# THAMIRABHARANI ENGINEERING COLLEGE
**(AN AUTONOMOUS INSTITUTION)**

## REGULATIONS 2024
### B. E. ELECTRONICS AND COMMUNICATION ENGINEERING
### CHOICE BASED CREDIT SYSTEM
### CURRICULUM AND SYLLABI FOR SEMESTERS I TO VIII

### SEMESTER I

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | 24IP0101 | Induction Programme | - | - | - | - | - | 0 |
| **THEORY** | | | | | | | | |
| 2 | 24HS0101 | Professional English I | HSMC | 3 | 0 | 0 | 3 | 3 |
| 3 | 24MA0101 | Matrices and Calculus | BSC | 3 | 1 | 0 | 4 | 4 |
| 4 | 24PH0101 | Engineering Physics I | BSC | 3 | 0 | 0 | 3 | 3 |
| 5 | 24CY0101 | Engineering Chemistry | BSC | 3 | 0 | 0 | 3 | 3 |
| 6 | 24GE0101 | Problem Solving and Python Programming | ESC | 3 | 0 | 0 | 3 | 3 |
| 7 | 24GE0102 | தமிழர் மரபு / Heritage of Tamils | HSMC | 1 | 0 | 0 | 1 | 1 |
| **PRACTICALS** | | | | | | | | |
| 8 | 24GE0103 | Problem Solving and Python Programming Laboratory | ESC | 0 | 0 | 4 | 4 | 2 |
| 9 | 24BS0101 | Physics and Chemistry Laboratory | BSC | 0 | 0 | 4 | 4 | 2 |
| 10 | 24HS0102 | English Laboratory I | EEC | 0 | 0 | 2 | 2 | 1 |
| | | **TOTAL** | | **16** | **1** | **10** | **27** | **22** |

## SEMESTER II

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY** | | | | | | | | |
| 1 | 24HS0203 | Professional English II | HSMC | 2 | 0 | 0 | 2 | 2 |
| 2 | 24MA0202 | Ordinary Differential Equations and Transform Techniques | BSC | 3 | 1 | 0 | 4 | 4 |
| 3 | 24PH0202 | Engineering Physics II | BSC | 3 | 0 | 0 | 3 | 3 |
| 4 | 24GE0204 | Environmental Science and Engineering | BSC | 2 | 0 | 0 | 2 | 2 |
| 5 | 24GE0205 | Engineering Graphics | ESC | 2 | 0 | 4 | 6 | 4 |
| 6 | 24GE0206 | Basic Electrical and Electronics Engineering | ESC | 3 | 0 | 0 | 3 | 3 |
| 7 | 24GE0207 | தமிழரும் ததொழில் நுட்பமும்/ Tamils and Technology | HSMC | 1 | 0 | 0 | 1 | 1 |
| **PRACTICALS** | | | | | | | | |
| 8 | 24GE0208 | Basic Electrical and Electronics Engineering Laboratory | ESC | 0 | 0 | 4 | 4 | 2 |
| 9 | 24GE0209 | Engineering Practices Laboratory | ESC | 0 | 0 | 4 | 4 | 2 |
| 10 | 24HS0204 | English Laboratory II | EEC | 0 | 0 | 2 | 2 | 1 |
| **TOTAL** | | | | **16** | **1** | **14** | **31** | **24** |

## SEMESTER III

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY** | | | | | | | | |
| 1 | 24MA0304 | Random Processes and Linear Algebra | BSC | 3 | 1 | 0 | 4 | **4** |
| 2 | 24CS5307 | C and Data Structures | PCC | 3 | 0 | 0 | 3 | **3** |
| 3 | 24EC4301 | Signals and Systems | PCC | 3 | 0 | 2 | 5 | **4** |
| 4 | 24EC4302 | Electronic Devices and Circuits | PCC | 3 | 0 | 0 | 3 | **3** |
| 5 | 24EC4303 | Circuit Analysis | PCC | 3 | 0 | 0 | 3 | **3** |
| 6 | 24EC4304 | Digital Systems Design | PCC | 3 | 0 | 2 | 5 | **4** |
| 7 | 24MX43XX | Mandatory Course I | MC | 3 | 0 | 0 | 3 | **0** |
| **PRACTICALS** | | | | | | | | |
| 8 | 24EC4305 | Electronic Devices and Circuits Laboratory | PCC | 0 | 0 | 3 | 3 | **1.5** |
| 9 | 24CS5308 | C and Data Structures Laboratory | PCC | 0 | 0 | 3 | 3 | **1.5** |
| | | | **TOTAL** | **21** | **1** | **10** | **32** | **24** |

## SEMESTER IV

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY** | | | | | | | | |
| 1 | 24EC4401 | Electromagnetic Fields | PCC | 3 | 0 | 0 | 3 | **3** |
| 2 | 24EC4402 | Networks and Security | PCC | 3 | 0 | 2 | 5 | **4** |
| 3 | 24EC4403 | Linear Integrated Circuits | PCC | 3 | 0 | 0 | 3 | **3** |
| 4 | 24EC4404 | Digital Signal Processing | PCC | 3 | 0 | 2 | 5 | **4** |
| 5 | 24EC4405 | Communication Engineering | PCC | 3 | 0 | 0 | 3 | **3** |
| 6 | 24EC4406 | Control Systems | PCC | 3 | 0 | 0 | 3 | **3** |
| 7 | 24MX44XX | Mandatory Course II | MC | 3 | 0 | 0 | 3 | **0** |
| **PRACTICALS** | | | | | | | | |
| 8 | 24EC4407 | Communication Engineering Laboratory | PCC | 0 | 0 | 3 | 3 | **1.5** |
| 9 | 24EC4408 | Linear Integrated Circuits Laboratory | PCC | 0 | 0 | 3 | 3 | **1.5** |
| 10 | 24GE0411 | Soft Skills I | EEC | 0 | 0 | 4 | 4 | **2** |
| | | | **TOTAL** | **21** | **0** | **14** | **35** | **25** |

## SEMESTER V

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY** | | | | | | | | |
| 1 | 24EC4501 | Wireless Communication | PCC | 3 | 0 | 2 | 5 | **4** |
| 2 | 24EC4502 | VLSI Design | PCC | 3 | 0 | 0 | 3 | **3** |
| 3 | 24EC4503 | Transmission Lines and Waveguides | PCC | 3 | 0 | 0 | 3 | **3** |
| 4 | 24EC4504 | Microprocessor and Microcontroller | PCC | 3 | 0 | 0 | 3 | **3** |
| 5 | 24EC45XX | Professional Elective I | PEC | - | - | - | - | **3** |
| 6 | 24HS0505 | English for Competitive Examinations | HSMC | 3 | 0 | 0 | 3 | **3** |
| **PRACTICALS** | | | | | | | | |
| 7 | 24EC4505 | VLSI Laboratory | PCC | 0 | 0 | 4 | 4 | **2** |
| **TOTAL** | | | | **-** | **-** | **-** | **-** | **21** |

## SEMESTER VI

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY** | | | | | | | | |
| 1 | 24EC4601 | Embedded Systems and IoT Design | PCC | 3 | 0 | 2 | 5 | 4 |
| 2 | 24EC4602 | Artificial Intelligence and Machine Learning | ESC | 3 | 0 | 2 | 5 | 4 |
| 3 | 24MGC601 | Principles of Management | HSMC | 3 | 0 | 0 | 3 | 3 |
| 4 | 24EC46XX | Professional Elective II | PEC | - | - | - | - | 3 |
| 5 | 24EC46XX | Professional Elective III | PEC | - | - | - | - | 3 |
| 6 | 24OXX6XX | Open Elective I | OEC | 3 | 0 | 0 | 3 | 3 |
| **PRACTICALS** | | | | | | | | |
| 7 | 24EC4603 | Model Development | EEC | 0 | 0 | 0 | 0 | **2** |
| 8 | 24GE0613 | Soft Skills II | EEC | 0 | 0 | 4 | 4 | **2** |
| | | | **TOTAL** | - | - | - | - | **24** |

## SEMESTER VII

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **THEORY** | | | | | | | | |
| 1 | 24EC4701 | Optical Communication and Networks | PCC | 3 | 0 | 0 | 3 | **3** |
| 2 | 24GE0714 | Professional Ethics | HSMC | 3 | 0 | 0 | 3 | **3** |
| 3 | 24EC47XX | Professional Elective IV | PEC | - | - | - | - | **3** |
| 4 | 24OXX7XX | Open Elective II | OEC | 3 | 0 | 0 | 3 | **3** |
| 5 | 24OXX7XX | Open Elective III | OEC | 3 | 0 | 0 | 3 | **3** |
| **PRACTICALS** | | | | | | | | |
| 6 | 24EC4703 | Internship | EEC | 0 | 0 | 0 | 0 | **2** |
| **TOTAL** | | | | - | - | - | - | **17** |

## SEMESTER VIII

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| **PRACTICAL** | | | | | | | | |
| 1 | 24EC4801 | Project Work | EEC | 0 | 0 | 20 | 20 | **10** |

**TOTAL CREDITS: 167**

## PROFESSIONAL ELECTIVE I

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | 24EC4506 | Low Power IC Design | PEC | 2 | 0 | 2 | 4 | 3 |
| 2 | 24EC4507 | Software Defined Radio | PEC | 2 | 0 | 2 | 4 | 3 |
| 3 | 24EC4508 | Analog IC Design | PEC | 2 | 0 | 2 | 4 | 3 |
| 4 | 24EC4509 | Satellite Communication | PEC | 3 | 0 | 0 | 3 | 3 |
| 5 | 24EC4510 | Therapeutic Equipment | PEC | 3 | 0 | 0 | 3 | 3 |

## PROFESSIONAL ELECTIVE II

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | 24EC4604 | Wireless Sensor Network Design | PEC | 3 | 0 | 0 | 3 | 3 |
| 2 | 24EC4605 | Fundamentals of Nanoelectronics | PEC | 3 | 0 | 0 | 3 | 3 |
| 3 | 24EC4606 | 4G/5G Communication Networks | PEC | 2 | 0 | 2 | 4 | 3 |
| 4 | 24EC4607 | Massive MIMO Networks | PEC | 2 | 0 | 2 | 4 | 3 |
| 5 | 24EC4608 | Medical Imaging Systems | PEC | 3 | 0 | 0 | 3 | 3 |

## PROFESSIONAL ELECTIVE III

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | 24EC4609 | Wearable Devices | PEC | 3 | 0 | 0 | 3 | 3 |
| 2 | 24EC4610 | Brain Computer Interface and Applications | PEC | 3 | 0 | 0 | 3 | 3 |
| 3 | 24EC4611 | Body Area Networks | PEC | 3 | 0 | 0 | 3 | 3 |
| 4 | 24EC4612 | IoT Based Systems Design | PEC | 3 | 0 | 0 | 3 | 3 |
| 5 | 24EC4613 | Positioning and Navigation Systems | PEC | 3 | 0 | 0 | 3 | 3 |

## PROFESSIONAL ELECTIVE IV

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | 24EC4704 | RF and Microwave Engineering | PEC | 3 | 0 | 0 | 3 | 3 |
| 2 | 24EC4705 | Radar Signal Processing | PEC | 3 | 0 | 0 | 3 | 3 |
| 3 | 24EC4706 | Embedded C Programming | PEC | 3 | 0 | 0 | 3 | 3 |
| 4 | 24EC4707 | RF Transceivers | PEC | 3 | 0 | 0 | 3 | 3 |
| 5 | 24EC4708 | Wireless Broadband Networks | PEC | 3 | 0 | 0 | 3 | 3 |

## MANDATORY COURSES I

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | 24MX4301 | Yoga & Value for Holistic Development | MC | 3 | 0 | 0 | 3 | 0 |
| 2 | 24MX4302 | Disaster Risk Reduction & Management | MC | 3 | 0 | 0 | 3 | 0 |

## MANDATORY COURSES II

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | 24MX4401 | Universal Human Values | MC | 3 | 0 | 0 | 3 | 0 |
| 2 | 24MX4402 | Industrial Safety | MC | 3 | 0 | 0 | 3 | 0 |

## OPEN ELECTIVE I

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | 24OCS601 | Software Engineering Fundamentals | OEC | 3 | 0 | 0 | 3 | 3 |
| 2 | 24OCS602 | C Programming | OEC | 3 | 0 | 0 | 3 | 3 |
| 3 | 24OAD601 | Foundations of Artificial Intelligence | OEC | 3 | 0 | 0 | 3 | 3 |
| 4 | 24OAD602 | Programming for Data Science | OEC | 3 | 0 | 0 | 3 | 3 |
| 5 | 24OEE602 | Batteries and Management System | OEC | 3 | 0 | 0 | 3 | 3 |
| 6 | 24OEE603 | Sensors and Actuators | OEC | 3 | 0 | 0 | 3 | 3 |

## OPEN ELECTIVE II

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | 24OCS701 | IoT Concepts and Applications | OEC | 3 | 0 | 0 | 3 | 3 |
| 2 | 24OCS702 | Introduction to Cloud Computing | OEC | 3 | 0 | 0 | 3 | 3 |
| 3 | 24OAD701 | Machine Learning using Python | OEC | 3 | 0 | 0 | 3 | 3 |
| 4 | 24OAD702 | Deep Learning and Neural Networks | OEC | 3 | 0 | 0 | 3 | 3 |
| 5 | 24OEE701 | Electric and Hybrid Vehicles | OEC | 3 | 0 | 0 | 3 | 3 |

## OPEN ELECTIVE III

| S. NO. | COURSE CODE | COURSE TITLE | CATE-GORY | PERIODS PER WEEK | | | TOTAL CONTACT PERIODS | CREDITS |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | |
| 1 | 24OCS703 | Data Structures and Algorithm | OEC | 3 | 0 | 0 | 3 | 3 |
| 2 | 24OAD703 | Large Language Models | OEC | 3 | 0 | 0 | 3 | 3 |
| 3 | 24OEE702 | Energy Conservation and Management | OEC | 3 | 0 | 0 | 3 | 3 |

## SUMMARY

| B.E. Electronics and Communication Engineering | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S. No. | Subject Area | Credits per Semester | | | | | | | | % of Subject Area | Total Credits |
| | | I | II | III | IV | V | VI | VII | VIII | | |
| 1 | HSMC | 4 | 3 | | | 3 | 3 | 3 | | **10** | **16** |
| 2 | BSC | 12 | 9 | 4 | | | | | | **15** | **25** |
| 3 | ESC | 5 | 11 | | | | 4 | | | **12** | **20** |
| 4 | PCC | | | 20 | 23 | 15 | 4 | 3 | | **39** | **65** |
| 5 | PEC | | | | | 3 | 6 | 3 | | **7** | **12** |
| 6 | OEC | | | | | | 3 | 6 | | **5** | **9** |
| 7 | EEC | 1 | 1 | | 2 | | 4 | 2 | 10 | **12** | **20** |
| 8 | Non-Credit/ Mandatory | | | | | √ | √ | | | **0** | **0** |
| **Total** | | **22** | **24** | **24** | **25** | **21** | **24** | **17** | **10** | **100** | **167** |

## Legends

| | |
|---|---|
| HSMC | Humanities, Social Sciences and Management Courses |
| BSC | Basic Sciences Courses |
| ESC | Engineering Sciences Courses |
| PCC | Professional Core Courses |
| PEC | Professional Elective Courses |
| OEC | Open Elective Courses |
| EEC | Employability Enhancement Courses |

## SEMESTER I

| 24IP0101 | INDUCTION PROGRAMME | L | T | P | C |
|---|---|---|---|---|---|
| | | - | - | - | 0 |

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed. One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character."

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

**(i) Physical Activity**

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

**(ii) Creative Arts**

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

**(iii) Universal Human Values**

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's,

but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

**(iv) Literary Activity**

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

**(v) Proficiency Modules**

This would address some lacunas that students might have, for example, English, computer familiarity etc.

**(vi) Lectures by Eminent People**

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

**(vii) Visits to Local Area**

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

**(viii) Familiarization to Dept./Branch & Innovations**

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

**(ix) Department Specific Activities**

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

**REFERENCES:**

Guide to Induction program from AICTE

| 24HS0101 | PROFESSIONAL ENGLISH I | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To improve the communicative competence of learners.
- To learn to use basic grammatic structures in suitable contexts.
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text.
- To help learners use language effectively in professional contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

| UNIT I | INTRODUCTION TO EFFECTIVE COMMUNICATION | 9 |
|---|---|---|

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

**INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION**

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One-word substitution; Abbreviations & Acronyms (as used in technical contexts).

| UNIT II | NARRATION AND SUMMATION | 9 |
|---|---|---|

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

| UNIT III | DESCRIPTION OF A PROCESS / PRODUCT | 9 |
|---|---|---|

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

| UNIT IV | CLASSIFICATION AND RECOMMENDATIONS | 9 |
|---|---|---|

Reading – Newspaper articles; Journal reports and Non Verbal Communication (tables, pie charts) - Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing

recommendations; Transferring information from non-verbal (chart, graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

| UNIT V | EXPRESSION | 9 |
|---|---|---|

Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Use appropriate words in a professional context.

CO2: Gain understanding of basic grammatical structures and use them in right context.

CO3: Read and infer the denotative and connotative meanings of technical texts.

CO4: Read and interpret information presented in tables, charts and other graphic forms.

CO5: Write definitions, descriptions, narrations and essays on various topics.

**TEXT BOOKS:**


1. "English for Engineers & Technologists", Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition).
2. Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, "English for Science & Technology", Cambridge University Press, Authored by, Department of English, Anna University, 2021.


**REFERENCE BOOKS:**


1. Meenakshi Raman and Sangeeta Sharma, "Technical Communication – Principles and Practices", Oxford Univ. Press, 2016, New Delhi.
2. Lakshminarayanan, "A Course Book on Technical English", Scitech Publications (India) Pvt. Ltd.
3. Aysha Viswamohan, "English for Technical Communication" (With CD), Mcgraw Hill Education, ISBN: 0070264244.
4. Kulbhusan Kumar and RS Salaria, "Effective Communication Skill", Khanna Publishing House.
5. Dr. V. Chellammal, "Learning to Communicate", Allied Publishing House, New Delhi, 2003.


**ASSESSMENT PATTERN**

Two internal assessments and an end semester examination to test students' reading and writing skills along with their grammatical and lexical competence.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **1** | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 1 | 3 | - | 3 | - | - | - |
| **2** | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 1 | 3 | - | 3 | - | - | - |
| **3** | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | - | - | - |
| **4** | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | - | - | - |
| **5** | 2 | 3 | 3 | 3 | - | 3 | 3 | 3 | 2 | 3 | - | 3 | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24MA0101 | MATRICES AND CALCULUS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**OBJECTIVES:**

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

| UNIT I | MATRICES | 9+3 |
|---|---|---|

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane.

| UNIT II | DIFFERENTIAL CALCULUS | 9+3 |
|---|---|---|

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications: Maxima and Minima of functions of one variable.

| UNIT III | FUNCTIONS OF SEVERAL VARIABLES | 9+3 |
|---|---|---|

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers

| UNIT IV | INTEGRAL CALCULUS | 9+3 |
|---|---|---|

Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.

| UNIT V | MULTIPLE INTEGRALS | 9+3 |
|---|---|---|

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications: Moments and centres of mass, moment of inertia.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Use the matrix algebra methods for solving practical problems.

CO2: Apply differential calculus tools in solving various application problems.

CO3: Able to use differential calculus ideas on several variable functions.

CO4: Apply different methods of integration in solving practical problems.

CO5: Apply multiple integral ideas in solving areas, volumes and other practical problems.

**TEXT BOOKS:**


1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].


**REFERENCE BOOKS:**


1. Anton. H, Bivens. I and Davis. S, "Calculus", Wiley, 10th Edition, 2016.
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K. "Calculus", Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Srimantha Pal and Bhunia. S.C, "Engineering Mathematics", Oxford University Press, 2015.
7. Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | 1 | 1 | - | - | - | - | 2 | - | 2 | 3 | - | - | - |
| 2 | 3 | 3 | 1 | 1 | - | - | - | - | 2 | - | 2 | 3 | - | - | - |
| 3 | 3 | 3 | 1 | 1 | - | - | - | - | 2 | - | 2 | 3 | - | - | - |
| 4 | 3 | 3 | 1 | 1 | - | - | - | - | 2 | - | 2 | 3 | - | - | - |
| 5 | 3 | 3 | 1 | 1 | - | - | - | - | 2 | - | 2 | 3 | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24PH0101 | ENGINEERING PHYSICS I | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- To equip the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

| UNIT I | MECHANICS | 9 |
|---|---|---|

Multiparticle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum – double pendulum –Introduction to nonlinear oscillations.

| UNIT II | ELECTROMAGNETIC WAVES | 9 |
|---|---|---|

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

| UNIT III | OSCILLATIONS, OPTICS AND LASERS | 9 |
|---|---|---|

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection – interference – Michelson interferometer – Theory of air wedge and experiment. Theory of laser – characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry.

| UNIT IV | BASIC QUANTUM MECHANICS | 9 |
|---|---|---|

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

| UNIT V | APPLIED QUANTUM MECHANICS | 9 |
|---|---|---|

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Understand the importance of mechanics.

CO2: Express their knowledge in electromagnetic waves.

CO3: Demonstrate a strong foundational knowledge in oscillations, optics and lasers.

CO4: Understand the importance of quantum physics.

CO5: Comprehend and apply quantum mechanical principles towards the formation of energy bands.

**TEXT BOOKS:**


1. D.Kleppner and R.Kolenkow. "An Introduction to Mechanics", McGraw Hill Education (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, "Electricity and Magnetism", Cambridge Univ.Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, "Concepts of Modern Physics", McGraw- Hill (Indian Edition), 2017.


**REFERENCE BOOKS:**


1. R. Wolfson. "Essential University Physics", Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2. Paul A. Tipler, "Physics" – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K. Thyagarajan and A. Ghatak. "Lasers: Fundamentals and Applications", Laxmi Publications, (Indian Edition), 2019.
4. D. Halliday, R. Resnick and J. Walker. "Principles of Physics", Wiley (Indian Edition), 2015.
5. N. Garcia, A. Damask and S. Schwarz. "Physics for Computer Science Students", Springer-Verlag, 2012.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - |
| 2 | 3 | 3 | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - |
| 3 | 3 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | - | 1 | - | - | - |
| 4 | 3 | 3 | 1 | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - |
| 5 | 3 | 3 | 1 | 1 | 2 | 1 | - | - | - | - | - | - | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24CY0101 | ENGINEERING CHEMISTRY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

| UNIT I | WATER AND ITS TREATMENT | 9 |
|---|---|---|

Water: Sources and impurities, Water quality parameters: Definition and significance of-colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, flouride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralization and zeolite process.

| UNIT II | NANOCHEMISTRY | 9 |
|---|---|---|

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, Nano rod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

| UNIT III | PHASE RULE AND COMPOSITES | 9 |
|---|---|---|

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

| UNIT IV | FUELS AND COMBUSTION | 9 |
|---|---|---|

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil

- cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. $CO_2$ emission and carbon foot print.

| UNIT V | ENERGY SOURCES AND STORAGE DEVICES | 9 |
|---|---|---|

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles-working principles; Fuel cells: $H_2$-$O_2$ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.

CO2: Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO3: Apply the knowledge of phase rule and composites for material selection requirements.

CO4: Understand the importance of quantum physics. Recommend suitable fuels for engineering processes and applications.

CO5: Recognize different forms of energy resources and apply them for suitable applications in energy sectors.

**TEXT BOOKS:**


1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.


**REFERENCE BOOKS:**


1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **1** | 3 | 2 | 2 | 1 | - | 1 | 1 | - | - | - | - | 1 | - | - | - |
| **2** | 2 | - | - | 1 | - | 2 | 2 | - | - | - | - | - | - | - | - |
| **3** | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **4** | 3 | 1 | 1 | - | - | 1 | 2 | - | - | - | - | - | - | - | - |
| **5** | 3 | 1 | 2 | 1 | - | 2 | 2 | - | - | - | - | 2 | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24GE0101 | PROBLEM SOLVING AND PYTHON PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

| UNIT I | COMPUTATIONAL THINKING AND PROBLEM SOLVING | 9 |
|---|---|---|

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

| UNIT II | DATA TYPES, EXPRESSIONS, STATEMENTS | 9 |
|---|---|---|

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

| UNIT III | CONTROL FLOW, FUNCTIONS, STRINGS | 9 |
|---|---|---|

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

| UNIT IV | LISTS, TUPLES, DICTIONARIES | 9 |
|---|---|---|

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

| UNIT V | FILES, MODULES, PACKAGES | 9 |
|---|---|---|

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Develop algorithmic solutions to simple computational problems.

CO2: Write simple Python programs using conditionals and looping for solving problems.

CO3: Decompose a Python program into functions.

CO4: Represent compound data using Python lists, tuples, dictionaries etc.

CO5: Read and write data from/to files in Python programs.

**TEXT BOOKS:**


1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginners Guide to Problem Solving and programming", 1st Edition, BCS Learning & Development Limited, 2017.


**REFERENCE BOOKS:**


1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press 2021.
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | 2 | 3 | 3 | - |
| 2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | - | 3 | - | - |
| 3 | 2 | 2 | - | 2 | 2 | - | - | - | - | - | 1 | - | 3 | - | - |
| 4 | 1 | 2 | - | - | 1 | - | - | - | - | - | 1 | - | 2 | - | - |
| 5 | 2 | 2 | - | - | 2 | - | - | - | - | - | 1 | - | 2 | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24GE0102 | தமிழர் மரபு | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |
| அலகு 1 | மொழி மற்றும் இலக்கியம் | | | 3 | |
| இந்திய மொழிக் குடும்பங்கள் திராவிட மொழிகள் தமிழ் ஒரு செம்மொழி தமிழ் செவ்விவக்கியங்கள் சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை -சங்க இலக்கியத்தில் பகிர்தல் அறம் திருக்குறளில் மேலாண்மைக் கருத்துக்கள் தமிழ்க் காப்பியங்கள். தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் சிற்றிலக்கியங்கள் தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு | | | | | |
| அலகு 2 | மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை | | | 3 | |
| நடுகல் முதல் நவீன சிற்பங்கள் வரை ஐம்பொன் சிலைகள் பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் தேர் செய்யும் கலை சுடுமண் சிற்பங்கள் நாட்டுப்புறத் தெய்வங்கள் குமரிமுனையில் திருவள்ளுவர் சிலை இசைக் கருவிகள் வினை, யாழ், நாதஸ்வரம், மிருதங்கம், பறை, தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு | | | | | |
| அலகு 3 | நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் | | | 3 | |
| தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம். தமிழர்களின் விளையாட்டுகள். | | | | | |
| அலகு 4 | தமிழர்களின் திணைக் கோட்பாடுகள் | | | 3 | |
| தமிழகத்தின் தாவரங்களும், விலங்குகளும் தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் தமிழர்கள் போற்றிய அறக்கோட்பாடு சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும். கல்வியும் சங்ககால நகரங்களும் துறை முகங்களும் சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி. | | | | | |
| அலகு 5 | இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு | | | 3 | |
| இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு கல்வெட்டுகள், கையெழுத்துப்படிகள் தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு. | | | | | |
| | | | | TOTAL: 15 PERIODS | |

**TEXT CUM REFERENCE BOOKS:**


1. தமிழக வரலாறு மக்களும் பண்பாடும். கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் முனைவர் இல சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி-வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு.
4. பொருறை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

| 24GE0102 | HERITAGE OF TAMILS | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

| UNIT I | LANGUAGE AND LITERATURE | 3 |
|---|---|---|

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

| UNIT II | HERITAGE- ROCK ART PAINTINGS TO MODERN ART– SCULPTURE | 3 |
|---|---|---|

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

| UNIT III | FOLK AND MARTIAL ARTS | 3 |
|---|---|---|

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

| UNIT IV | THINAI CONCEPT OF TAMILS | 3 |
|---|---|---|

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

| UNIT V | CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE | 3 |
|---|---|---|

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

**TOTAL: 15 PERIODS**

**TEXT CUM REFERENCE BOOKS:**


1. தமிழக வரலாறு மக்களும் பண்பாடும். கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் முனைவர் இல சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி-வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு.
4. பொருறை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

| 24GE0103 | PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

- To understand the problem-solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

**LIST OF EXPERIMENTS:**

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions. (exchange the values of two variables, circulate the values of n variables, distance between two points)
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries. (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Develop algorithmic solutions to simple computational problems.

CO2: Implement programs in Python using conditionals and loops for solving problems.

CO3: Deploy functions to decompose a Python program.

CO4: Process compound data using Python data structures.

CO5: Utilize Python packages in developing software applications.

**TEXT BOOKS:**


1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.


**REFERENCE BOOKS:**


1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data‘‘, Third Edition, MIT Press, 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | 3 | 2 | 3 | 3 | - |
| 2 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | - | 3 | - | - |
| 3 | 3 | 2 | - | 2 | 2 | - | - | - | - | - | 1 | - | 3 | - | - |
| 4 | 1 | 2 | - | - | 1 | - | - | - | - | - | 1 | - | 2 | - | - |
| 5 | 2 | - | - | - | 2 | - | - | - | - | - | 1 | - | 2 | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24BS0101 | PHYSICS AND CHEMISTRY LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |
| PHYSICS LABORATORY | | L | T | P | C |
| (Any Seven Experiments) | | 0 | 0 | 2 | 1 |

**OBJECTIVES:**

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

**LIST OF EXPERIMENTS:**

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus.
4. Uniform bending – Determination of Young's modulus.
5. Laser- Determination of the wave length of the laser using grating.
6. Air wedge - Determination of thickness of a thin sheet/wire.
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle.
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids.
10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect.
12. Michelson Interferometer.
13. Melde's string experiment.
14. Experiment with lattice dynamics kit.

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Understand the functioning of various physics laboratory equipment.

CO2: Use graphical models to analyze laboratory data.

CO3: Use mathematical models as a medium for quantitative reasoning and describing physical reality.

CO4: Access, process and analyze scientific information.

CO5: Solve problems individually and collaboratively.

**Rubrics:**

**(i) CIA**

| Description | Marks |
|---|---|
| Pre Lab Test | 10 |
| Observation | 30 |
| Post Lab Test | 10 |
| Record | 25 |
| Model exam | 25 |
| **Total** | **100** |
| **CIA = 6(x) / 10** | |

*x- Student CIA total marks

**(ii) ESE**

| Description | Marks |
|---|---|
| Aim/Apparatus required | 10 |
| Formula | 10 |
| Figure/Circuit diagram/Model graph | 10 |
| Tabulations/Observation | 30 |
| Calculations | 20 |
| Result | 10 |
| Viva voce | 10 |
| **Total** | **100** |
| **ESE = 4(x) / 10** | |

*x- Student ESE total marks

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **1** | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| **2** | 3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| **3** | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| **4** | 3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| **5** | 3 | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| CHEMISTRY LABORATORY | L | T | P | C |
|---|---|---|---|---|
| **(Any Seven Experiments)** | **0** | **0** | **2** | **1** |

**OBJECTIVES:**

- To inculcate experimental skills to test basic understanding of water quality parameters such as acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nano particles.

**LIST OF EXPERIMENTS:**

1. Preparation of $Na_2CO_3$ as a primary standard and estimation of acidity of a water sample using the primary standard.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by Argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of sodium /potassium present in water using flame photometer.
10. Preparation of nanoparticles ($TiO_2$/ZnO/CuO) by Sol-Gel method.
11. Corrosion experiments – weight loss method.
12. Proximate analysis of Coal.

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Analyze the quality of water samples with respect to their acidity, hardness and DO.

CO2: Determine the amount of metal ions through volumetric and spectroscopic techniques.

CO3: Analyze and determine the composition of coal and demonstrate the corrosion.

CO4: Learn simple method of synthesis nanoparticles.

CO5: Quantitatively analysis the impurities in solution by Electro analytical techniques.

**Rubrics:**

**(i) CIA**

| Description | Marks |
|---|---|
| Pre Lab Test | 10 |
| Observation | 30 |
| Post Lab Test | 10 |
| Record | 25 |
| Model exam | 25 |
| **Total** | **100** |
| **CIA = 6(x) / 10** | |

*x- Student CIA total marks

**(ii) ESE**

| Description | Marks |
|---|---|
| Aim/Apparatus required | 10 |
| Formula | 10 |
| Figure/Circuit diagram/Model graph | 10 |
| Tabulations/Observation | 30 |
| Calculations | 20 |
| Result | 10 |
| Viva voce | 10 |
| **Total** | **100** |
| **ESE = 4(x) / 10** | |

*x- Student ESE total marks

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| **1** | 3 | - | 1 | - | - | 2 | 2 | - | - | - | - | 2 | - | - | - |
| **2** | 3 | 1 | 2 | - | - | 1 | 2 | - | - | - | - | 1 | - | - | - |
| **3** | 3 | 2 | 1 | 1 | - | - | 1 | - | - | - | - | - | - | - | - |
| **4** | 2 | 1 | 2 | - | - | 2 | 2 | - | - | - | - | - | - | - | - |
| **5** | 2 | 1 | 2 | - | 1 | 2 | 2 | - | - | - | - | 1 | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24HS0102 | ENGLISH LABORATORY I | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**OBJECTIVES:**

- To improve the communicative competence of learners.
- To help learners use language effectively in academic /work contexts.
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

| UNIT I | INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION | 6 |
|---|---|---|

Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions (filling out a bank application for example).

| UNIT II | NARRATION AND SUMMATION | 6 |
|---|---|---|

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / Events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

| UNIT III | DESCRIPTION OF A PROCESS / PRODUCT | 6 |
|---|---|---|

Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities (large & small)-talking about precautions.

| UNIT IV | CLASSIFICATION AND RECOMMENDATIONS | 6 |
|---|---|---|

Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation.

| UNIT V | EXPRESSION | 6 |
|---|---|---|

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions- understanding a website-describing processes.

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Listen to and comprehend general as well as complex academic information.

CO2: Listen to and understand different points of view in a discussion.

CO3: Speak fluently and accurately in formal and informal communicative contexts.

CO4: Describe products and processes and explain their uses and purposes clearly and accurately.

CO5: Express their opinions effectively in both formal and informal discussions.

**ASSESSMENT PATTERN**

1. One online / app based assessment to test listening /speaking.
2. End Semester ONLY listening and speaking will be conducted online.
3. Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| 2 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| 4 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| 5 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

## SEMESTER II

| 24HS0203 | PROFESSIONAL ENGLISH II | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**OBJECTIVES:**

- To engage learners in meaningful language activities to improve their reading and writing skills.
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing.
- To develop analytical thinking skills for problem solving in communicative contexts.
- To demonstrate an understanding of job applications and interviews for internship and placements.

| UNIT I | MAKING COMPARISONS | 6 |
|---|---|---|

Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases.

| UNIT II | EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING | 6 |
|---|---|---|

Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds.

| UNIT III | PROBLEM SOLVING | 6 |
|---|---|---|

Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences.

| UNIT IV | REPORTING OF EVENTS AND RESEARCH | 6 |
|---|---|---|

Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions.

| UNIT V | THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY | 6 |
|---|---|---|

Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Compare and contrast products and ideas in technical texts.

CO2: Identify and report cause and effects in events, industrial processes through technical texts.

CO3: Analyze problems in order to arrive at feasible solutions and communicate them in the written format.

CO4: Present their ideas and opinions in a planned and logical manner.

CO5: Draft effective resumes in the context of job search.

**TEXT BOOKS:**


1. "English for Engineers & Technologists", Orient Blackswan Private Ltd, Department of English, Anna University, 2020.
2. Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN.Shoba, and Dr. Lourdes Joevani, "English for Science & Technology", Department of English, Anna University, Cambridge University Press 2021.


**REFERENCE BOOKS:**


1. Raman. Meenakshi and Sharma Sangeeta, "Professional English", Oxford university press, New Delhi, 2019.
2. V.N. Arora and Laxmi Chandra, "Improve Your Writing ed.," Oxford Univ. Press, New Delhi, 2001.
3. Dr. V. Chellammal, "Learning to Communicate", Allied Publishers, New Delhi, 2003.
4. Prof. R.C. Sharma & Krishna Mohan, "Business Correspondence and Report Writing", Tata McGrawHill & Co. Ltd., New Delhi, 2001.
5. Krishna Mohan and Meera Bannerji, "Developing Communication Skills", Macmillan India Ltd. Delhi, 1990.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | - | - | - |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | - | - | - |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | - | - | - |
| 4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| 5 | - | - | - | - | - | - | - | - | - | 3 | 3 | 3 | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24MA0202 | ORDINARY DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**OBJECTIVES:**

- To acquaint the students with differential equations which are significantly used in engineering problems.
- To make the students to understand the vector calculus techniques.
- To develop the analytic solutions for partial differential equations used in engineering by Fourier series.
- To acquaint the student with Fourier, transform techniques used in wide variety of situations in which the functions used are not periodic.
- To develop Z-transform techniques in solving difference equations.

| UNIT I | ORDINARY DIFFERENTIAL EQUATIONS | 9+3 |
|---|---|---|

Higher order linear differential equation with constant coefficient - Method of variation of parameters -Homogeneous equations of Euler–Cauchy and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

| UNIT II | VECTOR CALCULUS | 9+3 |
|---|---|---|

Gradient and directional derivative- Divergence and curl-Vector identities – irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral – Area of a curved surface- Volume integral- Green's, Gauss divergence and Stoke's theorem.

| UNIT III | FOURIER SERIES | 9+3 |
|---|---|---|

Dirichlet's conditions–General Fourier series–Odd and even functions – Half-range Sine and Cosine series – Parseval's identity – Computation of harmonics.

| UNIT IV | FOURIER TRANSFORMS | 9+3 |
|---|---|---|

Fourier integral theorem – Fourier transform pair - Fourier sine and cosine transforms – Properties – Transform of elementary functions – Inverse Fourier Transforms - Convolution theorem (without proof) – Parseval's identity.

| UNIT V | Z–TRANSFORM AND DIFFERENCE EQUATIONS | 9+3 |
|---|---|---|

Z-transform – Properties of Z-transform – Initial and final value theorem - Inverse Z-transform – Evaluation of Inverse Z transform using partial fraction method and convolution theorem– Formation of difference equations–Solution of difference equations using Z - transform.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Solve higher order ordinary differential equations which arise in engineering applications.

CO2: Understand the concept of Vector calculus.

CO3: Apply Fourier series techniques in engineering applications.

CO4: Understand the Fourier transforms techniques in solving engineering problems.

CO5: Understand the Z-transforms techniques in solving difference equations.

**TEXT BOOKS:**


1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 45th Edition, New Delhi, 2020.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Pvt Ltd., New Delhi, 2018.


**REFERENCE BOOKS:**


1. N. P. Bali and Manish Goyal, "A textbook of Engineering Mathematics", Laxmi Publications, Reprint, 2008.
2. Greenberg M. D., "Advanced Engineering Mathematics", Pearson Education 2nd Edition, 5th Reprint, Delhi, 2009.
3. Jain R. K. and Iyengar S. R. K., "Advanced Engineering Mathematics", Narosa Publications, 5th Edition, New Delhi, 2017.
4. Peter V. O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012.
5. Ramana B. V. "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | 2 | 3 | 1 | 2 | - | - | 2 | 1 | 1 | 3 | - | - | - |
| 2 | 3 | 3 | 2 | 3 | 1 | 2 | - | - | 2 | 1 | 1 | 3 | - | - | - |
| 3 | 3 | 3 | 1 | 1 | - | - | - | - | 2 | - | - | 3 | - | - | - |
| 4 | 3 | 3 | 1 | 1 | - | - | - | - | 2 | - | - | 3 | - | - | - |
| 5 | 3 | 3 | 1 | 1 | - | - | - | - | 2 | - | - | 3 | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24PH0202 | ENGINEERING PHYSICS II | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the fundamentals of elasticity, stress-strain relationships, and material deformation under various forces.
- To enable the students to gain knowledge in conductor and semiconductor physics.
- To impart knowledge on the magnetic properties of materials.
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications.
- To instill an understanding of the significance of nanostructures, quantum confinement, and their resulting applications in nanodevices.

| UNIT I | PROPERTIES OF MATTER | 9 |
|---|---|---|

Elasticity- Hooke's law- Relationship between three modulii of elasticity (qualitative) - Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength. Torsional stress and deformations - twisting couple - bending of beams. Bending moment - cantilever: theory and experiment. Uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

| UNIT II | CONDUCTING AND SEMICONDUCTING MATERIALS | 9 |
|---|---|---|

Classical free electron theory of metals – Expression for electrical conductivity-Thermal conductivity expression – Wiedemann-Franz law –Quantum free electron theory - Postulates-Fermi-Dirac Statistics –Density of energy states. Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors – Carrier concentration in N-type & P-type semiconductors.

| UNIT III | MAGNETIC PROPERTIES OF MATERIALS | 9 |
|---|---|---|

Origin of magnetic moment - magnetic permeability and susceptibility–Magnetic material classification: diamagnetism– paramagnetism–ferromagnetism–Domain theory - Hysteresis curve – Soft and Hard magnetic materials – antiferromagnetism – ferrimagnetism - Magnetic principle in computer data storage –Magnetic hard disc (GMR sensor).

| UNIT IV | OPTICAL PROPERTIES OF MATERIALS | 9 |
|---|---|---|

Classification of optical materials – Optical processes in semiconductors: optical absorption and emission, charge injection and recombination, optical absorption, loss and gain. Optical processes in quantum wells – Optoelectronic devices: light detectors and solar cells – light emitting diode – optical processes in organic semiconductor devices – excitonic state – Electro-optics and nonlinear optics: Modulators and switching devices – plasmonics.

| UNIT V | NANOELECTRONIC DEVICES | 9 |
|---|---|---|

Introduction – quantum confinement – quantum structures: quantum wells, wires and dots – Tunneling – Single electron phenomena: Coulomb blockade – resonant-tunneling diode – single electron transistor –quantum states – classical bits – quantum bits or qubits – photo processes –

spintronics – carbon nanotubes: Properties and applications.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Analyze and apply elasticity concepts to real-world structural and material applications.

CO2: Acquire knowledge on basics of conductor and semiconductor physics and its applications in various devices.

CO3: Illustrate the optical properties and their applications to optical devices.

CO4: Get knowledge on magnetic properties of materials and their applications in data storage.

CO5: Understand and apply quantum concepts and nanostructures in modern electronic and material technologies.

**TEXT BOOKS:**


1. S. O Pillai, "Solid State Physics", 10th edition, NEW AGE International Publishers, 2022.
2. Hilmi Unlu and Norman. "Progress in Nano scale and Low-Dimensional Materials and Devices", Springer International Publishers.
3. Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley (Indian Edition), 2007.
4. Arumugam M, "Engineering Physics", Anuradha Publishers, 2010.
5. Parag K. Lala, "Quantum Computing: A Beginner's Introduction", McGraw-Hill Education (Indian Edition), 2020.


**REFERENCE BOOKS:**


1. Charles Kittel, "Introduction to Solid State Physics" Wiley India Edition, 2019.
2. Senthil Kumar G. "Engineering Physics" VRB Publications, 2023.
3. Mani P. "Engineering Physics" Dhanam Publications, 2023.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 | 3 | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 | 3 | - | - | 1 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| 4 | 3 | - | 2 | 1 | 3 | - | 1 | - | - | - | - | - | - | - | - |
| 5 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | 2 | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24GE0204 | ENVIRONMENTAL SCIENCE AND ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**OBJECTIVES:**

- To introduce the basic concepts of environment, ecosystems and their functions.
- To acquire the knowledge about biodiversity and emphasize on the biodiversity of India and its conservation.
- To gain the knowledge about the different types of waste, how to handle them and their environmental impact.
- To learn about the causes effects and control measures of various pollutions and know the individual role in it.
- To learn how environmental issues, such as pollution, climate change and global warming to relate sustainable development.

| UNIT I | ECOSYSTEMS | 6 |
|---|---|---|

Concept of an ecosystem (Abiotic and biotic environment) - structure and function of an ecosystem–Producers-Consumers and decomposers. Energy flow in the ecosystem, (Nutrient cycle in the ecosystem) - Ecological succession - Food Chain - food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystems, Forest ecosystem, Grass land ecosystem, Desert ecosystems aquatic ecosystems [ponds, streams, lakes, rivers, ocean estuaries].

| UNIT II | BIODIVERSITY | 6 |
|---|---|---|

Introduction to biodiversity-genetic, species and ecosystem diversity- value of biodiversity - consumptive use- productive use –social, ethical, aesthetic and option values. India as a mega-diversity nation – hot-spots of biodiversity –threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

| UNIT III | WASTE MANAGEMENT | 6 |
|---|---|---|

Municipal solid waste management: Sources, characteristics, collection and transportation, waste processing and disposal (including reuse options, biological methods, energy recovery processes and land filling) Hazardous waste management: Characteristics, generation, fate of materials in the environment, treatment and disposal Management of biomedical waste, plastic waste and E-waste: Sources, generation and characteristics; Waste management practices including storage, collection and transfer

| UNIT IV | ENVIRONMENTAL POLLUTION | 6 |
|---|---|---|

Definition a) Air pollution b) Water pollution c) Soil pollution d) Marine pollution d) Noise pollution-Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in pollution control. Flood Case study

| UNIT V | SOCIAL ISSUES AND THE ENVIRONMENT | 6 |
|---|---|---|

From unsustainable to sustainable development – urban problems related to energy water

conservation, rain water harvesting, watershed management- resettlement and rehabilitation of people; its problem and concerns. Issues and possible solutions: Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Recognize and understand the functions of environment, ecosystems.

CO2: Know the bio diversity and their values and conservation.

CO3: Learn about proper waste disposal and minimize waste.

CO4: Understand the causes, effects of pollution and how to control it.

CO5: Understand the relationship between environment and society.

**TEXT BOOKS:**


1. Anubha Kaushik and C. P. Kaushiks "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2016.
3. John Pichtel, "Waste management practices", 2nd edition, Dev publication.
4. Allen, D. T. and Shonnard, D. R., "Sustainability Engineering: Concepts, Design and Case Studies", Prentice Hall.
5. Bradley. A.S, Adebayo, A.O, and Maria, P. "Engineering applications in sustainable design and development", Cengage learning.
6. Dr. Ashutosh Tripathi, "Environment and social issues", publication in 2019.
7. Mackenthun, K. M., "Basic Concepts in Environmental Management", Lewis Publication, London, 1998.


**REFERENCE BOOKS:**


1. R. K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media. edition, 2010.
2. Cunningham,W. P. Cooper and T.H.Gorhani, Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Yung Tse Hung, lawrence K wang and Nazih K shammas, "Handbook of Environment and waste management", volume 2.
4. Rajagopalan, R, "Environmental Studies From Crisisto Cure", Oxford University Press, Third Edition, 2015.
5. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", Orient Blackswan Pvt.Ltd. 2013.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **1** | 2 | 1 | - | - | - | 2 | 3 | - | - | - | - | 2 | - | - | - |
| **2** | 2 | 1 | - | - | - | 2 | 3 | - | - | - | - | 2 | - | - | - |
| **3** | 3 | 2 | - | - | - | 3 | 3 | - | - | - | - | 2 | - | - | - |
| **4** | 3 | - | 1 | - | - | 2 | 2 | - | - | - | - | 2 | - | - | - |
| **5** | 3 | 2 | 1 | - | - | 2 | 2 | - | - | - | - | 1 | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24GE0205 | ENGINEERING GRAPHICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 4 | 4 |

**OBJECTIVES:**

- To draw engineering curves.
- To draw freehand sketch of simple objects.
- To draw orthographic projection of solids and section of solids.
- To draw development of solids.
- To draw isometric and perspective projections of simple solids.

| UNIT I | PLANE CURVES AND FREEHAND SKETCHING | 6+12 |
|---|---|---|

Basic Geometrical constructions, Curves used in engineering practices: Conics - Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloid - construction of involutes of square and circle - Drawing of tangents and normal to the above curves - ortho graphic projection - principles - principle planes-first angle projection-projection of points.

| UNIT II | PROJECTION OF POINTS, LINES AND PLANE SURFACE | 6+12 |
|---|---|---|

Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

| UNIT III | PROJECTION OF SOLIDS | 6+12 |
|---|---|---|

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects - Layout of views- Freehand sketching of multiple views from pictorial views of objects.

| UNIT IV | PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES | 6+12 |
|---|---|---|

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other - obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids - Prisms, pyramids cylinders and cones.

| UNIT V | ISOMETRIC AND PERSPECTIVE PROJECTIONS | 6+12 |
|---|---|---|

Principles of isometric projection - isometric scale - isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones - combination of two solid objects in simple vertical positions - Perspective projection of simple solids - Prisms, pyramids and cylinders by visual ray method.

**TOTAL: 90 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Use BIS conventions and specifications for engineering drawing.

CO2: Construct the conic curves, involutes and cycloid.

CO3: Solve practical problems involving projection of lines.

CO4: Draw the orthographic, isometric and perspective projections of simple solids.

CO5: Draw the development of simple solids.

**TEXT BOOKS:**


1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
3. Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.


**REFERENCE BOOKS:**


1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edit ion, 2019.
2. Gopalakrishna K.R., "Engineering Drawing (Vol. I & II combined)", Subhas Publications, Bangalore, 27th Edition, 2017.
3. Luzzader, Warren. J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
6. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 1 | 2 | - | 2 | - | - | - | - | 3 | - | 2 | 2 | 2 | - |
| 2 | 3 | 1 | 2 | - | 2 | - | - | - | - | 3 | - | 2 | 2 | 2 | -- |
| 3 | 3 | 1 | 2 | - | 2 | - | - | - | - | 3 | - | 2 | 2 | 2 | - |
| 4 | 3 | 1 | 2 | - | 2 | - | - | - | - | 3 | - | 2 | 2 | 2 | - |
| 5 | 3 | 1 | 2 | - | 2 | - | - | - | - | 3 | - | 2 | 2 | 2 | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24GE0206 | BASIC ELECTRICAL AND ELECTRONICS ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the basics of electric circuits and analysis.
- To impart knowledge in the basics of working principles and application of electrical machines.
- To introduce semiconductor diodes characteristics.
- To educate on the fundamental concepts of transistors.
- To introduce the basics of power system.

| UNIT I | INTRODUCTION TO DC & AC CIRCUITS | 9 |
|---|---|---|

DC Circuits: Electrical Parameters – Ohm‘s Law - Kirchhoff‘s Laws –Independent and Dependent Sources –Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power.

| UNIT II | BASIC CONCEPTS OF ELECTRICAL MACHINES | 9 |
|---|---|---|

Faraday‘s Law - working principle and applications of Transformer – DC motor – types and applications – AC motor, types & applications.

| UNIT III | SEMICONDUCTOR DIODES | 9 |
|---|---|---|

Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode –application of diode – half wave and full wave rectifier - Zener diode and its characteristics – applications.

| UNIT IV | TRANSISTORS | 9 |
|---|---|---|

Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – working of FET & UJT.

| UNIT V | BASICS OF POWER SYSTEM | 9 |
|---|---|---|

Power system structure – Generation, Transmission and Distribution - earthling – methods of earthling, protective devices – switch fuse unit – Miniature circuit breaker – types, safety precaution and First Aid.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Compute the electric circuit parameters for simple problems.

CO2: Explain the working principle and applications of electrical machines.

CO3: Analyze the characteristics of semiconductors.

CO4: Explain the basic concepts of transistors.

CO5: Explain the basic power system structure and protection schemes.

**TEXT BOOKS:**


1. Kothari DP and I. J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020.
2. S. Salaivahanan, "Digital Electronics", McGraw Hill Education (India) Private Limited, 18th Sept 2018.
3. Sedha R. S., "A textbook book of Applied Electronics", S. Chand & Co., 2008.
4. V K Mehta and Rohit Mehta, "Principles of Electrical Machines", S Chand and Company limited, second edition, 2019.


**REFERENCE BOOKS:**


1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2. Thomas L. Floyd, "Digital Fundamentals", 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, "Electronic Principles", McGraw Hill Education; 7th edition, 2017.
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum'Outline Series, McGraw Hill, 2002.
5. H.S. Kalsi, "Electronic Instrumentation", Tata McGraw-Hill, New Delhi, 2010.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 2 | 2 | 1 | - | - | - | - | 1 | - | - | - | 2 | - | - | 1 |
| 2 | 2 | 2 | 1 | - | - | - | - | 1 | - | - | - | 2 | - | - | 1 |
| 3 | 2 | 1 | 1 | - | - | - | - | 1 | - | - | - | 2 | - | - | 1 |
| 4 | 2 | 2 | 1 | - | - | - | - | 1 | - | - | - | 2 | - | - | 1 |
| 5 | 2 | 2 | 1 | - | - | - | - | 1 | - | - | - | 2 | - | - | 1 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24GE0207 | தமிழரும் தொழில்நுட்பமும் | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |
| அலகு 1 | நெசவு மற்றும் பானைத் தொழில்நுட்பம் | | | 3 | |
| சங்க காலத்தில் நெசவுத் தொழில் பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள். | | | | | |
| அலகு 2 | வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் | | | 3 | |
| சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் மாமல்லபுரச் சிற்பங்களும், கோவில்களும் சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் நாயக்கர் காலக் கோயில்கள் மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள். பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ- சாரோசெனிக் கட்டிடக் கலை. | | | | | |
| அலகு 3 | உற்பத்தித் தொழில் நுட்பம் | | | 3 | |
| கப்பல் கட்டும் கலை உலோகவியல் -இரும்புத் தொழிற்சாலை இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் எலும்புத்துண்டுகள் தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள். | | | | | |
| அலகு 4 | வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம் | | | 3 | |
| அணை, ஏரி, குளங்கள், மதகு சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் கால்நடை பராமரிப்பு கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு- மீன்வளம் முத்து மற்றும் முத்துக்குளித்தல் பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம். | | | | | |
| அலகு 5 | அறிவியல் தமிழ் மற்றும் கணித்தமிழ் | | | 3 | |
| அறிவியல் தமிழின் வளர்ச்சி -கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் -தமிழ் மின் நூலகம் இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம். | | | | | |
| **TOTAL: 15 PERIODS** | | | | | |
| | | | | | |

**TEXT CUM REFERENCE BOOKS:**


1. தமிழக வரலாறு மக்களும் பண்பாடும். கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் முனைவர் இல சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி-வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு.
4. பொருறை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

| 24GE0207 | TAMILS AND TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

| UNIT I | WEAVING AND CERAMIC TECHNOLOGY | 3 |
|---|---|---|

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

| UNIT II | DESIGN AND CONSTRUCTION TECHNOLOGY | 3 |
|---|---|---|

Designing and Structural construction House; Designs in household materials during Sang am Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)-Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

| UNIT III | MANUFACTURING TECHNOLOGY | 3 |
|---|---|---|

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold Coins as source of history - Minting of Coins – Beads making-industries Stone beads – Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

| UNIT IV | AGRICULTURE AND IRRIGATION TECHNOLOGY | 3 |
|---|---|---|

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

| UNIT V | SCIENTIFIC TAMIL & TAMIL COMPUTING | 3 |
|---|---|---|

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**TOTAL: 15 PERIODS**

**TEXT CUM REFERENCE BOOKS:**


1. தமிழக வரலாறு மக்களும் பண்பாடும். கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் முனைவர் இல சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி-வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு.
4. பொருறை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author).
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

| 24GE0208 | BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

- To train the students in conducting load tests on electrical machines.
- To gain practical experience in experimentally obtaining the characteristics of electronics devices and rectifiers.

**LIST OF EXPERIMENTS:**

1. Verification of ohms and Kirchhoff‘s Laws.
2. Study of starter.
3. Speed control on DC Shunt Motor.
4. Load test on DC Series Motor.
5. Load test on Single Phase Transformer.
6. Load Test on Single Phase Induction Motor.
7. Characteristics of PN Diodes.
8. Characteristics of BJT.
9. Characteristics of Zener Diodes.
10. Half wave and Full Wave rectifiers.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Construct the circuit with appropriate connections for the given DC machine/transformer.

CO2: Acquire hands on experience of conducting various tests on induction motors and obtaining their performance indices using standard analytical as well as graphical methods.

CO3: Analyse the characteristics of PN diodes and BJT experimentally.

CO4: Analyse the characteristics of half-wave and full-wave rectifier with and without filters experimentally.

CO5: Understand DC motor starters.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | 2 | 1 | 1 | - | - | 2 | 2 | - | - | - | - | - | 1 |
| 2 | 3 | 3 | 2 | 1 | 1 | - | - | 2 | 2 | - | - | - | - | - | 1 |
| 3 | 3 | 3 | 2 | 1 | 1 | - | - | 2 | 2 | - | - | - | - | - | 1 |
| 4 | 3 | 3 | 2 | 1 | 1 | - | - | 2 | 2 | - | - | - | - | - | 1 |
| 5 | 3 | 3 | 2 | 1 | 1 | - | - | 2 | 2 | - | - | - | - | - | 1 |

**1 – low, 2 – medium, 3 – high, ‘-‘– no correlation**

| 24GE0209 | ENGINEERING PRACTICES LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

The main learning objective of this course is to provide hands on training to the students in:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

**GROUP – A (CIVIL & ELECTRICAL)**

| PART I | CIVIL ENGINEERING PRACTICES | 15 |
|---|---|---|

**PLUMBING WORK:**

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

**WOOD WORK:**

a) Sawing
b) Planning
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

**WOOD WORK STUDY:**

a) Studying joints in door panels and wooden furniture.
b) Studying common industrial trusses using models.

| PART II | ELECTRICAL ENGINEERING PRACTICES | 15 |
|---|---|---|

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket.
b) Staircase wiring.
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration.
e) Study of Iron Box wiring and assembly.
f) Study of Fan Regulator. (Resistor type and Electronic type using Diac/Triac/quadrac)

g) Study of emergency lamp wiring/Water heater.

**GROUP – B (MECHANICAL AND ELECTRONICS)**

| **PART III** | **MECHANICAL ENGINEERING PRACTICES** | **15** |
|---|---|---|

**WELDING WORK:**

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

**BASIC MACHINING WORK:**

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

**ASSEMBLY WORK:**

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an air conditioner.

**SHEET METAL WORK:**

a) Making of a square tray

**FOUNDRY WORK:**

a) Demonstrating basic foundry operations

| **PART IV** | **ELECTRONIC ENGINEERING PRACTICES** | **15** |
|---|---|---|

**SOLDERING WORK:**

a) Soldering simple electronic circuits and checking continuity.

**ELECTRONIC ASSEMBLY AND TESTING WORK:**

a) Assembling and testing electronic components on a small PCB

**ELECTRONIC EQUIPMENT STUDY:**

a) Study an elements of smart phone.
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/ laptop.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.

CO2: Wire various electrical joints in common household electrical wire work.

CO3: Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipment‘s; Make a tray out of metal sheet using sheet metal work.

CO4: Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

CO5: Apply safety protocols and use personal protective equipment (PPE) effectively in all engineering practices.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 2 | - | - | 1 | 1 | 1 | - | - | - | - | 2 | 2 | 1 | 1 |
| 2 | 3 | 2 | - | - | 1 | 1 | 1 | - | - | - | - | 2 | 2 | 1 | 1 |
| 3 | 3 | 2 | - | - | 1 | 1 | 1 | - | - | - | - | 2 | 2 | 1 | 1 |
| 4 | 3 | 2 | - | - | 1 | 1 | 1 | - | - | - | - | 2 | 2 | 1 | 1 |
| 5 | 3 | - | - | - | 1 | 2 | 2 | 3 | - | - | - | 2 | 2 | 1 | 1 |

**1 – low, 2 – medium, 3 – high, ‘-‘– no correlation**

| 24HS0204 | ENGLISH LABORATORY II | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**OBJECTIVES:**

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To analyses concepts and problems and make effective presentations explaining them clearly and precisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays.
- To give instructions and recommendations that are clear and relevant to the context.

| UNIT I | | 6 |
|---|---|---|

Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition discussing progress toward goals-talking about experiences- talking about events in life- discussing past events-Writing: writing emails ( formal & semi-formal).

| UNIT II | | 6 |
|---|---|---|

Speaking: discussing news stories-talking about frequency-talking about travel problems-discussing travel procedures- talking about travel problems- making arrangements-describing arrangements discussing plans and decisions- discussing purposes and reasons- understanding common technology terms-Writing: - writing different types of emails.

| UNIT III | | 6 |
|---|---|---|

Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons- discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

| UNIT IV | | 6 |
|---|---|---|

Speaking: discussing the natural environment-describing systems-describing position and movement- explaining rules-(example- discussing rental arrangements) - understanding technical instructions-Writing: writing instructions-writing a short article.

| UNIT V | | 6 |
|---|---|---|

Speaking: describing things relatively-describing clothing-discussing safety issues (making recommendations) talking about electrical devices-describing controlling actions- Writing: job application (Cover letter + Curriculum vitae)-writing recommendations.

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

At the end of the course, the students will be able to

CO1: Speak effectively in group discussions held in a formal/semi-formal contexts.

CO2: Discuss, analyses and present concepts and problems from various perspectives to arrive at suitable solutions.

CO3: Write emails, letters and effective job applications.

CO4: Write critical reports to convey data and information with clarity and precision.

CO5: Give appropriate instructions and recommendations for safe execution of tasks.

**REFERENCE BOOKS:**


1. Butterfield Jeff, "Soft Skills for Everyone", Cengage Learning: New Delhi, 2015.
2. "Interact English Lab Manual for Undergraduate Students", Orient Blackswan: Hyderabad, 2016.
3. E. Suresh Kumar et al., "Communication for Professional Success", Orient Blackswan: Hyderabad, 2015.
4. Raman, Meenakshi and Sangeeta Sharma, "Professional Communication", Oxford University Press: Oxford, 2014,
5. S. Hariharan et al., "Soft Skills", MJP Publishers: Chennai, 2010.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 2 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| 2 | 2 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| 3 | 2 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

## SEMESTER III

| 24MA0304 | RANDOM PROCESSES AND LINEAR ALGEBRA | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**OBJECTIVES:**

- To introduce the basic notions of vector spaces which will then be used to solve related problems.
- To understand the concepts of vector space, linear transformations, inner product spaces and orthogonalization.
- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To provide necessary basics in probability that are relevant in applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variable.

| UNIT I | PROBABILITY AND RANDOM VARIABLES | 12 |
|---|---|---|

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

| UNIT II | TWO - DIMENSIONAL RANDOM VARIABLES | 12 |
|---|---|---|

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables.

| UNIT III | RANDOM PROCESSES | 12 |
|---|---|---|

Classification – Stationary process – Markov process - Poisson process - Discrete parameter Markov chain – Chapman Kolmogorov equations (Statement only).

| UNIT IV | VECTOR SPACES | 12 |
|---|---|---|

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

| UNIT V | INNER PRODUCT SPACES | 12 |
|---|---|---|

Inner product and Norms – inner Product Spaces – Orthogonal vectors - Gram Schmidt orthogonalization process - Orthogonal Complement Least square approximation.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.

CO2: Demonstrate accurate and efficient use of advanced algebraic techniques.

CO3: Apply the concept of random processes in engineering disciplines.

CO4: Understand the fundamental concepts of probability with a thorough knowledge of standard distributions that can describe certain real-life phenomenon.

CO5: Understand the basic concepts of one and two dimensional random variables and apply them to model engineering problems.

**TEXT BOOKS:**


1. Gross D., Shortle J. F., Thompson J. M. and Harris C. M., "Fundamentals of Queueing Theory", Wiley Student 5th Edition, 2018.
2. Ibe O. C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 3rd edition, Indian Reprint, 2022.
3. Friedberg A. H., Insel A. J. and Spence L., "Linear Algebra", Prentice Hall of India, New Delhi, 4th Edition, 2021.


**REFERENCE BOOKS:**


1. Hsu, "Schaum‟s Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
2. Trivedi K. S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.
3. Yates R. D. and Goodman D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
4. Kolman B., Hill D. R., "Introductory Linear Algebra", Pearson Education, New Delhi, First Reprint, 2009.
5. Kumaresan S., "Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi, Reprint, 2010.
6. Strang G., "Linear Algebra and its applications", Thomson (Brooks/Cole), New Delhi, 2005.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | - | - | - | - | - | - | 3 | - | - | 2 | - | - | - |
| 2 | 3 | 3 | - | - | - | - | - | - | 3 | - | - | 2 | - | - | - |
| 3 | 3 | 3 | - | - | - | - | - | - | 3 | - | - | 2 | - | - | - |
| 4 | 3 | 3 | - | - | - | - | - | - | 3 | - | - | 2 | - | - | - |
| 5 | 3 | 3 | - | - | - | - | - | - | 3 | - | - | 2 | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24CS5307 | C AND DATA STRUCTURES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To learn how to write simple and modular C programs.
- To understand usage of Arrays, Pointers and strings.
- To learn linear data structures – lists, stacks and queues.
- To understand non-linear data structures – trees and graphs.
- To understand sorting, searching and hashing algorithms.

| UNIT I | C PROGRAMMING FUNDAMENTALS | 9 |
|---|---|---|

Structure of „C" program Data Types – Variables – Operators and Expressions - Decision Making: Branching statements, Looping statements – Functions – Declaration, Definition - Passing arguments by value, Recursive Functions – Arrays – Single and Multi-Dimensional Arrays.

| UNIT II | C PROGRAMMING – ADVANCED FEATURES | 9 |
|---|---|---|

Pointers - Passing arguments by address, Array of Pointers, Pointer to Pointer, Pointer to an array - Pointer to function. Structure: Declaration, Definition - Array of Structures - Pointer to Structure - Structure within a Structure – Union. Files: File Management functions, Random access in file - Working with Text Files and Binary Files.

| UNIT III | LINEAR DATA STRUCTURES | 9 |
|---|---|---|

Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List – Doubly - Linked Lists – Circular Linked List – Stack ADT – Implementation of Stack – Applications – Queue ADT – Priority Queues – Queue Implementation – Applications.

| UNIT IV | NON-LINEAR DATA STRUCTURES | 9 |
|---|---|---|

Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Hashing – Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.

| UNIT V | SORTING AND SEARCHING TECHNIQUES | 9 |
|---|---|---|

Insertion Sort – Selection Sort – Heap Sort – Merge Sort – Linear Search - Binary Search.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Solve simple problems using C and Control the sequence of the program using functions.

CO2: Develop programs using structures, union and pointers.

CO3: Define linear and non-linear data structures.

CO4: Write functions to implement linear and non-linear data structure operations.

CO5: Appropriately use sort and search algorithms for given application.

**TEXT BOOKS:**

1. Pradip Dey, Manas Ghosh, "Programming in C", AICTE Edition, Oxford University Press,

2018.
2. Behrouz A. Forouzan, Richard F. Gilberg, P. Golda Jeyasheeli, G. Priyanka, S. T. Veena, "Problem solving Using C A Structured Programming Approach", Volume I & II, First Edition, Cengage Publication, 2022.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2005.

**REFERENCE BOOKS:**

1. Yashavant P. Kanetkar, "Let Us C: Authentic guide to C programming language", Eighteenth Edition, BPB Publications, 2021.
2. Paul Deitel, Harvey Deitel, "C How to Program", Ninth Edition, Pearson, 2021.
3. Langsam, Augenstein and Tanenbaum, "Data Structures Using C and C++", 2nd Edition, Pearson Education, Reprint 2023.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Fourth Edition, McGraw Hill, MIT Press, 2022.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 2 | 3 | 1 | 2 | 2 | 1 | 1 | - | 1 | 2 | 1 | 3 | 2 | 1 | 3 |
| 2 | 1 | 2 | 1 | 2 | 2 | - | - | - | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 3 | 2 | 3 | 1 | 2 | 3 | - | - | - | 1 | 1 | 1 | 2 | 2 | 1 | 2 |
| 4 | 2 | 1 | - | 1 | 1 | - | - | - | 2 | 1 | 1 | 2 | 2 | 3 | 1 |
| 5 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | - | 1 | 2 | 1 | 3 | 2 | 2 | 3 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24EC4301 | SIGNALS AND SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

- To understand the basic properties of signal & systems.
- To know the methods of characterization of LTI systems in continuous time domain.
- To analyze continuous time signals and system in the Fourier and Laplace domain.
- To analyze discrete time signals and system in the Fourier and Z transform domain.
- To know the methods of characterization of LTI systems in discrete time domain.

| UNIT I | CLASSIFICATION OF SIGNALS AND SYSTEMS | 9 |
|---|---|---|

Standard signals - Classification of signals – Continuous time (CT) and Discrete Time (DT) signals - Classification of systems - CT systems and DT systems.

| UNIT II | ANALYSIS OF CONTINUOUS TIME SIGNALS | 9 |
|---|---|---|

Fourier series for periodic signals - Fourier Transform – properties - Laplace Transforms and Properties.

| UNIT III | LTI- CONTINUOUS TIME SYSTEMS | 9 |
|---|---|---|

Impulse response - convolution integral - Properties of convolution integral- Fourier and Laplace transforms in Analysis of CT systems - Solving of Differential Equation.

| UNIT IV | ANALYSIS OF DISCRETE TIME SIGNALS | 9 |
|---|---|---|

Baseband signal Sampling – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties.

| UNIT V | LTI-DISCRETE TIME SYSTEMS | 9 |
|---|---|---|

Impulse response – Difference equations - Convolution sum - Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems - DT systems connected in series and parallel.

**TOTAL: 45 PERIODS**

**PRACTICAL EXERCISES: 30 PERIODS**

**LIST OF EXPERIMENTS:**

MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of signals.
2. Create the Fourier Series.
3. Perform the Convolution Process (CT, DT).
4. Implement the DTFT.
5. Perform the Sampling Process.
6. Implement the Z-Transform.
7. Perform the RLC (Frequency response, Phase).

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Determine if a given system is linear/causal/stable.

CO2: Determine the frequency components present in a deterministic signal.

CO3: Characterize continuous LTI systems in the time domain and frequency domain.

CO4: Characterize discrete LTI systems in the time domain and frequency domain.

CO5: Compute the output of an LTI system in the time and frequency domains.

**TEXT BOOKS:**

1. Oppenheim, Willsky and Hamid, "Signals and Systems", 2nd Edition, Pearson Education, New Delhi, Reprint 2023.
2. Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley, Reprint 2020.

**REFERENCE BOOKS:**

1. B. P. Lathi, "Principles of Linear Systems and Signals", 3rd Edition, Oxford, Reprint 2023.
2. M. J. Roberts, "Signals and Systems Analysis using Transform methods and MATLAB", McGraw- Hill Education, 2018.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 2 | 3 | - | 3 | 2 | - | - | - | - | - | 3 | - | - | 1 |
| 2 | 3 | 3 | 3 | - | - | 2 | - | - | - | - | - | 3 | - | 3 | - |
| 3 | 3 | 3 | - | 2 | 3 | 2 | - | - | - | - | - | 3 | 2 | - | - |
| 4 | 3 | 3 | - | 1 | 3 | 2 | - | - | - | - | - | 3 | - | 3 | 1 |
| 5 | 3 | 3 | - | 3 | 3 | 2 | - | - | - | - | - | 3 | - | 3 | 1 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24EC4302 | ELECTRONIC DEVICES AND CIRCUITS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the operation and characteristic features of semiconductor devices.
- To analyze the frequency response of small signal amplifiers.
- To design and analyze single-stage and multistage amplifier circuits.
- To study the principles of feedback amplifiers and oscillators.
- To understand the design of power amplifiers and DC/DC converters.

| UNIT I | SEMICONDUCTOR DEVICES | 9 |
|---|---|---|

BJT - DC Load line, operating point, various biasing methods of BJT, Bias compensation, Thermal stability, various biasing methods of MOSFET, **Special semiconductor devices:** SCR, DIAC, TRIAC.

| UNIT II | AMPLIFIERS | 9 |
|---|---|---|

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model – Analysis of CS, CG and Source follower – Gain and frequency response - High frequency analysis.

| UNIT III | MULTISTAGE AMPLIFIERS | 9 |
|---|---|---|

Cascade stages: Two stage amplifiers, Cascode amplifier - Differential amplifier: Common mode and Difference mode analysis – tuned amplifiers – Gain and frequency response – Neutralization methods.

| UNIT IV | FEEDBACK AMPLIFIERS AND OSCILLATORS | 9 |
|---|---|---|

Negative feedback – Voltage / Current, Series, Shunt feedback Amplifiers – Positive feedback – Condition for oscillations, RC phase shift, Wien bridge, Hartley, Colpitts and Crystal oscillators.

| UNIT V | POWER AMPLIFIERS AND DC/DC CONVERTERS | 9 |
|---|---|---|

Power amplifiers: class A - Class B - Class AB - Class C - Power MOSFET- Class AB Power amplifier using MOSFET – DC/DC converters – Buck, Boost, Buck-Boost analysis and design.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Explain the operation of basic electronic devices.

CO2: Design and analyze amplifiers.

CO3: Analyze the frequency response of BJT and MOSFET amplifiers.

CO4: Design and analyze feedback amplifiers and oscillator principles.

CO5: Design and analyze power amplifiers and supply circuits.

**TEXT BOOKS:**


1. David A. Bell, "Electronic Devices and Circuits", Oxford H.Ed. press, 5th Edn, Reprint 2022.
2. S. Salivahanan, N. Suresh Kumar, "Electronic Devices and Circuits", McGraw Hill, 4th

Edition, 2023.

**REFERENCE BOOKS:**


1. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 11th Edition, Pearson Education / PHI, Reprint 2024.
2. T. Joel, "Electronic Devices and Circuits", Magnus Publications, 2021.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 2 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 3 | 1 | 1 |
| 2 | 2 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 3 | 1 | 1 |
| 3 | 2 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 3 | 1 | 1 |
| 4 | 2 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 3 | 1 | 1 |
| 5 | 2 | 2 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 3 | 1 | 1 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24EC4303 | CIRCUIT ANALYSIS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To develop the ability to solve the DC circuits.
- To impart knowledge on solving circuit equations using network theorems.
- To study the transient and steady state response of the circuits subjected to Step and sinusoidal excitations.
- To educate on obtaining the transient response and resonance of circuits.
- Perform general nodal and mesh (loop) analysis of electrical networks.

| UNIT I | DC CIRCUIT ANALYSIS | 9 |
|---|---|---|

Basic components of Electric Circuits, Electric Circuit Laws , Series & Parallel Connections of Sources and Resistors with Voltage and Current Division, Nodal analysis, Mesh analysis.

| UNIT II | NETWORK THEOREM AND DUALITY | 9 |
|---|---|---|

Circuit Analysis techniques - Linearity and superposition, Thevenin‟s and Norton‟s Equivalent Circuits, Maximum Power Transfer, Δ-Y and Y-Δ Conversions, Duals, Dual circuits.

| UNIT III | SINUSOIDAL STEADY STATE ANALYSIS | 9 |
|---|---|---|

Sinusoidal Steady – State analysis, Characteristics of Sinusoids, Complex Forcing Function, Phasor relationship for R, L, and C, impedance and Admittance, Phasor Diagrams, AC Circuit Power Analysis.

| UNIT IV | TRANSIENTS AND RESONANCE IN RLC CIRCUITS | 9 |
|---|---|---|

Basic RL and RC Circuits, Source- Free RL Circuit & RC Circuit, Unit-Step Function, Driven RL Circuits, RC Circuits & RLC Circuits, Frequency Response, Series and Parallel Resonance.

| UNIT V | COUPLED CIRCUITS AND TOPOLOGY | 9 |
|---|---|---|

Magnetically Coupled Circuits, Mutual Inductance, Linear Transformer, Ideal transformer, Introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Comprehend the basics of circuit analysis.
CO2: Solve electrical circuits using theorems.
CO3: Analyze the sinusoidal steady state response.
CO4: Analyze the transient and resonance in RLC circuits.
CO5: Understand coupled circuits and topology.

**TEXT BOOKS:**


1. Charles K. Alexander, Mathew N. O. Sadiku, “Fundamentals of Electric Circuits”, Sixth Edition, McGraw Hill, 2023.
2. Allan H. Robbins, Wilhelm C. Miller, “Circuit Analysis Theory and Practice”, Cengage Learning India, 2013.

3. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", 5th edition McGraw Hill, Reprint 2022.

**REFERENCE BOOKS:**

1. Chakrabarti A, "Circuits Theory (Analysis and synthesis)", Dhanpath Rai & Sons, New Delhi, 2023.
2. Jegatheesan R., "Analysis of Electric Circuits," McGraw Hill, 2015.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 2 | 1 | 1 | - | - | - | 1 | - | 1 | - | - | - | - | - |
| 2 | 3 | 3 | 2 | 2 | - | - | - | 1 | - | 1 | - | - | - | - | - |
| 3 | 3 | 3 | 3 | 3 | - | - | - | 1 | - | 1 | - | - | - | - | - |
| 4 | 3 | 3 | 3 | 3 | - | - | - | 1 | - | 1 | - | - | - | - | - |
| 5 | 3 | 3 | 3 | 2 | - | - | - | 1 | - | 1 | - | - | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24EC4304 | DIGITAL SYSTEMS DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

- To define the digital fundamentals and logical minimization methods.
- To explain the concept of combinational circuits using logic gates.
- To bring out the analysis and design procedures for Synchronous Sequential Circuits.
- To understand the analysis and design of Asynchronous Sequential Circuits.
- To examine the concepts of Programmable Logic Devices and Digital Integrated Circuits.

| UNIT I | BOOLEAN ALGEBRA AND MINIMIZATION TECHNIQUES | 9 |
|---|---|---|

Number systems representation - Boolean postulates and laws – Minimization of Boolean expressions using Boolean laws and theorem – Logic Gates -Min term and Max term - Sum of Products (SOP) – Product of Sums (POS) - Boolean expression – Canonical Form – Minimization of Boolean expressions using Karnaugh map and Quine McCluskey method – NAND and NOR implementation.

| UNIT II | COMBINATIONAL CIRCUITS | 9 |
|---|---|---|

Half adder / subtractor – Full Adder / subtractor – Parallel binary adder/Subtractor – Serial Adder/Subtractor – Carry Look Ahead adder – BCD adder – Binary Multiplier – Code converters – Magnitude Comparator - Decoder/Encoder – Priority Encoder - Multiplexer/ Demultiplexer — Model design: Parity checker/generators, ALU, seven segment display decoder.

| UNIT III | SYNCHRONOUS SEQUENTIAL CIRCUITS | 9 |
|---|---|---|

Latches, Flip flops – SR, D, JK, T – Edge and level Triggering – Realization of one flip flop using other flip flops – Analysis and design of clocked sequential circuits – Moore/Mealy models – Synchronous/Asynchronous counters – Ring counters - Shift registers – Universal shift registers.

| UNIT IV | ASYNCHRONOUS SEQUENTIAL CIRCUITS | 9 |
|---|---|---|

State assignment – State reduction – Hazards – Design of Hazard Free Switching circuits – Cycles and Races - Design and Analysis of Asynchronous Sequential Circuits: Design of fundamental mode and pulse mode circuits.

| UNIT V | PROGRAMMABLE LOGIC DEVICES AND MEMORY | 9 |
|---|---|---|

Implementation of combinational logic circuits using PROM, PAL, and PLA - Digital Integrated circuits: Propagation delay, Fan-In and Fan-Out, Power dissipation, Noise Margin - Logic Families: RTL, TTL and CMOS - Memories – SRAM/DRAM operation.

**TOTAL: 45 PERIODS**

**PRACTICAL EXERCISES: 30 PERIODS**

**LIST OF EXPERIMENTS:**

1. Study of logic gates.
2. Design and implementation of Adders and Subtractors.
3. Implementation of 4-bit binary adder/subtractor circuits.
4. Design and Implementation of code converters.

5. Design and Implementation of Encoder and Decoder circuits.
6. Design and Implementation of Multiplexers and Demultiplexers.
7. Design and Implementation of Synchronous/Asynchronous counters.
8. Implementation of a Shift registers.

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Minimize Boolean expressions in different forms and implement them using logic gates.

CO2: Infer the combinational circuits using logic gates.

CO3: Analyze and design the synchronous sequential circuits.

CO4: Analyze and design the asynchronous sequential circuits.

CO5: Analyze the characteristics and structure of different memory systems and programmable logic devices.

**TEXT BOOKS:**


1. M. Morris Mano and Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL and system verilog", 6th Edition, Pearson Education Pvt. Ltd., 2023.
2. S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", 5th Edition, Oxford University Press, Reprint 2022.


**REFERENCE BOOKS:**


1. John F. Wakerly, "Digital Design: Principles and Practices", 4th Edition, Pearson/PHI, Reprint 2023.
2. John M. Yarbrough, "Digital Logic Applications and Design", 1st edition Cengage Learning India, Reprint 2023.
3. Charles H. Roth Jr & Larry L. Kinney, "Fundamentals of Logic Design", 7th Edition, Cengage Learning, Reprint 2022.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 2 | 2 | 2 | - | 2 | - | - | - | - | 3 | 3 | 3 | 3 | 2 |
| 2 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | 2 | 1 | 2 | 3 | 2 |
| 3 | - | 3 | 3 | 2 | - | 2 | - | - | - | - | 2 | 2 | 3 | 3 | 2 |
| 4 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | 3 | 2 | 2 | 3 | 1 |
| 5 | - | 3 | 3 | 3 | - | - | - | - | - | - | 2 | 2 | 3 | 3 | 2 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24EC4305 | ELECTRONIC DEVICES AND CIRCUITS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**OBJECTIVES:**

- To learn the characteristics of MOSFET, UJT, SCR.
- To study the frequency response characteristics of amplifiers.
- To understand the characteristics of multistage amplifiers.
- To understand the operation of various oscillators.
- To analyze the characteristics of power amplifier.

**LIST OF EXPERIMENTS:**

DESIGN AND ANALYSIS OF THE FOLLOWING CIRCUITS:

1. Characteristics of MOSFET.
2. Characteristics of UJT.
3. Characteristics of SCR.
4. Frequency response of CE and CC amplifiers.
5. Frequency response of MOSFET CS amplifiers.
6. Frequency response of class C single tuned Amplifier.
7. CMRR measurement of Differential Amplifier.
8. Analyze the RC phase shift oscillator

SIMULATION EXPERIMENTS (Using Transistor):

9. Frequency response of Cascode amplifier.
10. Analyze the Wien bridge oscillator.
11. Analyze the Hartley/Colpitts oscillator.
12. Analyze class A transformer coupled power amplifier.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Understand the characteristics of MOSFET, UJT & SCR.
CO2: Analyze frequency response characteristics of amplifiers.
CO3: Analyze frequency response characteristics of multistage amplifiers.
CO4: Understand the characteristics of various oscillators.
CO5: Analyze the characteristics of Power Amplifier.

## Lab Equipment Requirement:

1. SCR-25No"s
2. Transistor- BC107, BC109, IRF540 -25 Each
3. Open source software with PC - Required

4. CRO & Function Generator – Required

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **1** | 2 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | - | 1 | 2 | 1 | 1 |
| **2** | 2 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | - | 1 | 2 | 1 | 1 |
| **3** | 2 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | - | 1 | 2 | 1 | 1 |
| **4** | 2 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | - | 1 | 2 | 1 | 1 |
| **5** | 2 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | - | 1 | 2 | 1 | 1 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24CS5308 | C AND DATASTRUCTURES LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**OBJECTIVES:**

- To develop applications in C.
- To implement linear and non-linear data structures.
- To understand the different operations of search trees.
- To get familiarized to sorting and searching algorithms.

**LIST OF EXPERIMENTS:**

1. Practice of C programming using statements, expressions, decision making and iterative statements.
2. Practice of C programming using Functions and Arrays.
3. Implement C programs using Pointers and Structures.
4. Implement C programs using Files.
5. Development of real time C applications.
6. Array implementation of List ADT.
7. Array implementation of Stack and Queue ADTs.
8. Linked list implementation of List, Stack and Queue ADTs.
9. Applications of List, Stack and Queue ADTs.
10. Implementation of Binary Trees and operations of Binary Trees.
11. Implementation of Binary Search Trees.
12. Implementation of searching techniques.
13. Implementation of Sorting algorithms: Insertion Sort, Quick Sort, Merge Sort.
14. Implementation of Hashing – any two collision techniques.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Use different constructs of C and develop applications.

CO2: Write functions to implement linear and non-linear data structure operations.

CO3: Suggest and use the appropriate linear / non-linear data structure operations for a given problem.

CO4: Apply appropriate hash functions that result in a collision free scenario for data storage and Retrieval.

CO5: Implement sorting and searching algorithms for a given application.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **1** | 2 | 3 | 1 | 2 | 2 | 1 | 1 | - | 1 | 2 | 1 | 3 | 2 | 1 | 3 |
| **2** | 1 | 2 | 1 | 2 | 2 | - | - | - | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| **3** | 2 | 3 | 1 | 2 | 3 | - | - | - | 1 | 1 | 1 | 2 | 2 | 1 | 2 |
| **4** | 2 | 1 | - | 1 | 1 | - | - | - | 2 | 1 | 1 | 2 | 2 | 3 | 1 |
| **5** | 1 | 2 | 1 | 2 | 2 | 1 | 1 | - | 1 | 2 | 1 | 3 | 2 | 2 | 3 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

## SEMESTER IV

| 24EC4401 | ELECTROMAGNETIC FIELDS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To impart knowledge on the basics of static electric field and the associated laws.
- To impart knowledge on the basics of static magnetic field and the associated laws.
- To give insight into coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations.
- To gain the behavior of the propagation of EM waves.
- To study the significance of Time varying fields

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

Co-ordinate Systems - Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Verify theorems for different path, surface and volume. Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem

| UNIT II | ELECTROSTATICS | 9 |
|---|---|---|

Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Poisson's and Laplace's equations, Uniqueness of electro static solutions, Current density

| UNIT III | MAGNETOSTATICS | 9 |
|---|---|---|

Lorentz force equation, Ampere's law, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Calculation of magnetic field intensity for various current distributions Magnetic circuits, Boundary conditions, Magnetic energy, Magnetic forces and torques.

| UNIT IV | TIME-VARYING FIELDS AND MAXWELL's EQUATIONS | 9 |
|---|---|---|

Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields, Observing the Phenomenon of wave propagation with the aid of Maxwell's equations

| UNIT V | PLANE ELECTROMAGNETIC WAVES | 9 |
|---|---|---|

Plane waves in lossless media, Plane waves in lossy media low-loss dielectrics and good conductors, Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Relate the fundamentals of vector, coordinate system to electromagnetic concepts.

CO2: Analyze the characteristics of Electrostatic field.

CO3: Interpret the concepts of Electric field in material space and solve the boundary conditions.

CO4: Explain the concepts and characteristics of Magneto Static field in material space and solve boundary conditions.

CO5: Determine the significance of time varying fields.

**TEXT BOOKS:**

1. Edward C. Jordan & Keith G. Balmain, "Electromagnetic waves and Radiating Systems", Second Edition, Prentice-Hall Electrical Engineering Series, Reprint 2022.
2. D. K. Cheng, "Field and wave electromagnetics", 2nd ed., Pearson (India), Reprint 2023.

**REFERENCE BOOKS:**

1. M. N. O. Sadiku and S. V. Kulkarni, "Principles of electromagnetics", 6th ed., Oxford (Asian Edition), Reprint 2023.
2. W. H. Hayt and J. A. Buck, "Engineering electromagnetics", 9th ed., McGraw-Hill (India), Reprint 2023.
3. B. M. Notaros, "Electromagnetics", Pearson: New Jersey, 1st Edition, Reprint 2023.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 2 | 1 | 1 | 1 | - | 2 | 1 | - | - | 1 | - | 2 | 3 | 3 | 1 |
| 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | - | - | 1 | 1 | 2 | 3 | 3 | 1 |
| 3 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | - | - | 1 | 1 | 2 | 3 | 3 | 1 |
| 4 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | - | - | 1 | 1 | 2 | 3 | 3 | 1 |
| 5 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | - | - | 2 | 2 | 1 | 3 | 3 | 1 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24EC4402 | NETWORKS AND SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

- To learn the Network Models and datalink layer functions.
- To understand routing in the Network Layer.
- To explore methods of communication and congestion control by the Transport Layer.
- To study the Network Security Mechanisms.
- To learn various hardware security attacks and their countermeasures**.**

| UNIT I | NETWORK MODELS AND DATALINK LAYER | 9 |
|---|---|---|

Overview of Networks and its Attributes – Network Models – OSI, TCP/IP, Addressing – Introduction to Datalink Layer – Error Detection and Correction – Ethernet (802.3) - Wireless LAN – IEEE 802.11, Bluetooth – Flow and Error Control Protocols – HDLC – PPP.

| UNIT II | NETWORK LAYER PROTOCOLS | 9 |
|---|---|---|

Network Layer – IPv4 Addressing – Network Layer Protocols(IP,ICMP and Mobile IP) Unicast and Multicast Routing – Intradomain and Interdomain Routing Protocols – IPv6 Addresses – IPv6 – Datagram Format - Transition from IPv4 to IPv6.

| UNIT III | TRANSPORT AND APPLICATION LAYERS | 9 |
|---|---|---|

Transport Layer Protocols – UDP and TCP Connection and State Transition Diagram - Congestion Control and Avoidance(DEC bit, RED)- QoS - Application Layer Paradigms – Client – Server Programming – Domain Name System – World Wide Web, HTTP, Electronic Mail.

| UNIT IV | NETWORK SECURITY | 9 |
|---|---|---|

OSI Security Architecture – Attacks – Security Services and Mechanisms – Encryption – Advanced Encryption Standard – Public Key Cryptosystems – RSA Algorithm – Hash Functions – Secure Hash Algorithm – Digital Signature Algorithm.

| UNIT V | HARDWARE SECURITY | 9 |
|---|---|---|

Introduction to hardware security, Hardware Trojans, Side – Channel Attacks – Physical Attacks and Countermeasures – Design for Security. Introduction to Blockchain Technology.

**TOTAL: 45 PERIODS**

**PRACTICAL EXERCISES: 30 PERIODS**

**LIST OF EXPERIMENTS:**

**Experiments using C**

1. Implement the Data Link Layer framing method
   (i) Bit Stuffing (ii) Character Stuffing
2. Implementation of Error Detection / Correction Techniques
   (i) LRC (ii) CRC (iii) Hamming code
3. Implementation of Stop and Wait, and Sliding Window Protocols
4. Implementation of Go back-N and Selective Repeat Protocols.
5. Implementation of Distance Vector Routing algorithm (Routing Information Protocol) (Bellman-Ford).

6. Implementation of Link State Routing algorithm (Open Shortest Path First) with 5 nodes.
7. Data encryption and decryption using Data Encryption Standard algorithm.
8. Data encryption and decryption using RSA (Rivest, Shamir and Adleman) algorithm.
Implement Client Server model using FTP protocol.

**Experiments using Tool Command Language**

9. Implement and realize the Network Topology - Star, Bus and Ring using NS2.
10. Implement and perform the operation of CSMA/CD and CSMA/CA using NS2.

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Explain the Network Models, layers and functions.
CO2: Categorize and classify the routing protocols.
CO3: List the functions of the transport and application layer.
CO4: Evaluate and choose the network security mechanisms.
CO5: Discuss the hardware security attacks and countermeasures.

**TEXT BOOKS:**


1. Behrouz A. Forouzan, "Data Communication and Networking", Fifth Edition, TMH, Reprint 2023 (Unit I, II, III).
2. William Stallings, "Cryptography and Network Security", Seventh Edition, Pearson Education, 2017(Unit-IV).
3. Bhunia Swarup, "Hardware Security - A Hands On Approach", Morgan Kaufmann, First edition, 2018 (Unit– V).


**REFERENCE BOOKS:**


1. James F. Kurose and Keith W. Ross, "Computer Networking – A Top–Down Approach", Sixth Edition, Pearson, 2017.
2. Doughlas E. Comer, "Computer Networks and Internets with Internet Applications", Fourth Edition, Pearson Education, 2008.
3. Dr. MuraliBabu and Dr. L. Agilandeeswari, "Networks and Security", Regulation 2021.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 2 | 3 | - | 3 | 2 | - | - | - | - | - | 3 | - | - | 1 |
| 2 | 3 | 3 | 3 | - | - | 2 | - | - | - | - | - | 3 | - | 3 | - |
| 3 | 3 | 3 | - | 2 | 3 | 2 | - | - | - | - | - | 3 | 2 | - | - |
| 4 | 3 | 3 | - | 1 | 3 | 2 | - | - | - | - | - | 3 | - | 3 | 1 |
| 5 | 3 | 3 | - | 3 | 3 | 2 | - | - | - | - | - | 3 | - | 3 | 1 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24EC4403 | LINEAR INTEGRATED CIRCUITS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the basic building blocks of linear integrated circuits.
- To learn the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To learn the theory of ADC and DAC.
- To introduce the concepts of waveform generation and introduce some special function ICs.

| UNIT I | BASICS OF OPERATIONAL AMPLIFIERS | 9 |
|---|---|---|

Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages and internal circuit diagram of IC 741, DC and AC performance characteristics.

| UNIT II | APPLICATIONS OF OPERATIONAL AMPLIFIERS | 9 |
|---|---|---|

Sign Changer, Scale Changer, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, First and second order Low-pass, high-pass and band-pass Butterworth filters.

| UNIT III | ANALOG MULTIPLIER AND PLL | 9 |
|---|---|---|

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection.

| UNIT IV | ADC AND DAC | 9 |
|---|---|---|

D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode *R - 2R* Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type.

| UNIT V | WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS | 9 |
|---|---|---|

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Opto-couplers and fiber optic IC.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Design linear and nonlinear applications of OP – AMPS.

CO2: Design applications using analog multiplier and PLL.

CO3: Design ADC and DAC using OP – AMPS.

CO4: Generate waveforms using OP – AMP Circuits.

CO5: Analyze special function ICs.

**TEXT BOOKS:**

1. D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2018, Fifth Edition. (Unit I – V).
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata Mc Graw-Hill, 2016 (Unit I – V).

**REFERENCE BOOKS:**

1. Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2015.
2. Robert F. Coughlin, Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.
3. S. Salivahanan & V. S. Kanchana Bhaskaran, "Linear Integrated Circuits", TMH, 2nd Edition, 4th Reprint, 2016.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | 3 | 2 | 1 | - | - | - | 1 | - | 1 | 2 | 1 | 1 | 3 |
| 2 | 2 | 2 | 3 | 2 | 1 | - | - | - | 1 | - | 1 | 2 | 1 | 1 | 3 |
| 3 | 3 | 3 | 2 | 1 | 2 | - | - | - | 1 | - | 1 | 2 | 1 | 1 | 3 |
| 4 | 3 | 2 | 3 | 2 | 1 | - | - | - | 1 | - | 1 | 2 | 1 | 1 | 3 |
| 5 | 2 | 3 | 2 | 2 | 1 | - | - | - | 1 | - | 1 | 2 | 1 | 1 | 3 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24EC4404 | DIGITAL SIGNAL PROCESSING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

- To learn discrete Fourier transform, properties of DFT and its application to linear filtering.
- To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands.
- To understand the effects of finite precision representation on digital filters.
- To understand the fundamental concepts of multi rate signal processing and its applications.
- To introduce the concepts of adaptive filters and its application to communication engineering.

| UNIT I | DISCRETE FOURIER TRANSFORM | 9 |
|---|---|---|

Analysis & synthesis equations for Discrete Fourier transform (DFT) - Properties of DFT - overlap save and overlap add method, Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT).

| UNIT II | INFINITE IMPULSE RESPONSE FILTERS | 9 |
|---|---|---|

Transformation techniques - Design of IIR filters - Butterworth filters, Chebyshev filters. Structure of IIR filters.

| UNIT III | FINITE IMPULSE RESPONSE FILTERS | 9 |
|---|---|---|

Gibb's phenomenon - Design of linear phase FIR filters using various windows (Rectangular, Hamming and Hanning window) and frequency sampling method. Structure of FIR filters.

| UNIT IV | FINITE WORD LENGTH EFFECTS | 9 |
|---|---|---|

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

| UNIT V | DSP Architecture | 9 |
|---|---|---|

DSP Architecture (TMS320C5X), Floating Point Architecture (TMS320C3X) - Addressing modes of TMS320C5X, Sampling rate conversion by a rational factor, Application of Adaptive filter.

**TOTAL: 45 PERIODS**

**PRACTICAL EXERCISES: 30 PERIODS**

**LIST OF EXPERIMENTS:**

MATLAB / EQUIVALENT SOFTWARE PACKAGE/ DSP PROCESSOR BASED IMPLEMENTATION

1. Generation of elementary Discrete-Time sequences.
2. Linear and Circular convolutions.
3. Auto correlation and Cross Correlation.
4. Frequency Analysis using DFT.

5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation.
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations.
7. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering.
8. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering.
9. Study of architecture of Digital Signal Processor.
10. Implement an Up-sampling and Down-sampling operation in DSP Processor.

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Apply DFT for the analysis of digital signals and systems.
CO2: Design IIR and FIR filters.
CO3: Characterize the effects of finite precision representation on digital filters.
CO4: Design multi rate filters.
CO5: Apply adaptive filters appropriately in communication systems.

**TEXT BOOKS:**


1. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing – Principles, Algorithms and Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. A. V. Oppenheim, R.W. Schafer and J. R. Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.
3. P. Ramesh Babu, "Digital Signal Processing", Scitech Publications in 2011.


**REFERENCE BOOKS:**


1. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata McGraw Hill, 2007.
3. Andreas Antoniou, "Digital Signal Processing", Tata McGraw Hill, 2006.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | 3 | 3 | 2 | 2 | - | - | - | 1 | 1 | 1 | 3 | 3 | 2 |
| 2 | 3 | 3 | 3 | 3 | 2 | 2 | - | - | - | 1 | 1 | 1 | 2 | 2 | 2 |
| 3 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | 1 | 1 | 3 | 2 | - | - |
| 4 | 3 | 3 | 2 | 2 | 3 | 1 | - | - | - | 1 | 1 | 3 | - | 3 | 1 |
| 5 | 3 | 2 | 2 | 2 | 3 | 2 | - | - | - | 1 | 1 | 3 | - | 3 | 1 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24EC4405 | COMMUNICATION ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce Analog Modulation Schemes
- To impart knowledge in random process
- To study various Digital techniques
- To introduce the importance of sampling & quantization
- To impart knowledge in demodulation techniques
- To enhance the class room teaching using smart connectivity instruments

| UNIT I | AMPLITUDE MODULATION | 9 |
|---|---|---|

Review of signals and systems, Time and Frequency domain representation of signals, Principles of Amplitude Modulation Systems - DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals. SSB Generation – VSB Generation – AM techniques, Superheterodyne Receiver.

| UNIT II | RANDOM PROCESS & SAMPLING | 9 |
|---|---|---|

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De emphasis, Threshold effect in angle modulation.

| UNIT III | DIGITAL TECHNIQUES | 9 |
|---|---|---|

Pulse modulation Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Digital Multiplexers, Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder

| UNIT IV | DIGITAL MODULATION SCHEME | 9 |
|---|---|---|

Geometric Representation of signals - Generation, detection, IQ representation, PSD & BER of Coherent BPSK, BFSK, & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers Synchronization and Carrier Recovery for Digital modulation, Spectrum Analysis – Occupied bandwidth – Adjacent channel power, Principle of DPSK

| UNIT V | DEMODULATION TECHNIQUES | 9 |
|---|---|---|

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission - Inter symbol Interference, Optimum demodulation of digital signals over band-limited channels.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Gain knowledge in amplitude modulation techniques.

CO2: Understand the concepts of Random Process to the design of communication systems.

CO3: Gain knowledge in digital techniques.

CO4: Gain knowledge in sampling and quantization.

CO5: Understand the importance of demodulation techniques.

**TEXT BOOKS:**


1. Simon Haykins, "Communication Systems", Wiley, 5th Edition, 2009.
2. B. P. Lathi, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2011.


**REFERENCE BOOKS:**


1. Wayne Tomasi, "Electronic Communication System", 5th Edition, Pearson Education, 2008.
2. D. Roody, J. Coolen, "Electronic Communications", 4th edition, PHI, 2006.
3. A. Papoulis, "Probability, Random variables and Stochastic Processes", McGraw Hill, 3rd edition, 1991.
4. B. Sklar, "Digital Communications Fundamentals and Applications", 2nd Edition, Pearson Education, 2007.
5. H P Hsu, Schaum Outline Series - "Analog and Digital Communications", TMH, 2006.
6. Couch L., "Modern Communication Systems", Pearson, 2001.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | - | - | 1 | 1 | 3 | 3 | - |
| 2 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | - | - | 1 | 1 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | - | - | - | 1 | 1 | 1 | 2 | 2 |
| 4 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | - | - | 1 | 1 | 2 | 2 | 3 |
| 5 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | - | - | 1 | 1 | 2 | 2 | 1 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24EC4406 | CONTROL SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To identify the various control system components and their representations.
- To analyze the various time domain parameters.
- To analyze the various frequency response plots and its system.
- To analyze the different compensation techniques required for the systems.
- To apply the concepts of various system stability criterions.

| UNIT I | SYSTEMS COMPONENTS AND THEIR REPRESENTATION | 9 |
|---|---|---|

Control System: Terminology and Basic Structure - Feed forward and Feedback control theory - Electrical and Mechanical Transfer Function Models - Block diagram Models - Signal flow graph models.

| UNIT II | TIME RESPONSE ANALYSIS | 9 |
|---|---|---|

Transient response - steady state response - Measures of performance of the standard first order and second order system - effect on an additional zero and an additional pole - steady error constant and system - type number - PID control - Analytical design for PD, PI, PID control systems.

| UNIT III | FREQUENCY RESPONSE AND SYSTEM ANALYSIS | 9 |
|---|---|---|

Closed loop frequency response - Performance specification in frequency domain – Frequency response of standard second order system - Bode Plot - Polar Plot - Design of lag, lead, lag – lead compensators using Bode plot.

| UNIT IV | STABILITY ANALYSIS | 9 |
|---|---|---|

Concept of stability - Bounded - Input Bounded - Output stability - Routh stability criterion - Relative stability - Root locus concept - Guidelines for sketching root locus - Nyquist stability criterion.

| UNIT V | ANALYSIS OF STATE VARIABLE METHODS | 9 |
|---|---|---|

State variable representation - Conversion of state variable models to transfer functions - Conversion of transfer functions to state variable models - Solution of state equations - Concepts of Controllability and Observability.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Acquire the knowledge of signals, systems and its classifications.

CO2: Analyze various system using time domain specifications.

CO3: Analyze various system using frequency domain specifications.

CO4: Apply the concepts of stability of the system using RH and Nyquist methods.

CO5: Design transfer functions of digital control system using state variable models.

**TEXT BOOK:**

1. J. Nagrath and M. Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.

**REFERENCE BOOKS:**

1. Nagoor Kani, "Control System Engineering", CBS Publication and Distributors, 2020.
2. Richard C. Dorf, Robert H. Bishop, "Modern Control System", Pearson, Edition, 2016.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 3 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | 2 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | 2 | 2 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | 3 | 3 | 2 | 3 |
| 4 | 3 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | 2 | 2 | 3 | 3 | 3 |
| 5 | 2 | 2 | 3 | 3 | 2 | 3 | - | - | - | - | 2 | 3 | 2 | 2 | 3 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24EC4407 | COMMUNICATION ENGINEERING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**OBJECTIVES:**

- To study the AM & FM Modulation and Demodulation.
- To learn and realize the effects of sampling and TDM.
- To understand the PCM & Digital Modulation.
- To simulate Digital Modulation Schemes.
- To implement Equalization Algorithms and Error Control Coding Schemes.

**LIST OF EXPERIMENTS:**

**CONSTRUCT AND TEST THE FOLLOWING CIRCUITS**

1. AM- Modulator and Demodulator.
2. FM - Modulator and Demodulator.
3. Pre-Emphasis and De-Emphasis.
4. Signal sampling and TDM.
5. Pulse Code Modulation and Demodulation.
6. Pulse Amplitude Modulation and Demodulation.
7. Pulse Position Modulation and Demodulation and Pulse Width Modulation and Demodulation.
8. Digital Modulation – ASK, PSK, FSK.
9. Delta Modulation and Demodulation.

## SIMULATION USING MATLAB

1. Simulation of ASK, FSK, and BPSK Generation and Detection Schemes.
2. Simulation of DPSK, QPSK and QAM Generation and Detection Schemes.
3. Simulation of Linear Block and Cyclic Error Control Coding Schemes.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Design AM, FM & Digital Modulators for specific applications.

CO2: Compute the sampling frequency for digital modulation.

CO3: Simulate & validate the various functional modules of Communication system.

CO4: Demonstrate their knowledge in base band signaling schemes through implementation of digital modulation schemes.

CO5: Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of Communication system.

## Lab Equipment Requirement:

1. Trainer Kits for AM, FM, Signal Sampling, TDM, PCM, PAM, PPM, PWM, DM and Line Coding Schemes Each - 2 Nos.
2. Trainer Kits for ASK, FSK and PSK Each - 2 Nos.
3. CRO/DSO (30 MHz) - 15 Nos
4. Signal Generators / Function Generators (3 MHz) -15 Nos
5. MATLAB or equivalent open-source software package for simulation Experiments - 15 Users
6. Standalone desktops PC - 15 Nos

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
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| 2 | 3 | 3 | 3 | 3 | 3 | 2 | - | - | - | 1 | 1 | 1 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 2 | - | - | - | 1 | 1 | 1 | 1 | 2 | 2 |
| 4 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | - | 1 | 1 | 1 | 2 | 2 | 3 |
| 5 | 3 | 3 | 3 | 3 | 3 | 2 | - | - | - | 1 | 1 | 1 | 2 | 2 | 1 |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24EC4408 | LINEAR INTEGRATED CIRCUITS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**OBJECTIVES:**

- To gain hands on experience in designing electronic circuits.
- To learn simulation software used in circuit design.
- To learn the fundamental principles of amplifier circuits.
- To differentiate feedback amplifiers and oscillators.
- To differentiate the operation of various multivibrators.

**LIST OF EXPERIMENTS:**

1. Inverting and non-inverting amplifier.
2. RC Integrator and Differentiator circuits using Op-Amp.
3. RC Phase shift oscillator.
4. Clippers and Clampers.
5. Instrumentation amplifier.
6. R-2R ladder type D-A converter using Op-Amp.
7. Study of PLL Characteristics and its use as frequency multiplier, clock synchronization.

**SIMULATION EXPERIMENTS:**

1. Active low-pass, High pass & Band pass filters.
2. Wein Bridge Oscillator.
3. Astable and Monostable Multivibrator.
4. Schmitt Trigger circuit.

**LAB EQUIPMENT REQUIREMENT:**

1. 30MHz DSO/CRO and 5 MHz Arbitrary Function Generator/ signal generator - 15 Nos.
2. Power Supplies (0–30V/3A)(0-30V/3A)(0-5V/3A) (+/-15V) - 15 Nos.
3. Digital Multimeter - 15 Nos.
4. Bread Boards - 15 Nos.
5. Resistors, Capacitors - sufficient quantities.
6. IC741, IC555, IC565, AD620 Each - 15 Nos.
7. Standalone desktops PC with Simulation software - 15 Nos.
8. IC Tester - 2 Nos.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Analyze the performance of amplifiers.

CO2: Design oscillators, wave-shaping circuits and multivibrators.

CO3: Design and simulate oscillators, wave-shaping circuits and multivibrators, filters.

CO4: Design amplifiers, oscillators, D-A converters using operational amplifiers.

CO5: Design filters using op-amp and performs an experiment on frequency response.

**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | 1 | 1 | 3 | 1 | - |
| 2 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | 1 | 1 | 3 | 1 | - |
| 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | 1 | 1 | 3 | 1 | - |
| 4 | 2 | 3 | 3 | 3 | 2 | - | - | - | - | - | 1 | 1 | 3 | 1 | - |
| 5 | - | - | - | - | - | - | - | - | - | - | - | - | 3 | 1 | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Develop vocabulary for effective communication and reading skills.

CO2: Build the logical reasoning and quantitative skills.

CO3: Solve various concepts of number systems and their techniques in solving the HCF, LCM factors and decimals.

CO4: Solve the problems on pipes and cisterns, simple interest, compound interest, growth and depreciation.

CO5: Understand the fundamental principles of structured programming and apply them to write efficient and error-free C programs.

**TEXT BOOKS:**


1. Dr. R. S. Aggarwal, "A Modern Approach to Verbal and Non-verbal Reasoning", Revised Edition, S. Chand Publications.
2. Abhijit Guha, "Quantitative Aptitude for Competitive Examinations", Fourth Edition, McGraw Hill Publications.
3. Y. Kanetkar, "Let Us C", 16th ed., BPB Publications, 2016.
4. R. Gopalan & V. Rajagopalan, "English for Competitive Examinations", Second Edition, Shorff Publishers.


**REFERENCE BOOKS:**


1. U. Mohan Rao, "Quantitative Aptitude for Competitive Examinations", Scitech Publications Pvt Ltd, India.
2. Dinesh Khattar, "The Pearson Guide to Quantitative Aptitude for Competitive Examinations", Third Edition, Pearson Education Pvt Ltd, India, 2016.
3. E. Balagurusamy, "Programming in ANSI C", 7th ed., McGraw Hill Education, 2017.
4. "Logical Reasoning for Competitive Examinations", Veranda RACE Publications, 2022.
5. "General English for Competitive Examinations", Veranda Learning Solutions Ltd, Volume-2, 2022.


**CO – PO – PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 2 | - | - | 3 | - | - | - | - | - | 2 | - | 2 | - | - | - |
| 2 | 2 | 1 | - | - | 2 | - | - | 2 | - | 2 | - | 2 | - | - | - |
| 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - | - |
| 4 | 3 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - | - |
| 5 | 3 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - | - |

**1 – low, 2 – medium, 3 – high, '-'– no correlation**

| 24GE0411 | SOFT SKILLS I | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

- To develop students' comprehensive understanding and effective use of English grammar.
- To enhance students' analytical and logical thinking abilities.
- To make sense of problems, develop strategies to find solutions and persevere in solving them.
- To reason, model, and draw conclusion so make decision with mathematical, statistical, and quantitative information.
- To understand the fundamental principles of C programming.

| UNIT I | ENGLISH PHASE I | 12 |
|---|---|---|

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension Ordering.

| UNIT II | LOGICAL REASONING PHASE I | 12 |
|---|---|---|

Logical Reasoning - Phase I Deductive Reasoning: Coding Deductive Logic, Directional Sense, Blood Relations, Objective Reasoning, Selection Decision Tables, Puzzles.

| UNIT III | QUANTITATIVE REASONING PHASE I | 12 |
|---|---|---|

Numbers- HCF & LCM of Numbers - Decimal Fractions - Simplification - Square Roots & Cube Roots - Average - Problems on Numbers - Problems on Ages - Surds & Indice.

| UNIT IV | NUMERACY SKILLS PHASE I | 12 |
|---|---|---|

Pipes & Cisterns - Problems on Trains - Boats & Streams - Allegation or Mixture - Simple Interest - Compound Interest -Logarithms - Area -Volume & Surface Areas.

| UNIT V | CODING PROFICIENCY PHASE I | 12 |
|---|---|---|

Introduction to C Programming - Operators and Expressions - Control Structures - Functions.

**TOTAL : 60 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the students will be able to

CO1: Develop vocabulary for effective communication and reading skills.
CO2: Build the logical reasoning and quantitative skills.
CO3: Solve various concepts of number systems and their techniques in solving the HCF, LCM factors and decimals.
CO4: Solve the problems on pipes and cisterns, simple interest, compound interest, growth and depreciation.
CO5**:**Understand the fundamental principles of structured programming and apply them to write efficient and error-free C programs.

**TEXT BOOKS :**


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5. "General English for Competitive Examinations", Veranda Learning Solutions Ltd, Volume-2, 2022.


**CO-PO-PSO MAPPING:**

| CO | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| 1 | 2 | - | - | 3 | - | - | - | - | - | 2 | - | 2 | - | - | - |
| 2 | 2 | 1 | - | - | 2 | - | - | 2 | - | 2 | - | 2 | - | - | - |
| 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - | - |
| 4 | 3 | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - | - |
| 5 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | - | - | - |

**1 - low, 2 - medium, 3 - high, '-' - no correlation**