A PARADIGM SHIFT.Introduction-crisp sets: an overview-fuzzy sets: basic types and basic concepts of fuzzy sets, Fuzzy sets versus crisp sets, Additional properties of cuts, Representation of fuzzy sets.

Module II (18 hours)
OPERATIONS ON FUZZY SETS AND FUZZY ARITHMETIC:Operations on fuzzy sets-types of operations, fuzzy complements, fuzzy intersections, t-norms, fuzzy unions, t-conorms. Fuzzy numbers, Linguistic variables, Arithmetic operations on intervals, Arithmetic operations on fuzzy numbers.

Module III (18 hours)
FUZZY RELATIONS :Crisp versus fuzzy relations, projections and cylindric extensions, Binary fuzzy relations, Binary relations on a single set, Fuzzy equivalence relations.

The topics to be discussed in this module can be found in
Chapter 1: Sections 1.1 to 1.4
Chapter 2: Sections 2.1 and 2.2
Chapter 3: Sections 3.1 to 3.4 (proof of theorems 3.7, 3.8, lemma 3.1, 3.2, theorems 3.11,3.12 3.13 need not be discussed)
Chapter 4: Sections 4.1 to 4.4
Chapter 5: Sections 5.1 to 5.5
of text [1] *below.*

Texts

Text 1 – George J Klir, Yuan. *Fuzzy sets and fuzzy logic: Theory and applications*, Prentice Hall of India Pvt. Ltd., New Delhi, 2000

References

Ref. 1 – Klir G J and T Folger. *Fuzzy sets, Uncertainty and Information*, PHI Pvt.Ltd., New Delhi, 1998

Ref. 2 – H J Zimmerman. *Fuzzy Set Theory and its Applications*, Allied Publishers, 1996

Ref. 3 – Dubois D and Prade H. *Fuzzy Sets and Systems: Theory and Applications*, Ac.Press, NY, 1988

FIRST DEGREE PROGRAMME UNDER CBCSS

SCHEME AND SYLLABI OF COMPLEMENTARY STATISTICS

FOR B. Sc. MATHEMATICS CORE w.e.f. 2018 Admission.

The goal of the syllabus is to equip the students with the concepts, principles and methods of Statistics. It is aimed that students be acquainted with the applications of statistical methods to analyze data and draw inferences wherever the statistical decisions are meaningful. Emphasis is given to understand the basic concepts and data analysis tools. There are practical sessions in each semester. Numerical problems solving using scientific calculators is also included in the End Semester Examination (ESE) of Courses in the semesters I, II, III & IV. There is one course in practical using Excel in Semester IV. ESE of courses in semesters I, II, III, & IV will be of 3 hours duration and have questions from all modules in the respective semester.

Courses in semesters I & II will be of 2 credits each and in semesters III & IV, 3 credits each. The ESE of Practical course in semester IV will be of 2 hours duration with credit 4.

It is mandatory to submit a fair record of practical done (module V of courses in semesters I, II, III and IV) and print-out of the output of the same duly certified at the time of ESE of practical course. ESE of the practical course will be held under the supervision of external examiners duly appointed by the University.

Semester	Title of the course	Hours/ week		No. of credits	Total Hrs/ week	ESE Duration	Weightage	
		L	P				CE	ESE
I	ST 1131.1: Descriptive Statistics	2	2	2	72	3 hrs	20	80
II	ST 1231.1: Probability and Random Variables	2	2	2	72	3 hrs	20	80
III	ST 1331.1: Statistical Distributions	3	2	3	90	3 hrs	20	80
IV	ST 1431.1: Statistical Inference	3	2	3	90	3 hrs	20	80
	ST 1432.1: Practical using EXCEL			4		2 hrs	20	80

SEMESTER I

Hours/week: 4

ST 1131.1: Descriptive Statistics

The course aims that students will learn to understand the characteristics of data and will get acquainted with describing data through illustrating examples and exercises. They will also learn to collect, organize and summarize data, create and interpret simple graphs and compute appropriate summary statistics.

Module I: Part A: Introduction (Not for Examination Purpose): Significance of Statistics, Limitations and misuse of Statistics, Official Statistical system of India. Types of Data: Concepts of primary data and secondary data, population and sample; Classification of data based on geographic, chronological, qualitative and quantitative characteristics.

Part B: Collection and Presentation of Data: Scales of data-Nominal, Ordinal, Ratio and Interval. Methods of collection of primary data–Preparation of questionnaires / schedules. Secondary data –major sources and limitations; Census and Sample Surveys; Methods of sampling: Probability and non-probability sampling, simple random sampling with replacement (SRSWR) & simple random sampling without replacement (SRSWOR), Systematic sampling and Stratified sampling (concepts only); sampling and non-sampling errors; Presentation of raw data: Classification and tabulation - Construction of Tables with one or more factors of classification, frequency distributions, relative and cumulative frequency distributions, their graphical representations.

Module II: Summarization of Data: Central tendency- mean, median, mode, geometric mean, harmonic mean; properties of Arithmetic Mean and Median; Relationship between AM, GM and HM; Absolute and relative measures of dispersion: Range, quartile deviation, mean deviation and standard deviation; Properties of mean deviation, standard deviation, combined mean and combined standard deviation; coefficient of variation; Moments- Raw and central moments; relationship between raw and central moments; effect of change of origin and scale; Skewness, Kurtosis and their measures.

Module III: **Bivariate data**: Scatter diagram, Fitting of curves- Principle of least squares, fitting of straight line, fitting parabola, curves $y=ab^x$, $y=ax^b$, $y=ae^{bx}$, and $y=ax^{-1}+b$.

Module IV: Regression lines and prediction, Karl Pearson's coefficient of correlation, Spearman's rank correlation.

Module V: Practical based on Modules I, II, III, & IV – Data analysis: presentation of data –Charts and Diagrams, Frequency table, Frequency graphs, calculation of descriptive statistics, curve fitting, correlation and regression.

References

1. Gupta S.C. and Kapoor V.K. (1980). *Fundamentals of Mathematical Statistics*. Sultan Chand and Sons, New Delhi.
2. Gupta, S. C., and Kapoor, V. K. (1994). *Fundamental of Mathematical Statistics*. Sultan Chand & Sons, New Delhi.
3. Gupta S. P. (2004). *Statistical Methods*. Sultan Chand & Sons, New Delhi.
4. Kenny J. F & Keeping E. S (1964). *Mathematics of Statistics –Part Two*. 2nd Edition, D. Van Nostard Company, New Delhi-1.
5. Kenny J. F (1947). *Mathematics of Statistics Part One*. 2nd Edition, D. Van Nostard Company, New Delhi-1. **ASIN: B0013G0LYA.**
6. Mukhopadhyay, P. (1996). *Mathematical Statistics*. New Central Book Agency (P) Ltd, Calcutta.
7. Agarwal, B.L. (2006). *Basic Statistics*. 4th Edition New Age international(P) Ltd., New Delhi. **ISBN: 8122418147, 9788122418149.**
8. Agarwal, B.L.(2013). *Basic Statistics*. Anshan, Uk. **ISBN-13: 978-1848290679; ISBN-10: 1848290675.**

SEMESTER II

Hours/week: 4

ST 1231.1: Probability and Random variables

This course will introduce the elementary ideas of probability and random variables.

Module I: Random experiments- sample point and sample space- Events, algebra of events, concepts of equally likely, mutually exclusive and exhaustive events; Probability: Statistical regularity, relative frequency and classical approaches, Axiomatic approach, theorems in probability, probability space.

Module II: Conditional probability, multiplication theorem, independence of two and three events, compound probability, Bayes' theorem and its applications.

Module III: Random variables- discrete and continuous, probability mass function and probability density function, distribution function, joint distribution of two random variables, marginal and conditional distributions, independence, transformation of variables- one-to-one transformation- univariate.

Module IV: Expectation of random variables and its properties, theorems on expectation of sums and product of independent random variables, conditional expectation, moments, moment generating function, characteristic function, their properties and uses; Bivariate moments, Cauchy- Schwartz inequality and correlation coefficient.

Module V: Practical (Numerical Problems) based on Modules I, II, III, & IV - random variables (univariate and bivariate), expectations and moments.

References

1. Bhat B.R. (1985). *Modern Probability Theory*. New Age International (P) Ltd, New Delhi.
2. Dudewicz E.J and Mishra S.N (1988). *Modern Mathematical Statistics*. John Wiley & Sons, New York.
3. Gupta, S. C., and Kapoor, V. K. (1994). *Fundamental of Mathematical Statistics*. Sultan Chand & Sons. New Delhi.
4. Pitman, J. (1993). *Probability*. Narosa Publishing House, New Delhi
5. Mukhopadhyay, P. (1996). *Mathematical Statistics*. New Central Book Agency (P) Ltd, Calcutta.
6. Rohatgi V. K.(1993). *An Introduction to Probability Theory and Mathematical Statistics*. Wiley Eastern, New Delhi.
7. Rao C.R (1973). *Linear Statistical Inference and its Applications*. 2/e, Wiley, New York.

SEMESTER III

Hours/week: 5

ST 1331.1: Statistical Distributions

This course introduces standard probability distributions, limit theorems and sampling distributions.

Module I: Standard Distributions(Discrete)- Uniform, binomial, Poisson and geometric- moments, moment generating function, characteristic function, problems, additive property (binomial and Poisson), recurrence relation (binomial and Poisson), Poisson as a limiting form of binomial, memory less property of geometric distribution; Fitting of binomial and Poisson distributions; hypergeometric distribution(definition, mean and variance only).

Module II: Standard Distributions (Continuous)– Uniform, exponential, and gamma - moment generating function, characteristic function, problems; memory less property of exponential distribution; additive property of gamma distribution; beta distribution (I and II)- moments, Normal distribution- moments, moment generating function, characteristic function, problems, recurrence relation of central moments; convergence of binomial and Poisson to normal.

Module III: Chebychev's inequality; Law of large numbers-BLLN, convergence in probability (definition only), WLLN; central limit theorem for iid random variables- statement and applications.

Module IV: Sampling distributions -Parameter and statistic, Sampling distributions- Distribution of mean of a sample taken from a normal population, Chi-square(χ^2)- definition and properties, t and F distributions (definitions only) and statistics following these distributions, relation between normal, χ^2 , t and F distributions.

Module V: Practical based on Modules I, II, III, & IV – Discrete and continuous probability distributions and applications, law of large numbers and CLT.

References

1. Medhi J.(2005). *Statistical Methods-An Introductory Text*. New Age International (P) Ltd, New Delhi.
2. Gupta S.C. and Kapoor V.K. (1980). *Fundamentals of Mathematical Statistics*. Sultan Chand and Sons, New Delhi.
3. John E. Freund(1980). *Mathematical Statistics*. Prentice Hall of India, New Delhi.
4. Mukhopadhyay, P. (1996). *Mathematical Statistics*. New Central Book Agency (P) Ltd, Calcutta.
5. Rohatgi V. K.(1993). *An Introduction to Probability Theory & Mathematical Statistics*. Wiley-Eastern, New Delhi.

SEMESTER IV

Hours/week: 5

ST 1431.1: Statistical Inference

This course enables the students to understand the methods of Statistical Inference.

Module I: Point estimation, Properties of estimators – unbiasedness, consistency, efficiency and sufficiency; Methods of estimation - Maximum likelihood method, method of moments; Interval estimation of mean, variance and proportion (single unknown parameter only).

Module II: Testing of Hypothesis- statistical hypotheses, simple and composite hypotheses, two types of errors, significance level, p-value, power of a test, Neyman-Pearson lemma (without proof) .

Module III: Large sample tests- testing mean and proportion (one and two sample cases), Chi-square (χ^2) test of goodness of fit, independence and homogeneity.

Small sample tests- Z-test for means; One sample test for mean of a normal population, Equality of means of two independent normal populations, Paired samples t-test, Chi-square test for variance, F-test for equality of variances.

Module IV: Design of Experiments- assumptions, principles, models and ANOVA tables of one way and two way classified data (Derivation of two – way model is not included).

Module V: Practical based on Modules I, II , III & IV.

References

1. Das M. N., Giri N. C.(2003). *Design and analysis of experiments*. New Age International (P) Ltd, New Delhi.
2. John E. Freund(1980). *Mathematical Statistics*. Prentice Hall of India, New Delhi.
3. Medhi J. (2005). *Statistical Methods-An Introductory Text*, New Age International(P) Ltd.. New Delhi.
4. Paul G. Hoel, Sidney C. Port, Charles J. Stone (1971). *Introduction to Statistical Theory*. Universal Book stall, New Delhi.

Course V - ST 1432.1: Practical using Excel

The students will learn to use statistical tools available in Excel and have hands on training in data analysis. This course covers topics of courses I, II, III & IV.

Use of Excel in statistics (Charts, functions and data analysis),

Practical covering Semesters I, II, III, & IV

Section I: Charts- Bar chart, Pie chart & scatter diagram

Functions- Evaluation of numerical problems using the following functions

AVEDEV	AVERAGE	BINORMDIST	CHIDIST	CHINV	CHITEST
CONFIDENCE	CORREL	COVAR	DEVSQ	FDIST	FINV
FREQUENCY	FTEST	GEOMEAN	HARMEAN	INTERCEPT	KURT
MEDIAN	MODE	LINEST	LOGEST	NORMDIST	NORMINV
NORMSDIST	PEARSON	POISSON	PROB	SKEW	SLOPE
STANDARDIZE	STDEVP	TDIST	TINV	TREND	TTEST

Section II: Data analysis

Histogram, Descriptive Statistics, Covariance, Correlation, Regression, Random Number Generation, Sampling, t-tests for means: Paired t-test, Equality of means of two normal populations, z-test: Two Sample test for Means, F-test for Variances, ANOVA- Single Factor and Two Factor without Replication.

References

1. Dan Remenyi, George Onofrei, Joe English (2010). *An Introduction to Statistics Using Microsoft Excel*. Academic Publishing Ltd., UK

2. Neil J Salkind (2010). *Excel Statistics, A Quick Guide*. SAGE Publication Inc. New Delhi

3.Vijai Gupta (2002). *Statistical Analysis with Excel*. VJ Books Inc. Canada

Record of Practical

Duly certified record of practical sessions is mandatory to appear for the practical examination. Five questions are to be worked out in each sheet based on the topics given below:

Sheets

1. Diagrams and Graphs
2. Measures of Central Tendency and Dispersion
3. Moments, Skewness and Kurtosis
4. Fitting of Curves
5. Correlation and Regression
6. Probability
7. Univariate Random Variables
8. Bivariate Random Variables
9. Mathematical Expectation
10. Bivariate Moments
11. Standard Distributions- Discrete
12. Standard Distributions- Continuous
13. Law of Large Numbers
14. Sampling Distributions
15. Point Estimation
16. Interval Estimation
17. Large Sample Tests
18. Small Sample Tests
19. Analysis of Variance
20. Charts in Excel
21. Functions in Excel
22. Analysis Tools in Excel

Print-out of output of practical sheets 20, 21 and 22 are to be attached. CE and ESE marks are to be awarded and consolidated as per regulations of the FDP in affiliated Colleges, 2013.

UNIVERSITY OF KERALA

REVISED SYLLABI FOR

FIRST DEGREE PROGRAMME IN

PHYSICS

UNDER

CHOICE BASED-CREDIT & SEMESTER-SYSTEM (CBCSS)

(2018 admission onwards)

AIM AND OBJECTIVES OF THE PROGRAMME

In this programme, we aim to provide a solid foundation in all aspects of Physics and to show a broad spectrum of modern trends in physics and to develop experimental, computational and mathematical skills of students. The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of physics by providing more or less complete and logical framework in almost all areas of basic Physics.

The programme also aims to

(i) Provide education in physics of the highest quality at the undergraduate level and generate graduates of the calibre sought by industries and public service as well as academic teachers and researchers of the future.

(ii) Attract outstanding students from all backgrounds.

(iii) Provide an intellectually stimulating environment in which the students have the opportunity to develop their skills and enthusiasms to the best of their potential.

(iv) Maintain the highest academic standards in undergraduate teaching.

(v) Impart the skills required to gather information from resources and use them.

(vi) Equip the students in methodology related to Physics.

Objectives

By the end of the first year (2nd semester), the students should have,

(i) Attained a common level in basic mechanics and properties of matter and laid a secure foundation in mathematics for their future courses.

(ii) Developed their experimental and data analysis skills through a wide range of experiments in the practical laboratories.

By the end of the fourth semester, the students should have

i. Been introduced to powerful tools for tackling a wide range of topics in Thermodynamics, Electrodynamics, Classical Mechanics and Relativistic Mechanics.

ii. Become familiar with additional relevant mathematical techniques.

iii. Further developed their experimental skills through a series of experiments which also illustrate major themes of the lecture courses.

By the end of the sixth semester, the students should have

i. Covered a range of topics in almost all areas of physics including Quantum Physics, Solid State Physics, Computational Physics, Electronics etc.

ii. Had experience of independent work such as projects, seminars etc.

iii. Developed their understanding of corePhysics.

I. General Structure for the First-Degree Programme in Physics

Sem.
No.

Course title	Instructional hours/week		Credit	University. Exam duration	Evaluation	Total credit
	L	**P**				
					Internal	
					Uty.	
					Exam	
I						
EN1111 English Lang I						
5						
4						
3 hours						

1111 Addl Lang I
4

3
”

EN1121 Foun Course I
4

2
”
20%
80%
16

PY1141 Core Course I
2

2
”

Core pract. I
-
2
-
-

MM1131.1 Compl. Course I
2

2

3
3 hours

Compl. Course II
2
2
2
„

(CH1131.1/ST1131.2/PCH1131.7/EL1131)

II
EN1211 Eng Lang. II
5

4
3 hours

EN1212 Eng Lang. III
4

3
„

1211 Addl Lang. II
4

3
,,
20%
80%
17

PY1241 Core Course II
2

2
,,

Core pract. I

2

MM1231.1 Compl. Course III
2
2-
3
,,

Compl. Course IV
2
2
2
,,

(CH1231.1/ST1231.2/ PCH1231.7/EL1231)

III
EN1311 Eng Lang. IV
5

4
3 hours

1311 Addl Lang. III
5

4
”

PY1341 Core Course II
3
-
3
”

20%
80%
18

Core Pract I
-
2
-
-

MM1331.1 Compl. Course V
3
2
4
3 hours

Compl. Course VI
3
2
3
„

(CH1331.1/ST1331.2/PCH1331.7/EL1331)

20%							80%
	IV						
	EN1411 Eng Lang. V						
	5						
	4						
	3 hours						
	1411Addl Lang. IV						
	5						
	4						
	,,						
	PY1441Core Course III						
	3						
	3						
	,,						

80% 80%

25

PY 1442 Core (Pract I) IV
-
2
3
,,

MM1431.1 Compl. Course VII
5
-
4
3 hours

Compl. Course VIII
3
-
3
,,

(CH1431.1/ST1431.2/ PCH1431.7/EL1431)

Compl. (Practical) IX
-

2

4

”

(CH1432.1/ST1432.2/ PCH1432.7/EL1432)

V

PY1541 Core Course V

4

-

4

3 hours

PY1542 Core Course VI

4

-

4

”

PY1543 Core Course VII

80% 4 80%

-

4

”

18

PY1544 Core Course VIII

4

-

4

”

Core (PracticalII)

-

4

-

-

Open Course

3

-

2

3 hours

(PY1551.1/PY1551.2/

PY1551.3/PY1551.4/

PY1551.5)

Project

-

2

-

-

VI

PY1641 Core Course IX

4

80%

80%

-

4

3 hours

PY1642 Core Course X

4

-

4

”

PY1643 Core Course XI

4

-

4

”

26

PY1644 Core Course XII

4

-

3

”

PY1645 Core (Pract II) XIII

-

2

2

”

PY1646 Core (Pract III) XIV
-
2
3
”

Elective Course
3
-
2
”

(PY1661.1/PY1661.2/

PY1661.3/PY1661.4/

PY1661.5)

PY1647 Project and Research

-

2

4

-

Institute/Science Museum visit

II. Course structure:(1a). ***Core Courses (theory)***

Sem.	Title of paper	Number of hours per week	Number of credits	Total hours/ semester	UE Duration	
1	PY1141 – Basic mechanics & Properties of matter	2	2	36	3 hrs	
2	PY1241 - Heat	2	2	36	3	

	& Thermodynamics				
3	PY1341 – Electrodynamics	3	3	54	3
4	PY1441 - Classical & Relativistic Mechanics	3	3	54	3
	PY1541– Quantum Mechanics	4	4	72	3
	PY1542 – Statistical Mechanics Research Methodology and Disaster Manage	4	4	72	3

	ment				
5					
	PY1543 – Electronics	4	4	72	3
	PY1544 –Atomic & Molecular Physics	4	4	72	3
	PY1551 – Open course	3	2	54	3
	PY1641 -Solid State Physics	4	4	72	3

	PY1642 – Nuclear & Particle Physics	4	4	72	3
6	PY1643 - Classical & Modern Optics	4	4	72	3
	PY1644 -Digital Electronics & Computer Science	4	3	72	3
	PY1661 – Elective Course	3	2	54	3

(1b). COURSE STRUCTURE FOR PRACTICAL AND PROJECT WORK

FOR THE CORE COURSE:

Sem	Title of Paper	Duration of Exam	Number Of Credits	Weightage IA	Weightage UE	Allotted hours Per week	Allotted hours Per year
4	**PY1442- Basic Physics Lab 1**	3	3	1	3	S1---2 S2---2 S3---2 S4—2	144
6	**PY1645- Advanced Physics Lab 2**	3	2	1	3	S5---2 S6—2	72
	PY1646- Advanced	3	3	1	3	S5---2	72

6	**Physics Lab 3**					S6—2	
6	PY-1647-Project	-	4	-	4	S5-2 S6-2	72

2(a). Complementary Courses (General structure)

Semester	Theory			Practical	
	Number of hours/ week	Number of credits	Total hours/sem	number of hours/ week	Number of credits
1	2	2	36	2	-
2	2	2	36	2	-
3	3	3	54	2	-

4	3	3	54	2	4

(2b). COMPLEMENTARY COURSES (Theory and Practical)

1. Physics for Mathematics B.Sc Programme

Semester	Title of the course		No. of hours/ week	No. of credits	Total credits	Total hours per sem.	UE duration
1	PY1131.1-Mechanics & properties of matter	2	2	2	36	3	
	Practical		2			36	
2	PY1231.1-Thermal		2	2	2	36	3

	Physics and statistical mechanics							
	Practical		2			36		
3	PY1331.1-Optics,magnetism & electricity	3	3	3	54	3		
	Practical		2			36		
4	PY1431-Modern Physics & Electronics	3	3	7		3		

	PY1 432- Practical	2	4		36		

2. Physics for Chemistry B.Sc Programmes

Semester	Title of the course	No. of	No. of hours/ week	Total credits	Total credits	UE hours per.	duration
1	PY1 131. 2- Rotational dynamics & properties of Matter	2	2	2	36	3	
	Practical		2			36	
2	PY 123	2	2	2	36	3	

	1.2-Thermal Physics							
	Practical		2			36		
3	PY 1331.2-Magnetism & Electricity	Optics,	3	3	3	54	3	
	Practical		2			36		
4	PY 1431.2-Atomic Quantum Electronics	physics, mechanics &	3	3	7	54	3	
	PY 143			2	4		36	3

	2- Pra ctic al							

3. Physics for Statistics B.Sc Programme

Semester	Title of the course	No. of	No. of hours/ week	Total credits	Total Credits	UE hours per sem.	duration
1	PY1131.3- Mechanics & properties of matter	2	2	2	36	3	
	Practical		2			36	
2	PY1231.3- Thermal & statistical mechanics	Physics	2	2	2	36	3

	Practical		2			36		
3	PY1331.3-Magnetism & electricity	Optics,	3	3	3	54	3	
	Practical			2			36	
4	PY1431.3-& Electronics	Modern	physics	3	3	7	54	3
	PY1432-Practical		2	4		36	3	

4. Physics for Geology B.Sc Programme

Semester	Title of the course	No. of	No. of hours/ week	Total credits	Total credits	UE hours per sem.	duration
1	PY1131.4-properties of matter	Mechanics &	2	2	2	36	3
	Practical		2			36	
2	PY1231.4-Physics & Physics of the Earth	Thermal	2	2	36	3	
	Practical		2			36	

3	PY1331.4-electrodynamics and Optics	3	3	3	54	3	
	Practical	2			36		
4	PY1431.4-Physics, crystallography Modern Electronics &	3	3	7	54	3	
	PY1432-Practical	2	4		36	3	

5. Physics for Home Science B.Sc Programme

Semester	Title of the course		No. of hours/ week	No. of credits	Total credits	Total hours per sem.	UE duration
1	PY1131.5-Mechanics & properties of matter	2	2	2	36	3	
	Practical		2			36	
2	PY1231.5-Thermal Physics		2	2	2	36	3
	Practical		2			36	
3	PY1331.5-Optics and		3	3	3	54	3

	electricity Practical		2			36	
4	PY1431.5-Atomic & Electronics	physics	3	3	7	54	3
	PY1432-Practical		2	4		36	3

6. Electronics for Physics B.Sc Programme

Semester	Title of the course	No. of hours/ week	No. of credits	Total credits	Total hours per sem.	UE duration	
1	EL1131-Electronics I	2	2	2	36	3	
	Practical	2			36		
2	EL1231-Electronics II	2	2	2	36	3	
	Practical	2			36		
3	EL1331-Electronics III	3	3	3	54	3	

	Practical	2			36		
4	EL1431-Electronics IV	3	3	7	54	3	
	EL1432-Practical	2	4		36	3	

7. Physics for Polymer Chemistry B.Sc Programme

Semester	Title of the course	No. of	No. of hours/ week	Total credits	Total credits	UE hours per sem.	duration
1	PY1131.7–Mechanics and Fluid	2	2	2	36	3	

	dynamics of								
	Practical			2			36		
2	PY 1231.7-Thermal Physics		2	2	2	36	3		
	Practical			2			36		
3	PY 1331.7-Modern Optics & Electricity			3	3	3	54	3	
	Practical			2			36		
4	PY 143	Physics	3	3	7	54	3		

	1.7-Atomic and Electronics &								
	PY 1432-Practical		2	4		36	3		

III. QUESTION PAPER PATTERN

For all semesters

1. The examination has duration of 3 hours
2. Each question paper has four parts A, B, C & D.
3. Part A contains 10 questions and the candidate has to answer all questions. Each question carries 1mark. The answer may be in the forms-one word/one sentence
4. Part B contains 12 short answer questions. Out of these 12 questions, the candidate has to answer 8 questions. Each question carries 2marks.
5. Part C contains 9 questions of which the candidate has to answer 6 of them. Each question carries 4 marks.
6. Part D contains 4 long answer questions (essays) of which the candidate has to answer 2 questions. Each question carries 15 marks.
7. The total weightage for the entire questions to be answered is 80 marks.

QUESTION PAPER PATTERN FOR TEST

Question No	Type of Question	Marks
Part A : 1-10	10 One word/ One sentence	10
Part B : 11-22	8 out of 12; Short answer	16
Part C : 23-31	6 out of 9; Short essay/ problem	24
Part D : 32-35	2 out of 4; Essay	30

Total=
80
marks

V. OPEN/ELECTIVE COURSES

During the programme the students have to undergo two open/elective courses. The students attached to the Physics department can opt one course from the Physics department (Elective course) and the other from any one of the other departments (Open course). The student has to do the open course during the fifth semester and the elective course during the sixth semester. As a beginning, the department will choose one open course for the fifth semester and one elective course for the sixth semester depending on the faculty and infrastructure available.

(a). Open Courses.

i) Bio-Physics ii) Astronomy & Astrophysics iii) Applied Physics
iv) Environmental Physics v) Energy Physics

(b). Elective Courses.

i) Photonics ii) Nano science iii) Computer hardware and networking iv) Instrumentation v) Space Science

VI. IMPLEMENTATION OF PROJECT WORK AND STUDY TOUR(RESEARCH INSTITUTE/SCIENCE MUSEUM VISIT)

As part of study the candidate has to do a project work. The aim of the project work is to bring out the talents of students and to introduce research methodology. The work may be chosen from any branch of Physics, which may be experimental, theoretical or computational. Emphasis should be given for originality of approach. The project shall be done individually or as a group of maximum 5 students. The projects are to be identified during the 4^{th} semester with the help of the supervising teacher. The report of the project (of about 30-40 pages) in duplicate shall be submitted to the department by the end of the 6^{th} semester well before the commencement of the examination. The reports are to be produced before the external examiners appointed by the University for valuation.

STUDY TOUR

Students are directed to visit one research institute /science museum preferably within the state of Kerala. Scientifically prepared hand-written study tour report must be submitted by each student for ESE on the day of the examination of project evaluation.

VII. CONTINUOUS EVALUATION

There will be continuous evaluation (CE) based on continuous assessment and end semester examination (ESE) for each course. CE carries 20 marks based on specific components such as attendance, tests, assignments, seminars etc. and ESE 80 marks. Out of the 20marks in internal assessment, 5marks shall be given to attendance, 10 marks to test papers, 5marks to seminar / assignments (minimum one test & one assignment). The components of the internal evaluation for theory and practical and their marks are given below.

(a). Theory

No	Component	marks
1	Attendance	5
2	Assignment	5
3	Test paper	10
	Total	20

The continuous evaluation (CE) shall be based on periodic written tests, assignments, viva/ seminar and attendance in respect of theory courses. **Written Tests**: Each test paper may have duration of minimum 3 hours. For each course there shall be a minimum of one written test during a semester. **Assignments**: Each student is required to submit one assignment for a theory course. Seminar / Viva: For each theory course, performance of a student shall also be assessed by conducting a viva – voce examination or seminar presentation based on topics in that course.

(b). Continuous Evaluation CE (Practical)

No	**Component**	**Marks**
1	Attendance	5
2	Skill & Punctuality	5
3	Laboratory record	5
4	Test (internal exam)	5
	Total	20

Lab skill is to be assessed based on the performance of the student in practical classes. Minimum one practical test paper and an internal viva – voce examination based on the experiments done in the lab are to be conducted in each practical course. The laboratory record should contain an index and a certificate page. Separate records are to be used for each practical course. **A candidate shall be permitted to attend an end semester practical examination only if he / she submit a certified record with a minimum of 10 experiments**. This is to be

endorsed by the examiners.
The **evaluation of certified record** shall be according to the scheme given below.

No of experiments recorded	Marks
18	10
16	9
14	8
12	7
10	6

(c) The allotment of marks for attendance shall be as follows.

	% of attendance	Marks
Attendance	Attendance less than 50%	0
	51%-60%	1
	61%-70%	2
	71%-80%	3
	81%-90%	4
	91%-100%	5

(d) Tests, Assignments and Seminars

For each course there shall be at least two class tests during a semester. Marks for the test in continuous evaluation shall be awarded on the basis of the markssecured for the better of the two tests. Valued answer scripts shall be made available to the students for perusal within 10 working days from the date of the test.

Each student shall be required to do one assignment and one seminar for each course. Valued assignments shall be returned to the students. The seminars shall be organized by the teacher in charge and the same shall be assessed by a group of teachers including the teacher in charge of that course.

VIII. END SEMESTER EXAMINATION (ESE)

The external theory examinations of all semesters shall be conducted by the University. There will be no supplementary examinations. For reappearance/ improvement, as per university rules, the students can appear along with the next batch.

IX. EVALUATION OF PROJECT AND TOUR REPORT

The evaluation of the project shall be done by two external examiners according to the scheme given above. Each candidate shall be evaluated separately. There shall be a maximum of 12 candidates per session with two sessions per day. However, there shall be no continuous evaluation for the project.

The **evaluation of project** shall be according to the scheme given below.

Component	Marks
Originality of approach	15
Relevance of the topic	10
Involvement	10
Viva-voce	15
Presentation of report	20
Research Institute/Science museum visit and Report	**30**

Evaluation of Tour report

The evaluation of tour report shall be according to the scheme given below

Component	**Marks**
Presentation of the report	10
Certified report	20

X. EVALUATION OF PRACTICAL EXAMINATION

The practical examinations for the core subject shall be conducted by the University at the end of semesters 4 and 6 with a common time table and questions set by the University. Similarly, the practical examination for the complementary course shall be conducted by the University at the end of the 4th semester. The examiners shall be selected from a panel of experts prepared by the University. **For each examination centre there shall be two external examiners and one internal examiner who is not in charge of the practical at that centre.** The mark sheet duly certified by the head of the institution should be sent to the University

before the commencement of the end semester examinations.
The evaluation scheme for the end semester practical examinations shall be as follows.

Component	Marks
Formula, circuit,graph, brief procedure	20
Setting and experimental skill	15
Observations and tabulations	15
Substitution, calculation, result with correct unit	20
Certified record with 18 experiments	10
Total	80

For electronics experiments, the scheme shall be as follows.

Component	Marks
Formula, circuit,graph, brief procedure	20
Observations, skill and	25

tabulations	
Substitution, calculation, result with correct unit	25
Certified record with 18 experiments	10
Total	80

For computer experiments, the following scheme shall be followed.

Component	Marks
Writing the programme	30
Execution of the programme	20
Output/Result	20
Certified record with 18 experiments	10
Total	80

PY1141:BASIC MECHANICS & PROPERTIES OF MATTER

(36 HOURS-2 CREDITS)

MECHANICS (22 hrs)

Unit 1- Dynamics of Rigid Bodies (7 hrs)

Equations of motion for rotating rigid bodies- angular momentum and M.I- Theorems on MI.- calculation of MI. of bodies of regular shapes- uniform rod, ring, disc, annular ring, solid cylinder, hollow cylinder and solid sphere- KE of rotating and rolling bodies- torque- Determination of MI. of a fly wheel (theory, experiment and applications).

Unit 2- Conservation of energy (3 hrs)

Energy Conservation law- Work – power- Kinetic Energy – Work Energy theorem- Conservative Forces - potential energy- Conservation of energy for a particle– energy function- .

Unit 3-Oscillations (12 hrs)

Simple harmonic motion – Energy of harmonic oscillators-simple pendulum-mass on a spring-oscillation of two particles connected by a spring- compound bar pendulum - interchange ability of suspension and oscillation-four points collinear with C.G about which the time period is the same-conditions for maximum and minimum periods - Determination of g using symmetric bar pendulum.Mechanical and electromagnetic wave motion- General equation of a wave motion-expression for a plane progressive harmonic wave- energy density for a plane progressive wave.

PROPERTIES OF MATTER (14hrs)

Unit 4- Elasticity (8 hrs)

Modulus of elasticity (revision)Relations connecting the three elastic moduli-Poisson's ratio- bending of beams- bending moment-cantilever-centrally loaded beams and uniformly bent beams-I section girders-torsion of a cylinder-expression for torsional couple -work done in twisting a wire-torsion pendulum-.

Unit 5– Surface Tension (3 hrs)

Surface tension-molecular explanation of ST.-angle of contact(revision)shapes of drops -expression for excess of pressure on a curved liquid surface -variation of ST. with temperature.

Unit 6 – Fluid Dynamics (3 hrs)

Streamline and turbulent flow-equation of continuity-Bernoulli's theorem-venturimeter-viscosity-Newton's law- Stoke's formula.

Books for Study:

1. Mechanics: Hans H. S. and Puri S. P,TMH, 2nd Edn.

2. Mechanics: J.C. Upadhyaya and,Ram Prasad S. Chand Publications, 2017

3. Elements of Properties of Matter: D.S. Mathur, S. Chand Publications,2008

4. Fundamentals of Physics: Halliday and Resnick, Wiley India Pvt. Ltd.,2006

Books for Reference:

1. Properties of matter: Brijlal and Subramaniam, S.Chand & Co.,2004

2. Principles of Physics: P.V.Naik, PHI,2010

Topics for assignments /discussion in the tutorial session (sample)

1. Physics-The fundamental science-historical development of mechanics-some implications of the principle of mechanics-The scope of mechanics.

2. Life of eminent physicists- Newton, Einstein, C.V.Raman, Edison.

3. Study of Young's modulus for different types of wood.

4. Study of variation of surface tension for different detergents.

5. Study of viscosity of different types of ink and to arrive at knowledge of its fluidity.

6. Wide applications of Bernoulli's equation.

7. Variation of surface tension with temperature by Jaeger's method

PY1241 –HEAT AND THERMODYNAMICS

(36 HRS-2 CREDITS)

Unit 1- Transference of heat (8 hrs)

Thermal conductivity - determination by Lee's Disc method for bad conductor radial flow of heat, cylindrical flow,thermal conductivity of rubber, Weidman-Franz law. Radiation of heat, Stefan's law, determination of Stefan's constant, solar constant, determination of solar temperature

Unit 2- Thermodynamics (18 hrs)

Zeroth Law & First law of Thermodynamics, differential form-Thermodynamic Processes-Expression for work done in isothermal and adiabatic processes. Application of first law to specific heat and latent heat.Reversible and irreversible processes.Second law of thermodynamics- Clausius and Kelvin statements-Carnot engine- Principle of refrigerator- working and efficiency, Otto engine and Diesel engine – working and efficiency.

Unit 3- Entropy (10 hrs.)

Definition of entropy, change of entropy in reversible and irreversible cycle, Clausius inequality and second law of thermodynamics, entropy and available energy,Entropy, probability and disorder.Nernst theorem and third law of thermodynamics.phase transition, phase diagram,first order and second order phase transition (qualitative idea) Clausius-Clepeyron Equation

Books for Study:

1. Thermal and Statistical Mechanics: S.K. Roy, NewAge International
2. Heat and Thermodynamics: D. S. Mathur, S. Chand &Co
3. Heat and Thermodynamics: Brijlal &Subramaniam, S. Chand &Co
4. Thermal Physics, Statistical Physics and SolidState Physics: C. J. Babu, Calicut University Press
5. Engineering Thermodynamics:P. K. Nag, McGraw-Hill,5thEdn.

Books for Reference:

1. Heat and Thermodynamics: Zemansky, McGraw-Hill
2. Heat and Thermodynamics: Rose C McCarthy, The Rosen Publishing Group, Inc.NY,2005
3. Thermodynamics, Kinetic Theory and Statistical Thermodynamics: F. W. Sears and G. L. Salinger, Addison-Wesley Publishing Company, 3rdEdn.

PY 1341 ELECTRODYNAMICS

(54 Hours-3Credits).

Unit 1-Electrostatic Field (10hrs)

Electric field: introduction, Coulomb's law,Electric field, continuous distribution(Revision) , Divergence and curl of electrostatic fields; Field lines,flux applications of gauss's law,Curl of E, Electric potential: Introduction to potential, Comments on potential, Poisson's and Laplace's equations,potential of a localized charge distribution, Electrostatic boundary , Work and Energy in Electrostatics: The work done to move a charge, the energy of a point charge distribution, The energy of a continuous charge distribution.

Unit 2-Electrostatic fields in matter (10 hrs)

Polarization: Dielectrics,induced dipoles, Polarization, The field of a polarized object: Bound charges, physical interpretation of bound charges and the field inside a dielectric Electric displacement: Gauss's law in the presence dielectrics,

Boundary conditions.

Unit 3-Magnetostatics (7hrs)

IntroductionThe Biot- Savart law,Ampere's force law (revision), Magnetic torque, Magnetic flux and gauss's law for magnetic fields, magnetic vector potential, Magnetic intensity and Ampere's circuital law, magnetic materials.

Unit 4-Electromagnetic Induction (7hrs)

Electromotive force: Ohm's law Electromagnetic Induction Faraday's law,the induced electric field, Maxwell's equations, Magnetic charge,

Unit 5-Electromagnetic waves (6hrs)

Waves in one dimension: The wave equation Electromagnetic waves in vacuum: The wave equation for E and B, Monochromatic plane waves, Energy and momentum in electromagnetic waves.

Unit 6-Transient currents(7hrs)

Growth and decay of current in LR and CR Circuits-Measurement of high resistance by leakage-Charging and discharging of a capacitor through LCR circuit.

Unit 7-Alternating current (7 hrs)

AC through series LCR (acceptor circuit) and parallel LCR circuit (rejecter circuit)- Q- factor, Power in AC-power factor.

Books for Study:

1. Electrodynamics: David J Griffith, PHI, 3rd Edn.
2. Electricity and Magnetism:Murugesan, S.Chand & Co.
3. Electricity and Magnetism: K.K.Tiwari, S.Chand & Co.
4. Principles of electromagnetics: Matthew N.O. Sadiku and S. V. Kulkarni, Oxford University Press, 6th Edn.

Books for Reference:

1. Electricity and Magnetism: Muneer H. Nayfeh & Norton K. Bressel, John Wiley & Sons
2. Electricity and Magnetism: E.M. Purcell, Berkley Physics course, Vol.2, MGH
3. Electricity and Magnetism: J.H. Fewkes & John Yarwood, University Tutorial Press
4. Classical Electrodynamics: Walter Greiner, Springer International Edn.
5. Electromagnetic waves and radiating systems: Jordan & Balmain, PHI
6. Electromagnetics: B.B.Laud, Wiley Eastern Ltd., 2nd Edn.
7. Introduction to electrodynamics: Reitz&Milford Addison Wesley

8. Electromagnetic theory fundamentals: Bhag Guru and Huseyin Hizirogulu, Cambridge University Press, 2nd Edn.
9. Electricity and Magnetism: D.C.Tayal, Himalaya Publishing Co.

Topics for discussion in Tutorial session/Assignments (sample)

1. Comment on how electrostatic energy is stored in a field
2. Discuss the electrostatic properties of conductors
3. What is meant by electrostatic shielding? In what way it helps us?
4. Discuss the peculiarities of electric displacement D and electric field E. How they are incorporated in Maxwell's Equations
5. Discuss the properties of linear dielectrics. What differentiates adielectric to be linear or not?
6. Discuss applications of Ampere's circuital law
7. Compare electrostatics and magnetostatics
8. Why magnetic forces cannot do work
9. Discuss about cyclotron motion & cycloid motion
10. Discuss whether there exists any stand-off between ohm's law and Newton'ssecond law
11. A battery has an *emf*. Can this *emf*. be a 'force'? How will you interpret electromotive force?
12. Discuss the role of motional *emf* in power generation
13. Discuss the orthogonality of E, B and propagation vector k
14. A wave function can have a sinusoidal representation. Solve the wave equation for this function and discuss the various terms related to a wave such as amplitude, frequency, phase, wave number.
15. Complex representation of wave function has good advantage. Why? Discuss the linearity of wave function. (use complex notation)

16. Discuss AC through LC, LR and CR circuits

17. Show that sharpness of resonance is equal to Q- factor

18. What is a choke coil? Discuss the advantage of using a choke coil instead of a resistor

PY1441CLASSICAL AND RELATIVISTIC MECHANICS
(54 Hours-3Credits).

Unit 1 - Particle Dynamics (5 hrs)

Mechanics of a particle – equation of motion of a particle – Motion of a charged particle in electromagnetic field – mechanics of a system of particles.

Unit 2-Conservation laws (6 hrs)

linear uniformities of space and conservation of linear momentum – rotational invariance of space and law of conservation of angular momentum – homogeneity of flow of time and conservation of energy.

Unit 3- Motion in central force field (10 hrs)

Equivalent one body problem – motion in central force field – general features of motion – motion in an inverse square law force field – equation of the orbit – Kepler's laws of planetary motion and their deduction.

Unit 4 - Collisions (6 hrs)

Conservation laws- Conservation of momentum- laboratory and centre of mass systems- kinetic energies in thelab and CM systems-Cross-section of elastic scattering

Unit 5. Lagrangian Dynamics(9hrs)

Constraints-generalized coordinates- principle of virtual work-D' Alembert's principle, Lagrange's equation from D'Alembert's principle-applications of Lagrange's equation in simple pendulum,Atwood's machine and compound pendulum, Comparison of Lagrangian approach with Newtonian approach.

Unit 6. Hamiltonian Dynamics(5hrs)

Generalized momentum and cyclic coordinates- Hamiltonian function H-conservation of energy- Hamilton's equation - examples of Hamiltonian dynamics-one dimensional harmonic oscillator

Unit 7. Frames of Reference, Galilean transformation and Special theory of relativity(13hrs)

Inertial frames of reference- Galilean transformation- non- inertial frames

Origin and significance of special theory of relativity-search for universal frame of reference-Michelson-Morley experiment- postulates of special theory of relativity-consequences-Lorentz transformation equations- kinematical consequences of Lorentz transformations-length contraction-time dilation-twin paradox-transformation of velocity- variation of mass with velocity- mass energy equivalence

Books for Study:

1. Classical Mechanics: J. C. Upadhyaya, Himalaya Publishing
2. Mechanics: H.S.Hans and S.P.Puri, Tata-McGraw Hill
3. Classical Mechanics: G. Aruldhas, PHI Learning Pvt Ltd., 2008
4. Introduction to classical mechanics: R.G.Thakwale and P.S.Puranik, Tata-McGraw Hill.
5. Classical Mechanics: Vimal Kumar Jain, ,Ane Books Pvt. Ltd., 2009

Books for Reference:

1.Classical Mechanics: Goldstein.

2.Modern Physics:Ronald Gautreau, Shaum's outlines series,1999

3.Classical Mechanics-Systems of Particles & Hamiltonian Dynamics:Walter Greiner, Springer,2nd Edn.

4.Classical Mechanics: N.C Rana and P.S.Joag, TMH Education Pvt. Ltd., 2015

PY1541- QUANTUM MECHANICS

(72 HRS-4 CREDITS)

Unit 1 – The Emergence of Quantum Mechanics (18 hrs)

Limitations of classical physics, Black body radiation curve-Optical spectra –- photoelectric effect -specific heat of solids -Plank's quantum hypothesis, Einstein's theory of photoelectric effect -Compton effect- Quantum theory of specific heat of solids, -Bohr model- hydrogen atom- Bohr postulates-The correspondence principle.

Unit 2-Wave Mechanics (22 hrs)

Wave nature of particles-electron diffraction- standing wave of electron in the orbit uncertainty principle -uncertainty relation among canonically conjugate pairs-application- non-existence of electrons in the nucleus-ground state energy of hydrogen atom- width of spectral lines-Properties of wave function-Conditions for Physical Acceptability of Wave Function, Normalization and orthogonality condition. Superposition Principle-wave packets, relation between - Particle velocity- group velocity and phase velocity- Probability Interpretation of Wave Function -Statistical Interpretation of Wave function -probability current density in one dimension-Expectation value- Time dependent Schrodinger equation,-Time independent Schrodinger equation - stationary states.

Unit 3-One Dimensional Energy Eigen Value Problems (14hrs)

Free particle Schrodinger equation–square-well potential with infinite walls-Square well potential with finite walls, square potential barrier– The Harmonic oscillator- (Schrodinger method)-

Unit 4- General Formalism of Quantum Mechanics (18hrs)

Linear vector space, Linear operator, Eigen values and Eigen functions-, Hermitian operator, Postulates of Quantum Mechanics-Equation of motion-Schrodinger representation- Momentum representation

Books for Study:

1. Quantum Mechanics: G. Aruldhas, PHI, 2nd Edn., 2002
2. A Text book of Quantum Mechanics: P.M. Mathews & K. Venkatesan- McGraw Hill, 2nd Edn., 2010
3. Quantum Mechanics: Robert Eisberg and Robert Resnick, Wiley, 2nd Edn. 2002
4. Quantum Mechanics: Leonard I. Schiff, TMH, 3rd Edn., 2010
5. Concepts of Modern Physics: Arthur Beiser, TMH, 6th Edn.

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Books for Reference:

1. Quantum Mechanics:Eugen Merzbacher, John Wiley and Sons Inc.,2004
2. Introduction to Quantum Mechanics: David J. Griffith, Pearson Education, 2nd Ed. 2005
3. Quantum Mechanics: Walter Greiner, Springer,4thEdn., 2001
4. Quantum Mechanics: Bruce Cameron Reed, Jones and Bartlett, 2008.
5. Quantum Mechanics for Scientists & Engineers: D.A. B. Miller, Cambridge University Press, 2008
6. Shaum's outline series

PY1542: STATISTICAL PHYSICS, RESEARCH METHODOLOGY AND DISASTER MANAGEMENT
(72 HRS- 4 CREDITS)

Unit 1- Statistical Physics (18 hrs)

Statistical probability, Macro and Micro states, Phase space, Statistical ensemble, Postulate of equal probability, Maxwell Boltzmann distribution, Velocity distribution. Indistinguishability of identical particles, Bose Einstein and Fermi Dirac distribution function, comparison of three statistics

Unit 2 Research Methodology (18 hrs)

Research - Objectives and motivation in research – different types of research- research approaches- Significance of research- Research methods and

methodology – Research and scientific method- Various steps in a research process- importance of literature survey- criteria of good research.

Thesis/ Report writing - preliminary section (Title page, declaration of author, certificate of supervisor, table of contents, list of tables and figures, preface acknowledgement), Main Text (abstract, introduction, experimental section, results and discussion), Conclusions, references, scope for future study.

Unit 3 Error Analysis (12 hrs)

Significant figures- Basic ideas of error measurement, uncertainties of measurement, importance of estimating errors, dominant errors, random errors, systematic errors, rejection of spurious measurements.

Estimating and reporting of errors, errors with reading scales, absolute and relative errors, and standard deviation, Variance in measurements, error bars and graphical representation.

Unit 4 – Disaster Management (24hrs)

Global natural disasters: Natural hazards and natural disasters, Recent major disasters and their relief efforts, Impact of global climate change and major natural disasters, Human adaptability of natural disasters, Fragile natural eco-environment, Disaster reduction activity, achievements, challenges and future development

Earth quake disaster and their and their effects, Advancement in research of earthquake disaster, earthquake and tsunami warnings, earthquake disaster prevention, earthquake disaster mitigation

Health emergencies and diseases: environmental health and diseases, disasters and emergencies, steps in disaster management, pre-disaster activity, role of water supply, need for protecting large scale water supply schemes, assessment of damaged and available and water resources, water quality testing- Personal hygiene, control of communicable diseases and prevention of epidemics, measures for controlling communicable diseases and epidemics.

Radiation emergencies, health consequence of radiation, measures to prevent sudden health emergencies due to radiation

Books for Study:

1. Thermal and Statistical Mechanics: S.K. Roy –New Age International-2001
2. Elements of Statistical Mechanics: Kamal Singh and S. P. Singh- S. Chand & Co,1999
3. Thermal Physics, Statistical Physics and Solid State Physics: C. J. Babu, Calicut University Press
4. Introduction to Statistical Mechanics: S. K. Sinha, Alpha Science International Ltd. 2005
5. Statistical Mechanics: B. K. Agarwal- New Age International 2007
6. Research Methodology: C. R. Kothari, New Age International

Publishers.
7. Natural disaster mitigation – a scientific and practical approach: Science Press, Beijing, 2009
8. Environmental health in emergencies and disasters: A practical guide, B.Wisner & J.Adams (Eds.), WHO, Geneva, 2002 ISBN 92-4 154541-0.
9. Introduction to Disaster Management: SatishModh, Macmillan, 2010

Books for Reference:

1. Statistical Mechanics: S. Rajagopal
2. Introduction to Statistical Physics: Kerson Huang -CRC Press, 2001
3. Statistical Mechanics: Norman Davison, Courier Corporation, 2013
4. Disaster Management: Harsh K Gupta, Universities Press, 2003

PY1543-ELECTRONICS
(72 HOURS-4 CREDITS)

Unit 1. Circuit Theory (4 hours)

Kirchhoff's law- Ideal voltage and current sources- Thevenin's and Norton'stheorem, Maximum power transfer theorem

Unit 2. Diode Circuits(14 hours)

Extrinsic semiconductors-n- type and – p-type semiconductors-PN junction-PN junction under forward and reverse biased conditions-r m s value and peakinverse voltage- diode characteristics-ac and dc resistances- half wave and full wave rectifiers- (average dc value of current, ripple factor and efficiency)- different types of filters(shunt capacitor, LC and RC)- break down mechanism in diodes- Zener diode- voltage regulator-

Unit 3.Transistors(16 hours)

Theory of BJT operation- CB,CE and CC characteristics-alpha , beta and gamma – relation between transistorcurrents- biasing circuits(CE configuration)- stability factors-selection of operating point-ac and dc load lines-Q point-collector feedback; base resistor and potential divider methods- BJT amplifiers- input and outputimpedances-graphical analysis of CE amplifier(frequency response,band width and gain in dB)- emitter follower.

Unit 4. Power amplifiers: (5 hours)

Amplifier classes and efficiency - class A operation - transformer coupled class A amplifier - class B amplifier - push pull amplifier - basic ideas of class C operation - distortion in amplifiers.

Unit 5. Feedback & Oscillator circuits (8 hours)

Feedback principles – negative feedback - advantages of negative feedback - positive feedback - principle of sinusoidal feedback- oscillation - Barkhausen criterion for oscillations - RC phase shift, Hartley Oscillator, Colpitt's, Oscillator (derivations not required).

Unit 6. Modulation (5 hours)

Fundamentals of modulation - AM, FM - frequency spectrum of AM - power in AM - demodulation of AM signal - frequency spectrum for FM

Unit 7. Special devices: (8 hours)

JFET- Basic construction - Theory of operation - Static characteristics - Drain characteristics- Advantages - MOSFET – Depletion enhancement MOSFET – Construction – Static characteristics. Uni-junction Transistor - Construction-operation.

Unit 8. Operational amplifiers (IC741)(12 hours)

Introduction – Schematic symbol and pin configuration - circuit configuration and block diagram representation – differential amplifier-ideal OP amp. - CMRR – differential mode and common mode – virtual ground principle – parameters of OP amp. - inverting amplifier – non-inverting amplifier –summing- differentiator-integrator amplifiers.

Books for Study:

1. Basic electronics: Devices, circuits and IT fundamentals: Santiram Kal, PHI, 2009

2. Basic Electronics-Solid State: B. L. Theraja, S. Chand Ltd., 2005

3. Principles of Electronics: V. K. Mehta, S. Chand Ltd.,2005

4. A first course in Electronics: Anwar A. Khan, Kanchan K. Dey,PHI, 2006

5. Communication Electronics:Jose Robin and Ubald Raj, Indira Publications, 2002

Books for Reference:

5. Electronic Devices and Circuits: Theodore F. Bogart Jr., Universal book stall

6. Electronic devices and Circuit theory: Robert Boylestad & Louis Nashelski,PHI,5th Edn.

7. Electronic fundamentals & applications: John D Ryder, PHI, 4thEdn.

8. Electronic Communications: Dennis Roddy, John Coolen,Pearson, 4thEdn.

Topics for assignments/discussion in the tutorial session (sample)

1. Electronic projects using flip flops.

2. Electronic projects using logic gates.

3. Electronic projects using IC 741 OP amp.

4. Electronic projects using timer 555.

5. Electronic projects using IC 311.

6. Constant voltage power supplies.

7. Constant current sources.

8. Oscillators of different frequencies.

9. Low range frequency generators.

10. High range frequency generators.

11. Voltage regulated dc power supplies with variable output.

12. Voltage regulated dual power supplies with variable output.

13. Instrument for the measurement of capacitance.

14. Instrument for the measurement of dielectric constant of a liquid/ solid.

15. Effect of temperature on electronic components.

PY1544-ATOMIC & MOLECULAR PHYSICS

(72 HOURS-4 CREDITS)

Unit 1- Vector Atom Model (10hrs)

Bohr's theory, correspondence principle Somerfield's atom modeland explanation of fine structureof H line inBalmer series of hydrogen atom.Limitationof Sommerfeld atommodel.Vector atommodel-Various quantum numbers associated with vector atom model-, L.S and j.j couplings –application of spatial quantization-Pauli's exclusion principle - magnetic dipole moment of electron due to orbital and spin motion - Spin-Orbit coupling.

Unit 2- Atomic Spectra (14hrs)

Optical spectra-Spectral terms and notations - selection rules - intensity rule and interval rule - fine structure of sodium D lines – hyperfine structure-alkali spectra - Zeeman effect - Larmor's theorem – quantum mechanical explanation of normal Zeeman effect. Anomalous Zeeman effect –Paschen-Back effect-Stark effect.

Unit 3- X-ray Diffraction (8 hrs)

X-rays- Discovery- properties -scattering -Measurement of X-ray wavelengths by ruled gratings-X-ray Spectra- continuous and characteristics X- ray spectrum-Origin of continuous Spectrum -Origin of characteristic X-rays-X-ray energy level diagram. -Absorption of X-rays-Applications of X-rays

Unit 4- Molecular spectra (28 hrs)

Electromagnetic spectra-molecular energies-classification of molecules-rotational spectra of diatomic molecules-rotational energy levels-selection rules-rotational spectrum-isotope effect- bond length and atomic mass.

Diatomic vibrational spectra-vibrational energy levels-selection rule-vibrational transitions-Rotation-Vibration transitions-IR spectrometer
Raman scattering- classical description of Raman scattering, quantum theory of Raman scattering- -vibrational Raman spectra-diatomic molecules-polyatomic molecules-rotational Raman spectra Raman spectrometer.
Electronic spectra sequences and progressions-Frank-Condon principle-

Unit 5- Resonance Spectroscopy (12 hrs)
NMR principle-Resonance condition-NMR spectrometer-chemical shift-indirect spin-spinInteraction- applications of NMR spectroscopy-
ESR principle- Resonance condition –ESRspectrometer-hyperfineinteraction – applicationsofESRspectroscopy.
Mossbauerspectroscopy- principle -isomer shift.

Books for Study:

1. Modern Physics: G.Aruldas and P.Rajagopal, PHI, New Delhi, 2005
2. Modern Physics: R.Murugesan, S.Chand& Co., Reprint, 2008
3. Atomic and Nuclear Physics: N.Subramaniam&Brijlal, S.Chand& Co.
4. Atomic Physics: J.B.Rajam, S.Chand&Co.
5. Concepts of Modern Physics: A. Beiser, TMH, New Delhi, 6thEdn.

Books for Reference:

1. Fundamentals of Molecular Spectroscopy: Banwell, TMH
2. Spectroscopy: Walker & Straw, Chapman & Hill.
3. Molecular Spectroscopy: G.Aruldhas, PHI, 2004
4. Atomic and Nuclear Physics: Dr.V.W.Kulkarni-Himalaya Publishing House

PY 1551-OPEN COURSES
(54 HOURS-2CREDITS) FOR EACH COURSE

PY1551.1. BIO PHYSICS (54 HOURS)

Unit 1 (18 hrs)

Bio mechanics- biophysics and fluid flow—Gas transport—physics of audition
Physics of vision (chapter 1 to 5 of Reference 3)

Unit 2 Cellular – Molecular biophysics (18 hrs)

Cell -components-proteins-nucleic acids—physics of bio-membranes
-Thermodynamics of bio systems (Chapter 6 to 9 of reference 3)

Unit 3 (18 hrs)

Radiation biophysics

Bio –electronics and Bio Instrumentation (chapter 17 of reference 1) Bio – informatics - (chapter 6 of reference 1) Demonstration of biophysics experiments (reference 3)

Booksfor Study

1. Essentials of Biophysics: P. Narayanan, 2nd Edn. New Age publishers

2. A text book of biophysics: R.N.Roy, New central book agency Kolkata.

3. Elementary bio physics,P.K.Srivastava,Narosa publishing house ,New Delhi
4. Introduction to Biophysics ,Pranab kumar banerjee,S.Chand& co ,New Delhi

5.Biological science ,Green,Stout,&Taylor, Cambridge university press

Reference

PY 1551.2 ASTRONOMY AND ASTROPHYSICS

(54 Hours)

Unit 1: Introduction to Astronomy (10 hours)

What is Astronomy – Branches of Astronomy - The celestial sphere and stellar magnitudes: constellations, stellar magnitudes, apparent magnitudes – The celestial coordinate system – Precession of Earth's axis.

Unit 2: History of Modern Astronomy (14 hours)

Ptolemy's model of Universe – Copernican and Galilean contributions – Laws of planetary motion: Tycho Brahe's observations, Kepler's laws – Newton and his law of Universal law of Gravity – Einstein's special and general theories of relativity (*topics in this unit are intended as brief qualitative introductions only*)

Unit 3: The Solar system (15 hours)

Formation of solar system: Nebular hypothesis – The Sun: Physical properties – Internal structure – Solar atmosphere - Sun spots – Solar wind, prominences and flares – Physical characteristics of planets in solar system – Earth's motion and Seasons - Lunar and Solar eclipses – Brief familiarisation of solar system objects: Satellites, Asteroid belt, Kuiper belt, Comets and Meteorites.

Unit 5: Outer Universe (15 hours)

Properties of stars: luminosity, colour and surface temperature – Spectral types of stars – Hertzsprung-Russel diagram – Evolution of a Sun-like star – Fate of high-mass stars: Supernova, Neutron stars and Black holes (*qualitative description only*) – Brief familiarization of Milky Way galaxy, Types of galaxies according to shape.

Sources for Study:

1. https://www.space.com/16014-astronomy.html
2. Introduction to Astronomy and Cosmology – Ian Morison (Wiley)
3. https://theplanets.org/solar-system/

Additional Reference:

1. Planet Earth, Cesare Emiliani, (Cambridge University Press)
2. Astrophysics - K. D. Abhayankar (University Press)
3. Introduction to Astrophysics – Baidyanadh Basu

PY 1551.3- APPLIED PHYSICS(54HOURS)

UNIT-1.ELECTRIC AND ELECTRONIC EQUIPMENTS (14 hrs)

Electric motor-principles of working, Microwave oven-principle-technical specifications-applications-advantages, public address system-Block diagram representation- function of each unit-CD player and drives-DVD player and drives-Telephonic communication(Cable and cellular)-principles (qualitative study using block diagram) -Cell phone-SIM card-technical specifications-Radio –History of radio revolution-different types of radios-Television-working(qualitative)-Touch screens & ATM (Automatic Telling machine)

UNIT-2- X-RAY AND ITS APPLICATIONS (11 hrs)

Discovery of X-rays, Gas filled tube, Coolidge X-ray tube, Properties of X-ray, X-ray spectra-continues and characteristic spectra, C T Scan-basic principle-applications and advantages –MRI Scan-Principle, applications and advantages.

UNIT-3- LASERS (13 hrs)

Introduction-Interaction of light with matter, Absorption, spontaneous emission, stimulated emission, Light amplification, population inversion, metastable states-Components of Laser-Principal pumping Schemes-Role of resonant cavity- Ruby laser, He-Ne Laser-Applications.

UNIT-4- HOLOGRAPHY(6 hrs)

Introduction, principle of holography, Recording of the hologram, Reconstruction of the image-applications.

UNIT-5-FIBRE OPTIC COMMUNICATION (10 hrs)

Introduction, optical fibre, Necessity of cladding, optical fibre system, Total internal reflection, propagation of light through an optical fibre, critical angle of propagation , Modes of propagation- Types of rays-classification of optical fibres-Applications

References

1. Audio and Video Systems. R.G.Gupta, Technical Education Series.
2. Mobile Satellite Communication Network (ch 1 &2),Ray E Sherrif &Y. Funttu,Wiley India Edu.
3. Television Engineering & Video System, R.g.Gupta,TMH.
4. Electrical Technology (Vol 1& 2),B.L.Theraja
5. A Text book of Optics by DR. N. Subrahmanyam Brijlal,Dr MN Avadhanulu-S.Chand & Company Pvt Ltd
6. Modern Physics by R.Murugesan & Kiruthiga Siva Prasath

   S.Chand & Company Pvt Ltd

7. Atomic and Nuclear Physics By Dr.V.W.Kulkarni-Himalaya Publishing House

PY1551.4. ENVIRONMENTAL PHYSICS
(54 HOURS)

Unit 1 Essentials of Environmental physics (18 hrs)

Structure and thermodynamics of the atmosphere; composition of air; Greenhouse effect; Transport of matter; energy and momentum in nature; Stratification and stability of the atmosphere; Laws of motion; Hydrostatic equilibrium; General circulation of the tropics; Elements of weather and climate in India.

Unit 2 Environmental pollution and Degradation(18 hrs)

Factors governing air, water and noise pollution; Air and water quality standards;Waste disposal; Heat island effect; Land and sea breeze; Puffs and Plumes; Gaseous and particulate matter; Wet and dry deposition; Dispersal mechanism of air and water pollutants; Mixing height and turbulence; Gaussian plume models; Dispersion models; Environmental degradation; Thermal and radioactive pollution; Nuclear radiation; Health hazards and safety.

Unit 3 Environmental Changes and remote sensing (18 hrs)

Energy sources and combustion processes; Renewable sources of energy; Solar energy, Wind energy, Bio energy, hydro power; fuel cells; and nuclear energy;Forestry and bio-energy; Deforestation; Degradation of soils; Agriculture and land use changes; Changing composition of local and global environment; Remote sensing techniques.

Books for Study:

1. The Physics of Monsoon:R.N.Kesavamoorthy andN. Sankar Rao,Allied Publications
2. 2 The Physics of Atmosphere: J.T.Houghton, Cambridge University
3. Renewal Energy Resources:J.T Widell and J Weir,ELBS 1988
4. Numerical Weather Prediction:G.J.Haltiner and R.T.Williams, John Wiley

PY1551.5. ENERGY PHYSICS

(54 HOURS)

Unit I (7 hrs)

Various forms of energy – renewable and conventional energy systems – comparison – coal, oil and natural gas – availability – applications – merits and demerits.

Unit 2 (10 hrs)

Solar energy - Solar radiation measurements, solar energy collector, principle of the conversion of solar radiation in to heat, Solar energy storage, solar heaters, space cooling, solar ponds, solar cookers, solar distillation, solar furnaces, solar green houses, merits and demerits of solar energy.

Unit 3 (9 hrs)

Wind energy: Basic principle of wind energy conversion, basic components of wind energy conversion system (WECS), wind energy collectors. application of wind energy.

Unit 4 (9 hrs)

Biomass energy, classification, photosynthesis, biomass conversion process, Gober gas plants, wood gasification, ethanol from wood, merits and demerits of biomass as energy source

Unit 5 (9 hrs)

Energy from Oceans and Chemical energy resources: Ocean thermal energy Conversion, energy from waves and tides – basic ideas, nature, applications, merits and demerits.

Unit 6 (10 hrs)

Patterns of energy consumption in domestic, industrial, transportation and agricultural sectors –energy crisis and possible solutions – energy options for the developing countries – energy storage-primary and secondary cells – fuel cells (basics) – impact due to non-conventional energy sources – global warming.

Books for Study:

1. Non – Conventional Energy Resources: G. D. Rai, Khanna Publishers,2008.

2. Solar energy: G.D. Rai, 5th edition, 1995.

3. Solar Energy Fundamentals and application: H.P. Garg and J. Prakash, Tata McGraw - Hill Publishing company Ltd., 1997.

Books for Reference:

1. Energy Technology: S. Rao and Dr. B.B. Parulekar, 1997, 2nd Edn.

2. Power Plant Technology: A. K. Wahil. 1993.

3. Solar energy: S. P. Sukhatme, Tata McGraw- Hill Publishing company Ltd.,1997.

PY 1641SOLID STATE PHYSICS
(72 HOURS -4 CREDITS)

Unit 1Crystal Structure(18hrs)

Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors.Lattice with a Basis – Unit Cell-Elements of symmetry-Types of Lattices -two and three dimensional- Miller Indices-Reciprocal Lattice.-.Brillouin Zones.Diffraction of X-rays by Crystals.Bragg's Law.X- ray diffraction techniques-Inter atomic forces. Types of bonding

Unit 2 Conduction in Metals- Free electron model (12 hrs) Introduction-conduction electrons-free electron gas-electrical conductivity-electrical resistivity versus temperature-heat capacity of conduction electrons -Fermi surface -electrical conductivity-effects of the Fermi surface-thermal conductivity in metals-Hall effect and magneto resistance -A.C conductivity and optical properties-failure of free electron model. -The Kronig -Penney model- conductors, semiconductors and insulators.

Unit 3 Band theory(10 hrs)

Bloch theorem- Kronig Penny model-Band Gaps- Conductors-Semiconductors and insulators- P and N type Semiconductors- Conductivity of Semiconductors- mobility- Hall Effect- Hall coefficient.

Unit 4 Dielectric Properties of Materials (12 hrs)

Polarization- Local Electric Field at an Atom- Depolarization Field- Electric Susceptibility- Polarizability- Clausius Mosotti Equation- Classical Theory of Electric Polarizability- Normal and Anomalous Dispersion- Cauchy and Sellmeir relations- Langevin-Debye equation- Complex Dielectric Constant- Optical Phenomena- Application: Plasma Oscillations- Plasma Frequency- Plasmons

Unit 5Magnetic Properties of Matter(12hrs) Dia, Para, Ferri and Ferromagnetic Materials.Classical Langevin Theory ofDia and Paramagnetic Domains.Quantum Mechanical Treatment of Para magnetism.Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains.Discussion of B-H Curve. Hysteresis and Energy Loss

Unit 6 Superconductivity(8 hrs)

Critical Temperature-Critical magnetic field-Meissner effect- Type I and type II Superconductors- London's Equation and Penetration Depth- Isotope effect-.BCS theory- Tunnelling and Josephson effect(Qualitative study)

Books for Study:

1.Elements of Solid State Physics: J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India

2.Elementary Solid State Physics: 1/e M. Ali Omar, Pearson India, 1999

3.Solid State Physics: M.A.Wahab,NarosaPublication, 2011

4. Elements of Solid State Physics: J.P. Srivastava, 2nd Edn., Prentice-Hall of India, 2006

Books for Reference:

1. Introduction to Solid State Physics: Charles Kittel, 8th Edn., Wiley India Pvt. Ltd., 2004
2. Introduction to Solids: Leonid V. Azaroff, Tata Mc-Graw Hill,2004
3. Solid State Physics: Neil W. Ashcroft and N. David Mermin, Cengage Learning,1976
4. Solid State Physics: Rita John, McGraw Hill, 2014
5. Solid-state Physics: H. Ibach and H Luth, Springer,2009

PY 1642NUCLEAR ANDPARTICLE PHYSICS
(72 HOURS-4 CREDITS)

Unit 1.General Properties of Nuclei(14hrs)

Constituents of nucleus and their Intrinsic properties-quantitative facts about size- mass- charge density (matter energy), binding energy- average binding energy and its variation with mass number- main features of binding energy versus mass number curve- nuclear stability- angular momentum- parity- magnetic moment- electric quadrupole moments- Nuclear forces-meson theory.

Unit 2. Nuclear Models(11 hrs)

Liquid drop model -semi empirical mass formula and significance of various terms, condition of nuclear stability. Shell model-evidence for nuclear shell structure, nuclear magic numbers, basic assumptions of shell model, Collective model.

Unit 3. Radioactivity:**(12 hrs)**

Alpha decay-basics of α-decay processes, theory of α-emission, Gamow's theory, Geiger Nuttall law, -decay- energy kinematics for -decay, positron emission, electron capture, neutrino hypothesis, Gamma decay: Gamma ray emission & kinematics, internal conversion.

Unit 4.Nuclear Reactions (9 hrs)

Types of Reactions, Conservation Laws, kinematics of reactions, Q-value- reaction rate- reaction cross section- reaction mechanism-Concept of compound nucleus.

Unit 5. Particle Detectors & Accelerators (6 hrs)

GM counter-scintillation counter- Linear accelerator- Cyclotron- Synchrotron- betatron.

Unit 6 – Nuclear fission and fusion (12 hrs)

Nuclear fission-energy released in fission-Bohr and Wheeler's theory-chain reaction -multiplication factor-critical size-atom bomb-nuclear reactors-breeder reactors-uses of nuclear reactors. Nuclear fusion-sources of stellar energy-thermonuclear reactions-hydrogen bomb-controlled thermo-nuclear reactions-magnetic bottle-Tokamak- inertial confinement-nuclear power in India.

Unit 7.Particle physics: (8 hrs) Particle interactions- basic features- types of particles and its families-Symmetries and Conservation Laws-baryon number- Lepton number- Isospin- Strangeness and charm- concept of quark model- Cerenkov radiation.

Books for Study

1. Modern Physics: R. Murugesan, S. Chand & Co., Reprint,2008
2. Modern Physics: G. Aruldhas and P. Rajagopal, PHI, New Delhi, 2005.
3. Nuclear Physics: D. C. Tayal, Himalaya Publishing House, 4thEdn.
4. Concepts of Modern Physics: A. Beiser, Tata McGraw-Hill, New Delhi, 6thEdn.
5. Atomic and Nuclear Physics:N. Subramaniam and Brijlal, S.Chand & Co.
6. Atomic Physics: J.B.Rajam, S.Chand & Co.

7. Introduction to Elementary Particles: D. Griffith, John Wiley & Sons
8. Nuclear Physics: S.N.Ghoshal, S.Chand & Co.

Books for Reference:

1. Concepts of nuclear physics: Bernard L. Cohen, Tata Mcgraw Hill, 1998
2. Nuclear Physics: Kaplan, Narosa publications
3. Introductory nuclear Physics: Kenneth S. Krane, Wiley India Pvt. Ltd., 2008
4. Introduction to the physics of nuclei & particles: R.A. Dunlap, Thomson Asia, 2004
5. Quarks and Leptons: F. Halzen and A.D. Martin, Wiley India, New Delhi
6. Basic ideas and concepts in Nuclear Physics An Introductory Approach: K. Heyde, Institute of Physics Publishing, 2004
7. Radiation detection and measurement: G.F. Knoll, John Wiley & Sons, 2000
9. Theoretical Nuclear Physics: J.M. Blatt & V.F. Weisskopf, Dover Pub.Inc., 1991

PY1643- CLASSICAL AND MODERN OPTICS
(72 HRS-4 CREDITS)

Unit 1. Interference of light (**12 hrs**)

The principle of superposition - coherent sources – Double slit interference (theory of interference fringes and band width) - Interference by division of wave front and amplitude –Fresnel's biprism-interference in thin films-classification of fringes-wedge shaped films-testing of optical flatness-Newton's rings(reflected system)-refractive index of a liquid-
Michelson interferometer – determination of wavelength

Unit 2. Diffraction (**14 hrs**)

Fresnel diffraction: - Half-period zones - explanation of rectilinear propagation of light– diffraction at a straight edge-zone plate. Fraunhofer diffraction: - Diffraction at a single slit,
double slits – plane transmission grating - Rayleigh's criterion for resolution -

resolving power ofdiffraction grating.

Unit 3.Dispersion (5 hrs)

Unit 4. Polarisation (**12 hrs**)

Plane polarized light -polarization by reflection – Brewster's law - pile of plates -
Malus law - Double refraction - Huygens explanation for double refraction in uniaxial
crystals - Nicol prism - Nicol prism as a polarizer and analyzer – Theory- production and
analysis of plane, circularly and elliptically polarized light - quarter and half wave plates.

Unit 4. Laser (**14 hrs**)

Basic principle of laser operation Einstein coefficient, light propagation through medium and condition for light amplification population inversion by pumping and cavity threshold condition, line shape function- optical resonators (qualitative) Q factor various laser systems –Ruby laser - He-NE laser, Dye laser, semiconductor laser, (working principle only) Application of lasers- characteristics of laser beams -spatial coherence - Temporal coherence and spectral energy density Nonlinear optics : Nonlinear Polarization –second harmonic generation – phase matching

Unit 5. Fibre Optics (8 hrs)

Introduction, optical fibre, the numerical aperture, coherent bundle, pulse dispersion in step
index fibre, graded index fibre, single mode fibre, multimode fibre, Fibre optic sensors
(qualitative), fibre optic communication (qualitative), Advantages of fibre optic communication system.

Unit 6. Holography: (7 hrs)

Principle of holography, recording of holograms, reconstruction of images (Theory not needed), application of holography, different types of holograms, transmission and reflection types.

Books for Study:

1. Text Book of Optics: Subramaniam & Brijlal, .Avadhanulu, 23rd edition,2006
2. Optics: Ajoy Ghatak, TMH, 2005
3. Optics and spectroscopy: R.Murugesan and K Sivaprasad, S. Chand & Co., 2010
4. Lasers Principles, Types and applications: K.R.Nambiar, New Age International Pvt. Ltd. 2006
5. Optics: Eugene Hecht, Addison-Wesley 2002

Books for Reference:

1. Fundamentals of Optics: Jenkins and White, MCH

2. Modern Classical Optics: Geoffrey Brooker, Oxford University Press, 2003

3.Fundamentals of Optics-Geometrical Physical and Quantum:D. R. Khanna and H. R. Gulati, R. Chand,1984

4.Lasers &Non-Linear Optics: B. B. Laud,New Age International Pvt. Ltd., 2011

5.Electronic Communications: Dennis Roddy & John Coolen, Pearson, 1995

Topics for assignments/discussion in the tutorial session (sample)

1. Michelson's interferometer-Standardization of metre.
2. Diffraction at a rectangular aperture and circular aperture
3. Optical activity-Fresnel's theory of optical rotation.
4. Resolving power of prism and telescope
5. Constant deviation spectrometer.
6. Laurent's half shade polarimeter.
8. Laser applications.
9. Study of Fraunhofer lines using spectrometer. .
10. Determination of refractive index of liquid by Newton's rings method.
11. Comparison of radii of curvature by Newton's rings method.

PY1644-DIGITAL ELECTRONICS AND COMPUTER SCIENCE

(72HRS-4 CREDITS)

Unit-1 (22hrs)

Number systems :-Decimal number system-binary number system-conversion 2of binary number to decimal and decimal number to binary-binary addition and subtraction-21's complement-2's complement-binary subtraction using 2's complement-signed arithmetic operation-conversion of real numbers-conversion of decimal fraction to binary fraction-binary coded decimal -hexadecimal number system-conversion of hexadecimal number to decimal, decimal to hexadecimal, binary to hexadecimal and hexadecimal to binary-real or floating point representation of numbers-ASCII code.

Boolean algebra and logic gates: - Logic gates AND, OR, NOT, NAND,NOR And Ex-OR gate-realization of other logic functions using NAND / NOR gates-tri state logic gate-Boolean laws- Demorgan's theorem-Simplification of Boolean equations using Boolean laws. Karnaugh map

Arithmetic circuits:-Half adder-full adder-controlled inverter-binary adder-subtractor.

Sequential circuits:- Flip-Flop, S-R Flip Flop, J-K Flip-flop, Master slave JK Flip-Flop

Unit2 (11hrs)

Basics of computers:-Hardware- input and output units- memory unit-ALU-control unit–basicoperational concepts-Software – operating systems

The memory systems:- Basic concepts-semiconductor RAM- internal organization memorychips-static memories-asynchronous and synchronous DRAM-structure of large memories– ROM,PROM,EPROM, EEPROM–flash memory-speed size and cost-Basic concepts of cache memory and virtual memories. Secondary storage-magnetic hard disks-optical disks-magnetic tape systems.

Unit-3: Programming in C++ (25 hrs)

Features of c++ - basic structure of c++ program – library files-header files – preprocessor directives- inbuilt functions- output using cout- input with cin - constants and variables – data types – declaration of variables – integer variables, character variables, floating point types, type bool - assigning values to variables–manipulators-operators and expressions–arithmetic operators, relational operators, logical operators, short hand operators-control statements-for loops , while loop, do…while loop- if statement, if……else, else….if constructions, switch statement- break, continue, goto statements-user defined functions-function definition,

function declaration, function header and body, function call and execution, passing arguments to functions, returning values from functions, overloaded functions, inline functions, default arguments, scope rule for functions- storage classes-Arrays-array elements, array initialization, multidimensional arrays, passing arrays to functions-strings-basics of structures and pointers in c++, classes and objects (introduction only)-basic file operations-serial and sequential files, reading and writing -simple examples of c++ programs for solving problems in physics-compilation and execution of data.

Unit 4: Introduction to microprocessors (14 hrs)

Microprocessors and microcontrollers (definition only)-intel 8085- 8 bit microprocessor-pin disruption - 8085 instructions - addressing modes(definition only)- interrupts (definition only) -assembly language - simple programs- addition, subtraction.

Books for study:

1. Fundamentals of Microprocessors and Microcomputers: B. Ram,Dhanpat Rai Publications
2. Digital principles and Applications: Malvino and Leach.TMH, New Delhi, 4th Edn.
3. Fundamentals of Computers: V.Rajaram, PHI, New Delhi, 4th Edn.
4. A first course in Computers: S. Saxena, Vikas Publishing House Pvt. Ltd.,
5. Programming in C++: D. Ravichandran, Tata Mc Graw Hill, 2011
6. Object oriented programming in C++:Robert Lfore,Galgotia publications Pvt Ltd., 3Edn., 2004
7. The C++ programming language:Bjome Stroustrup, 4th Edn. Addison Wesley
8. Object oriented programming with C++: E. Balaguruswami, 5Edn., Tata Mc Graw Hill
9. Programming in C++: M.T. Somasekharan, PHI Pvt. Publishing,2005
10. Numerical Methods with computer programs in C++:P. Ghosh, PHI Learning Pvt. Ltd.

11. The 8085 microprocessors:K. Udayakumar and B. S. Umasankar, Dorling Kindersley (India) Pvt. Ltd.,2008

12. Microprocessor 8085,8086:Abhishek yadav, University Science Press, New Delhi 2008

13. Microprocessor-Architecture, Programming and applications with 8085:R.S. Gaonkar,

Books for Reference: -

1. Introduction to digital electronics:NIIT, PHI.
2. A first course in Computers:Sanjay Saxena, Vikas publishing house Pvt. Ltd.

PRACTICAL

PY1442- Basic Physics Lab 1
(minimum 18 experiments to be done)

1. Fly Wheel - Moment of Inertia
2. Compound Bar Pendulum – Symmetric
3. Compound Bar Pendulum – Asymmetric
4. Uniform Bending---Y---Pin and Microscope
5. Uniform bending—Y- optic lever method
6. Non-uniform bending-Y-Optic lever& telescope
7. Rigidity modulus –Static torsion
8. Torsion pendulum I- By Torsional oscillations
9. Torsion pendulum I- By Equal masses
11. Kater’s pendulum-Acceleration due to gravity
12. Melde’s string-----Frequency of fork
13. Phase transition-determination of M.P of wax.
14. Determination of thermal conductivity of rubber
15. Lee’s disc-determination of thermal conductivity of a bad conductor
16. Viscosity-Continuous flow method using constant pressure head.
17. Viscosity-Variable pressure head arrangement
18. Surface tension-Capillary rise
19. Sonometer-frequency of A.C
20. Kundt’s tube-determination of velocity of sound.

21. Determination of m and Bh using deflection and vibration magnetomers.
22. Potentiometer-Resistivity.
23. Comparison of least counts of measuring instruments.
24. Evaluation of errors in simple experiments.

References

1. Yarwood and Wittle; Experimental Physics for Students, Chapman &Hall Publishers.

2. An advanced course in practical physics, Chathopadhyaya, Rakshit and Saha, New central agency, Kolkata.

3. A text book of practical physics, S.Viswanathan & Co., Chennai.

4. Advanced Practical Physics, B.L.Worsnop and H.T.Flint, Khosla Publishers, Delhi.

PY1645-Advanced Physics Lab 2
(Minimum 18 experiments to be done)

1. Spectrometer-A, D and n of a solid prism.
2. Spectrometer –Dispersive power and Cauchy's constants
3. Spectrometer Grating—Normal incidence- N & wavelength
4. Spectrometer-i-d curve
5. Spectrometer- Hollow prism
6. Liquid lens-refractive index of liquid and lens
7. Newton's Rings—Reflected system
8. Air wedge-diameter of a wire
9. Potentiometer-Resistivity.
10. Potentiometer-Calibration of ammeter
11. Potentiometer –Reduction factor of T.G
12. Potentiometer –Calibration of low range voltmeter

13. Potentiometer – Calibration of high range voltmeter

14. Thermoemf-measurement of emf using digital multimeter.

15. Carey Foster's bridge-Resistivity

16. Carey Foster's bridge-Temperature coefficient of resistance.

17. Mirror galvanometer-figure of merit.

18. BG- Absolute capacity of a condenser

19. Conversion of galvanometer into ammeter and calibration using digital Multimeter

20. Conversion of galvanometer into voltmeter and calibration using digital Voltmeter.

21. Circular coil-Calibration of ammeter.

22. Study of network theorems-Thevenin's & Norton's theorems and maximum power transfer theorem.

23. Circular coil-Study of earth's magnetic field using compass box.

24. Absolute determination of m and Bh using box type and Searle's type vibration magnetometers.

25. Searle's vibration magnetometer-comparison of magnetic moments.

References

1. Yarwood and Wittle; Experimental Physics for Students, Chapman & Hall Publishers.

2. An advanced course in practical physics, Chathopadhyaya, Rakshit and Saha, New central agency, Kolkata.

3. A text book of practical physics, S.Viswanathan & Co., Chennai.

4. Advanced Practical Physics, B.L.Worsnop and H.T.Flint, Khosla Publishers, Delhi.

PY1646—Advanced Physics Lab 3
(Minimum 18 experiments to be done – 4 from Computer Science)

ELECTRONICS

1. PN junction Diode (Ge & Si) characteristics-To draw the characteristic curves of a PN junction diode and to determine its ac and dc forward resistances.

2. Full wave (centre tapped) rectifier-To construct a full wave rectifier using junction diode and to calculate the ripple factor with and without shunt filter (10 readings for R_L 100 to 5000).

3. Full wave (centre tapped) rectifier-To construct a full wave rectifier using junction diode and to study effect of L,C, and LC filters on the ripple factor (for different R_L).

4. Bridge rectifier-To construct a bridge rectifier using junction diodes and to calculate the ripple factor with and without shunt filter (10 readings for R_L 100 to 5000).

5. Bridge rectifier- Dual power supply-To construct a dual power supply using bridge rectifier and measure the output voltages for different pair of identical load resistors.

6. Zener diode characteristics-To draw the I-V characteristic of a Zener diode and to find the break down voltage and the dynamic resistance of the diode.

7. Zener diode as a voltage regulator-To construct a voltage regulator using Zener diode and to study the output voltage variation (i) for different RL and (ii) for different input voltage with same R_L.

8. Transistor characteristics-CE-To draw the characteristic curves of a transistor in the CE configuration and determine the current gain, input impedance and output impedance.

9. Transistor characteristics-CB-To draw the characteristic curves of a transistor in the CB configuration and determine the current gain, input impedance and output impedance.

10. Single stage CE amplifier-To construct a single stage CE transistor amplifier and study its frequency response.

11. OP amp. IC741- Inverting amplifier-To construct an inverting amplifier using IC741 and determine its voltage gain.

12. OP amp. IC741- Non inverting amplifier

To construct a non inverting amplifier using IC741 and determine its voltage gain.

13. OP amp. IC741- Differentiator-To construct an OP amp. Differentiator, determine its voltage gain and study the output response to pulse and square wave.

14. OP amp. IC741- Integrator-To construct an OP amp. Integrator, determine its voltage gain and study the output response to pulse and square wave.

15. Phase shift oscillator-To construct a phase shift oscillator using transistor and measure the frequency of the output waveform.

16. Logic gates- OR and AND-To verify the truth tables of OR and AND gates using diodes.

17. Logic gate- NOT-To verify the truth tables of NOT gate using a transistor.

18. Network theorems (Superposition, Thevenin's & Norton's theorems)

To verify the (i) Superposition, (ii) Thevenin's & (iii)
Norton's theorems

19. RC-Filter circuits (Low pass)

To construct an RC –low pass filter circuit and to find the upper cut off frequency.

20. RC-Filter circuits (High pass)-To construct an RC –high pass filter circuit and to find the lower cut off frequency.

Computer Science (C++ Programs)

1. Program to find the roots of a quadratic equation (both real and imaginary root)
2. Program to find the dot product and cross product of vectors
3. Program to plot the functions Sin x, Tan x and e^x
4. Program to find the matrix addition, multiplication, trace, transpose and inverse.

5. Program to convert hexadecimal to decimal number, decimal to hexadecimal number, binary to hexadecimal numbers and hexadecimal to binary numbers
6. Program to find the result of binary addition and subtraction.
7. Program to find the moment of inertia of regular bodies about various axes of rotation.
8. Program to find the velocity of a rolling body (without sliding) at any point in an inclined plane
9. Program to study the motion of a spherical body in a viscous fluid
10. Program to study the motion of projectile in central force field
11. Program to study the planetary motion and Kepler's law
12. Monte carlo simulation

References:

1. Basic electronics and linear circuits; N.N. Bhargava, D.C. Kulshreshtha, S.C.Gupta
2. OP- Amps and linear integrated circuits; Ramakant A. Gayakwad
3. Basic electronics; Santiram Kal
4. Basic electronics; B. L. Theraja
5. Principles of electronics; V. K. Mehta
6. A first course in Electronic s; Anwar A. Khan, Kanchan K. Dey

PY1661. ELECTIVE COURSES

(54 HOURS-2CREDITS) FOR EACH COURSE

PY1661.1 ELECTRONIC INSTRUMENTATION

Unit 1 (14 hrs)

Basic concepts of measurements- Instruments for measuring basic parameters-

ammeter-voltmeters-multimeter- digital voltmeter-accuracy and resolution of DVM.

Unit 2 – Oscilloscopes (14 hrs)

Cathode ray tubes- CRT circuits- vertical deflection system- delay line- horizontal deflection system-multiple trace- oscilloscope probes and transducer- storage oscilloscopes.

Unit 3 – Transducers (10 hrs)

Basic principles- classification of transducers- Passive and Active transducers- strain gauges- temperature measurements- thermistors-photosensitive devices.

Unit 5 – Signal Generation and Analysis (16 hrs)

Sine wave generator- frequency synthesizer- sweep generator- astable multivibrator- laboratory pulse generator- function generator- wave analysers harmonic distortion analyzer- wave meter- spectrum analyzer (qualitative idea only).

Books for Study:

1. Modern Electronic Instrumentation and Measurement Techniques: Albert D.Helfrick & William D.Cooper, PHI, Ltd.
2. Electronic Instrumentation:Kalsi H. S, 2nd Edn, TMH Publishers.
3. Instrumentation-Devices and Systems: C.S. Rangan, G.R.Sarma, V.S.V.Mani, TMH Publishers.
4. Electronic Instruments and Instrumentation Technology: M.M.S.Anand, PHI Ltd.

Books for Reference:

1. Sensors and Transducers: D.Patranabis, Wheeler Publishing Co. Ltd.
2. Industrial Electronics and Control: S.K.Bhattacharya & S.Chatterjee,TMH Publishers.
3. Electronic measurement and Instrumentation: K.B.Klaassen,Cambridge University Press.
4. Measurement Systems-Applications and Design: Ernest O.Doebelin & Dhanesh N.Manik, 5th Edn.TMH Publishers.

5. Principles of Measurement systems: John P.Bentley,Longman, Pearson Education Publishers. 3rd Edn.

PY1661.2. SPACE SCIENCE
54 HOURS-2CREDITS)

Unit 1. Universe (12 hrs) [Book3]

Large Scale Structure of the Universe: Astronomy and Cosmology, Our Galaxy,Galaxy types, Radio sources, Quasars, Structures on the largest scale, Coordinates and catalogues of astronomical objects, Expansion of the Universe

Unit 2. The evolution of Stars (9hrs) [Book4]

Introduction, Classification of Stars: The Harvard classification, Hertzsprung – Russel diagram, Stellar evolution, White dwarfs, Electrons in a white dwarf star,Chandrasekhar limit, Neutron stars, Black holes, Supernova explosion, Photon diffusion time, Gravitational potential energy of a star, Internal temperature of a star,Internal pressure of a star.

Unit 3. The active Sun (10 hrs) [Book2]

Introduction, Sunspots and Solar storms, Sunspots and Solar activity, Cosmic rays of Solar origin, The Solar wind, Solar corona and the origin of the solar wind, Disturbed Solar wind.

The earth's Atmosphere (15 hrs) [Book 1]

Introduction, Nomenclature and temperature profile, Temperature distribution in the troposphere, Temperature of stratosphere, temperature of mesosphere and thermosphere,Temperature variability, The pressure profile, Scale height, Density variation.The Ionosphere: Effect on scale height, Ionospheric electric fields, Ionization profile,Layer of charge, Ionospheric hydrogen and Helium.

Magnetosphere (8 hrs) [Book 2]

Introduction, The magnetic field of Earth, Earth's variable magnetic field, Solar activity and Earth's magnetic weather, solar wind interaction, The Chapman-Ferraro closed magnetosphere, Dungey's open magnetosphere, Structure of the

magnetosphere: Magneto tail and Plasma sheet, Plasma sphere, Earth's radiation belts.

Books for Study

1. Introduction to Space Science – Robert C Hymes (1971), John Wiley & Sons Inc.

2. Earth's Proximal Space- Chanchal Uberoi (2000), Universities Press (India)

3. Introduction to Cosmology- J. V. Narlikar (1993), Cambridge University Press

4. Modern Physics- R. Murugeshan, Kiruthika Sivaprasath (2007), S.Chand & Company Ltd.

Books for reference

1. Space Physics and Space Astronomy – Michael D Pappagiannis (1972), Gordon and Breach Science Publishers Ltd.

2. Introductory Course on Space Science and Earth's environment-Degaonkar (Gujarat University, 1978)

3. Introduction to Ionosphere and magnetosphere- Ratcliffe (CUP, 1972)

4. The Physics of Atmospheres-Houghton (Cambridge University Press)

5. Introduction to Ionospheric Physics-Henry Rishbeth &Owen K. Garriot (Academic Press, 1969)

6. Space Science –Louise K. Harra& Keith O. Mason(Imperial College Press,London, 2004)

7. Introduction to Space Physics- Kivelson and Russel
8. Introduction to Astrophysics – Baidyanadh Basu

9.Astrophysics - K. D. Abhayankar (University Press)

PY1661.3. PHOTONICS

(54 HOURS)

Unit 1: (5 hrs)

Photons in semiconductors-semiconductors-energy band and charge carriers-direct and indirect gap semiconductors –Different type of semi conducting materials--generation, recombination and injection-electron hole injection homo andhetero junctions-quantum wells ,quantum dots and quantum wires.

Unit 2: (6 hrs)

Semiconductor photon sources -light emitting diodes-injection electroluminescence-in thermal equilibrium –in the presence of carrier injection-LED characteristics- internal photon flux-output photon flux and efficiency-responsivity- spectral distribution- materials- response time-device structures (Basics).

Unit 3: (10 hrs)

Semiconductor laser amplifiers-gain-amplifier band width-optical pumping-electrical current pumping-hetero structures -semiconductor injection lasers-amplification-feedback and oscillators-laser amplification-resonator losses -gain condition-Laser threshold-Power-internal photon flux-output photon flux.

Unit 4: (10 hrs)

Semiconductor photon detectors-The external photo effect-photo electron emission-The internal photo effect-properties of semiconductor photo detectors--quantum efficiency-responsivity devices with gain-response time-photoconductors-gain-spectral response- p-n photo diodes-PIN photo diodes-hetero structure photo diode- Schotky barrier photodiodes - array detectors-avalanche photodiodes (basics)-

Unit 5: (8 hrs)

Electro optics, Pockels and Kerr effects- electro optic modulators and switches phase modulators–dynamic wave retarders- intensity Modulators- scanners-directional couplers-spatial light modulators-

Unit 6: (7 hrs)

Non linear optics-second order non-linear optics - electro-optic effect-three wave mixing- third order non-linear optics- self phase modulation-optical kerr effect-self focusing. .

Unit 7: (8 hrs)

Photonic switching and computing-photonic switches-switches-opto mechanical, electro optic, acousto-optic and magneto optic switches-all optical switches-optical computing-digital optical computing-analog optical processing.

Book for Study:

1. Fundamentals of Photonics: BFA Saleh and M.C.Teich, John Wiley &Sons, Inc.

Books for Reference:

1. Semiconductor optoelectronic devices: Pallab Bhattacharya, Printice Hall of India.
2. Optics and Photonics- An introduction: F. Graham Smith and Terry A.King, John Wiley & Sons,Inc.
3. Lasers and Non linear Optics: B.B.Laud, New Age International Pvt Ltd.

Core Course – XII (ELECTIVE) 54 hrs (Credit – 2)

PY 1661.4: NANO SCIENCE AND TECHNOLOGY

Module 1: Introduction : (6 Hrs)

Length scales in Physics- nanometre- Nanostructures: Zero, One Two and Three dimensional nanostructures (Chapter 3, Text 2)

Band Structure and Desnsity of State at nanoscale: Energy Bands, Density of States at low dimensional structures. (Chapter 3, Text 1)

Module 2: Electrical Transport in Nanostructure: (15 hours)

Electrical conduction in metals, The free electron model. Conduction in insulators/ionic crystals - Electron transport in semiconductors - Various conduction mechanisms in 3D (bulk), 2D(thin film) and low dimensional systems: Thermionic emission, field enhanced thermionic emission (Schottky effect). (Chapter 4, Text 1)

Module 3: Introductory Quantum Mechanics for Nanoscience: (8 hrs)

Size effects in small systems, Quatum behavious of nanometric world: Applications of Schrödinger equation – infinite potential well, potential step, potenial box; trapped particle in 3D (nanodot), electron trapped in 2D plane (nanosheet), electrons moving in 1D (nanowire, nanorod, nanobelt), Excitons, Quantun confinement effect in nanomaterials (Chapter 5, Text 1)

Module 4: Growth Techniques of Nanomaterials (Elementary ideas only): (9 hrs)

Top down vs bottom up techniques, Lithographic process, Non Lithographic techniques: Plasma arc discharge, sputtering. Evaporation: Thermal evaporation, Electron beam evaporation. Chemical Vapour Deposition (CVD). Pulsed Laser Deposition, Molecular Beam Epitaxy, Sol-Gel Technique, Electro-deposition., Ball-milling. (Chapter 6, Text 1)

Module 5: Characterization tools of nanomaterials: (Qualitative ideas only) (10 hrs)

Atomic Structures -Grain size determination – XRD (Debye Scherrer equation), Microscopy – Scanning Electron Microscope (SEM), Tunneling Electron Microscope (TEM), Scanning Probe Microscope (SPM), Scanning Tunneling Microscope (STM), Atomic Force Microscope (AFM). (Text -1).

Module 6: Applications of nanotechnology: (Elementary ideas only) (6 hrs)

Buckminster fullerene, Carbon nanotube, nano diamomd, BN Nanotune, Nanoelectronics - single electron transistor (no derivation), Molecular machine, Nanobiomatrics (Chapter 8, Text 1).

Applications of nanotechnology: (**Elementary ideas only**) Potential applications, Expected benefits from nanotechnologies, Can nanotechnology helps in addressing various challenges?, Energy and Energy Efficiency, new energy producers, Medicine, security, Other Applications. (Text book-2, Chapter 5, 6, 7 &8, Nanotechnology: Technology Revolution of 21st Century, Rakesh Rathi, S Chand & Company, New Delhi.).

Text books:

1. Introduction to Nanoscience & Nanotechnology by K. K. Chattopadhyay and A. N. Banerjee, Publisher: PHI Learning and Private Limited

2. Nanotechnology, Rakesh Rathi, S Chand & Company, New Delhi

3.NANO: The Essentials, T.Pradeep, McGraw Hill Education (India) Private Limited

References:

1. Nanoparticle Technology Handbook – M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama (Eds.), Elsevier 2007

2. Encyclopaedia of Materials Characterization, Surfaces, Interfaces, Thin Films, Eds. Brundle, Evans and Wilson, Butterworth – Heinmann, 1992

3. Springer Handbook of nanotechnology, Bharat Bhushan (Ed.), Springer-Verlag, Berlin, 2004

4. Nano Science and Technology, V. S. Muraleedharan and A Subramaniam, Ane Books Pvt. Ltd, New Delhi

5. A Handbook on Nanophysics, John D, Miller, Dominant Publishers and Distributors, Delhi-51 6. Introduction to Nanotechnology, Charles P Poole Jr. and Frank J Owens, Wiley Students Edition 7. Nano-and micro materials, K Ohno et. al, Springer International Edition 2009, New Delhi

PY1661.5. COMPUTER HARDWARE & NETWORKING(54 HRS)

Unit 1 - 3 hrs
P.C. Architecture Functional block diagram of a computer. Processors Introduction to Microprocessor.CISC, RISC processors Type of Processors and their specification.(Intel: Celeron, Pentium family-PII, PIII, PIV, dual core, core 2duo - AMD-K5,K6 series
Unit 2 -10 hrs
Motherboards:Motherboard components Types, Form factor, Different components of Motherboard (BIOS, CMOS,BICMOS, RAM, CMOS Battery, I/O slots, I/O connectors), Riser architecture, Main Memory (SIMM, DIMM, RIMM), extended/expanded/cache memories. Chipsets (Intel & AMD)-ROM, DRAM, SDRAM, CDRAM, RDRAM, WRAM. Bus standards: Types of Buses (PC, ISA, MCA, AGP, PCI, USB, IEEE FireWire).Add on Cards Different latest Add on Cards (TV Tuner Card, DVR card, Video Capture,Internal Modem, Sound Card)

Unit 3 -9 hrs
Drivers:

1. Floppy Disk Drive- Floppy Drive Components(overview only)
2. Hard Disk Drive (HDD)

Types, Capacity, Hard Disk Components (Media, Read/Write Head, Spindle Motor Head Actuator), Connector, Jumper setting, trouble shooting in HDD.Hard Disk Controller (HDC) – Block diagram,

Working, Interfacing (IDE,SCSI, ATA and SATA series) Configuration of HDD-Installation, Formatting, File Format (FAT, NTFS).Pen drive, i-pods
3.Optical Disk Drive
Types (ROM, R/W, DVD ROM, DVD R/W), Capacity, Difference between CD &DVD (capacity, format)-trouble shooting.

Unit 4 -5 hrs
Peripherals . Keyboard and Mouse- operation

Types of VDU (CRT, LCD, and TFT), Resolution, and Dot pitch -Printers – Types (dot matrix, inkjet, laser) Scanner- operation.Power conditioning Device:SMPS-Block diagram, operation-UPS- Types (online, off line, Hybrid)-trouble shooting in all these devices.

Unit 5- 4 hrs

Viruses & Vaccines-Virus- Introduction, infection methods,Types of viruses, Different symptoms of virus attack, precautions.Vaccine- Method of vaccine, Different types of Antivirus used in PC,Firewalls
Unit 6- 7 hrs

NETWORKING ESSENTIALS
Introduction-Need for networking-Network Topology-OSI Model-Types of networks (LAN, WAN, MAN)

Protocols-LAN Protocols- Classification, Examples, Ethernet networking-WAN Protocols- PPP, X

.25, PPTP, L2TP, ISDN
Unit 7-- 8 hrs

LAN Connectivity Devic es- NIC, Repeater, Hub, Switch, Bridge.Internet Connectivity Device-Routers, Gateways, CSU/DSU-TCP/IP Protocol Suite-What is TCP/IP, Importance, OSI vs TCP/IP
Unit 8- 6 hrs

IP Addressing-Overview, Address classes, Network ID, Host ID and Subnet Mask,Addressing guidelines, Reserved IP Address, Subnetting and Supernetting(overview)

Unit 9 -2 hrs

Emerging Technologies-Wireless Technology - Bluetooth, WAP-Mobile Technology- GSM, CDMA, GPRS
Books for Study:
1. D. Balasubramanian, “Computer Installation & Servicing”, Tata McGraw Hill.

2. Rom Gilster, Black book, “PC Upgrading and Repairing”, Dream tech, New Delhi.

3. Street Smart, James Pyler, “PC Upgrading and Repairing”, Wiley Publishing, Inc.

4. Stephen.J.Bigelow,”Bigelow’s Troubleshooting, Maintenance & Repairing PCs”,Tata McGraw Hill

5. Craig Zacker, “The Complete Reference- Networking”, Tata McGraw Hill

6. Douglowe, “Networking All in One Desk Reference”-3Edn, Wiley India Pvt Ltd

Books for Reference:

1. Mark Minasi, “The Complete PC Upgrade & Maintenance Guide” BPB Publication

2. C.A. Schmidt, “The Complete Computer Upgrade & Repair Book”, Dreamtech

3. Craig Zacker, John Rourke, “The Complete Reference- PC Hardware”Tata McGraw Hill

4. Scott Mueller, “Upgrading & Repairing PC’s”, Pearson Education

5. Vishnu Priya Sing & Meenakshi Singh, “Computer Hardware Course”, Computech

6. Manahar Lotia, Pradeep Nair, Payal Lotia, “Modern Computer Hardware Course”,BPB Publication.

7. Richard Mc Mohan, “Introduction to Networking”, Tata McGraw Hill.

Internet Resources:

www.edugrid.ac.in/webfolder/courses/cn/cn_resourses.htm

www.howstuffwork.com

www.e-tutes.com

www.learnthat.com

www.intel.com

www.amd.com

http://en.wikipedia.org

II Complementary Courses

Semester 1 (Mathematics Main)

PY1131.1 – Mechanics and Properties of matter (36 hours)

Unit I (28 hours)

Dynamics of rigid bodies (7 hours)

Theorems of M.I with proof-Calculation of M.I of bodies of regular shapes rectangular lamina, uniform bar of rectangular cross section, annular disc, circular disc, solid sphere-K.E of a rotating body. Determination of M.I of a fly wheel (theory and experiment).

Oscillations and waves (13 hours)

Examples of S.H oscillator-compound pendulum-determination of g -torsion pendulum-oscillations of two particles connected by a spring-vibration state of a diatomic molecule.

Wave motion-general equation of wave motion-plane progressive harmonic wave -energy density of a plane progressive wave -intensity of wave and spherical waves-

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity, **.**

Unit II (8 hours)

Surface Tension (5 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula -limitations-Ostwald's viscometer-variation of viscosity with temperature.

Books for Study

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons

2. Oscillations & Waves: K.RamaReddy, S.Bbadami & V.Balasubramaniam (University Press)

Semester 2 (Mathematics Main)

PY1231.1 – Thermal Physics and statistical mechanics (36 hours)

Unit I – Transmission of Heat (14 hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment-Weidmann and Franz law (statement only)-energy distribution in the spectrum of black body and results-Wien's displacement law-Rayleigh-Jeans law-their failure and Planck's hypothesis-Planck's law-comparison-solar constant-its determination-temperature of sun.

Unit II – Thermodynamics (9 hours).

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticityHeat engines-Carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements.

Unit III – Entropy (9 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

Unit 4- Statistical Mechanics(4hours)

Statistical probability-Macro and Microstates- Phase space-statistical ensemble-postulates of equal probability-Maxwell Boltzmann Distribution- velocity distribution.

Books for Study

1. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
2. Heat & Thermodynamics: W.Zemansky, McGraw Hill
3. Heat & Thermodynamics: C.L.Arora.

Semester 3 (Mathematics Main)

PY1331.1 – Optics, Magnetism and Electricity (54 hours)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and

bandwidth.Interferencein thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness -Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer.Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength.

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laserapplications of lasers. Light propagation in optical fibres-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Magnetism (10 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability.Magneticproperties-diamagnetism-paramagnetism-ferromagnetism-antiferromagnetism.Electron theory of magnetism-explanation of ferromagnetism.

Electricity (10 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

Books for Study

1.A text book of optics – Brijlal & Subramaniam
2.Electricity and Magnetism – R.Murugeshan, S.Chand & Co Ltd.
3.A text book of B.Sc subsidiary Physics – P.Vivekanandan.

Semester 4 (Mathematics Main)

PY1431.1ModernPhysicsandElectronics(54hours)

Unit 1..Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-

Atomic nucleus-basic properties of nucleus-charge, mass, spin, magnetic moment-binding energy and packing fraction-nuclear forces-salient features-radioactivity-radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity.

Quantum Mechanics (10 hours)

Inadequacies of classical physics-experimental evidences- quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrödinger equation-time dependent and time independent-particle in a potential box.

Unit2.
(20hours)Electronics(1
6hour)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p -n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.

Construction and operation of a bipolar junction transistor-transistor configurationscurrent components-transistor characteristics-DC load line-Q point-AC load linetransistor biasing-need for biasing-bias stabilization-biasing circuits-voltage divider bias. amplifier-basic features of an amplifier-gain, -frequency response and band width

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates. Boolean algebra-Boolean operations -logic expressions-laws of Boolean algebra-DeMorgan's theorem-Boolean expression for gate network-simplification of Boolean expression.

Books for Study:

1. Modern Physics – R.Murugeshan, S.Chand & Co. Ltd.
2. Principles of Electronics – V.K.Mehta.

Semester 1 (Chemistry Main)

PY1131.2 – Rotational dynamics and Properties of matter (36 hours)
Unit I (28 hours)
Dynamics of rigid bodies (7 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes-

rectangular lamina, uniform bar of rectangular cross section, annular disc, circular

disc, solid cylinder, solid sphere-K.E of a rotating body-Determination of MI of a flywheel(Theory and Experiment).

Oscillations and waves (13 hours)
Examples of S.H oscillator-compound pendulum-determination of g-torsion pendulum-oscillations of two particles connected by a spring-vibration state of a diatomic molecule-

Wave motion-general equation of wave motion-plane progressive harmonic wave -energy density of a plane progressive wave -intensity of wave and spherical waves-

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity.

Unit II (8hours)
Surface Tension (5 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula -limitations-Ostwald's viscometer-variation of viscosity with temperature.

References

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons

2. Oscillations&Waves: K.RamaReddy, S.B.badami & V.Balasubramaniam (University Press)

Semester 2 (Chemistry Main)
PY1231.2 – Thermal Physics (36 hours)

Unit I – Diffusion (4 hours)

Graham's law of diffusion in liquids-Fick's law-analogy between liquid diffusion and heat conduction-methods of estimating concentrations-determination of coefficient of diffusivity.

Unit II.Transmission of Heat (14hours)

Thermal conductivity and thermometric conductivity – Lee's Disc experiment-Weidmann and Franz law (statement only) -Radiation of heat-black body radiation-Kirchoff's laws of heat radiation-absorptive power-emissive power-Stefan's law (no derivation) -energy distribution in the spectrum of black body and results-Wien's displacement law - Rayleigh-Jeans law-their failure and Planck's hypothesis -Planck's law-comparison-solar constant-temperature of sun.

Unit III – Thermodynamics (9 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity. Heat engines-carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements.

Unit IV – Entropy (9 hours)
Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

References

1. The general Properties of matter: F.H.Newman & V.H.L.Searle
2. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
3. Heat & Thermodynamics: W.Zemansky, McGraw Hill
4. Heat & Thermodynamics: C.L.Arora.

Semester 3 (Chemistry Main)

PY1331.2 – Optics, Magnetism and Electricity (54 hours)

Unit I (34 hours)
Interference (11 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth.Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness.Newton's rings-reflected system-measurement of wavelength and refractive index of a liquid.

Diffraction (11 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer.Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge.
Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength.

Polarisation (6 hours)

Experiments showing the transverse nature of light-plane polarized light-polarization by reflection-Brewster's law-double refraction-Nicol prism-propagation of light in uni-axial crystals-positive and negative crystals-principal refractive indices-half wave plate plate and quarter wave plate-elliptically and circularly polarized light-optical activity.

Laser and Fibre Optics (6 hours)
Principle of operation of laser-population inversion-optical pumping-ruby laserapplications of lasers. Light propagation in optical fibres-step index fibre-graded index fibre-applications.
Unit II (20 hours)
Magnetism (10 hours)
Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability.Magnetic properties-diamagnetismparamagnetism-ferromagnetism-antiferromagnetism.Electron theory of magnetism-explanation of ferromagnetism.

Electricity (10 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

References

1. A text book of optics – Brijlal & Subramaniam

2. Electricity and Magnetism – R.Murugeshan, S.Chand & Co Ltd.

3. A text book of B.Sc subsidiary Physics – P.Vivekanandan .

Semester 4 (Chemistry Main)

PY1431.2 – Atomic Physics, Quantum Mechanics and Electronics (54 hours)

Unit I Atomic physics (12 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table.

Unit II Superconductivity (8 hours)

Properties of superconductors-zero electrical resistance- Meissner effect- electrical magnetic filed-TypeI and Type II superconductors-isotope effect-high temperature ceramic superconductors-applications of superconductors.

Unit III Quantum mechanics (14 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrodinger equation-time dependent and time independent-particle in a potential box.

Unit IV. Spectroscoic Techniques(4hours)

EM Spectrum- UV, Visible, IR,, Radio and microwave regions-principle of various spectrometers used in specific regions of EM spectrum-absorption spectroscopy, emission spectroscopy.

Unit V. Electronics (12 hours)

Current-voltage characteristics of a diode -forward and reverse bias-breakdown
mechanism of p -n junction diode-zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.
Construction and operation of a bipolar junction transistor-transistor configurationscurrent components-transistor characteristics-DC load line-Q point-

AC load linetransistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feed back bias, voltage divider bias (qualitative study only). Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width

Unit V. Digital Electronics(4hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates..

References

1. Modern Physics – R.Murugeshan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

Semester 1 (Statistics Main)

PY1131.3 – Mechanics and Properties of matter (36 hours)

Unit I (28 hours)

Dynamics of rigid bodies (8 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes-rectangular lamina, uniform bar of rectangular cross section, annular disc, circular
disc, solid sphere-K.E of a rotating body. Determination of M.I of a fly wheel (theory
and experiment).

Oscillations and waves (12 hours)

Examples of S.H oscillator-compound pendulum-determination of g-torsion pendulum-oscillations of two particles connected by a spring.
Wave motion-general equation of wave motion-plane progressive harmonic wave energy density of a plane progressive wave-intensity of wave and spherical waves transverse waves in stretched string-modes of transverse vibrations of string longitudinal waves in rods and in gases.

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the

above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity.

Unit II (8 hours)

Surface Tension (5 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula -limitations-Ostwald's viscometer-variation of viscosity with temperature.

References

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons

2. Oscillations & Waves: K.RamaReddy, S.Bbadami & V.Balasubramaniam (University Press)

Semester 2 (Statistics Main)

PY1231.3 – Thermal Physics and statistical mechanics (36 hours)

Unit I – Transmission of Heat (8 hours)

Thermal conductivity and thermometric conductivity-Lee's disc experimentWeidmann and Franz law (statement only)-energy distribution in the spectrum of black body and results-Wien's displacement law**.**

Unit II – Thermodynamics (8 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity.Heat engines-carnot's cycle-derivation of efficiency- second law of thermodynamicsKelvin and Clausius statements.

Unit III – Entropy (8 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

Unit IV – Statistical Mechanics (12 hours)

Concepts of phase-space-ensemble and statistical equilibrium-probability

theorems in

statistical thermodynamics-distribution laws-Maxwell-Boltzman, Fermi -Dirac and Bose-Einstein distribution laws (no derivation)-comparison of three statistics-Molecular energies in an ideal gas-Quantum statistics-Rayleigh-Jeans formulaPlanck's radiation law-specific heat of solids-free electrons in metals-electron energy distribution.

References

1. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
2. Heat & Thermodynamics: W.Zemansky, McGraw Hill
3. Heat & Thermodynamics: C.L.Arora.
4. Concepts of modern physics: Arthur Beiser (TMH).
5. Statistical Mechanics: Sinha (TMH).
6. Theoretical Chemistry: Samuel Gladstone, New York, D Van Nostrand Co., Inc.
7. Heat: Saha and Srivasthava.

Semester 3 (Statistic s Main)

PY1331.3 –Optics , Magnetism and Electricity (54 hours)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth.Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness.Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer.Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength-Resolving power of grating.

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laserapplications of lasers. Light propagation in optical fibres-step index fibre-graded index fibre-applications.

Unit II (20 hours)

Magnetism (10 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability.Magnetic properties-diamagnetism-paramagnetism-ferromagnetism-antiferromagnetism.Electron theory of magnetism-explanation of ferromagnetism.

Electricity (10 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

References

1.A text book of optics – Brijlal & Subramaniam

2.Electricity and Magnetism – R.Murugeshan, S.Chand & Co Ltd

1.

3. A text book of B.Sc subsidiary Physics – P.Vivekanandan.

Semester 4 (Statistics Main)

PY1431.3 – Modern Physics and Electronics (54 hours)

Unit I

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table.

Atomic nucleus-basic properties of nucleus-charge, mass, spin, magnetic moment-binding energy and packing fraction-nuclear forces-salient features-radioactivity-radioactive decay-decay laws-decay constant-half life and mean life-
Radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity.

Quantum mechanics (14 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrodinger equation-time dependent and time independent-particle in a potential box.

Unit II (20 hours)
Electronics (12 hours)

Current-voltage characteristics of a diode -forward and reverse bias-breakdown

mechanism of p -n junction diode-zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.
Construction and operation of a bipolar junction transistor-transistor configurationscurrent components-transistor characteristics-DC load line-Q point-AC load linetransistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feed back bias, voltage divider bias (qualitative study only).
Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width.
Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates. Boolean algebra-Boolean operations -logic expressions-laws of Boolean algebra-DeMorgan's theorem-Boolean expression for gate network-simplification of Boolean expression.
References

1. Modern Physics – R.Murugeshan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

Semester 1 (Geology Main)
PY1131.4 – Mechanics and Properties of matter (36 hours)

Unit I (29 hours)
Dynamics of rigid bodies (7 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes-

rectangular lamina, uniform bar of rectangular cross section, annular disc, circular

disc, solid cylinder, solid sphere-K.E of a rotating body- Determination of MI of a flywheel(Theory and Experiment).
.
Oscillations and waves (15 hours)

Examples of S H oscillator- compound pendulum- determination of g-torsion pendulum-oscillations of two particles connected by a spring- vibrational state of diatomic molecule -damped and forced harmonic oscillators-damping force-damped harmonic oscillator -examples-power dissipation-Q factor. Wave motion-general equation of wave motion-plane progressive harmonic wave intensity of wave and spherical waves-waves in solids-longitudinal waves –transverse waves-torsional waves-common characteristics-reflection and transmission of waves-reflection and transmission of energy- flexural vibrations-applications of geophysicscharacteristics-reflection and transmission of waves-reflection and transmission of energy-flexural vibrations-applications in geophysics.

Mechanics of solids (7 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-torsional rigidity.

Unit II (7 hours)

Surface Tension (4 hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (3 hours)

Flow of liquid through a capillary tube-derivation of Poiseuille's formula -limitations-Ostwald's viscometer-variation of viscosity with temperature.

References

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K.RamaReddy, S.B.badami & V.Balasubramaniam (University Press)

Semester 2 (Geology Main)

PY1231.4 – Thermal Physics and Physics of the Earth (36 hours)

Unit I – Transmission of Heat (9 hours)

Thermal conductivity and thermometric conductivity-Lee's disc experimentWeidmann and Franz law (statement only)-energy distribution in the spectrum of black body and results-Wien's displacement law-Rayleigh-Jeans law-their failure and Planck's hypothesis-Planck's law -comparison-solar constant-temperature of sun.

Unit II – Thermodynamics (9 hours)

Isothermal and adiabatic process- work done -isothermal and adiabatic elasicity

Heat engines-carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements-Carnot's theorem with proof.

Unit III – Physics of the Earth (18 hours)

The solar system-origin of solar system-the dynamic earth-continental drift-earth's

structure-earth's size and shape-gravitation-gravitational field and potentialequipotential surfaces-gravitational field and potential due to a thin spherical shell and solid sphere-gravitational self energy-gravity measurements-free fall method-rise and fall method-gravity anomalies. The tide-tidal effect of sun-earth quakes-causesseismic wave propagation-seismographs.Atmospheric physics-atmospheric structure and composition-atmospheric pressure, density and temperature-measurement of air temperature-daily cycle of air temperature-atmospheric radiation-ionosphere-magnetosphere.

References

1. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
2. Heat & Thermodynamics: W.Zemansky, McGraw Hill
3. Heat & Thermodynamics: C.L.Arora.
4. Fundamentals of Geophysics: William Lowrie, Cambridge University Press.
5. Applied Physics: G.Aruldas et al, Rajam publishers, Tvpm.

Semester 3 (Geology Main)

PY1331.4 – Optics and Electrodynamics (54 hours)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth.Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness.Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (14 hours)

Phenomenon of diffraction-classification-Fresnel and Fraunhofer.Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength-Resolving power of grating.

Polarisation (8 hours)

Experiments showing the transverse nature of light-plane polarized light-polarization by reflection-Brewster's law-double refraction-Nicol prism-propagation of light in uni-axial crystals-positive and negative crystals-principal refractive indices-half wave plate and quarter wave plate-elliptically and circularly polarized light-optical activity-Fresnel's theory and applications.

Unit II (20 hours)

Magnetism (12 hours)

Magnetic properties of matter-definition and relation between magnetic vectors B, H and M. Magnetic susceptibility and permeability. Magnetic properties-diamagnetism- paramagnetism-ferromagnetism-anti-ferro magnetism. Electron theory of magnetism-Explanation of ferromagnetism
Earth's magnetism-dip- inclination -vertical components-magnetic maps -magnetographs -cause of earth's magnetism geomagnetic prospecting.

Electricity (8 hours)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

Books for study:

1. A text book of optics – Brijlal & Subramaniam

2. Electricity and Magnetism – R.Murugeshan, S.Chand & Co Ltd.

3. A text book of B.Sc. subsidiary Physics – P.Vivekanandan.

Semester 4 (Geology Main)

PY1431.4 – Modern Physics, Electronics and Crystallography(54hours)

Unit I

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table.

Atomic nucleus-basic properties of nucleus-charge, mass, spin, magnetic moment-binding energy and packing fraction-nuclear forces-salient features-radioactivity-radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-radio carbon dating-age of the earth-biological effects of radiation. Crystallography (16 hours)

Crystal structure-crystal lattice and translation vectors-unit cell-symmetry operations point groups and space groups-types of lattices-lattice directions and planes interplaner spacing-simple crystal structures-close packed structures-structure of diamond-zinc blend structure-sodium chloride structure. X-ray crystallography-diffraction of x -rays-Bragg's law-x-ray diffraction methodsrotating crystal method-powder diffraction method.

Unit II (18 hours)

Electronics (10 hours)

Current-voltage characteristics of a diode -forward and reverse bias-breakdown mechanism of p-n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency.

Construction and operation of a bipolar junction transistor-transistor configurationscurrent components-transistor characteristics-DC load line-Q point-AC load linetransistor biasing-need for biasing-bias stabilization-biasing circuits-fixed biasemitter feedback bias, voltage divider bias (qualitative study only).

Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width-small signal CE amplifier-circuit and its operation

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates. Boolean algebra-Boolean operations -logic expressions-laws of Boolean algebra-DeMorgan's theorem-Boolean expression for gate network-simplification of Boolean expression.

References

1. Modern Physics – R.Murugeshan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan. 3. Principles of Electronics – V.K.Mehta.

Semester 1 (Home Science Main)

PY1131.5–Mechanics and Properties of matter (36 hours)

Unit I (26 hours)

Dynamics of rigid bodies (8 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes-

rectangular lamina, uniform bar of rectangular cross section, annular disc, circular

circular disc, solid cylinder, solid sphere-K.E of a rotating body-Determination of MI of fl heel(Theory and experiment)

Oscillations and waves (12 hours)

Examples of S.H oscillator- oscillations of two particles connected by a springvibration state of a diatomic molecule..Wave motion-general equation of wave motion-plane progressive harmonic wave - energy density of a plane progressive wave-intensity of wave and spherical waves-

Mechanics of solids (6 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear-

Unit II (10 hours) Surface

Tension (5hours)

Excess of pressure on a curved surface-force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension and its temperature dependence by Jaeger' method-equilibrium of a liquid drop over solid and liquid surfaces.

Viscosity (5 hours)

Flow of liquid through a capillary tube -derivation of Poiseuille's formula-limitations - variation of viscosity with temperature-Stokes formula-determination of viscosity of a highly viscous liquid by Stokes method.

References

1. Mechanics: J.C.Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K.RamaReddy, S.Bbadami & V.Balasubramaniam
   (University Press)

Semester 2 (Home Science Main)

PY1231.5 – Thermal Physics (36 hours)

Unit I – Diffusion (4 hours)

Graham's law of diffusion in liquids-Fick's law-analogy between liquid diffusion and heat conduction-methods of estimating concentrations-determination of coefficient of diffusivity.

Unit II – Transmission of Heat (14hours)

Thermal conductivity and thermometric conductivity- disc experiment Lee's -
Weidmann and Franz law (statement only) -Radiation of heat-black body radiation - absorptive power-emissive power-Stefan's law (no derivation) -energy distribution in the spectrum of black body and results-Wien's displacement law -Rayleigh-Jeans law -
their failure and Planck's hypothesis-Planck's law-comparison-solar constanttemperature of sun.

Unit III – Thermodynamics (10 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity.Heat engines-carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements.
Phase transition- first order and second order-liquid helium-super fluidity.

Unit IV – Entropy (8 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-entropy and available energy-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

References

1. The general Properties of matter: F.H.Newman & V.H.L.Searle
2. Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
3. Heat & Thermodynamics: W.Zemansky, McGraw Hill
4. Heat & Thermodynamics: C.L.Arora.

Semester 3 (Home Science Main)

PY1331.5 – Optics and Electricity (54 hours)

Unit I (34 hours)

Interference (12 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth.Interference in thin films-reflected system-colour of thin films-fringes of equal inclination and equal thickness.Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (14 hours)

Phenomenon of diffraction-classific ation-Fresnel and Fraunhofer.Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge and circular aperture. Fraunhofer diffraction at a single slit, two slits and N slits. Plane transmission grating-determination of wavelength.

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser-applications of lasers.

Light propagation in optical fibers-step index fibre-graded index fibre-applications.

Unit II (**20 hours)**

Electricity

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers.

Electric motors- principles of working- Devices working with electric motors-Electric fan- wet grinder, Mixer grinder, Microwave oven – principle – technical specifications - applications – advantages,

References

1. A text book of optics – Brijlal & Subramaniam
2. . Electricity and Magnetism – R.Murugeshan, S.Chand & Co Ltd.
3. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
4. Electrical Technology (Vol I & II), B.L.Theraja.

Semester 4 (Home Science Main)

PY1431.5 – Atomic Physics and Electronics (54 hours)

Unit I

Modern Physics (20 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table.

Atomic nucleus-basic properties of nucleus -charge, mass, spin magnetic moment-binding energy and packing fraction-nuclear forces-salient features-radioactivity-

radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-

Unit II Superconductivity (8 hours)

Properties of superconductors-zero electrical resistance-Meissner effect-critical magnetic field-Type I and Type II superconductors-isotope effect-high temperature ceramic superconductors-applications of superconductors.

Unit III Spectroscopic Techniques (8 hours)

EM spectrum-UV, Visible, IR, Radio and microwave regions-principle of various spectrometers used in specific regions of EM spectrum-absorption spectroscopy-emission spectroscopy-mass spectroscopy-qualitative ideas of ESR & NMR spectrometer.

Unit IV (18 hours)

Electronics (10 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p -n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency. Construction and operation of a bipolar junction transistor-transistor configurations-current components-transistor characteristics-DC load line-Q point-AC load line-transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feedback bias, voltage divider bias (qualitative study only).

Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width-small signal CE amplifier-circuit and its operation

Digital Electronics (8 hours)

Number systems and codes-decimal numbers-binary arithmetic -1's and 2's compliment-decimal to binary conversion-octal numbers-hexadecimal numbers-binary coded decimal-digital codes-logic gates-NOT, OR, AND, NOR and NAND gates.Boolean algebra-Boolean operations -logic expressions-laws of Boolean algebra-DeMorgan's theorem-Boolean expression for gate network-simplification of Boolean expression.

References

1. Modern Physics – R.Murugeshan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

Complementary Electronics for Physics Main
Semester 1

EL 1131-ELECTRONICS I

(36 HOURS)

Unit 1 Circuit Elements and Fundamentals (10 hour)

Ohm's Law, Linear and non-linear Resistors, Resistor types-Wire wound Resistors, Carbon composition Resistors, Carbon film Resistors, Metal film Resistors, Resistor Colour code, Resistive circuits, Series and Parallel Resistor

circuits, Series aiding and Series opposing Voltages, Proportional Voltage formula, Proportional Current formula, Series Voltage Dividers, 'Open' and 'Short' in Series, Parallel and Series –Parallel Circuits.

Inductor, Inductor Types- Air core inductor, Iron-core Inductor, Ferrite-core Inductor, Self Inductance, Mutual Inductance, Coefficient of Coupling, Inductors in Series or Parallel without M, series combination with M, Stray Inductance, Reactance offered by a Coil.

Capacitors, Type of Capacitors- Fixed Capacitors, Variable Capacitors, Capacitance, Capacitors in Series and Parallel, Reactance offered by the Capacitor, Cells in Series and Parallel

Unit 2 Network Theorems (6 hour)

Kirchhoff's Law, Super position theorem, Ideal constant Voltage Source, Ideal constant Current Source, Thevenin's and Norton's Theorem, Maximum Power Transfer Theorem(Proof).

Unit 3 Magnetism and A.C (8 hour)

Magnetic Field, Type of Magnets, Magnetic Shielding, Magnetic Terms and Units, Ohm's Law in Magnetism, Transformer, Transformer working, Transformer Types, Transformer Impedance.

Type of alternating waveforms, Different values of sinusoidal voltage and current, Phase and Phase difference of A.C, Non-sinusoidal waveform, Harmonics, A.C through Resistor, Inductor, Capacitor, L-R, R-C and LCR circuits, Sharpness of resonance, Q-factor, Bandwidth, Tuning of radio, Parallel LCR.

Unit 4 Transient Current (6 hour)

Rise and fall of Current in pure Resistance, Time constant of an L-R Circuit, Inductive Kick, Time constant of an R-C Circuit, Charging and Discharging of capacitor, Decreasing Time Constant, Flasher, Pulse Response of an R-C Circuit, Effect of Long and Short Time Constants.

Unit 5 Introduction to semiconductors(6 hour)

Energy Band, Valance band, Conduction Band, Classification of materials based on energy bands, Type of semiconductors-Intrinsic and Extrinsic, hole formation and its movements, Type of Extrinsic semiconductors-P-type and N-type, Drift current in Intrinsic semiconductors.

Books of Study

a. Basic Electronics Solid State – B.L.Theraja, S.Chand & Co. Ltd.

b. Principles of Electronics – V.K.Mehta.

Semester 2

EL1231 - Electronics II (36 hours)

Unit I (Chapters 11, 15, 16, 17, 18, 19 of Book 1) – 21 hrs

Tuning circuits and filters (4 hrs), Opto-electronic devices (4 hrs), DC power supplies (5 hrs), The basic transistor (4 hrs), Transistor characteristics and approximations (4 hrs).

Unit II (Chapters 20, 21 of Book 1) – 15 hrs

Load line and DC bias circuits (5 hrs), Transistor equivalent circuits and models (10 hrs).

Books of Study

1Basic Electronics Solid State – B.L.Theraja, S.Chand & Co. Ltd. 2Principles of Electronics – V.K.Mehta.

EL 1331 - ELECTRONICS III

(Total 54 Hours)

1. Single Stage Transistor Amplifiers (10 Hrs)

Amplifier Classifications - Common Base (CB), Common Emitter (CE) and Common Collector (CC) Amplifier : Gains and Characteristics - Comparison of Amplifier Configurations - Classification of Amplifiers Based on Biasing Conditions - Class A Amplifier - Transformer Coupled Class A Amplifier - Class B Amplifier - Class B Push Pull Amplifier - Cross Over Distortion - Complimentary Symmetry Push Pull Class B Amplifier - Class C Amplifier - Distortion in Amplifiers - Noise

2. Multi Stage Amplifiers (9 Hrs)

Amplifier Coupling - RC Coupled Two Stage Amplifier - Impedance Coupled Two Stage Amplifier - Transformer Coupled Two Stage Amplifier - Direct Coupled Two Stage Amplifier Using Similar Transistors - Direct Coupled Two Stage Amplifier Using Complimentary Symmetry of Two Transistors - Darlington Pair - Differential Amplifier.

3. Decibels and Frequency Response (3 Hrs)

Decibel System - Frequency Response - Cut off Frequencies - Alpha and Beta Cut off Frequencies - Gain Bandwidth Product.

4. Feedback Amplifiers (4 Hrs)

Feedback Principle - Types of Feedback - Negative Feedback and its Properties - Forms of Negative Feedback.

5. Field Effect Transistors (7 Hrs)

FET - JFET : Structure, Theory of Operation and Characteristics - JFET Parameters - MOSFET - DE MOSFET and E only MOSFET : Working and Characteristics - FET Applications.

6. Breakdown Devices (6 Hrs)

Unijunction Transistor (UJT) - UJT Relaxation Oscillator - Silicon Controlled Rectifier (SCR) - Triac - Diac - Silicon Controlled Switch.

7. Sinusoidal Oscillators (8 Hrs)

Difference between Amplifier and Oscillator - Classification of Oscillators - Types of Sinusoidal Oscillations - Oscillatory Circuit and its Frequency - Essentials of Transistor LC Oscillator - Barkhausen Criterion for Oscillator - Tuned Base Oscillator - Tuned Collector Oscillator - Hartley Oscillator - Colpitt's Oscillator - Clapp Oscillator - Phase Shift Oscillator - Wien Bridge Oscillator - Crystal Controlled Oscillators.

8. Nonsinusoidal Oscillators (7 Hrs)

Nonsinusoidal Waveforms - Classification of Nonsinusoidal Oscillators - UJT Sawtooth Generator - Multivibrators - Astable Multivibrator - Monostable Multivibrator - Bistable Multivibrator - Schmitt Trigger - Transistor Blocking Oscillator.

Books of Study

1Basic Electronics Solid State – B.L.Theraja, S.Chand & Co. Ltd. 2Principles of Electronics – V.K.Mehta.

Semester 4
EL1431 - Electronics IV (54 hours)

Unit I (Chapters 31 to 35 of Book 1) – 32 hrs

Integrated circuits (8 hrs), Number systems (6 hrs), Logic gates (8 hrs), Boolean algebra (6 hrs), Logic families (4 hrs).

Unit II (Chapters 36, 37, 38 of Book 1) – 22 hrs

Transducers (8 hrs), Electronic instruments (6 hrs), Fibre optics (8 hrs).

Books of Study

1. Basic Electronics Solid State – B.L.Theraja, S.Chand & Co. Ltd.
2. Principles of Electronics – V.K.Mehta.

Semester 1 (Polymer chemistry Main)

PY1131.7–Mechanics and fluid dynamics (36 hours)

Unit I (18 hours)

Dynamics of rigid bodies (8 hours)

Theorems of M.I with proof -Calculation of M.I of bodies of regular shapes-

rectangular lamina, uniform bar of rectangular cross section, circular disc, annular ring

solid cylinder, solid sphere- spherical shell, K. E of a rotating body-

Oscillations and waves (10 hours)

Examples of S.H oscillator- oscillations of two particles connected by a spring, vibration state of a diatomic molecule- wave motion-general equation of wave motion-plane progressive harmonic wave - energy density of a plane progressive wave-intensity of wave and spherical waves, superposition principle-

Unit II (18 hours)

Mechanics of solids (8 hours)

Bending of beams-bending moment-cantilever-beam supported at its ends-and loaded in the middle-uniform bending-experimental determination of Y using the above principles with pin and microscope-twisting couple on a cylinder-angle of twist and angle of shear- Torsional rigidity (Qualitative study)

Surface Tension (5hours)

Excess of pressure on a curved surface- force between two plates separated by a thin layer of liquid-experiment with theory to find surface tension of a liquid by

Jaeger' method- temperature dependence of surface tension.

Viscosity (5 hours)

Equation of continuity, Bernoulli's theorems- venturimeter, - Flow of liquid through a pipe -derivation of Poiseuille's formula-limitations – variation of viscosity with temperature-Stokes formula-

Books for study:

1. Mechanics: J. C. Upadhyaya, Ram Prasad & Sons
2. Oscillations & Waves: K. RamaReddy, S. Badami & V.Balasubramaniam (University Press)

Semester 2 (Polymer chemistry Main)

PY1231.7 – Thermal Physics (36 hours)

Unit I – Behaviour of real gases (4 hours)

Joule Thomson effect- Theory and experiment, Phase transition- first order and second order-liquid helium-super fluidity.

Unit II – Transmission of Heat (14hours)

Thermal conductivity and thermometric conductivity-Lee's disc experiment

Weidmann and Franz law (statement only) -Radiation of heat-black body radiation - absorptive power-emissive power-Stefan's law (no derivation) -energy distribution in the spectrum of black body and results-Wien's displacement law -Rayleigh-Jeans law - their failure and Planck's hypothesis-Planck's law-comparison-solar constant, temperature of sun.

Unit III – Thermodynamics (10 hours)

Isothermal and adiabatic processes-work done-isothermal and adiabatic elasticity Heat engines-Carnot's cycle -derivation of efficiency-petrol and diesel engine cycles-efficiency in these two cases-second law of thermodynamics-Kelvin and Clausius statements.

Unit IV – Entropy (8 hours)

Concept of entropy-change of entropy in reversible and irreversible cycles-principle of increase of entropy-entropy and disorder-T-S diagram for Carnot's cycle-second law in terms of entropy-calculation of entropy when ice is converted into steam.

Books for Study:

1.The general Properties of matter: F.H.Newman & V.H.L.Searle
2.Heat & Thermodynamics: N.Subramaniam & Brijlal, S.Chand & Co
3.Heat & Thermodynamics: W.Zemansky, McGraw Hill
4.Heat & Thermodynamics: C.L.Arora.

Semester 3 (Polymer chemistry Main)

PY1331.7 – Modern Optics and Electricity (54 hours)

Unit I (18 hours)

Interference (8 hours)

Analytical treatment of interference-theory of interference fringes and bandwidth. Interference in thin films-reflected system-colour of thin films- Newton's rings-reflected system-measurement of wavelength and refractive index of liquid.

Diffraction (10 hours)

Phenomenon of diffraction- classification-Fresnel and Fraunhofer diffraction Fresnel's theory of approximate rectilinear propagation of light-Fresnel diffraction at a straight edge. Fraunhofer diffraction at a single slit, double slits. Plane transmission grating-determination of wavelength.

Unit II (18 hours)

Polarization (10hrs)

Experiments showing the transverse nature of light-plane polarized light-polarization by reflection-Brewster's law-double refraction-Nicol prism-propagation of light in uni-axial crystals-positive and negative crystals-principal refractive indices-half wave plate and quarter wave plate-elliptically and circularly polarized light-optical activity-Fresnel's theory and applications.

Laser and Fibre Optics (8 hours)

Principle of operation of laser-population inversion-optical pumping-ruby laser-applications of lasers -Light propagation in optical fibres-step index fibre-graded index fibre-single mode and multi-mode fibres (qualitative ideas only).

Unit III

Electricity (18 hrs)

EMF induced in a coil rotating in a magnetic field-peak, mean, rms and effective values of A.C. Ac circuits-AC through RC, LC, LR and LCR series circuits-resonance-sharpness of resonance-power factor and choke coil-transformers,

Electric motors principle of working Devices working with electric motors – electric fan wet grinder.

Books for Study:

1. A text book of optics – Brijlal & Subramaniam
2. Electricity and Magnetism – R.Murugeshan, S.Chand & Co Ltd.
3. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
4. Electrical Technology (Vol I & II), B.L.Theraja.

Semester 4 (Polymer Science Main)

PY1431.7 – Atomic Physics and Electronics (54 hours)

Unit I

Modern Physics (18 hours)

Basic features of Bohr atom model-Bohr's correspondence principle -vector atom model-various quantum numbers-magnetic moment of orbital electrons -electron spin-Spin-Orbit coupling-Pauli's exclusion principle-periodic table. Atomic nucleus-basic of nucleus -charge, mass, spin magnetic properties moment-binding energy and packing fraction-nuclear forces-salient features-Radioactivity radioactive decay-decay laws-decay constant-half life and mean life-radioactive equilibrium-secular and transient equilibrium-measurement of radioactivity-

Unit II Superconductivity
(8 hours)

Properties of superconductors-zero electrical resistance-Meissner effect-critical magnetic field-Type I and Type II superconductors-isotope effect-high temperature ceramic superconductors-applications of superconductors.

Unit III Quantum Mechanics (10 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum

theory-Planck's hypothesis-foundation of quantum mechanics-wave function and probability density-Schrödinger equation-time dependent and time independent-particle in a potential box.

Unit III (18 hours)

Electronics (18hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown
mechanism of p -n junction diode-Zener diode and its characteristics-half wave and full wave rectifiers-bridge rectifier-ripple factor, efficiency. Construction and operation of a bipolar junction transistor-transistor configurations-current components-transistor characteristics-DC load line-Q point-AC load line-transistor biasing-need for biasing-bias stabilization-biasing circuits-fixed bias, emitter feedback bias, voltage divider bias (qualitative study only).
Transistor amplifier-basic features of an amplifier-gain, input and output resistances-frequency response and band width-small signal CE amplifier-circuit and its operation

Books for Study:

1. Modern Physics – R.Murugeshan, S.Chand & Co. Ltd.
2. A text book of B.Sc subsidiary Physics – P.Vivekanandan.
3. Principles of Electronics – V.K.Mehta.

COMPLEMENTARY PRACTICAL (PHYSICS)

(Common for all complementary subjects)

PY1432-Practical

List of Experiments (Minimum 18 experiments to be done)

1. Torsion Pendulum- n by torsional oscillations
2. Torsion Pendulum- n and I using equal masses
3. Fly Wheel
4. Cantilever- Y by pin and microscope method
5. Uniform bending- Y by pin and microscope
6. Symmetric bar pendulum - g and radius of gyration
7. Surface tension- capillary rise method
8. Coefficient of viscosity- capillary flow method
9. Specific heat-method of mixtures applying Barton's correction

10. Lee's disc- Thermal conductivity of cardboard
11. Melde's string- frequency of tuning fork
12. Method of parallax- optical constants of convex lens using

i) mirror and mercury ii) mirror and water

13Method of parallax- refractive index of liquid.

14. Spectrometer- A, D and n

15. Spectrometer- dispersive power of a prism
16. Spectrometer- Grating-normal incidence
17. Deflection and vibration magnetometer- M and Bh
18. Circular coil- magnetization of a magnet
19. Carey Foster's bridge - Resistivity

20. Potentiometer- Resistivity
21. Potentiometer- Calibration of ammeter

22. Mirror galvanometer- Current and Voltage sensitivity
23. Diode Characteristics (for Ge and Si diodes)
24. Half wave rectifier-Measurement of ripple factor with and without filter capacitor
25. Full wave rectifier- Measurement of ripple factor with and without filter capacitor

COMPLEMENTARY ELECTRONICS PRACTICAL

EL1432-Practical

List of Experiments (Minimum 18 experiments to be done)

1. Semiconductor diode (IN 4001/ IN 4007) characteristics; To (i) trace and construct the circuit,
(ii) to draw the forward V-I characteristic curve and
(iii) to determine the static and dynamic resistances of the diode at a particular operating point.

2. Zener diode characteristics: To (i) trace and construct the circuit, (ii) to plot the V-I characteristic under reverse biased condition and (iii) to calculate the dynamic resistance of the diode under reverse bias when conducting.

3. LED and photo diode characteristics: To (i) study the variations in resistance with varying current and (ii) to study the output characteristics of a photo diode.

4. Thevenin and Norton equivalent circuits: To (i) determine Thevenin's and Norton's equivalent circuits of Wheatstone's bridge and (ii) to verify the power transfer theorem.

5. R-C resonant circuits: To (i) study the input-output characteristics of an R -C circuit as a function of frequency and (ii) to study the square wave response of R-C circuits.

6. Transistor characteristics; CE configuration: (i) Construct the circuit, (ii) To plot the input characteristics (IB-VBE graph for constant V CE) and to calculate the dynamic resistance at an operating point, (iii) To study the output characteristics (IC-VCE graph for constant I B) and to calculate the output ac resistance, dc gain and ac current gain at a given operating point.

7. Transistor characteristics; CB configuration: (i) Construct the circuit, (ii) Plot the input characteristics (IE-VEB graph for constant VCB) and to calculate the dynamic resistance at an operating point, (iii) To study the output characteristics (IC-VCB graph for constant I C) and to calculate the output dynamic resistance, dc current gain and ac current gain at a given operating point.

8. FET characteristics: (i) Trace the circuit (ii) To plot the static drain characteristics of FET (iii) To calculate the FET parameters (drain dynamic resistance, mutual conductance and amplification factor at a given operating point).

9. Fixed-bias circuit with and without emitter resistor: (i) Trace the circuit (ii) To measure the Q-Point (IC and VCE) with and without emitter resistor RE. (iii) To note the variation of Q -point by increasing the temperature of the transistor in fixed bias circuit with and without emitter resistor (iv) To note the variation of Q-point by changing the base resistor in bias circuit with and without emitter resistor

10. Collector-to-base feedback bias circuit: (i) Trace the circuit (ii) To measure the Q-Point (IC and VCE) (iii) To note the variation of Q-point by increasing the temperature of the transistor

11. Potential -divider biasing circuit: (i) Trace the circuit (ii) To measure the Q-Point (IC and VCE) (iii) To note the variation of Q-point by increasing the temperature of the transistor (iv) To measure the operating point when one of the bias resistor changes

12. Half-wave rectifier: (i) To draw the input and output wave shapes (ii) To verify Vdc = Vm/p and ripple factor = 1.21 (Observe for different load resistances)

13. Full-wave rectifier – Centre tapped: (i) To draw the input and output wave shapes (ii) To verify Vdc = 2Vm/p and ripple factor = 0.482 (Observe for different load resistances)

14. Bridge rectifier: (i) To draw the input and output wave shapes (ii) To verify Vdc = 2Vm/p and ripple factor = 0.482 (Observe for different load resistances)

15. Filter circuits (shunt capacitor, LC and CLC filters): (i) To plot the output wave shapes with and without shunt capacitor (ii) To find the ripple factor with and without different filters

16. Single stage RC coupled amplifier: (i) To measure the Q-point (IC and VCE) (ii) To measure the maximum signal that can be amplified by the amplifier without clipping (iii) To measure the voltage gain at 1 KHz (iv) To plot the frequency response (v) To find the voltage gain for different values of load resistance

17. FET amplifier: (i) To measure the frequency response (ii) To measure voltage gain, BW and gain-BW product

18. Hartley oscillator: (i) Trace the circuit (ii) To measure the Q-point of the transistor (iii) To observe the output wave form and to measure the frequency of oscillations

19. Phase shift oscillator: (i) Trace the circuit (ii) To measure the frequency from the output wave form (iii) To observe the phase shift at different points

20. Clipping circuits: (i) To observe the output wave form corresponding to different clipping circuits

21. Clamping circuits: (i) To observe the output wave form corresponding to different clamping circuits

22. OP amp. - Inverting amplifier using IC 741 (i) Trace the circuit (ii) To construct an inverting amplifier using IC 741 and determine its voltage gain for different input voltage

23. OP amp. - Non inverting amplifier using IC 741 (i) Trace the circuit (ii) To construct a Non inverting amplifier using IC 741 and determine its voltage gain for different input voltage

24. OP amp. - Unity gain buffer using IC 741 (i) Trace the circuit and (ii) To construct a unity gain buffer using IC 741 and to find the voltage gain.