**ANNA UNIVERSITY, CHENNAI**
**AFFILIATED INSTITUTIONS**
**B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING**
**REGULATIONS – 2017**
**CHOICE BASED CREDIT SYSTEM**

## PROGRAMME EDUCATIONAL OBJECTIVES

PEO1: To enable graduates to pursue research, or have a successful career in academia or industries associated with Electronics and Telecommunication Engineering, or as entrepreneurs.

PEO2: To provide students with strong foundational concepts and also advanced techniques and tools in order to enable them to build solutions or systems of varying complexity.

PEO3: To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.

## PROGRAMME OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAM SPECIFIC OBJECTIVES (PSOs)**

1. To analyse, design and develop solutions by applying foundational concepts of electronics and communication engineering.
2. To apply design principles and best practices for developing quality products for scientific and business applications.
3. To adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions to existing/novel problems.

**Contribution 1: Reasonable 2: Significant 3: Strong**

**MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES**

A broad relation between the programme objective and the outcomes is given in the following table

| PROGRAMME EDUCATIONAL OBJECTIVES | PROGRAMME OUTCOMES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L |
| 1 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 3 | 1 |
| **2** | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| **3** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 2 |

**MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES**

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

| PROGRAM SPECIFIC OBJECTIVES | PROGRAMME OUTCOMES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J | K | L |
| 1 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| **2** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 3 | 3 | 3 |
| **3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 3 |

**MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:**

A broad relation between the Course Outcomes and Programme Outcomes is given in the following table

| COURSE OUTCOMES | | PROGRAMME OUTCOMES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sem** | **Course Name** | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **l** |
| **I** | Foundational English | √ | | | √ | √ | | √ | √ | √ | √ | √ | |
| | Mathematics - I | √ | √ | √ | √ | | | | | | | √ | √ |
| | Engineering Physics | √ | √ | √ | √ | | | | | | | √ | √ |
| | Engineering Chemistry | √ | √ | √ | √ | | | | | | | √ | √ |
| | Computing Techniques | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | Basic Sciences Laboratory | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | Computer Practices Laboratory | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | | | | | | | | | | | | | |
| **II** | Technical English | √ | | | √ | √ | | √ | √ | √ | √ | √ | √ |
| | Mathematics - II | √ | √ | √ | √ | | | | | | | √ | √ |
| | Physics for Electronics and Information Science | √ | √ | √ | √ | | | | | | | √ | √ |
| | Circuit Theory | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Electronic Devices | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Engineering Graphics | | | | | | | | | | | | |
| | Electron Devices and Circuits Laboratory | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | Engineering Practices Laboratory | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | | | | | | | | | | | | | |
| **III** | Linear Algebra and Partial Differential Equations | √ | √ | √ | √ | | | | | | | √ | √ |
| | Fundamentals of Data Structures in C | √ | √ | √ | √ | √ | √ | | | | | √ | √ |
| | Electronic Circuits – I | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Signals and Systems | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Digital Principles and System Design | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Control Systems Engineering | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Analog and Digital Circuits Laboratory | √ | √ | √ | √ | √ | √ | | | | | √ | √ |
| | Fundamentals of Data Structures in C Laboratory | √ | √ | √ | √ | √ | √ | | | | | √ | √ |
| | Interpersonal Skills/Listening &Speaking | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | | | | | | | | | | | | | |
| **IV** | Probability and Random Processes | √ | √ | √ | √ | | | | | | | √ | √ |
| | Electronic Circuits-II | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Analog Communication Theory and Systems | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Electromagnetic Fields | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Linear Integrated Circuits and its applications | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Environmental Science and Engineering | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Circuits Design and Simulation Laboratory | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | Linear Integrated Circuits Laboratory | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | | | | | | | | | | | | | |
| **V** | Digital Communication Techniques | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Discrete-Time Signal Processing | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Computer Architecture and Organization | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Communication Networks | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Professional Elective – I | | | | | | | | | | | | |
| | Open Elective I | | | | | | | | | | | | |
| | Digital Signal Processing Laboratory | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | Communication Systems Laboratory | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | Networks Laboratory | √ | √ | √ | √ | √ | √ | | | | | √ | √ |
| | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VI** | Mobile Ad hoc network | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | VLSI Design | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Wireless Communication | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Telecommunication systems and services | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Transmission Lines and RF Systems | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Professional Elective –II | | | | | | | | | | | | |
| | Network Security Laboratory | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | VLSI Laboratory | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | Technical Seminar | √ | √ | √ | √ | √ | √ | | | | | √ | √ |
| | Professional Communication | | | | | | √ | | | | √ | | √ |
| | | | | | | | | | | | | | |
| **VII** | Microwave and optical Communication | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | RISC Processors and Embedded System | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Satellite communication | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Antennas and Radio Wave Propagation | √ | √ | √ | √ | | √ | | | | | √ | √ |
| | Professional Elective -III | | | | | | | | | | | | |
| | Open Elective - II | | | | | | | | | | | | |
| | Microwave and Optical Communication Laboratory | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | Embedded systems Laboratory | √ | √ | √ | √ | √ | | | | | | √ | √ |
| | | | | | | | | | | | | | |
| **VIII** | Professional Elective - IV | | | | | | | | | | | | |
| | Professional Elective - V | | | | | | | | | | | | |
| | Project Work | √ | √ | √ | √ | √ | | | | √ | √ | √ | √ |

**ANNA UNIVERSITY, CHENNAI**
**AFFILIATED INSTITUTIONS**
**B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING**
**REGULATIONS – 2017**
**CHOICE BASED CREDIT SYSTEM**
**I - VIII SEMESTERS CURRICULA AND SYLLABI**

## SEMESTER I

| Sl. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | HS8151 | Communicative English | HS | 4 | 4 | 0 | 0 | 4 |
| 2. | MA8151 | Engineering Mathematics - I | BS | 4 | 4 | 0 | 0 | 4 |
| 3. | PH8151 | Engineering Physics | BS | 3 | 3 | 0 | 0 | 3 |
| 4. | CY8151 | Engineering Chemistry | BS | 3 | 3 | 0 | 0 | 3 |
| 5. | GE8151 | Problem Solving and Python Programming | ES | 3 | 3 | 0 | 0 | 3 |
| 6. | GE8152 | Engineering Graphics | ES | 6 | 2 | 0 | 4 | 4 |
| **PRACTICALS** | | | | | | | | |
| 7. | GE8161 | Problem Solving and Python Programming Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| 8. | BS8161 | Physics and Chemistry Laboratory | BS | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **31** | **19** | **0** | **12** | **25** |

## SEMESTER II

| Sl. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | HS8251 | Technical English | HS | 4 | 4 | 0 | 0 | 4 |
| 2. | MA8251 | Engineering Mathematics - II | BS | 4 | 4 | 0 | 0 | 4 |
| 3. | PH8253 | Physics for Electronics Engineering | BS | 3 | 3 | 0 | 0 | 3 |
| 4. | BE8254 | Basic Electrical and Instrumentation Engineering | ES | 3 | 3 | 0 | 0 | 3 |
| 5. | EC8251 | Circuit Analysis | PC | 4 | 4 | 0 | 0 | 4 |
| 6. | EC8252 | Electronic Devices | PC | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 7. | EC8261 | Circuits and Devices Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | GE8261 | Engineering Practices Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **29** | **21** | **0** | **8** | **25** |

**SEMESTER III**

| Sl. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | MA8352 | Linear Algebra and Partial Differential Equations | BS | 4 | 4 | 0 | 0 | 4 |
| 2. | EC8393 | Fundamentals of Data Structures in C | ES | 3 | 3 | 0 | 0 | 3 |
| 3. | EC8351 | Electronic Circuits -I | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | EC8352 | Signals and Systems | PC | 4 | 4 | 0 | 0 | 4 |
| 5. | CS8351 | Digital Principles and System Design | PC | 4 | 4 | 0 | 0 | 4 |
| 6. | EC8391 | Control Systems Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 7. | EC8381 | Fundamentals of Data Structures in C Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| 8. | EC8361 | Analog and Digital Circuits Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 9. | HS8381 | Interpersonal Skills/Listening & Speaking | EEC | 2 | 0 | 0 | 2 | 1 |
| | | | **TOTAL** | **31** | **21** | **0** | **10** | **26** |

**SEMESTER IV**

| Sl. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | MA8451 | Probability and Random Processes | BS | 4 | 4 | 0 | 0 | 4 |
| 2. | EC8452 | Electronic Circuits -II | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | TL8401 | Analog Communication Theory and Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | EC8451 | Electromagnetic Fields | PC | 4 | 4 | 0 | 0 | 4 |
| 5. | TL8402 | Linear Integrated Circuits and its Applications | PC | 3 | 3 | 0 | 0 | 3 |
| 6. | GE8291 | Environmental Science and Engineering | HS | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 7. | EC8461 | Circuits Design and Simulation Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | EC8462 | Linear Integrated Circuits Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **28** | **20** | **0** | **8** | **24** |

**SEMESTER V**

| Sl. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | TL8501 | Digital Communication Techniques | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | EC8553 | Discrete-Time Signal Processing | PC | 4 | 4 | 0 | 0 | 4 |
| 3. | EC8552 | Computer Architecture and Organization | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | EC8551 | Communication Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | | Professional Elective –I | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | | Open Elective I | OE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 7. | EC8562 | Digital Signal Processing Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | EC8561 | Communication Systems Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 9. | EC8563 | Communication Networks Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **31** | **19** | **0** | **12** | **25** |

**SEMESTER VI**

| Sl. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | TL8601 | Mobile Ad hoc Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | EC8095 | VLSI Design | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | EC8652 | Wireless Communication | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | TL8602 | Telecommunication Systems and Services | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | EC8651 | Transmission Lines and RF Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 6. | | Professional Elective –II | PE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 7. | TL8611 | Network Security Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | EC8661 | VLSI Design Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 9. | TL8612 | Technical Seminar | EEC | 2 | 0 | 0 | 2 | 1 |
| 10. | HS8581 | Professional Communication | EEC | 2 | 0 | 0 | 2 | 1 |
| | | | **TOTAL** | **30** | **18** | **0** | **12** | **24** |

**SEMESTER VII**

| Sl.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | TL8701 | Microwave and optical Communication | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | TL8702 | RISC Processors and Embedded System | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | EC8094 | Satellite Communication | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | TL8703 | Antennas and Radio Wave Propagation | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | | Professional Elective -III | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | | Open Elective - II | OE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 7. | TL8711 | Microwave and Optical Communication Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 8. | TL8712 | Embedded systems Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **26** | **18** | **0** | **8** | **22** |

**SEMESTER VIII**

| Sl.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | | Professional Elective IV | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | | Professional Elective V | PE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 3. | TL8811 | Project Work | EEC | 20 | 0 | 0 | 20 | 10 |
| | | | **TOTAL** | **26** | **6** | **0** | **20** | **16** |

**TOTAL NO. OF CREDITS: 187**

## HUMANITIES AND SOCIAL SCIENCES (HS)

| Sl. NO | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | HS8151 | Communicative English | HS | 4 | 4 | 0 | 0 | 4 |
| 2. | HS8251 | Technical English | HS | 4 | 4 | 0 | 0 | 4 |
| 3. | GE8291 | Environmental Science and Engineering | HS | 3 | 3 | 0 | 0 | 3 |

## BASIC SCIENCES (BS)

| Sl.NO | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | MA8151 | Engineering Mathematics I | BS | 4 | 4 | 0 | 0 | 4 |
| 2. | PH8151 | Engineering Physics | BS | 3 | 3 | 0 | 0 | 3 |
| 3. | CY8151 | Engineering Chemistry | BS | 3 | 3 | 0 | 0 | 3 |
| 4. | BS8161 | Physics and Chemistry Laboratory | BS | 4 | 0 | 0 | 4 | 2 |
| 5. | MA8251 | Engineering Mathematics II | BS | 4 | 4 | 0 | 0 | 4 |
| 6. | PH8253 | Physics for Electronics | BS | 3 | 3 | 0 | 0 | 3 |
| 7. | MA8352 | Linear Algebra and Partial Differential Equations | BS | 4 | 4 | 0 | 0 | 4 |
| 8. | MA8451 | Probability and Random Processes | BS | 4 | 4 | 0 | 0 | 4 |

## ENGINEERING SCIENCES (ES)

| Sl. NO | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | GE8161 | Problem Solving and Python Programming | ES | 3 | 3 | 0 | 0 | 3 |
| 2. | GE8152 | Engineering Graphics | ES | 6 | 2 | 0 | 4 | 4 |
| 3. | GE8161 | Problem Solving and Python Programming Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| 4. | BE8254 | Basic Electrical and Instrumentation Engineering | ES | 3 | 3 | 0 | 0 | 3 |
| 5. | GE8261 | Engineering Practices Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| 6. | EC8393 | Fundamentals of Data Structures in C | ES | 3 | 3 | 0 | 0 | 3 |
| 7. | EC8381 | Fundamentals of Data Structures in C Laboratory | ES | 4 | 0 | 0 | 4 | 2 |

## PROFESSIONAL CORE (PC)

| Sl.NO | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | EC8251 | Circuit Analysis | PC | 4 | 4 | 0 | 0 | 4 |
| 2. | EC8252 | Electronic Devices | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | EC8261 | Circuits and Devices Lab | PC | 4 | 0 | 0 | 4 | 2 |
| 4. | EC8351 | Electronic Circuits I | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | EC8352 | Signals and Systems | PC | 4 | 4 | 0 | 0 | 4 |
| 6. | CS8351 | Digital Principles and System Design | PC | 3 | 3 | 0 | 0 | 3 |
| 7. | EC8391 | Control Systems Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 8. | EC8361 | Analog and Digital Circuits Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 9. | EC8452 | Electronic Circuits -II | PC | 3 | 3 | 0 | 0 | 3 |
| 10. | TL8401 | Analog Communication Theory and Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 11. | EC8451 | Electromagnetic Fields | PC | 4 | 4 | 0 | 0 | 4 |
| 12. | TL8402 | Linear Integrated Circuits and its Applications | PC | 3 | 3 | 0 | 0 | 3 |
| 13. | EC8461 | Circuits Design and simulation Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 14. | EC8462 | Linear Integrated Circuits Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 15. | TL8501 | Digital Communication Techniques | PC | 3 | 3 | 0 | 0 | 3 |
| 16. | EC8553 | Discrete-Time Signal Processing | PC | 4 | 4 | 0 | 0 | 4 |
| 17. | EC8552 | Computer Architecture and Organization | PC | 3 | 3 | 0 | 0 | 3 |
| 18. | EC8551 | Communication Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 19. | EC8562 | Digital Signal Processing Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 20. | EC8561 | Communication Systems Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 21. | EC8563 | Communication Networks Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 22. | TL8601 | Mobile Ad hoc Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 23. | EC8095 | VLSI Design | PC | 3 | 3 | 0 | 0 | 3 |
| 24. | EC8652 | Wireless Communication | PC | 3 | 3 | 0 | 0 | 3 |
| 25. | TL8602 | Telecommunication Systems and Services | PC | 3 | 3 | 0 | 0 | 3 |
| 26. | EC8651 | Transmission Lines and RF Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 27. | TL8611 | Network Security | PC | 4 | 0 | 0 | 4 | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Laboratory | | | | | | |
| 28. | EC8661 | VLSI Design Lab | PC | 4 | 0 | 0 | 4 | 2 |
| 29. | TL8701 | Microwave and optical Communication | PC | 3 | 3 | 0 | 0 | 3 |
| 30. | EC8094 | Satellite Communication | PC | 3 | 3 | 0 | 0 | 3 |
| 31. | TL8702 | RISC Processors and Embedded System | PC | 3 | 3 | 0 | 0 | 3 |
| 32. | TL8703 | Antenna and Radio Wave Propagation | PC | 3 | 3 | 0 | 0 | 3 |
| 33. | TL8711 | Microwave and Optical Communication Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 34. | TL8712 | Embedded Systems Laboratory | PC | 4 | 0 | 0 | 4 | 2 |

## PROFESSIONAL ELECTIVES (PE)*

### SEMESTER V
### ELECTIVE I

| Sl.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | CS8392 | Object Oriented Programming | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | TL8001 | Nano electronics – Devices and Materials | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | TL8002 | Telecommunication System Modeling And Simulation | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | TL8003 | Information theory and Coding | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | EC8073 | Medical Electronics | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | GE8074 | Human Rights | PE | 3 | 3 | 0 | 0 | 3 |
| 7. | GE8077 | Total Quality Management | PE | 3 | 3 | 0 | 0 | 3 |

### SEMESTER VI
### ELECTIVE II

| Sl. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | EC8093 | Digital Image Processing | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | TL8004 | Spread Spectrum Communication | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | TL8005 | Micro Electro Mechanical Systems | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | CS8792 | Cryptography and Network security | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | TL8006 | Bluetooth Technology | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | GE8075 | Intellectual Property Rights | PE | 3 | 3 | 0 | 0 | 3 |

### SEMESTER VII
### ELECTIVE III

| Sl. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | TL8007 | Telecommunication Network Management | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | TL8008 | Advanced Electronic System Design | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | EC8071 | Cognitive Radio | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | TL8009 | Multimedia Compression Techniques | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | TL8071 | Radar and Navigation Aids | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | GE8072 | Foundation Skills in Integrated Product Development | PE | 3 | 3 | 0 | 0 | 3 |
| 7. | GE8071 | Disaster Management | PE | 3 | 3 | 0 | 0 | 3 |

**SEMESTER VIII**
**ELECTIVE IV**

| Sl. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | TL8010 | Broadband Communications | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | TL8011 | Communication Systems and Simulation | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | TL8012 | On-Chip Communication Architectures | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | CS8086 | Soft Computing | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | TL8013 | 3G and 4G Wireless Mobile Communications | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | EC8072 | Electro Magnetic Interference and Compatibility | PE | 3 | 3 | 0 | 0 | 3 |
| 7. | GE8076 | Professional Ethics in Engineering | PE | 3 | 3 | 0 | 0 | 3 |

**SEMESTER VIII**
**ELECTIVE V**

| Sl. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | EC8092 | Advanced Wireless Communication | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | TL8014 | Remote Sensing | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | TL8015 | Opto Electronic Devices | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | TL8016 | Detection and Estimation Theory | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | TL8017 | Wireless Sensor Networks | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | GE8073 | Fundamentals of Nano Science | PE | 3 | 3 | 0 | 0 | 3 |

**Professional Electives are grouped according to elective number as was done previously.**

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

| Sl. NO | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | HS8381 | Interpersonal Skills/Listening & Speaking | EEC | 2 | 0 | 0 | 2 | 1 |
| 2. | TL8612 | Technical Seminar | EEC | 2 | 0 | 0 | 2 | 1 |
| 3. | HS8581 | Professional Communication | EEC | 2 | 0 | 0 | 2 | 1 |
| 4. | TL8811 | Project Work | EEC | 20 | 0 | 0 | 20 | 10 |

**SUMMARY**

| S.NO. | SUBJECT AREA | CREDITS AS PER SEMESTER | | | | | | | | CREDITS TOTAL | Percentage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | | |
| 1. | HS | 4 | 4 | | 3 | | | | | 11 | 6 |
| 2. | BS | 12 | 7 | 4 | 4 | | | | | 27 | 14.5 |
| 3. | ES | 9 | 5 | 5 | | | | | | 19 | 10.2 |
| 4. | PC | | 9 | 16 | 17 | 19 | 19 | 16 | | 96 | 51.62 |
| 5. | PE | | | | | 3 | 3 | 3 | 6 | 15 | 8 |
| 6. | OE | | | | | 3 | | 3 | | 6 | 3 |
| 7. | EEC | | | 1 | | | 2 | | 10 | 13 | 6.46 |
| | Total | 25 | 25 | 26 | 24 | 25 | 24 | 22 | 16 | 187 | 99.78 |
| 8. | Non Credit / Mandatory | | | | | | | | | | |

| HS8151 | COMMUNICATIVE ENGLISH | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |

**OBJECTIVES:**

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

**UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 12**

**Reading**- short comprehension passages, practice in skimming-scanning and predicting- **Writing**- completing sentences- - developing hints. **Listening**- short texts- short formal and informal conversations. **Speaking-** introducing oneself - exchanging personal information- **Language development**- Wh- Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development-**- prefixes- suffixes- articles.- count/ uncount nouns.

**UNIT II GENERAL READING AND FREE WRITING 12**

**Reading -** comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening**- telephonic conversations. **Speaking –** sharing information of a personal kind—greeting – taking leave- **Language development** – prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

**UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12**

**Reading**- short texts and longer passages (close reading) **Writing-** understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences **Listening** – listening to longer texts and filling up the table- product description- narratives from different sources. **Speaking**- asking about routine actions and expressing opinions. **Language development**- degrees of comparison- pronouns- direct vs indirect questions- **Vocabulary development –** single word substitutes- adverbs.

**UNIT IV READING AND LANGUAGE DEVELOPMENT 12**

**Reading-** comprehension-reading longer texts- reading different types of texts- magazines **Writing**- letter writing, informal or personal letters-e-mails-conventions of personal email- **Listening**- listening to dialogues or conversations and completing exercises based on them. **Speaking-** speaking about oneself- speaking about one's friend- **Language development-** Tenses- simple present-simple past- present continuous and past continuous- **Vocabulary development**- synonyms-antonyms- phrasal verbs

**UNIT V EXTENDED WRITING** **12**

**Reading-** longer texts- close reading –**Writing**- brainstorming -writing short essays **–** developing an outline- identifying main and subordinate ideas- dialogue writing-**Listening** – listening to talks-conversations- **Speaking –** participating in conversations- short group conversations-**Language development**-modal verbs- present/ past perfect tense - **Vocabulary development**-collocations-fixed and semi-fixed expressions.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**At the end of the course, learners will be able to:**

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

**TEXT BOOKS:**


1. Board of Editors. **Using English** A Coursebook for Undergarduate Engineers and Technologists**.** Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. **Interchange Students' Book-2** New Delhi: CUP, 2015.


**REFERENCES:**


1. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.
2. Means,L. Thomas and Elaine Langlois. **English & Communication For Colleges.** CengageLearning ,USA: 2007
3. Redston, Chris &Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. **Speaking Effectively: Developing Speaking Skills for Business English.** Cambridge University Press, Cambridge: Reprint 2011
5. Dutt P. Kiranmai and Rajeevan Geeta. **Basic Communication Skills,** Foundation Books: 2013.

**MA8151 ENGINEERING MATHEMATICS – I L T P C**
**4 0 0 4**

**OBJECTIVES :**

The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

**UNIT I DIFFERENTIAL CALCULUS 12**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

**UNIT II FUNCTIONS OF SEVERAL VARIABLES 12**

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 – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

**UNIT III INTEGRAL CALCULUS 12**

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.

**UNIT IV MULTIPLE INTEGRALS 12**

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.

**UNIT V DIFFERENTIAL EQUATIONS 12**

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

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**After completing this course, students should demonstrate competency in the following skills:**

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

**TEXT BOOKS :**

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - 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].

**REFERENCES :**


1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.
2. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.


| | | L | T | P | C |
|---|---|---|---|---|---|
| **PH8151** | **ENGINEERING PHYSICS** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

**UNIT I PROPERTIES OF MATTER 9**

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - 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 WAVES AND FIBER OPTICS 9**

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers : population of energy levels, Einstein’s A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement.

**UNIT III THERMAL PHYSICS 9**

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Forbe’s and Lee’s disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

**UNIT IV QUANTUM PHYSICS 9**

Black body radiation – Planck’s theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger’s wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanning tunnelling microscope.

**UNIT V CRYSTAL PHYSICS 9**

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon completion of this course,**

- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
- the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
- the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
- the students will understand the basics of crystals, their structures and different crystal growth techniques.

**TEXT BOOKS:**


1. Bhattacharya, D.K. & Poonam, T. “Engineering Physics”. Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. “Engineering Physics”. Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. & Chaturvedi, S. “Engineering Physics”. Cengage Learning India, 2012.


**REFERENCES:**


1. Halliday, D., Resnick, R. & Walker, J. “Principles of Physics”. Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. “Physics for Scientists and Engineers”. Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. “Physics for Scientists and Engineers with Modern Physics’. W.H.Freeman, 2007.


**CY8151 ENGINEERING CHEMISTRY L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

**UNIT I WATER AND ITS TREATMENT 9**

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

**UNIT II SURFACE CHEMISTRY AND CATALYSIS 9**

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement. Catalysis: Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

**UNIT III ALLOYS AND PHASE RULE 9**

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

**UNIT IV FUELS AND COMBUSTION 9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - 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).

**UNIT V ENERGY SOURCES AND STORAGE DEVICES 9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – $H_2$-$O_2$ fuel cell.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

**TEXT BOOKS:**


1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.


**REFERENCES:**


1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

**GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures –- lists, tuples, dictionaries.
- To do input/output with files in Python.

**UNIT I ALGORITHMIC PROBLEM SOLVING 9**

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, EXPRESSIONS, STATEMENTS 9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

**UNIT III CONTROL FLOW, FUNCTIONS 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: selection sort, insertion sort, mergesort, histogram.

**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.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to**

- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- 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, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

**REFERENCES:**

1. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
5. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

**GE8152 ENGINEERING GRAPHICS L T P C**
**2 0 4 4**

**OBJECTIVES:**

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination) 1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+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.

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 II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. 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 5+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+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**

**OUTCOMES:**

**On successful completion of this course, the student will be able to:**

- Familiarize with the fundamentals and standards of Engineering graphics
- Perform freehand sketching of basic geometrical constructions and multiple views of objects.
- Project orthographic projections of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Visualize and to project isometric and perspective sections of simple solids.

**TEXT BOOKS:**


1. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.


**REFERENCES:**


1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. 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.
5. N S Parthasarathy And Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.


**Publication of Bureau of Indian Standards**:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**GE8161 PROBLEM SOLVING ANDPYTHON PROGRAMMING LABORATORY L T P C**
**0 0 4 2**

**OBJECTIVES**

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

**LIST OF PROGRAMS**

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

**PLATFORM NEEDED**

Python 3 interpreter for Windows/Linux

**OUTCOMES**

**Upon completion of the course, students will be able to:**

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

**TOTAL: 60 PERIODS**

**BS8161 PHYSICS AND CHEMISTRY LABORATORY L T P C**
**(Common to all branches of B.E. / B.Tech Programmes) 0 0 4 2**

**OBJECTIVES:**

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

**LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)**

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

**TOTAL: 30 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students will be able to

- Apply principles of elasticity, optics and thermal properties for engineering applications.

**CHEMISTRY LABORATORY: (Any seven experiments to be conducted)**

**OBJECTIVES**:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometery.

1. Estimation of HCl using $Na_2CO_3$ as primary standard and Determination of alkalinity in water sample.
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 iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

**OUTCOMES:**

- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

**TOTAL: 30 PERIODS**

**TEXTBOOKS:**

1. Vogel's Textbook of Quantitative Chemical Analysis ($8^{TH}$ edition, 2014)

| HS8251 | TECHNICAL ENGLISH | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |

**OBJECTIVES:**

**The Course prepares second semester engineering and Technology students to:**

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

**UNIT I INTRODUCTION TECHNICAL ENGLISH 12**

**Listening**- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- **Speaking** –Asking for and giving directions- **Reading** – reading short technical texts from journals- newsapapers- **Writing**- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations- **Vocabulary Development**- technical vocabulary **Language Development** –subject verb agreement - compound words.

**UNIT II READING AND STUDY SKILLS 12**

**Listening**- Listening to longer technical talks and completing exercises based on them- **Speaking** – describing a process-**Reading** – reading longer technical texts- identifying the various transitions in a text- paragraphing- **Writing**- interpreting cgarts, graphs- **Vocabulary Development-**vocabularyused in formal letters/emails and reports **Language Development-** impersonal passive voice, numerical adjectives.

**UNIT III TECHNICAL WRITING AND GRAMMAR 12**

**Listening**- Listening to classroom lectures/ talkls on engineering/technology -**Speaking** – introduction to technical presentations- **Reading** – longer texts both general and technical, practice in speed reading; **Writing**-Describing a process, use of sequence words- **Vocabulary Development-** sequence words- Misspelled words. **Language Development-** embedded sentences

**UNIT IV REPORT WRITING 12**

**Listening**- Listening to documentaries and making notes. **Speaking** – mechanics of presentations- **Reading** – reading for detailed comprehension- **Writing**- email etiquette- job application – cover letter –Résumé preparation( via email and hard copy)- analytical essays and issue based essays--**Vocabulary Development**- finding suitable synonyms- paraphrasing-. **Language Development-** clauses- if conditionals.

**UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12**

**Listening**- TED/Ink talks; **Speaking** –participating in a group discussion -**Reading**– reading and understanding technical articles **Writing**– Writing reports- minutes of a meeting- accident and survey-**Vocabulary Development- verbal analogies Language Development-** reported speech

**TOTAL :60 PERIODS**

**OUTCOMES:**

**At the end of the course learners will be able to:**

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

**TEXT BOOKS:**

1. Board of editors. **Fluency in English A Course book for Engineering and Technology.** Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication**. Cambridge University Press: New Delhi, 2016.

**REFERENCES:**

1. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication Principles and Practice.**Oxford University Press: New Delhi,2014.
2. Kumar, Suresh. E. **Engineering English**. Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana**, Project Work,** Oxford University Press**,** Oxford: 2014.
4. Grussendorf, Marion, **English for Presentations,** Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois, **English & Communication For Colleges.** Cengage Learning, USA: 2007

**Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.**

**MA8251 ENGINEERING MATHEMATICS – II L T P C**
**4 0 0 4**

**OBJECTIVES :**

This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

**UNIT I MATRICES 12**

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

**UNIT II VECTOR CALCULUS 12**

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 theorems – Verification and application in evaluating line, surface and volume integrals.

**UNIT III ANALYTIC FUNCTIONS 12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c, cz, \frac{1}{z}, z^2$ - Bilinear transformation.

**UNIT IV COMPLEX INTEGRATION 12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

**UNIT V LAPLACE TRANSFORMS 12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**After successfully completing the course, the student will have a good understanding of the following topics and their applications:**

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

**TEXT BOOKS :**


1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.


**REFERENCES :**


1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi , 3rd Edition, 2007.
3. O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.
4. Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.


| | | L | T | P | C |
|---|---|---|---|---|---|
| **PH8253** | **PHYSICS FOR ELECTRONICS ENGINEERING** (Common to BME, ME, CC, ECE, EEE, E&I, ICE) | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To understand the essential principles of Physics of semiconductor device and Electron transport properties. Become proficient in magnetic, dielectric and optical properties of materials and nano devices.

**UNIT I ELECTRICAL PROPERTIES OF MATERIALS 9**

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - electrons in metals – Particle in a three dimensional box – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential: Bloch thorem – metals and insulators - Energy bands in solids– tight binding approximation - Electron effective mass – concept of hole.

**UNIT II SEMICONDUCTOR PHYSICS 9**

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport - Einstein's relation – Hall effect and devices – Zener and avalanche breakdown in p-n junctions - Ohmic contacts – tunnel diode - Schottky diode – MOS capacitor - power transistor.

**UNIT III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS 9**

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory. Dielectric materials: Polarization processes – dielectric loss – internal field – Clausius-Mosotti relation- dielectric breakdown – high-k dielectrics.

**UNIT IV OPTICAL PROPERTIES OF MATERIALS 9**

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and Semiconductors (concepts only) - photo current in a P- N diode – solar cell –photo detectors - LED – Organic LED – Laser diodes – excitons - quantum confined Stark effect – quantum dot laser.

**UNIT V NANOELECTRONIC DEVICES 9**

Introduction - electron density in bulk material – Size dependence of Fermi energy– quantum confinement – quantum structures - Density of states in quantum well, quantum wire and quantum dot structures –Zener-Bloch oscillations – resonant tunneling – quantum interference effects – mesoscopic structures: conductance fluctuations and coherent transport – Coulomb blockade effects - Single electron phenomena and Single electron Transistor – magnetic semiconductors– spintronics - Carbon nanotubes: Properties and applications.

**TOTAL :45 PERIODS**

**OUTCOMES:**

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

- Gain knowledge on classical and quantum electron theories, and energy band structuues,
- Acquire knowledge on basics of semiconductor physics and its applications in various devices,
- Get knowledge on magnetic and dielectric properties of materials,
- Have the necessary understanding on the functioning of optical materials for optoelectronics,
- Understand the basics of quantum structures and their applications in spintronics and carbon electronics..

**TEXT BOOKS:**


1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.


**REFERENCES:**


1. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009
3. Rogers, B., Adams, J. & Pennathur, S. "Nanotechnology: Understanding Small Systems". CRC Press, 2014

**BE8254 BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVES:**

**To impart knowledge on**

- Operation of Three phase electrical circuits and power measurement
- Working principles of Electrical Machines
- Working principle of Various measuring instruments

**UNIT I AC CIRCUITS AND POWER SYSTEMS 9**

Three phase power supply – Star connection – Delta connection – Balanced and Unbalanced Loads- Power equation – Star Delta Conversion – Three Phase Power Measurement - Transmission & Distribution of electrical energy – Over head Vs Underground system – Protection of power system – types of tariff – power factor improvement

**UNIT II TRANSFORMER 9**

Introduction - Ideal Transformer – Accounting For Finite Permeability And Core Loss – Circuit Model Of Transformer – Per Unit System – Determination Of Parameters Of Circuit Model Of Transformer – Voltage Regulation – Name Plate Rating – Efficiency – Three Phase Transformers - Auto Transformers

**UNIT III DC MACHINES 9**

Introduction – Constructional Features– Motoring and generation principle - Emf And Torque equation – Circuit Model – Methods of Excitation and magnetisation characteristics – Starting and Speed Control – Universal Motor

**UNIT IV AC MACHINES 9**

Principle of operation of three-phase induction motors – Construction –Types – Equivalent circuit, Single phase Induction motors -Construction– Types–starting and speed control methods. Alternator- working principle–Equation of induced EMF – Voltage regulation, Synchronous motors-working principle-starting methods -– Torque equation – Stepper Motors – Brushless DC Motors

**UNIT V MEASUREMENT AND INSTRUMENTATION 9**

Type of Electrical and electronic instruments – Classification- Types of indicating Instruments – Principles of Electrical Instruments –Multimeters, Oscilloscopes- Static and Dynamic Characteristics of Measurement – Errors in Measurement – Transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

- Understand the concept of three phase power circuits and measurement.
- Comprehend the concepts in electrical generators, motors and transformers
- Choose appropriate measuring instruments for given application

**TEXT BOOKS:**


1. D P Kothari and I.J Nagarath, “Basic Electrical and Electronics Engineering”, McGraw Hill Education(India) Private Limited, Third Reprint ,2016
2. Giorgio Rizzoni, “Principles and Applications of Electrical Engineering”, McGraw Hill Education(India) Private Limited, 2010
3. S.K.Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson India, 2011

**REFERENCES:**


1. Del Toro ,"Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2015.
2. Leonard S Bobrow, " Foundations of Electrical Engineering", Oxford University Press, 2013
3. Rajendra Prasad ,"Fundamentals of Electrical engineering", Prentice Hall of India, 2006.
4. Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, 24th reprint 2016
5. A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, "Basic Electrical Engineering", McGraw Hill Education(India) Private Limited, 2009


**EC8251 CIRCUIT ANALYSIS L T P C**
**4 0 0 4**

**OBJECTIVES:**

- To introduce the basic concepts of DC and AC circuits behavior
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems, duality and topology.

**UNIT I BASIC CIRCUITS ANALYSIS AND NETWORK TOPOLOGY 12**

Ohm's Law – Kirchhoff's laws – Mesh current and node voltage method of analysis for D.C and A.C. circuits - Network terminology - Graph of a network - Incidence and reduced incidence matrices – Trees –Cutsets - Fundamental cutsets - Cutset matrix – Tie sets - Link currents and Tie set schedules -Twig voltages and Cutset schedules, Duality and dual networks.

**UNIT II NETWORK THEOREMS FOR DC AND AC CIRCUITS 12**

Network theorems -Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem, and Maximum power transfer theorem ,application of Network theorems- Network reduction: voltage and current division, source transformation – star delta conversion.

**UNIT III RESONANCE AND COUPLED CIRCUITS 12**

Resonance - Series resonance - Parallel resonance - Variation of impedance with frequency - Variation in current through and voltage across L and C with frequency – Bandwidth - Q factor - Selectivity. Self inductance - Mutual inductance - Dot rule - Coefficient of coupling - Analysis of multiwinding coupled circuits - Series, Parallel connection of coupled inductors - Single tuned and double tuned coupled circuits.

**UNITIV TRANSIENT ANALYSIS 12**

Natural response-Forced response - Transient response of RC, RL and RLC circuits to excitation by Step Signal, Impulse Signal and exponential sources - Complete response of RC, RL and RLC Circuits to sinusoidal excitation.

**UNIT V TWO PORT NETWORKS 12**

Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid(H) Parameters, Interconnection of two port networks, Symmetrical properties of T and π networks.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Develop the capacity to analyze electrical circuits, apply the circuit theorems in real time
- Design and understand and evaluate the AC and DC circuits.

**TEXT BOOKS:**

1. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis" , McGraw Hill Science Engineering, Eighth Edition, 11th Reprint 2016.
2. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

**REFERENCES:**

1. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Fifth Edition, McGraw Hill, 9th Reprint 2015.
2. A.Bruce Carlson, "Cicuits: Engineering Concepts and Analysis of Linear Electric Circuits", Cengage Learning, India Edition 2nd Indian Reprint 2009.
3. Allan H.Robbins, Wilhelm C.Miller, "Circuit Analysis Theory and Practice", Cengage Learning, Fifth Edition, 1st Indian Reprint 2013.

**EC8252 ELECTRONIC DEVICES L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices

**UNIT I SEMICONDUCTOR DIODE 9**

PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

**UNIT II BIPOLAR JUNCTION TRANSISTORS 9**

NPN -PNP -Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - Hybrid -π model - h-parameter model, Ebers Moll Model- Gummel Poon-model, Multi Emitter Transistor.

**UNIT III FIELD EFFECT TRANSISTORS 9**

JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with JFET.

**UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9**

Metal-Semiconductor Junction- MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Schottky barrier diode-Zener diode-Varactor diode –Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

**UNIT V POWER DEVICES AND DISPLAY DEVICES 9**

UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

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

- Explain the V-I characteristic of diode, UJT and SCR
- Describe the equivalence circuits of transistors
- Operate the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices

**TEXT BOOKS:**

1. Donald A Neaman, “Semiconductor Physics and Devices”, Fourth Edition, Tata Mc GrawHill Inc. 2012.
2. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, “Electronic Devices and circuits”, Third Edition, Tata McGraw- Hill, 2008.

**REFERENCES:**

1. Robert Boylestad and Louis Nashelsky, “Electron Devices and Circuit Theory” Pearson Prentice Hall, 10th edition, July 2008.
2. R.S.Sedha, “ A Text Book of Applied Electronics” S.Chand Publications, 2006.
3. Yang, “Fundamentals of Semiconductor devices”, McGraw Hill International Edition, 1978.

**EC8261 CIRCUITS AND DEVICES LABORATORY L T P C**
**0 0 4 2**

**OBJECTIVES:**

- To learn the characteristics of basic electronic devices such as Diode, BJT,FET, SCR
- To understand the working of RL,RC and RLC circuits
- To gain hand on experience in Thevinin & Norton theorem, KVL & KCL, and Super Position Theorems

1. Characteristics of PN Junction Diode
2. Zener diode Characteristics & Regulator using Zener diode
3. Common Emitter input-output Characteristics
4. Common Base input-output Characteristics
5. FET Characteristics
6. SCR Characteristics
7. Clipper and Clamper & FWR
8. Verifications Of Thevinin & Norton theorem
9. Verifications Of KVL & KCL
10. Verifications Of Super Position Theorem
11. verifications of maximum power transfer & reciprocity theorem
12. Determination Of Resonance Frequency of Series & Parallel RLC Circuits
13. Transient analysis of RL and RC circuits

**LABORATORY REQUIREMENTS**

| | |
|---|---|
| BC 107, BC 148,2N2646,BFW10 | - 25 each |
| 1N4007, Zener diodes | - 25 each |
| Resistors, Capacitors, Inductors | - sufficient quantities |
| Bread Boards | - 15 Nos |
| CRO (30MHz) | – 10 Nos. |
| Function Generators (3MHz) | – 10 Nos. |
| Dual Regulated Power Supplies ( 0 – 30V) | – 10 Nos. |

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Analyze the characteristics of basic electronic devices
- Design RL and RC circuits
- Verify Thevinin & Norton theorem KVL & KCL, and Super Position Theorems

**GE8261 ENGINEERING PRACTICES LABORATORY L T P C**
**0 0 4 2**

**OBJECTIVES:**

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

## GROUP A (CIVIL & MECHANICAL)

### I CIVIL ENGINEERING PRACTICE 13

**Buildings:**

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works**:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

### II MECHANICAL ENGINEERING PRACTICE 18

**Welding:**

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
(b) Gas welding practice

**Basic Machining:**

(a) Simple Turning and Taper turning
(b) Drilling Practice

**Sheet Metal Work:**

(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

**Machine assembly practice:**

(a) Study of centrifugal pump
(b) Study of air conditioner

**Demonstration on:**

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS)**

**III ELECTRICAL ENGINEERING PRACTICE 13**

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

**IV ELECTRONICS ENGINEERING PRACTICE 16**

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the student will be able to**

- Fabricate carpentry components and pipe connections including plumbing works.
- Use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and
- fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

**CIVIL**

| | |
|---|---|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets. |
| 2. Carpentry vice (fitted to work bench) | 15 Nos. |
| 3. Standard woodworking tools | 15 Sets. |
| 4. Models of industrial trusses, door joints, furniture joints | 5 each |
| 5. Power Tools: (a) Rotary Hammer | 2 Nos |
| (b) Demolition Hammer | 2 Nos |
| (c) Circular Saw | 2 Nos |
| (d) Planer | 2 Nos |
| (e) Hand Drilling Machine | 2 Nos |
| (f) Jigsaw | 2 Nos |

**MECHANICAL**

| | |
|---|---|
| 1. Arc welding transformer with cables and holders | 5 Nos. |
| 2. Welding booth with exhaust facility | 5 Nos. |
| 3. Welding accessories like welding shield, chipping hammer, wire brush, etc. | 5 Sets. |
| 4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. | 2 Nos. |
| 5. Centre lathe | 2 Nos. |
| 6. Hearth furnace, anvil and smithy tools | 2 Sets. |

| | |
|---|---|
| 7. Moulding table, foundry tools | 2 Sets. |
| 8. Power Tool: Angle Grinder | 2 Nos |
| 9. Study-purpose items: centrifugal pump, air-conditioner | One each. |

**ELECTRICAL**

| | |
|---|---|
| 1. Assorted electrical components for house wiring | 15 Sets |
| 2. Electrical measuring instruments | 10 Sets |
| 3. Study purpose items: Iron box, fan and regulator, emergency lamp | 1 each |
| 4. Megger (250V/500V) | 1 No. |
| 5. Power Tools: (a) Range Finder | 2 Nos |
| (b) Digital Live-wire detector | 2 Nos |

**ELECTRONICS**

| | |
|---|---|
| 1. Soldering guns | 10 Nos. |
| 2. Assorted electronic components for making circuits | 50 Nos. |
| 3. Small PCBs | 10 Nos. |
| 4. Multimeters | 10 Nos. |
| 5. Study purpose items: Telephone, FM radio, low-voltage power supply | |

**MA8352 LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**OBJECTIVES:**

- To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
- To understand the concepts of vector space, linear transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.
- To understand the procedure to solve partial differential equations.
- To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

**UNIT I VECTOR SPACES** **12**

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

**UNIT II LINEAR TRANSFORMATION AND DIAGONALIZATION** **12**

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Eigenvalues and eigenvectors - Diagonalizability.

**UNIT III INNER PRODUCT SPACES** **12**

Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

**UNIT IV PARTIAL DIFFERENTIAL EQUATIONS** **12**

Formation – Solutions of first order equations – Standard types and equations reducible to standard types – Singular solutions – Lagrange's linear equation – Integral surface passing through a given curve – Classification of partial differential equations - Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

**UNIT V FOURIER SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12**

Dirichlet's conditions – General Fourier series – Half range sine and cosine series - Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**Upon successful completion of the course, students should be able to:**

- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- Able to solve various types of partial differential equations.
- Able to solve engineering problems using Fourier series.

**TEXTBOOKS:**


1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Friedberg, A.H., Insel, A.J. and Spence, L., "Linear Algebra", Prentice Hall of India, New Delhi, 2004.


**REFERENCES :**


1. Burden, R.L. and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. James, G. "Advanced Modern Engineering Mathematics", Pearson Education, 2007.
3. Kolman, B. Hill, D.R., "Introductory Linear Algebra", Pearson Education, New Delhi, First Reprint, 2009.
4. Kumaresan, S., "Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi, Reprint, 2010.
5. Lay, D.C., "Linear Algebra and its Applications", 5th Edition, Pearson Education, 2015.
6. O'Neil, P.V., "Advanced Engineering Mathematics", Cengage Learning, 2007.
7. Strang, G., "Linear Algebra and its applications", Thomson (Brooks/Cole), New Delhi, 2005.
8. Sundarapandian, V. "Numerical Linear Algebra", Prentice Hall of India, New Delhi, 2008.


**EC8393 FUNDAMENTALS OF DATA STRUCTURES IN C L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To learn the features of C
- To learn the linear and non-linear data structures
- To explore the applications of linear and non-linear data structures
- To learn to represent data using graph data structure
- To learn the basic sorting and searching algorithms

**UNIT I C PROGRAMMING BASICS 9**

Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two-dimensional arrays. Strings- String operations – String Arrays. Simple programs- sorting-searching – matrix operations.

**UNIT II FUNCTIONS, POINTERS, STRUCTURES AND UNIONS 9**

Functions – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic. Structures and unions - definition – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**UNIT III LINEAR DATA STRUCTURES 9**

Arrays and its representations – Stacks and Queues – Linked lists – Linked list-based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition.

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

Trees – Binary Trees – Binary tree representation and traversals –Binary Search Trees – Applications of trees. Set representations - Union-Find operations. Graph and its representations – Graph Traversals.

**UNIT V SEARCHING AND SORTING ALGORITHMS 9**

Linear Search – Binary Search. Bubble Sort, Insertion sort – Merge sort – Quick sort - Hash tables – Overflow handling.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Implement linear and non-linear data structure operations using C
- Suggest appropriate linear / non-linear data structure for any given data set.
- Apply hashing concepts for a given problem
- Modify or suggest new data structure for an application
- Appropriately choose the sorting algorithm for an application

**TEXTBOOKS:**


1. Pradip Dey and Manas Ghosh, —Programming in C, Second Edition, Oxford University Press, 2011.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008.


**REFERENCES:**


1. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 1996
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, 1983.
3. Robert Kruse, C.L.Tondo, Bruce Leung, Shashi Mogalla , — Data Structures and Program Design in C, Second Edition, Pearson Education, 2007
4. Jean-Paul Tremblay and Paul G. Sorenson, —An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, 1991.

| EC8351 | ELECTRONIC CIRCUITS I | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the methods of biasing transistors
- To design and analyze single stage and multistage amplifier circuits
- To analyze the frequency response of small signal amplifiers
- To design and analyze the regulated DC power supplies.
- To troubleshoot and fault analysis of power supplies.

**UNIT I BIASING OF DISCRETE BJT, JFET AND MOSFET 9**

BJT– Need for biasing - DC Load Line and Bias Point – DC analysis of Transistor circuits - Various biasing methods of BJT – Bias Circuit Design - Thermal stability - Stability factors - Bias compensation techniques using Diode, thermistor and sensistor – Biasing BJT Switching Circuits- JFET - DC Load Line and Bias Point - Various biasing methods of JFET - JFET Bias Circuit Design - MOSFET Biasing - Biasing FET Switching Circuits.

**UNIT II BJT AMPLIFIERS 9**

Small Signal Hybrid π equivalent circuit of BJT – Early effect - Analysis of CE, CC and CB amplifiers using Hybrid π equivalent circuits - AC Load Line Analysis- Darlington Amplifier - Bootstrap technique - Cascade, Cascode configurations - Differential amplifier, Basic BJT differential pair – Small signal analysis and CMRR.

**UNIT III SINGLE STAGE FET, MOSFET AMPLIFIERS 9**

Small Signal Hybrid π equivalent circuit of FET and MOSFET - Analysis of CS, CD and CG amplifiers using Hybrid π equivalent circuits - Basic FET differential pair- BiCMOS circuits.

**UNIT IV FREQUENCY RESPONSE OF AMPLIFIERS 9**

Amplifier frequency response – Frequency response of transistor amplifiers with circuit capacitors – BJT frequency response – short circuit current gain - cut off frequency – fα, fβ and unity gain bandwidth – Miller effect - frequency response of FET - High frequency analysis of CE and MOSFET CS amplifier - Transistor Switching Times.

**UNIT V POWER SUPPLIES AND ELECTRONIC DEVICE TESTING 9**

Linear mode power supply - Rectifiers - Filters - Half-Wave Rectifier Power Supply - Full-Wave Rectifier Power Supply - Voltage regulators: Voltage regulation - Linear series, shunt and switching Voltage Regulators - Over voltage protection - BJT and MOSFET – Switched mode power supply (SMPS) - Power Supply Performance and Testing - Troubleshooting and Fault Analysis, Design of Regulated DC Power Supply.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**After studying this course, the student should be able to:**

- Acquire knowledge of
  - Working principles, characteristics and applications of BJT and FET
  - Frequency response characteristics of BJT and FET amplifiers
- Analyze the performance of small signal BJT and FET amplifiers - single stage and multi stage amplifiers
- Apply the knowledge gained in the design of Electronic circuits

**TEXT BOOKS:**


1. Donald. A. Neamen, Electronic Circuits Analysis and Design, 3rd Edition, Mc Graw Hill Education (India) Private Ltd., 2010. (Unit I-IV)
2. Robert L. Boylestad and Louis Nasheresky, “Electronic Devices and Circuit Theory”, 11th Edition, Pearson Education, 2013. (Unit V)

**REFERENCES**


1. Millman J, Halkias.C.and Sathyabrada Jit, Electronic Devices and Circuits, 4th Edition, Mc Graw Hill Education (India) Private Ltd., 2015.
2. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, 4th Edition, , Mc Graw Hill Education (India) Private Ltd., 2017.
3. Floyd, Electronic Devices, Ninth Edition, Pearson Education, 2012.
4. David A. Bell, Electronic Devices & Circuits, 5th Edition, Oxford University Press, 2008.
5. Anwar A. Khan and Kanchan K. Dey, A First Course on Electronics, PHI, 2006.
6. Rashid M, Microelectronics Circuits, Thomson Learning, 2007.


| EC8352 | SIGNALS AND SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |

**OBJECTIVES:**

- To understand the basic properties of signal & systems
- To know the methods of characterization of LTI systems in 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

**UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 12**

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_ Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

**UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 12**

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

**UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 12**

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

**UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 12**

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

**UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 12**

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: 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- To be able to determine if a given system is linear/causal/stable
- Capable of determining the frequency components present in a deterministic signal
- Capable of characterizing LTI systems in the time domain and frequency domain
- To be able to compute the output of an LTI system in the time and frequency domains

**TEXT BOOK:**

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson, 2015.(Unit 1-V)

**REFERENCES**

1. B. P. Lathi, “Principles of Linear Systems and Signals”, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, “Signals & Systems - Continuous and Discrete”, Pearson, 2007.
3. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007.

| CS8351 | DIGITAL PRINCIPLES AND SYSTEM DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |

**OBJECTIVES:**

- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

**UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 12**

Number Systems - Arithmetic Operations - Binary Codes- Boolean Algebra and Logic Gates - Theorems and Properties of Boolean Algebra - Boolean Functions - Canonical and Standard Forms - Simplification of Boolean Functions using Karnaugh Map - Logic Gates – NAND and NOR Implementations.

**UNIT II COMBINATIONAL LOGIC 12**

Combinational Circuits – Analysis and Design Procedures - Binary Adder-Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoders – Encoders – Multiplexers - Introduction to HDL – HDL Models of Combinational circuits.

**UNIT III SYNCHRONOUS SEQUENTIAL LOGIC 12**

Sequential Circuits - Storage Elements: Latches , Flip-Flops - Analysis of Clocked Sequential Circuits - State Reduction and Assignment - Design Procedure - Registers and Counters - HDL Models of Sequential Circuits.

**UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC 12**

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

**UNIT V MEMORY AND PROGRAMMABLE LOGIC 12**

RAM – Memory Decoding – Error Detection and Correction - ROM - Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices.

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- Simplify Boolean functions using KMap
- Design and Analyze Combinational and Sequential Circuits
- Implement designs using Programmable Logic Devices
- Write HDL code for combinational and Sequential Circuits

**TEXT BOOK:**

1. M. Morris R. Mano, Michael D. Ciletti, “Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog”, 6th Edition, Pearson Education 2017.

**REFERENCES:**

1. G. K. Kharate, Digital Electronics, Oxford University Press, 2010
2. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017.
3. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013
4. Donald D. Givone, Digital Principles and Design‖, Tata Mc Graw Hill, 2003.

| EC8391 | CONTROL SYSTEMS ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

**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 graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

**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- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

**UNIT IV CONCEPTS OF 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 CONTROL SYSTEM ANALYSIS USING 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-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Identify the various control system components and their representations.
- Analyze the various time domain parameters.
- Analysis the various frequency response plots and its system.
- Apply the concepts of various system stability criterions.
- Design various transfer functions of digital control system using state variable models.

**TEXT BOOK:**

1. M.Gopal, “Control System – Principles and Design”, Tata McGraw Hill, 4th Edition, 2012.

**REFERENCES:**

1. J.Nagrath and M.Gopal, “Control System Engineering”, New Age International Publishers, 5 th Edition, 2007.
2. K. Ogata, ‘Modern Control Engineering’, 5th edition, PHI, 2012.
3. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
4. Benjamin.C.Kuo, “Automatic control systems”, Prentice Hall of India, 7th Edition,1995.

**EC8381 FUNDAMENTALS OF DATA STRUCTURES IN C LABORATORY L T P C**
**0 0 4 2**

**OBJECTIVES:**

- To understand and implement basic data structures using C
- To apply linear and non-linear data structures in problem solving.
- To learn to implement functions and recursive functions by means of data structures
- To implement searching and sorting algorithms

**LIST OF EXERCISES**

1. Basic C Programs – looping, data manipulations, arrays
2. Programs using strings – string function implementation
3. Programs using structures and pointers
4. Programs involving dynamic memory allocations
5. Array implementation of stacks and queues
6. Linked list implementation of stacks and queues
7. Application of Stacks and Queues
8. Implementation of Trees, Tree Traversals
9. Implementation of Binary Search trees
10. Implementation of Linear search and binary search
11. Implementation Insertion sort, Bubble sort, Quick sort and Merge Sort
12. Implementation Hash functions, collision resolution technique

**TOTAL:60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Write basic and advanced programs in C
- Implement functions and recursive functions in C
- Implement data structures using C
- Choose appropriate sorting algorithm for an application and implement it in a modularized way

| EC8361 | ANALOG AND DIGITAL CIRCUITS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

**The student should be made to:**

- Study the Frequency response of CE,CB and CC Amplifier
- Learn the frequency response of CS Amplifiers
- Study the Transfer characteristics of differential amplifier
- Perform experiment to obtain the bandwidth of single stage and multistage amplifiers
- Perform SPICE simulation of Electronic Circuits
- Design and implement the Combinational and sequential logic circuits

**LIST OF ANALOG EXPERIMENTS:**

1. Design of Regulated Power supplies
2. Frequency Response of CE, CB, CC and CS amplifiers
3. Darlington Amplifier
4. Differential Amplifiers - Transfer characteristics, CMRR Measurement
5. Cascode and Cascade amplifiers
6. Determination of bandwidth of single stage and multistage amplifiers
7. Analysis of BJT with Fixed bias and Voltage divider bias using P-Spice
8. Analysis of FET, MOSFET with fixed bias, self-bias and voltage divider bias using PSpice
9. Analysis of Cascode and Cascade amplifiers using PSpice
10. Analysis of Frequency Response of BJT and FET using PSpice

**LIST OF DIGITAL EXPERIMENTS**

1. Design and implementation of code converters using logic gates(i) BCD to excess-3 code and vice versa (ii) Binary to gray and vice-versa
2. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483
3. Design and implementation of Multiplexer and De-multiplexer using logic gates
4. Design and implementation of encoder and decoder using logic gates
5. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters
6. Design and implementation of 3-bit synchronous up/down counter

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**On completion of this laboratory course, the student should be able to:**

- Design and Test rectifiers, filters and regulated power supplies.
- Design and Test BJT/JFET amplifiers.
- Differentiate cascode and cascade amplifiers.
- Analyze the limitation in bandwidth of single stage and multi stage amplifier
- Measure CMRR in differential amplifier
- Simulate and analyze amplifier circuits using PSpice.
- Design and Test the digital logic circuits.

**LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS, 2 STUDENTS / EXPERIMENT:**

| S.NO | EQUIPMENTS FOR ANALOG LAB |
|---|---|
| 1 | CRO/DSO (30MHz) – 15 Nos. |
| 2 | Signal Generator /Function Generators (3 MHz) – 15 Nos |
| 3 | Dual Regulated Power Supplies ( 0 – 30V) – 15 Nos. |
| 4 | Standalone desktop PCs with SPICE software – 15 Nos. |
| 5 | Transistor/FET (BJT-NPN-PNP and NMOS/PMOS) – 50 Nos |
| 6 | Components and Accessories: Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, Transformers. |
| 7 | SPICE Circuit Simulation Software: (any public domain or commercial software) |

| S.NO | EQUIPMENTS FOR DIGITAL LAB |
|---|---|
| 1 | Dual power supply/ single mode power supply - 15 Nos |
| 2 | IC Trainer Kit - 15 Nos |
| 3 | Bread Boards - 15 Nos |
| 4 | Seven segment display -15 Nos |
| 5 | Multimeter - 15 Nos |
| 6 | ICs each 50 Nos<br>7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 / 74151 / 74147 / 7445 / 7476/7491/ 555 / 7494 / 7447 / 74180 / 7485 / 7473 / 74138 / 7411 / 7474 |

| | | L | T | P | C |
|---|---|---|---|---|---|
| **HS8381** | **INTERPERSONAL SKILLS/LISTENING&SPEAKING** | **0** | **0** | **2** | **1** |

**OBJECTIVES:**

**The Course will enable learners to:**

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

**UNIT I**

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

**UNIT II**

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

**UNIT III**

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

**UNIT IV**

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

**UNIT V**

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

**TOTAL : 30 PERIODS**

**OUTCOMES:**

**At the end of the course Learners will be able to:**

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

**TEXT BOOKS:**


1. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010


**REFERENCES**


1. Bhatnagar, Nitin and MamtaBhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
3. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014


| MA8451 | PROBABILITY AND RANDOM PROCESSES | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |

**OBJECTIVES:**

- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of correlation and spectral densities.
- To understand the significance of linear systems with random inputs.

**UNIT I PROBABILITY AND RANDOM VARIABLES 12**

Probability – Axioms of probability – Conditional probability – Baye's theorem - 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 – Central limit theorem (for independent and identically distributed random variables).

**UNIT III RANDOM PROCESSES 12**

Classification – Stationary process – Markov process - Markov chain - Poisson process – Random telegraph process.

**UNIT IV CORRELATION AND SPECTRAL DENSITIES 12**

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

**UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 12**

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

**TOTAL : 60 PERIODS**

**OUTCOMES :**

**Upon successful completion of the course, students should be able to:**

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept random processes in engineering disciplines.
- Understand and apply the concept of correlation and spectral densities.
- The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.

**TEXT BOOKS:**


1. Ibe, O.C.," Fundamentals of Applied Probability and Random Processes ", 1st Indian Reprint, Elsevier, 2007.
2. Peebles, P.Z., "Probability, Random Variables and Random Signal Principles ", Tata McGraw Hill, 4th Edition, New Delhi, 2002.


**REFERENCES :**


1. Cooper. G.R., McGillem. C.D., "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3rd Indian Edition, 2012.
2. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes ", Tata McGraw Hill Edition, New Delhi, 2004.
3. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2004.
4. Stark. H. and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing ", Pearson Education, Asia, 3rd Edition, 2002.
5. Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012.

**EC8452 ELECTRONIC CIRCUITS II**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To give a comprehensive exposure to all types of amplifiers and oscillators constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- To study about feedback amplifiers and oscillators principles
- To design oscillators.
- To study about turned amplifier.
- To understand the analysis and design of LC and RC oscillators, amplifiers, multi vibrators, power amplifiers and DC convertors.

**UNIT I FEEDBACK AMPLIFIERS AND STABILITY 9**

Feedback Concepts – gain with feedback – effect of feedback on gain stability, distortion, bandwidth, input and output impedances; topologies of feedback amplifiers – analysis of series-series, shunt-shunt and shunt-series feedback amplifiers-stability problem-Gain and Phase-margins-Frequency compensation.

**UNIT II OSCILLATORS 9**

Barkhausen criterion for oscillation – phase shift, Wien bridge - Hartley & Colpitt's oscillators – Clapp oscillator-Ring oscillators and crystal oscillators – oscillator amplitude stabilization.

**UNIT III TUNED AMPLIFIERS 9**

Coil losses, unloaded and loaded Q of tank circuits, small signal tuned amplifiers – Analysis of capacitor coupled single tuned amplifier **–** double tuned amplifier - effect of cascading single tuned and double tuned amplifiers on bandwidth – Stagger tuned amplifiers - Stability of tuned amplifiers – Neutralization - Hazeltine neutralization method.

**UNIT IV WAVE SHAPING AND MULTIVIBRATOR CIRCUITS 9**

Pulse circuits – attenuators – RC integrator and differentiator circuits – diode clampers and clippers –Multivibrators - Schmitt Trigger- UJT Oscillator.

**UNIT V POWER AMPLIFIERS AND DC CONVERTERS 9**

Power amplifiers- class A-Class B-ClassAB-Class C-Power MOSFET-Temperature Effect-Class AB Power amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Analyze different types of amplifier, oscillator and multivibrator circuits
- Design BJT amplifier and oscillator circuits
- Analyze transistorized amplifier and oscillator circuits
- Design and analyze feedback amplifiers
- Design LC and RC oscillators, tuned amplifiers, wave shaping circuits, multivibrators, power amplifier and DC convertors.

**TEXT BOOKS:**


1. Sedra and Smith, "Micro Electronic Circuits"; Sixth Edition, Oxford University Press, 2011. (UNIT I, III,IV,V)
2. Jacob Millman, 'Microelectronics', McGraw Hill, 2nd Edition, Reprinted, 2009. (UNIT I,II,IV,V)

**REFERENCES:**


1. Robert L. Boylestad and Louis Nasheresky, “Electronic Devices and Circuit Theory”, 10th Edition, Pearson Education / PHI, 2008
2. David A. Bell, “Electronic Devices and Circuits”, Fifth Edition, Oxford University Press, 2008.
3. Millman J. and Taub H., “Pulse Digital and Switching Waveforms”, TMH, 2000.
4. Millman and Halkias. C., Integrated Electronics, TMH, 2007.


| TL8401 | ANALOG COMMUNICATION THEORY AND SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the fundamentals of various analog modulations
- To know the generation and detection of AM and FM waves
- To know the AM and FM transmitter and Receiver
- To know the effect of noise on communication systems

**UNIT I AMPLITUDE MODULATION 9**

Need for modulation, Definition, Time domain and frequency domain description of AM waves, single tone modulation, power relations in AM waves, Generation of AM waves, Detection of AM Waves. power relations in DSB/SC AM waves, Generation of DSBSC Waves, Coherent detection of DSB-SC Modulated waves, Generation of SSB Modulated waves, Demodulation of SSB Waves, Vestigial side band modulation, Comparison of AM Techniques.

**UNIT II ANGLE MODULATION 9**

Basic concepts, Frequency Modulation - Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Direct method of FM, Indirect method of FM, Detection of FM Waves, PLL as FM Demodulator Comparison of FM & AM.

**UNIT III AM AND FM TRANSMITTERS 9**

Radio Transmitter - Classification of Transmitter, AM Transmitter, Effect of feedback on performance of AM Transmitter, FM Transmitter – Variable reactance type and phase modulated FM Transmitter, frequency stability in FM Transmitter.

**UNIT IV AM AND FM RECEIVERS 9**

Radio Receiver - Receiver Types - Tuned radio frequency receiver, Superhetrodyne receiver, RF section and Characteristics - Frequency conversion and tracking, Intermediate frequency, AGC, FM Receivers, Comparison with AM Receiver, Amplitude limiting.

**UNIT V NOISE CHARACTERIZATION 9**

Noise sources and types – Noise figure and noise temperature – Noise in cascaded systems. Narrow band noise – PSD of in-phase and quadrature noise –Noise performance in AM systems – Noise performance in FM systems – Pre-emphasis and de-emphasis – Capture effect, threshold effect.

**TOTAL:45PERIODS**

**OUTCOMES:**

**At the end of the course, the students would**

- Design AM communication systems.
- Design Angle modulated communication systems.
- Ability to understand and analyze the AM and FM receivers.
- Examine the noise performance of AM and FM systems.

**TEXT BOOK:**

1. Simon S Haykin, “Communication Systems”, John Wiley, 3rd Edition, 2004.(For Units 1,2,3,4 & 5)

**REFERENCES:**

1. H.Taub, D L Schilling and G Saha, “Principles of Communication”, 3rd Edition, Pearson Education, 2007.
2. B. P.Lathi, “Modern Analog and Digital Communication Systems”, 3rd Edition, Oxford University Press, 2007.
3. B.Sklar, “Digital Communications Fundamentals and Applications”, 2nd Edition Pearson Education 2007.
4. Martin S.Roden, “Analog and Digital Communication System”, 3 Edition, Prentice Hall of India,2002.

| EC8451 | ELECTROMAGNETIC FIELDS | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 4 |

**OBJECTIVES:**

- To gain conceptual and basic mathematical understanding of electric and magnetic fields in free space and in materials
- To understand the coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations
- To understand wave propagation in lossless and in lossy media
- To be able to solve problems based on the above concepts

**UNIT I INTRODUCTION 12**

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem

**UNIT II ELECTROSTATICS 12**

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, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law

**UNIT III MAGNETOSTATICS 12**

Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques.

**UNIT IV TIME-VARYING FIELDS AND MAXWELL's EQUATIONS 12**

Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields

**UNIT V PLANE ELECTROMAGNETIC WAVES 12**

Plane waves in lossless media, Plane waves in lossy media (low-loss dieelctrics 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:60 PERIODS**

**OUTCOMES:**

**By the end of this course, the student should be able to:**

- Display an understanding of fundamental electromagnetic laws and concepts
- Write Maxwell's equations in integral, differential and phasor forms and explain their physical meaning
- Explain electromagnetic wave propagation in lossy and in lossless media
- Solve simple problems requiring estimation of electric and magnetic field quantities based on these concepts and laws.

**TEXT BOOKS:**

1. D.K. Cheng, Field and wave electromagnetics, 2nd ed., Pearson (India), 1989 (UNIT I, II,III IV,V)
2. W.H. Hayt and J.A. Buck, Engineering electrmagnetics, 7th ed., McGraw-Hill (India), 2006 (UNIT I-V)

**REFERENCES:**

1. D.J. Griffiths, Introduction to electrodynamics, 4th ed., Pearson (India), 2013
2. B.M. Notaros, Electromagnetics, Pearson: New Jersey, 2011
3. M.N.O. Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford (Asian Edition), 2015

| | | L | T | P | C |
|---|---|---|---|---|---|
| **TL8402** | **LINEAR INTEGRATED CIRCUITS AND ITS APPLICATIONS** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To study the IC fabrication procedure
- To study characteristics; realize circuits; design for signal analysis using Op-amps
- To study the applications of Op-amp
- To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, ADCs

**UNIT I CHARACTERISTICS OF OPAMP 9**

Ideal OP-AMP characteristics, DC characteristics, AC characteristics: frequency response of OP-AMP, frequency compensation, Slew rate of OP-AMP. General stages of OP-AMP, Internal circuit diagram of OP-AMP IC741. Open loop and closed loop configuration of OP-AMP. Basic applications of op-amp – Inverting and Non-inverting Amplifiers, differential amplifier.

**UNIT II APPLICATIONS OF OPAMP 9**

Instrumentation amplifier, Integrator, Differentiator, Summer, Subtractor. V/I and I/V converters, Logarithmic amplifier, Antilogarithmic amplifier, first and second order active filters, comparators, Multivibrators, Schmitt trigger, waveform generators, precision rectifier, clippers, clampers, peak detector.

**UNIT III ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS 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 - A/D Converter using Voltage-to-Time Conversion.

**UNIT IV APPLICATIONS OF ANALOG ICS - TIMER AND PLL 9**

Functional block of 555 - applications of 555 Timer IC: Astable Multivibrator, Monostable multivibrator, and Schmitt trigger- Functional block of PLL- IC565: Phase detector, Low pass filter and VCO, applications of 565 PLL IC: FM detection, Frequency Synthesis, Frequency Multiplier and FSK demodulation.

**UNIT V APPLICATIONS OF ANALOG ICS - VOLTAGE REGULATOR AND FUNCTION GENERATOR 9**

Voltage regulator ICs –LM78XX,79XX, Fixed voltage regulators - LM317, LM723, Variable voltage regulators, Switching regulator- SMPS- LM 380, Power amplifier IC - 8038, Function generator IC.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**By the end of this course, the student would be able to:**

- Design linear and non-linear applications of op-amps.
- Design the applications using Timer and PLL.
- Design the applications using Voltage regulator and Function generator ICs

**TEXT BOOKS:**


1. David A.Bell, 'Op-amp & Linear ICs', Oxford, 2013.(For Units 1,2 & 3 )
2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003. (For Units 4,5)


**REFERENCES**


1. Fiore,"Opamps & Linear Integrated Circuits Concepts & Applications",Cengage,2010.
2. Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', PHI Learning, 6th edition,2012.
4. Ramakant . Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2001.
5. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition,Tata Mc Graw-Hill, 2007.

**GE8291 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth‟s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – 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. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION 8**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES 10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

**UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

**UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

**TEXTBOOKS:**


1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.


**REFERENCES :**


1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD,New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.


| EC8461 | CIRCUITS DESIGN AND SIMULATION LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**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

**DESIGN AND ANALYSIS OF THE FOLLOWING CIRCUITS**

1. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance
2. RC Phase shift oscillator and Wien Bridge Oscillator
3. Hartley Oscillator and Colpitts Oscillator
4. Single Tuned Amplifier
5. RC Integrator and Differentiator circuits
6. Astable and Monostable multivibrators
7. Clippers and Clampers

**SIMULATION USING SPICE (Using Transistor):**

1. Tuned Collector Oscillator
2. Twin -T Oscillator / Wein Bridge Oscillator
3. Double and Stagger tuned Amplifiers
4. Bistable Multivibrator
5. Schmitt Trigger circuit with Predictable hysteresis
6. Analysis of power amplifier

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**On completion of this laboratory course, the student should be able to:**

- Analyze various types of feedback amplifiers
- Design oscillators, tuned amplifiers, wave-shaping circuits and multivibrators
- Design and simulate feedback amplifiers, oscillators, tuned amplifiers, wave-shaping circuits and multivibrators using SPICE Tool.

**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:**

| S.NO | EQUIPMENTS | |
|---|---|---|
| 1 | CRO (Min 30MHz) | - 15 Nos |
| 2 | Signal Generator /Function Generators (2 MHz) | – 15 Nos |
| 3 | Dual Regulated Power Supplies (0 – 30V) | - 15 Nos |
| 4 | Digital Multimeter | - 15 Nos |
| 5 | Digital LCR Meter | - 2 Nos |
| 6 | Standalone desktops PC | - 15 Nos |
| 7 | Transistor/FET (BJT-NPN-PNP and NMOS/PMOS) | - 50 Nos |

**Components and Accessories:**

Transistors, Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, Transformers. SPICE Circuit Simulation Software: (any public domain or commercial software)

EC8462 **LINEAR INTEGRATED CIRCUITS LABORATORY** **L T P C**
**0 0 4 2**

**OBJECTIVES:**

- To understand the basics of linear integrated circuits and available ICs
- To understand the characteristics of the operational amplifier.
- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function IC.
- To use SPICE software for circuit design

**DESIGN AND TESTING OF THE FOLLOWING CIRCUITS**

1. Inverting, Non inverting and differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass, High-pass and band-pass filters.
5. Astable & Monostable multivibrators using Op-amp
6. Schmitt Trigger using op-amp.
7. Phase shift and Wien bridge oscillators using Op-amp.
8. Astable and Monostable multivibrators using NE555 Timer.
9. PLL characteristics and its use as Frequency Multiplier, Clock synchronization
10. R-2R Ladder Type D- A Converter using Op-amp.
11. DC power supply using LM317 and LM723.
12. Study of SMPS

**SIMULATION USING SPICE :**

1. Active low-pass, High-pass and band-pass filters using Op-amp
2. Astable and Monostable multivibrators using NE555 Timer.
3. A/ D converter ( Flash Type)
4. Analog multiplier

**TOTAL:60PERIODS**

**OUTCOMES:**

**On completion of this laboratory course, the student should be able to:**

- Design amplifiers, oscillators, D-A converters using operational amplifiers.
- Design filters using op-amp and performs an experiment on frequency response.
- Analyze the working of PLL and describe its application as a frequency multiplier.
- Design DC power supply using ICs.
- Analyze the performance of filters, multivibrators, A/D converter and analog multiplier using SPICE.

**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:**

**EQUIPMENTS:**

1. CRO/DSO (Min 30MHz) -- 15 Nos
2. Signal Generator /Function Generators (2 MHz) – 15 Nos
3. Dual Regulated Power Supplies (0 – 30V) -- 15 Nos
4. Digital Multimeter -- 15 Nos
5. IC Tester -- 5 Nos
6. Standalone desktops PC -- 15 Nos
7. Components and Accessories – 50 Nos

**Components and Accessories:**
Transistors, Resistors, Capacitors, diodes, Zener diodes, Bread Boards, Transformers, wires, Power transistors, Potentiometer, A/D and D/A convertors, LEDs .

**Note:** Op-Amps uA741, LM 301, LM311, LM 324, LM317, LM723, 7805, 7812, 2N3524, 2N3525, 2N3391, AD 633, LM 555, LM 565 may be used.

| | | L | T | P | C |
|---|---|---|---|---|---|
| **TL8501** | **DIGITAL COMMUNICATION TECHNIQUES** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To know the principles of sampling & quantization
- To study the various waveform coding schemes
- To learn the various baseband transmission schemes
- To understand the various Band pass signaling schemes
- To know the fundamentals of channel coding

**UNIT I SAMPLING AND PULSE MODULATION 9**

Introduction to Digital Communication Systems, Sampling process, Aliasing, Sampling theorem for band limited signals, pulse amplitude modulation (PAM), pulse width modulation (PWM), pulse position modulation (PPM), pulse code modulation (PCM), Bandwidth, Noise trade off, Quantization -Uniform & non-uniform quantization, Noise considerations in PCM Systems, Logarithmic Companding of speech signal, TDM.

**UNIT II WAVEFORM CODING 9**

Properties of Line codes, Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ – Manchester. Encoding Techniques for Analog Sources- Temporal waveform encoding, Spectral waveform encoding, Model-based encoding, Comparison of speech encoding methods. Prediction filtering and DPCM, Delta Modulation, ADPCM & ADM principles, Linear Predictive Coding.

**UNIT III BASEBAND TRANSMISSION & RECEPTION TECHNIQUES 9**

Inter symbol Interference, Nyquist's criterion for Distortionless Base band Binary Transmission, Receiving Filter – Correlator type, Matched Filter type; Equalising Filter, Maximum Likelihood Detector, Error Probability, Figure-of-Merit for Digital Detection, Adaptive Equalization, Eye patterns.

**UNIT IV BANDPASS SIGNAL TRANSMISSION AND RECEPTION 9**

Geometric Representation of signals - Generation, detection, PSD & BER of Coherent BPSK, BASK, BFSK, QPSK, QAM, MSK schemes - Carrier Synchronization - structure of Non-coherent Receivers - Principle of DPSK. Comparison of Digital modulation systems using a single carrier – Carrier and symbol synchronization.

**UNIT V ERROR CONTROL CODING 9**

Discrete Memoryless channels - Shannon- Fano coding, Huffman Coding -Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder.

**TOTAL:45PERIODS**

**OUTCOMES:**

**At the end of the course, the student will be able to**

- Design PCM systems
- Design and implement base band transmission and reception schemes
- Design and implement band pass signaling schemes
- Design error control coding schemes

**TEXT BOOKS:**

1. Simon Haykin, “Digital Communications”, John Wiley, 2006.(For units 1,2 & 3)
2. Amitabha Bhattacharya, “Digital Communications”, Tata McGraw Hill, 2006.(For units 4 & 5)

**REFERENCES**


1. John.G. Proakis, “Fundamentals of Communication Systems”, Pearson Education, 2006.
2. Herbert Taub & Donald L Schilling – Principles of Communication Systems ( 3rd Edition ) – Tata McGraw Hill, 2008.
3. B. Sklar, “Digital Communication Fundamentals and Applications”, 2nd Edition, Pearson Education, 2009.
4. Michael. B. Purrsley, “Introduction to Digital Communication”, Pearson Education, 2006.


| EC8553 | DISCRETE-TIME SIGNAL PROCESSING | L | T | P | C |
|---|---|---|---|---|---|
| | | 4 | 0 | 0 | 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 12**

Review of signals and systems, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - 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). Linear filtering using FFT.

**UNIT II INFINITE IMPULSE RESPONSE FILTERS 12**

Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

**UNIT III FINITE IMPULSE RESPONSE FILTERS 12**

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

**UNIT IV FINITE WORD LENGTH EFFECTS 12**

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 INTRODUCTION TO DIGITAL SIGNAL PROCESSORS 12**

DSP functionalities - circular buffering – DSP architecture – Fixed and Floating point architecture principles – Programming – Application examples.

**TOTAL:60PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to**

- Apply DFT for the analysis of digital signals and systems
- Design IIR and FIR filters
- Characterize the effects of finite precision representation on digital filters
- Design multirate filters
- Apply adaptive filters appropriately in communication systems

**TEXT BOOK:**

1. John G. Proakis & Dimitris G.Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Fourth Edition, Pearson Education / Prentice Hall, 2007. (UNIT I – V)

**REFERENCES**

1. Emmanuel C. Ifeachor & Barrie. W. Jervis, “Digital Signal Processing”, Second Edition, Pearson Education / Prentice Hall, 2002.
2. A. V. Oppenheim, R.W. Schafer and J.R. Buck, “Discrete-Time Signal Processing”, 8th Indian Reprint, Pearson, 2004.
3. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Tata Mc Graw Hill, 2007.
4. Andreas Antoniou, “Digital Signal Processing”, Tata Mc Graw Hill, 2006.

| EC8552 | COMPUTER ARCHITECTURE AND ORGANIZATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To make students understand the basic structure and operation of digital computer
- To familiarize with implementation of fixed point and floating-point arithmetic operations
- To study the design of data path unit and control unit for processor
- To understand the concept of various memories and interfacing
- To introduce the parallel processing technique

**UNIT I COMPUTER ORGANIZATION & INSTRUCTIONS 9**

Basics of a computer system: Evolution, Ideas, Technology, Performance, Power wall, Uniprocessors to Multiprocessors. Addressing and addressing modes. Instructions: Operations and Operands, Representing instructions, Logical operations, control operations.

**UNIT II ARITHMETIC 9**

Fixed point Addition, Subtraction, Multiplication and Division. Floating Point arithmetic, High performance arithmetic, Subword parallelism

**UNIT III THE PROCESSOR 9**

Introduction, Logic Design Conventions, Building a Datapath - A Simple Implementation scheme - An Overview of Pipelining - Pipelined Datapath and Control. Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions.

**UNIT IV MEMORY AND I/O ORGANIZATION 9**

Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory.
Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass storage, Input and Output Devices.

**UNIT V ADVANCED COMPUTER ARCHITECTURE 9**

Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers - Introduction to Multiprocessor network topologies.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to**

- Describe data representation, instruction formats and the operation of a digital computer
- Illustrate the fixed point and floating-point arithmetic for ALU operation
- Discuss about implementation schemes of control unit and pipeline performance
- Explain the concept of various memories, interfacing and organization of multiple processors
- Discuss parallel processing technique and unconventional architectures

**TEXT BOOKS:**

1. David A. Patterson and John L. Hennessey, “Computer Organization and Design”, Fifth edition, Morgan Kauffman / Elsevier, 2014. (UNIT I-V)

2. Miles J. Murdocca and Vincent P. Heuring, “Computer Architecture and Organization: An Integrated approach”, Second edition, Wiley India Pvt Ltd, 2015 (UNIT IV,V)

**REFERENCES**

1. V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, “Computer Organization“, Fifth edition, Mc Graw-Hill Education India Pvt Ltd, 2014.
2. William Stallings “Computer Organization and Architecture”, Seventh Edition, Pearson Education, 2006.
3. Govindarajalu, “Computer Architecture and Organization, Design Principles and Applications", Second edition, McGraw-Hill Education India Pvt Ltd, 2014.

| EC8551 | COMMUNICATION NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The student should be made to:**

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

**UNIT I FUNDAMENTALS & LINK LAYER 9**

Overview of Data Communications- Networks – Building Network and its types– Overview of Internet - Protocol Layering - OSI Mode – Physical Layer – Overview of Data and Signals - introduction to Data Link Layer - Link layer Addressing- Error Detection and Correction

**UNIT II MEDIA ACCESS & INTERNETWORKING 9**

Overview of Data link Control and Media access control - Ethernet (802.3) - Wireless LANs – Available Protocols – Bluetooth – Bluetooth Low Energy – WiFi – 6LowPAN–Zigbee - Network layer services – Packet Switching – IPV4 Address – Network layer protocols ( IP, ICMP, Mobile IP)

**UNIT III ROUTING 9**

Routing - Unicast Routing – Algorithms – Protocols – Multicast Routing and its basics – Overview of Intradomain and interdomain protocols – Overview of IPv6 Addressing – Transition from IPv4 to IPv6

**UNIT IV TRANSPORT LAYER 9**

Introduction to Transport layer –Protocols- User Datagram Protocols (UDP) and Transmission Control Protocols (TCP) –Services – Features – TCP Connection – State Transition Diagram – Flow, Error and Congestion Control - Congestion avoidance (DECbit, RED) – QoS – Application requirements

**UNIT V APPLICATION LAYER 9**

Application Layer Paradigms – Client Server Programming – World Wide Web and HTTP - DNS- - Electronic Mail (SMTP, POP3, IMAP, MIME) – Introduction to Peer to Peer Networks – Need for Cryptography and Network Security – Firewalls.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Identify the components required to build different types of networks
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Trace the flow of information from one node to another node in the network

**TEXT BOOK:**

1. Behrouz A. Forouzan, “Data communication and Networking”, Fifth Edition, Tata McGraw – Hill, 2013 (For units 1,2,3,4 & 5)

**REFERENCES:**

1. James F. Kurose, Keith W. Ross, “Computer Networking - A Top-Down Approach Featuring the Internet”, Seventh Edition, Pearson Education, 2016.
2. Nader. F. Mir,“ Computer and Comm unication Networks”, Pearson Prentice Hall Publishers, 2nd Edition, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”, Mc Graw Hill Publisher, 2011.
4. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers, 2011.

| EC8562 | DIGITAL SIGNAL PROCESSING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

**The student should be made:**

- To perform basic signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB
- To implement FIR and IIR filters in MATLAB and DSP Processor
- To study the architecture of DSP processor
- To design a DSP system to demonstrate the Multi-rate and Adaptive signal processing concepts

**LIST OF EXPERIMENTS: MATLAB / EQUIVALENT SOFTWARE PACKAGE**

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

**DSP PROCESSOR BASED IMPLEMENTATION**

1. Study of architecture of Digital Signal Processor
2. Perform MAC operation using various addressing modes
3. Generation of various signals and random noise
4. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering
5. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering
6. Implement an Up-sampling and Down-sampling operation in DSP Processor

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Carryout basic signal processing operations
- Demonstrate their abilities towards MATLAB based implementation of various DSP systems
- Analyze the architecture of a DSP Processor
- Design and Implement the FIR and IIR Filters in DSP Processor for performing filtering operation over real-time signals
- Design a DSP system for various applications of DSP

| EC8561 | COMMUNICATION SYSTEMS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

**The student should be made:**

- To visualize the effects of sampling and TDM
- To Implement AM & FM modulation and demodulation
- To implement PCM & DM
- To simulate Digital Modulation schemes
- To simulate Error control coding schemes

**LIST OF EXPERIMENTS:**

1. Signal Sampling and reconstruction
2. Time Division Multiplexing
3. AM Modulator and Demodulator
4. FM Modulator and Demodulator
5. Pulse Code Modulation and Demodulation
6. Delta Modulation and Demodulation
7. Line coding schemes
8. Simulation of ASK, FSK, and BPSK generation schemes
9. Simulation of DPSK, QPSK and QAM generation schemes
10. Simulation of signal constellations of BPSK, QPSK and QAM
11. Simulation of ASK, FSK and BPSK detection schemes
12. Simulation of Linear Block and Cyclic error control coding schemes
13. Simulation of Convolutional coding scheme
14. Communication link simulation

**TOTAL:60PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Simulate & validate the various functional modules of a communication system
- Demonstrate their knowledge in base band signaling schemes through implementation of digital modulation schemes
- Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system
- Simulate end-to-end communication Link

**LAB Requirements for a Batch of 30 students (3 students per experiment):**

i) Kits for Signal Sampling, TDM, AM, FM, PCM, DM and Line Coding Schemes

ii) CROs/DSOs – 15 Nos, Function Generators – 15 Nos.

iii) MATLAB or equivalent software package for simulation experiments

iv) PCs - 15 Nos

| EC8563 | COMMUNICATION NETWORKS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

**The student should be made to:**

- Learn to communicate between two desktop computers
- Learn to implement the different protocols
- Be familiar with IP Configuration
- Be familiar with the various routing algorithms
- Be familiar with simulation tools

**LIST OF EXPERIMENTS:**

1. Implementation of Error Detection / Error Correction Techniques
2. Implementation of Stop and Wait Protocol and sliding window
3. Implementation and study of Goback-N and selective repeat protocols
4. Implementation of High Level Data Link Control
5. Implementation of IP Commands such as ping, Traceroute, nslookup.
6. Implementation of IP address configuration.
7. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
8. Network Topology - Star, Bus, Ring
9. Implementation of distance vector routing algorithm
10. Implementation of Link state routing algorithm
11. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
12. Implementation of Encryption and Decryption Algorithms using any programming language

**TOTAL: 60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Communicate between two desktop computers
- Implement the different protocols
- Program using sockets.
- Implement and compare the various routing algorithms
- Use the simulation tool.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

**SOFTWARE**

- C / Python / Java / Equivalent Compiler
- MATLAB SOFTWARE (Few experiments can be practiced with MATLAB)
- Standard LAN Trainer Kits 4 Nos
- Network simulator like NS2/ NS3 / Glomosim/OPNET/ 30 Equivalent

**HARDWARE**

Standalone Desktops 30 Nos

**TL8601** **MOBILE ADHOC NETWORKS**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the characteristic features of adhoc wireless networks and their applications to the students.
- To enable the student to understand the functioning of different access and routing protocols that can be used for adhoc networks.
- To enable the student to understand the need for security and the challenges and also the role of crosslayer design in enhancing the network performance

**UNIT I INTRODUCTION** **10**

Introduction to Ad Hoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - entity and group models.

**UNIT II MEDIUM ACCESS PROTOCOLS 9**

MAC Protocols: design issues, goals and classification. Contention based protocols, reservation based protocols, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

**UNIT III NETWORK PROTOCOLS 9**

Addressing issues in ad hoc network, Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Power/ Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

**UNIT IV END -TO - END DELIVERY AND SECURITY 8**

Transport layer: Issues in designing- Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

**UNIT V CROSS LAYER DESIGN AND INTEGRATION 9**

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective, Co-operative networks:- Architecture, methods of co-operation, co-operative antennas, Integration of ad hoc network with other wired and wireless networks.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- The student would be able to demonstrate an understanding of the trade-offs involved in the design of adhoc networks
- The student would be able to design and implement protocols suitable to adhoc communication scenario using design tools and characterize them.
- The student is exposed to the advances in adhoc network design concepts

**TEXT BOOKS:**


1. C.Siva Ram Murthy and B.S.Manoj, ―Ad hoc Wireless Networks Architectures and protocols‖,2nd edition, Pearson Education. 2007 (For units1,2 & 3)
2. Charles E. Perkins, ―Ad hoc Networking‖, Addison – Wesley, 2000 (For units 4 & 5)


**REFERENCES:**


1. Mohammad Ilyas, ―The handbook of adhoc wireless networks‖, CRC press, 2002.
2. Erdal Çayırcı and Chunming Rong c, ― Security in Wireless Ad Hoc and Sensor Networks 2009, John Wiley & Sons, Ltd.


**EC8095 VLSI DESIGN L T P C**
**3 0 0 3**

**OBJECTIVES:**

- Study the fundamentals of CMOS circuits and its characteristics.
- Learn the design and realization of combinational & sequential digital circuits.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
- Learn the different FPGA architectures and testability of VLSI circuits.

**UNIT I INTRODUCTION TO MOS TRANSISTOR 9**

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

**UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 9**

**Circuit Families:** Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.

**Power:** Dynamic Power, Static Power, Low Power Architecture.

**UNIT III SEQUENTIAL CIRCUIT DESIGN 9**

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

**Timing Issues :** Timing Classification Of Digital System, Synchronous Design.

**UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9**

**Arithmetic Building Blocks**: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

**Designing Memory and Array structures**: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

**UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9**

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: *Ad Hoc* Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**UPON COMPLETION OF THE COURSE, STUDENTS SHOULD be ABLE TO**

- Realize the concepts of digital building blocks using MOS transistor.
- Design combinational MOS circuits and power strategies.
- Design and construct Sequential Circuits and Timing systems.
- Design arithmetic building blocks and memory subsystems.
- Apply and implement FPGA design flow and testing.

**TEXT BOOKS:**


1. Neil H.E. Weste, David Money Harris “CMOS VLSI Design: A Circuits and Systems Perspective”, 4th Edition, Pearson , 2017 (UNIT I,II,V)
2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, ”Digital Integrated Circuits:A Design perspective”, Second Edition , Pearson , 2016.(UNIT III,IV)


**REFERENCES**


1. M.J. Smith, “Application Specific Integrated Circuits”, Addisson Wesley, 1997
2. Sung-Mo kang, Yusuf leblebici, Chulwoo Kim “CMOS Digital Integrated Circuits:Analysis & Design”,4th edition McGraw Hill Education,2013
3. Wayne Wolf, “Modern VLSI Design: System On Chip”, Pearson Education, 2007
4. R.Jacob Baker, Harry W.LI., David E.Boyee, “CMOS Circuit Design, Layout and Simulation”, Prentice Hall of India 2005.

| EC8652 | WIRELESS COMMUNICATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To study the characteristic of wireless channel
- To understand the design of a cellular system
- To study the various digital signaling techniques and multipath mitigation techniques
- To understand the concepts of multiple antenna techniques

**UNIT I WIRELESS CHANNELS 9**

Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters-Coherence bandwidth – Doppler spread & Coherence time, fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.

**UNIT II CELLULAR ARCHITECTURE 9**

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity-trunking & grade of service – Coverage and capacity improvement.

**UNIT III DIGITAL SIGNALING FOR FADING CHANNELS 9**

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

**UNIT IV MULTIPATH MITIGATION TECHNIQUES 9**

Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

**UNIT V MULTIPLE ANTENNA TECHNIQUES 9**

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**The student should be able to:**

- Characterize a wireless channel and evolve the system design specifications
- Design a cellular system based on resource availability and traffic demands
- Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.

**TEXT BOOKS:**


1. Rappaport,T.S., ―Wireless communications‖, Pearson Education, Second Edition, 2010.(UNIT I, II, IV)
2. Andreas.F. Molisch, ―Wireless Communications‖, John Wiley – India, 2006. (UNIT III,V)


**REFERENCES:**


1. Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011
2. Van Nee, R. and Ramji Prasad, ―OFDM for wireless multimedia communications, Artech House, 2000
3. David Tse and Pramod Viswanath, ―Fundamentals of Wireless Communication, Cambridge University Press, 2005.
4. Upena Dalal, ―Wireless Communication‖, Oxford University Press, 2009.

| | | L | T | P | C |
|---|---|---|---|---|---|
| TL8602 | TELECOMMUNICATION SYSTEMS AND SERVICES | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To acquaint the students with the architecture, theory and operation of telecommunication systems
- To discuss various issues related to telecommunication systems and the services rendered by the system to the end users.

**UNIT I BASICS OF TELECOMMUNICATION 9**

End users, nodes and connectivities, telephone numbering and Routing, use of Tandem switches in Local area connectivity, Busy Hour and Grade of Service, Simple, Half duplex and full duplex, One-way and two-way circuits, Network topologies, variations in traffic flow, quality of service, Standardization in telecommunication.

**UNIT II SIGNALLING IN TELECOMMUNICATION 9**

Introduction, purpose of signaling, Defining the functional areas-supervisory signaling, address signaling and Call Progress-audio and visual. Signaling techniques - conveying signaling information, evolution of signaling subscriber call progress tones and push button codes, compelled signaling, concepts of Link-by-link and end-to-end signaling, effects of numbering on signaling, associated and disassociated channel signaling, signaling in the subscriber loop-background and purpose, metallic trunk signaling - basic loop signaling, reverse-battery signaling, stimulus signaling, functional signaling, Object-oriented signaling.

**UNIT III TELECOMMUNICATION TRAFFIC 9**

Unit of Traffic, traffic measurement, a mathematical model, Lost- call systems: Theory, traffic performance, loss systems in tandem. Queuing systems - Erlang Distribution, probability of delay, Finite queue capacity, systems with a single server, Queues in tandem, delay tables and application of Delay formulae. Traffic Characteristics - arrival distributions, Holding time distribution. Loss Systems - Lost calls cleared, lost calls returning, lost calls Held, lost calls cleared. Overflow Traffic.

**UNIT IV TELECOMMUNICATION SERVICES ENGINEERING 9**

Introduction, definition for service and service engineering. Telecommunication services engineering- Telecommunication services on broad band networks - basics of ATM, connection oriented and connectionless services.

**UNIT V QUALITY OF SERVICE AND TELECOMMUNICATION IMPAIRMENTS 9**

QoS (voice, data and image) - signal-to-noise ratio, voice transmission, data circuits, video. Basic impairments - amplitude distortion, phase distortion and noise. Level - typical levels, echo and singing. QoS issues in video transmission - problems and solutions. Protocols for QoS support for audio and video applications – RSVP applications, Real-Time Streaming Protocol Applications and Active Streaming Format, Internet stream protocol (version 2), IP Multicast

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Understand the basics of telecommunication signaling
- Analyze the traffic in telecommunication systems
- Acquire knowledge about QoS and various impairments

**TEXT BOOKS:**


1. Roger L. Freeman, “Fundamentals of Telecommunications”, John Wiley & Sons, 1999. (For Units 1,2,3 & 4)
2. Kornel Terplan, Patricia Morreale Boca Raton, “The Telecommunications Handbook”, CRC Press LLC, 2000.(For Unit 5)

**REFERENCE:**

1. Kornel Terplan, Patricia Morreale Boca Raton, “The Telecommunications Handbook”, CRC Press LLC, 2000

| EC8651 | TRANSMISSION LINES AND RF SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the various types of transmission lines and its characteristics
- To give thorough understanding about high frequency line, power and impedance measurements
- To impart technical knowledge in impedance matching using smith chart
- To introduce passive filters and basic knowledge of active RF components
- To get acquaintance with RF system transceiver design

**UNIT I TRANSMISSION LINE THEORY 9**

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading and different methods of loading - Line not terminated in Z0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

**UNIT II HIGH FREQUENCY TRANSMISSION LINES 9**

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

**UNIT III IMPEDANCE MATCHING IN HIGH FREQUENCY LINES 9**

Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart - Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

**UNIT IV WAVEGUIDES 9**

General Wave behavior along uniform guiding structures – Transverse Electromagnetic Waves, Transverse Magnetic Waves, Transverse Electric Waves – TM and TE Waves between parallel plates. Field Equations in rectangular waveguides, TM and TE waves in rectangular waveguides, Bessel Functions, TM and TE waves in Circular waveguides.

**UNIT V RF SYSTEM DESIGN CONCEPTS 9**

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors Basic concepts of RF design, Mixers, Low noise amplifiers, voltage control oscillators, Power amplifiers, transducer power gain and stability considerations.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student should be able to:**

- Explain the characteristics of transmission lines and its losses
- Write about the standing wave ratio and input impedance in high frequency transmission lines
- Analyze impedance matching by stubs using smith charts
- Analyze the characteristics of TE and TM waves
- Design a RF transceiver system for wireless communication

**TEXT BOOKS:**

1. John D Ryder, “Networks, lines and fields”, 2nd Edition, Prentice Hall India, 2015. (UNIT I-IV)
2. Mathew M. Radmanesh, “Radio Frequency &Microwave Electronics”, Pearson Education Asia, Second Edition,2002. (UNIT V)

**REFERENCES:**

1. Reinhold Ludwig and Powel Bretchko,” RF Circuit Design – Theory and Applications”, Pearson Education Asia, First Edition,2001.
2. D. K. Misra, “Radio Frequency and Microwave Communication Circuits- Analysis and Design”, John Wiley & Sons, 2004.
3. E.C.Jordan and K.G. Balmain, —Electromagnetic Waves and Radiating Systems Prentice Hall of India, 2006.
4. G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines Pearson Education, First edition 2005.

| TL8611 | NETWORK SECURITY LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

- To introduce the various types of transmission lines and its characteristics
- To give thorough understanding about high frequency line, power and impedance measurements
- To impart technical knowledge in impedance matching using smith chart
- To introduce the concept of waveguides
- To get acquaintance with cavity resonator

**LIST OF EXPERIMENTS**

1. Implement the following substitution & transposition techniques concepts
    a. Caesar cipher
    b. Play fair cipher
    c. Hill cipher
    d. Vigenere cipher
    e. Rail fence – row & column transformation
2. Implement the following algorithms
    a. DES
    b. RSA Algorithm
    c. Diffiee- Hellman
    d. MD5
    e. SHA-1
3. Implement the Signature Scheme - Digital Signature Standard
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG)

5. Setup a honey pot and monitor the honeypot on network (KF Sensor)
6. Installation of rootkits and study about the variety of options
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA (Net Stumbler)
8. Demonstrate intrusion detection system (ids) using any tool (snort s/w)

**TOTAL : 60 PERIODS**

**LIST OF HARDWARE REQUIREMENTS & SOFTWARE REQUIREMENTS**

**SOFTWARE REQUIREMENTS**

- C
- C++
- Java or equivalent compiler GnuPG
- KF sensor or equivalent
- Snort
- Net stumbler or equivalent

**HARDWARE REQUIREMENTS**

- Standalone desktops (or) Server supporting 30 terminals or more

| EC8661 | VLSI DESIGN LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

**The student should be made:**

- To learn Hardware Descriptive Language(Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital and analog domain
- To familiarize fusing of logical modules on FPGAs
- To provide hands on design experience with professional design (EDA) platforms

**LIST OF EXPERIMENTS:**

**Part I: Digital System Design using HDL & FPGA (24 Periods)**

1. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
2. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
3. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
4. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
6. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA

Compare pre synthesis and post synthesis simulation for experiments 1 to 6.

Requirements: Xilinx ISE/Altera Quartus/ equivalent EDA Tools along with Xilinx/Altera/equivalent FPGA Boards

Part-II Digital Circuit Design (24 Periods)

7. Design and simulate a CMOS inverter using digital flow
8. Design and simulate a CMOS Basic Gates & Flip-Flops
9. Design and simulate a 4-bit synchronous counter using a Flip-Flops
   Manual/Automatic Layout Generation and Post Layout Extraction for experiments 7 to 9
   Analyze the power, area and timing for experiments 7 to 9 by performing Pre Layout and Post Layout Simulations.

Part-III Analog Circuit Design (12 Periods)

10. Design and Simulate a CMOS Inverting Amplifier.
11. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers.
    Analyze the input impedance, output impedance, gain and bandwidth for experiments 10 and 11 by performing Schematic Simulations.
12. Design and simulate simple 5 transistor differential amplifier. Analyze Gain, Bandwidth and CMRR by performing Schematic Simulations.

Requirements: Cadence/Synopsis/ Mentor Graphics/Tanner/equivalent EDA Tools

**TOTAL :60 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Write HDL code for basic as well as advanced digital integrated circuit
- Import the logic modules into FPGA Boards
- Synthesize Place and Route the digital IPs
- Design, Simulate and Extract the layouts of Digital & Analog IC Blocks using EDA tools

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS**

| S.NO | EQUIPMENT | REQUIRED |
|---|---|---|
| 1 | Xilinx ISE/Altera Quartus/ equivalent EDA Tools | 10 User License |
| 2 | Xilinx/Altera/equivalent FPGA Boards | 10 no |
| 3 | Cadence/Synopsis/ Mentor Graphics/Tanner/equivalent EDA Tools | 10 User License |
| 4 | Personal Computer | 30 no |

**HS8581 PROFESSIONAL COMMUNICATION**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**OBJECTIVES:**

**The course aims to:**

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

**UNIT I**

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

**UNIT II**

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

**UNIT III**

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -– questioning and clarifying –GD strategies- activities to improve GD skills

**UNIT IV**

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

**UNIT V**

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

**TOTAL : 30 PERIODS**

**OUTCOMES:**

**At the end of the course Learners will be able to:**

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

**Recommended Software**

1. Globearena
2. Win English

**REFERENCES:**


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

| TL8701 | MICROWAVE AND OPTICAL COMMUNICATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To deal with the microwave generation and microwave measurement techniques
- To deal with the issues in the design of microwave amplifier
- To instill knowledge on the properties of various microwave components.
- To Facilitate the knowledge about optical fiber sources and transmission techniques

**UNIT I PASSIVE AND ACTIVE MICROWAVE DEVICES 9**

Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid Junctions, Power dividers, Circulator, Isolator, Impedance matching devices: Tuning screw, Stub and quarter wave transformers. Crystal and Schottkey diode detector and mixers, PIN diode switch, Gunn diode oscillator, IMPATT diode oscillator and amplifier, Varactor diode.

**UNIT II MICROWAVE GENERATION 9**

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

**UNIT III INTRODUCTION TO OPTICAL FIBERS 9**

Evolution of fiber optic system - Total internal reflection-Acceptance angle –Numerical aperture – Skew rays Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts-Linearly Polarized Modes -Single Mode Fibers-Graded Index fiber structure.

**UNIT IV OPTICAL SOURCES AND DETECTORS 9**

**OPTICAL SOURCES:** Light Emitting Diodes - LED structures - surface and edge emitters, mono and hetero structures - internal - quantum efficiency, injection laser diode structures - comparison of LED and ILD.

**OPTICAL DETECTORS**: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties, Comparison of performance, Photo detector noise -Noise sources ,Signal to Noise ratio , Detector response time.

**UNIT V OPTICAL NETWORKS AND SYSTEM TRANSMISSION 9**

Basic Networks – SONET / SDH – Broadcast – and –select WDM Networks –Wavelength Routed Networks – Non linear effects on Network performance –-Link Power budget -Rise time budget-Noise Effects on System Performance-Operational Principles of WDM Performance of WDM + EDFA system – Solutions – Optical CDMA – Ultra High Capacity NETWORKS.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Examine the digital transmission and its associated parameters on system performance.
- Know the various optical fiber modes, configurations
- Generate Microwave signals and design microwave amplifiers.
- Measure and analyze Microwave signal and parameters

**TEXT BOOKS:**


1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Third Edition “Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (For units-1&2)
2. Raj Kamal “Embedded Systems: Architecture, Programming and Design” 3rd Edition, Mc Graw Hill India (2014). (For Unit 3)
3. Jonathan W. Valvano, “Embedded Systems: Real-Time Interfacing to Arm Cortex-M Microcontrollers” 5th Edition, Createspace Independent Publishing Platform,2016 (For units-4&5)

**REFERENCES:**


1. David M. Pozar, “Microwave Engineering”, Wiley India (P) Ltd, New Delhi, 2008..
2. Thomas H Lee, “Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits”, Cambridge University Press, 2004.
3. Ramaswami, Sivarajan and Sasaki “Optical Networks”, Morgan Kaufmann, 2009.
4. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.


| TL8702 | RISC PROCESSORS AND EMBEDDED SYSTEM | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The student should be made to:**

- To teach the embedded system architecture, 8051 and ARM Microcontrollers
- To teach the Device Drivers and Interrupts Service Mechanism
- To teach Real Time Operating Systems and Programming
- To teach the application development with embedded ARM processor

**UNIT I INTRODUCTION TO EMBEDDED SYSTEMS AND MICROCONTROLLERS 9**

Introduction to Embedded Systems - 8051 and ARM Microcontrollers, Real-World Interfacing, and the Inputs and Outputs Using Buses.

**UNIT II EMBEDDED SYSTEM ARCHITECTURES 9**

ARM Architectures and Processor-Memory Organisations - I/O Devices, Communication Buses and Distributed Networked Embedded Architectures.

**UNIT III DEVICE DRIVERS AND INTERRUPTS SERVICE MECHANISM 9**

Interrupts Servicing Mechanism Using Programmed I/O, Interrupt-driven Input and Output, Interrupt Service Routine Concept, Interrupt Sources, Hardware Interrupts, Software Interrupts, Interrupt-servicing Mechanism, Multiple Interrupts, Interrupt Service Threads as Second-Level Interrupt Handlers -Interrupt Latency - Direct Memory Access Driven I/O - Device Driver Programming.

**UNIT IV REAL TIME OPERATING SYSTEMS AND PROGRAMMING 9**

**REAL TIME OPERATING SYSTEMS**: Processes, Tasks and Threads and their Synchronization Using Inter-process Communication, Basic Functions of OS and RTOS.

**REAL-TIME OPERATING SYSTEM PROGRAMMING**: MicroC/OS-II and VxWorks, Real-Time Linux, Windows CE, Handheld Devices and Automotives Operating Systems.

**UNIT V DESIGN EXAMPLES AND CASE STUDIES 9**

Automatic Chocolate Vending Machine using MUCOS RTOS - Application to Communication—Network Router for IP Packets - Embedded Systems in Robotics: Case Study of Orchestra Playing Robots - RTOS for Control Systems: Case Study of an Embedded System for an Adaptive Cruise Control (ACC) System in a Car, Case Study of an Embedded System for a Smart Card, Access Control Systems (Smart Cards, RFIDs, Finger scan) - Case Study of a Mobile-Phone Software for Key Input.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student would be able to:**

- Understand embedded system architecture, 8051 and ARM Microcontrollers
- To device drivers programming and interrupts service mechanism
- To realtime programming for embedded real-time applications

**TEXT BOOKS:**

1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Third Edition “Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (For units-1&2)
2. Raj Kamal “Embedded Systems: Architecture, Programming and Design” 3rd Edition, Mc Graw Hill India (2014). (For Unit 3)
3. Jonathan W. Valvano, “Embedded Systems: Real-Time Interfacing to Arm Cortex-M Microcontrollers” 5th Edition, Createspace Independent Publishing Platform,2016 (For units-4&5)

**REFERENCES:**

1. Jason Bakos, “Embedded systems: ARM programming and optimization” Morgan Kaufmann, 2015.
2. Steve Furber, “ARM System-on-Chip Architecture” (2nd Edition) Pearson India, 2015.
3. Joseph Yiu, “The Definitive Guide to ARM Cortex -M3 and Cortex -M4 Processors, Third Edition 3rd Edition, Elsevier Inc, 2014.

**EC8094 SATELLITE COMMUNICATION L T P C**
**3 0 0 3**

**OBJECTIVES:**

**The student should be made to:**

- Understand the basics of satellite orbits
- Understand the satellite segment and earth segment
- Analyze the various methods of satellite access
- Understand the applications of satellites
- Understand the basics of satellite Networks

**UNIT I SATELLITE ORBITS 9**

Kepler‟s Laws, Newton‟s law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

**UNIT II SPACE SEGMENT 9**

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders-The Antenna Subsystem.

**UNIT III SATELLITE LINK DESIGN 9**

Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

**UNIT IV SATELLITE ACCESS AND CODING METHODS 9**

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods, compression – encryption, Coding Schemes.

**UNIT V SATELLITE APPLICATIONS 9**

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student would be able to:**

- Analyze the satellite orbits
- Analyze the earth segment and space segment
- Analyze the satellite Link design
- Design various satellite applications

**TEXT BOOKS:**


1. Dennis Roddy, “Satellite Communication”, 4th Edition, Mc Graw Hill International, 2006.
2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,”Satellite Communication”,2nd Publications,2002


**REFERENCES**


1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, “Satellite Communica Engineering”, Prentice Hall/Pearson, 2007.
2. N.Agarwal, “Design of Geosynchronous Space Craft”, Prentice Hall, 1986.
3. Bruce R. Elbert, “The Satellite Communication Applications”, Hand Book, Artech H London, 1997.
4. Tri T. Ha, “Digital Satellite Communication”, II nd edition, 1990.
5. Emanuel Fthenakis, “Manual of Satellite Communications”, Mc Graw Hill Book Co., 198
6. Robert G. Winch, “Telecommunication Trans Mission Systems”, Mc Graw-Hill Book Co.,
7. Brian Ackroyd, “World Satellite Communication and earth station Design”, BSP profes 1990.
8. G.B.Bleazard, “Introducing Satellite communications“, NCC Publication, 1985.
9. M.Richharia, “Satellite Communication Systems-Design Principles”, Macmillan 2003.


| | | L | T | P | C |
|---|---|---|---|---|---|
| **TL8703** | **ANTENNAS AND RADIO WAVE PROPAGATION** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To Examine radiation from a current element.
- To Examine antenna arrays
- To Examine aperture antennas
- To learn special antennas such as frequency independent and broad band antennas.
- To Examine radio wave propagation

**UNIT I FUNDAMENTALS OF ANTENNA AND RADIATION 9**

Introduction, Basic Antenna Parameters - Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivty-Gain-Resolution, Antenna Apertures, Effective Height. Related Problems. Antenna characteristics: Radiation pattern, Beam solid angle, Directivity, Gain, Input impedance, Polarization, Bandwidth, Reciprocity, Equivalence of Radiation patterns, Equivalence of Impedances, Effective aperture, Vector effective length, Antenna temperature.

**UNIT II WIRE ANTENNAS AND ANTENNA ARRAYS 9**

Wire antennas: Short dipole, Radiation resistance and Directivity, Half wave Dipole, Monopole, Small loop antennas. Antenna Arrays: Linear Array and Pattern Multiplication,Two-element Array, Uniform Array, Polynomial representation, Array with non-uniform Excitation-Binomial Array.

**UNIT III APERTURE AND SLOT ANTENNAS 9**

Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna , Reflector antenna , Aperture blockage , Feeding structures , Slot antennas ,Microstrip antennas – Radiation mechanism – Application ,Numerical tool for antenna analysis.

**UNIT IV SPECIAL ANTENNAS AND ANTENNA MEASUREMENTS 9**

Special Antennas: Long wire, V and Rhombic Antenna, Yagi-Uda Antenna, Turnstile Antenna, Helical Antenna- Axial mode helix, Normal mode helix, Biconical Antenna, Log periodic Dipole Array, Spiral Antenna, Microstrip PatchAntennas.Antenna Measurements: Radiation Pattern measurement,GainandDirectivityMeasurements, Anechoic Chamber measurement.

**UNIT V RADIO WAVE PROPAGATION 9**

Calculation of Great Circle Distance between any two points on earth, Ground Wave Propagation, Free-space Propagation, Ground Reflection, Surface waves, Diffraction, Wave propagation in complex Environments, Tropospheric Propagation, Tropospheric Scatter. Ionospheric propagation: Structure of ionosphere, Sky waves, skip distance,Virtual height, Critical frequency, MUF, Electrical properties of ionosphere, Effects of earth's magnetic fields, Faraday rotation, Whistlers.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Know basic terminology and concepts of Antennas.
- Aware of parameter considerations viz. antenna efficiency, beam efficiency, radiation resistance etc. in the design of an antenna.
- Examine the electric and magnetic field emission from various basic antennas and mathematical formulation of the analysis.
- To have knowledge on antenna operation and types as well as their usage in real time field.
- Knowledge about the means of propagation of Electromagnetic wave i.e. free space propagation and also about frequency dependent layer selection, its respective issues for an effective transmission of information in the form of EM wave to a remote location and related issues.

**TEXT BOOKS:**


1. Constantine A. Balanis, "Antenna Theory: Analysis and Design", John Wiley, 4th Edition 2016. (units-1& 2)
2. K D Prasad "Antenna and Wave Propagation" Satya Prakashan 3rd Edition 2012. (units-3,4 & 5)


**REFERENCES:**


1. John D.Kraus, Ronald J Marhefka and Ahmad S Khan, "Antennas for all Applications¨, Tata McGraw-Hill Book Company, 3 ed, 2007.
2. G.S.N.Raju, Antenna Wave Propagation, Pearson Education, 2004.
3. R.E.Collins, "Antenna and Radiowave propagation¨.
4. W.L Stutzman and G.A. Thiele, "Antenna analysis and design¨, John Wiley, 2000
5. A.R.Harish, M.Sachidanada, "Antennas and Wave propagation¨, Oxford University Pres, 2007

| TL8711 | MICROWAVE AND OPTICAL COMMUNICATION LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

- To gain insight of fiber optic components
- To gain knowledge about various microwave components with regard to communication.

**LIST OF EXPERIMENTS:**

1. Reflex Klystron – Mode characteristics
2. Gunn Diode – Characteristics
3. VSWR, Frequency and Wave Length Measurement
4. Directional Coupler – Directivity and Coupling Coefficient – S – parameter measurement
5. Isolator and Circulator – S - parameter measurement
6. Isolator and Circulator – S - parameter measurement
6. S - matrix Characterization of E-Plane T, H-Plane T and Magic T.
7. Radiation Pattern of Antennas.
8. Antenna Gain Measurement

**OPTICAL EXPERIMENT**

1. DC characteristics of LED and PIN Photo Diode.
2. Mode Characteristics of Fibers
3. Measurement of Connector and Bending Losses.
4. Fiber Optic Analog and Digital Link
5. Numerical Aperture Determination for Fibers
6. Attenuation Measurement in Fibers

**TOTAL : 60 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- To inculcate an ability to analyze Electronics and Communications Engineering problems by applying the knowledge of mathematics and core engineering subjects
- To design Electronics & Communication systems with specifications based on societal and environmental considerations
- To teach the use of modern engineering tools, techniques, equipments, software and programming language skills necessary for designing and testing Electronics and Communication Engineering systems
- To make the students understand the impact of the engineering solutions in a global, economic, environmental and societal context

| TL8712 | EMBEDDED SYSTEMS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 4 | 2 |

**OBJECTIVES:**

**The student should be made to:**

- Learn the working of ARM processor
- Understand the Building Blocks of Embedded Systems
- Learn the concept of memory map and memory interface
- Know the characteristics of Real Time Systems
- Write programs to interface memory, I/Os with processor
- Study the interrupt performance
- Learn single board computers

**LIST OF EXPERIMENTS:**

1. LED Interfacing using ARM processor
2. LCD Interfacing using ARM processor
3. Keyboard Interfacing using ARM processor
4. Temperature sensor Interfacing using ARM processor
5. Stepper Motor Interfacing using ARM processor
6. Flashing of LEDs using ARM processor
7. ADC Interfacing using ARM processor
8. DAC Interfacing using ARM processor
9. Interrupt pooling using ARM processor
10. EPROM Interfacing using ARM processor.
11. Real Time Clock Interfacing using ARM processor.
12. Implementing zigbee protocol with ARM.
13. Study of one type of Real Time Operating Systems (RTOS) with ARM Processor
14. Study of basic image processing algorithm using Single board computers such as Raspberry Pi, BeagleBone block etc

**OUTCOMES:**

**Upon completion of the course, the student would be able to:**

- Understand ARM processor and Building Blocks of Embedded Systems
- Understanding peripheral interface with ARM Processor
- Acquire Knowledge on Real Time Operating Systems using ARM
- Understanding the realization of image processing algorithm using single board computers

**PREFERABLE DEVELOPMENT KIT:**

1. STM32 MCU Discovery Kits
2. TI Launch Pad development kits
3. Single board computers (Raspberry Pi, Beaglebone Block, etc)
4. Required interface boards

**CS8392 OBJECT ORIENTED PROGRAMMING L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

**UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10**

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment **-** Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

**UNIT II INHERITANCE AND INTERFACES 9**

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, ArrayLists - Strings

**UNIT III EXCEPTION HANDLING AND I/O 9**

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

**UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 8**

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

**UNIT V EVENT DRIVEN PROGRAMMING 9**

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Develop Java programs using OOP principles
- Develop Java programs with the concepts inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Develop Java applications with threads and generics classes
- Develop interactive Java programs using swings

**TEXT BOOKS:**

1. Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.

**REFERENCES:**

1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
2. Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
3. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.

| TL8001 | NANO ELECTRONICS – DEVICES AND MATERIALS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To know the basic circuit design using FINFET
- To describe the concepts of SRAM,NRAM,MRAM.
- To understand the interconnection is done using the nano wire and nano scale
- To know the usage of CNT in VLSI.
- To provide an overview of Graphene transistor and quantum cellular

**UNIT I FINFET CIRCUIT DESIGN 9**

Shorted-Gate and Independent-Gate FinFETs-Logic Design using FinFETs-Threshold Voltage Control-The principle of TCMS-Logic Design using TCMS- Schmitt trigger -Latch Design-Precharge – Evaluate Logic Circuits-FinFET Layout-Oriented FinFETs-Metal Organic Chemical Vapor Deposition-Stranski-Krastanow transition and assemble quantum dot formation-quantum wells and superlattices.

**UNIT II SRAM DESIGN AND HYBRID NANO CMOS SYSTEM 9**

Fundamentals Nonplanar SRAM-Modeling of FinFET Devices for SRAM Applications-SRAM Design-FinFET Design for SRAM-NRAM-MRAM-PCM-Temporal Logic Folding-Architecture of Nature-power Estimation-NanoMap Optimization Flow.

**UNIT III NANO WIRE ARRAYS AND NANOSCALE ASIC 9**

Introduction to Nanowires Fabrication Technologies-Architecture of Nanowire Crossbars-Testing procedure of crossbars-NASIC Building Blocks-NASIC Circuit Styles-NASIC Logic Styles-NASIC Architecture-Post- growth characterization tecchniques:Double Crystal X-Ray diffraction.

**UNIT IV CARBON NANOTUBE VLSI CIRCUITS AND FPCNA 9**

Fundamentals of CNT -CNT Logic Design-Metallic CNT Immune CNFET Circuits-Design Flow-Nanoelectronic Devices-FPCNA Architecture-Nanotube LUT Fabrication-Circuit Characterization-Photoluminescence-E-beam lithography and evaporation.

**UNIT V GRAPHENE TRANSISTOR AND QUANTUM CELLULAR AUTOMATE 9**

Introduction - Fabrication –Analog Circuits-Digital Circuits-Resonant Tunneling Diodes Fundamentals-QCA Fundamentals Logic Design with QCA -Nano-Imaging and Local spectroscopy: Scanning Tunnelling Microscopy, Scanning/Atomic Force Microscopy-Scanning Electron Microscopy and Transmission electron Microscopy-Raman Spectroscopy.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Design using FINFET
- Understand the interconnection using nano wire and nano scale.
- Knowledge on the usage of CNT in VLSI
- Gain the concept of Graphene transistor and quantum cellular

**TEXT BOOKS:**


1. Deming Chen and Niraj K. Jha ,“Nanoelectronic Circuit Design” ,Springer, (2011).(For units 1,2 ,3)

2. Nladimir V. Mitin,Viatcheslav A. Kochelap& Michael A. Stroscio,”Introduction to Nanoelectronics (For units 4,5)

**REFERENCES**


1. Science, Nanotechnology, Engineering and Applications", Cambridge University Press.
2. Peter J.F. Harris, "Carbon Nanotube Science Synthesis, Properties and Applications" Cambridge University Press.
3. Sze S.M., "VLSI Technology", Mc.Graw.Hill Second Edition,1998.
4. Goser K., Glosekotter P. Dienstuhl J."Nanoelectronics and Nanosystems from Transistors to molecular and quantum Devices", Springer(2008).


| TL8002 | TELECOMMUNICATION SYSTEM MODELING AND SIMULATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

The student should be made to:

- To gain knowledge in modeling of different communication systems.
- To know the techniques involved in performance estimation of telecommunication systems.
- To learn the use of random process concepts in telecommunication system simulation.
- To study the modeling methodologies of a telecommunication system.
- To study about the QAM digital radio link environment

**UNIT I SIMULATION OF RANDOM VARIABLES RANDOM PROCESS 9**

Generation of random numbers and sequence – Gaussian and uniform random numbers Correlated random sequences – Testing of random numbers generators – Stationary and uncorrelated noise – Goodness of fit test.

**UNIT II MODELING OF COMMUNICATION SYSTEMS 9**

Radio frequency and optical sources – Analog and Digital signals – Communication channel and model – Free space channels – Multipath channel and discrete channel noise and interference.

**UNIT III ESTIMATION OF PERFORMANCE MEASURE FOR SIMULATION 9**

Quality of estimator – Estimation of SNR – Probability density function and bit error rate – Monte Carlo method – Importance sampling method – Extreme value theory.

**UNIT IV SIMULATION AND MODELING METHODOLOGY 9**

Simulation environment – Modeling considerations – Performance evaluation techniques – Error source simulation – Validation.

**UNIT V CASE STUDIES 9**

Simulations of QAM digital radio link environment – Light wave communication link – Satellite system.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Apply the constituents of a telecommunication systems.
- Analyze various modeling methodologies and simulation techniques.
- Estimate the performance measures of telecommunication systems.
- Apply system modeling in telecommunication.
- Demonstrate light wave communication and satellite communication systems.

**TEXT BOOKS:**

1. Jeruchim MC Balaban P Sam K Shanmugam Simulation of communication Systems: Modeling, Methodology and Techniques Plenum press , New York 2002. (For units-1&2)
2. Jerry banks John S Carson Discrete Event System Simulation Prentice Hall of India1996.(For units-3,4&5)

**REFERENCES:**

1. Averill M Law Simulation Modeling and Analysis McGraw-Hill Inc 2007.
2. Geoffrey Gorden System Simulation Prentice Hall of India 1992.
3. Turin W Performance Analysis of Digital Communication Systems Computer Science Press, New York 1990.

**TL8003** **INFORMATION THEORY AND CODING**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

The student should be made to:

- Study the basic concepts information theory
- Understand the concept of error control coding: bloack code, convolution codes.
- Learn various Image and Video Formats

**UNIT I INFORMATION THEORY** **9**

Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memoryless channels – BSC, BEC – Channel capacity, Shannon limit.

**UNIT II ERROR CONTROL CODING:BLOCK CODES** **9**

Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder – CRC.

**UNIT III ERROR CONTROL CODING: BCH Codes** **9**

Binary primitive BCH codes, Decoding procedures, Implementation of Galois field Arithmetic, Implementation of Error correction. Non –binary BCH codes: q –ary Linear Block Codes, Primitive BCH codes over GF (q), Reed –Solomon Codes, Decoding of Non –Binary BCH and RS codes: The Berlekamp – Massey Algorithm.

**UNIT IV ERROR CONTROL CODING:CONVOLUTIONAL CODES** **9**

Encoding of Convolutional codes, Structural properties, Distance properties, Viterbi Decoding Algorithm for decoding, Soft –output Viterbi Algorithm, Stack and Fano sequential decoding Algorithms, Majority logic decoding.

**UNIT V ERROR CONTROL CODING: Concatenated Codes & Turbo Codes** **9**

Single level Concatenated codes, Multilevel Concatenated codes, Soft decision Multistage decoding, Concatenated coding schemes with Convolutional Inner codes, Introduction to Turbo coding and their distance properties, Design of Turbo codes.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Understand the concepts of information theory.
- Identifiy the errors using error control coding: bloack code, convolution codes..
- Knoweldge on various Image and Video Formats

**TEXT BOOKS:**

1. Shu Lin &Daniel J. Costello, Jr. “Error Control Coding "Pearson / Prentice Hall, Second Edition, 2004. (For units-1&2)
2. R Bose, “Information Theory, Coding and Cryptography”, TMH 2007. (For units-3,4&5)

**REFERENCES**

1. S. Gravano, “Introduction to Error Control Codes”, Oxford University Press 2007.
2. Amitabha Bhattacharya, “Digital Communication”, TMH 2006.

| EC 8073 | MEDICAL ELECTRONICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The student should be made:**

- To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters
- To study about the various assist devices used in the hospitals
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

**UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9**

Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

**UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 9**

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

**UNIT III ASSIST DEVICES 9**

Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

**UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY 9**

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

**UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9**

Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**On successful completion of this course, the student should be able to:**

- Know the human body electro- physiological parameters and recording of bio-potentials
- Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.
- Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators
- Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies , and bio-telemetry principles and methods
- Know about recent trends in medical instrumentation

**TEXT BOOK:**

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007. (UNIT I – V)

**REFERENCES:**

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TATA Mc Graw-Hill, New Delhi, 2003
2. John G.Webster, "Medical Instrumentation Application and Design", 3rd Edition, Wiley India Edition, 2007
3. Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, New York, 2004.

**GE8074 HUMAN RIGHTS L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I** **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II** **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

**UNIT III** **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV** **9**

Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V** **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

**TOTAL : 45 PERIODS**

**OUTCOME :**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**


1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.


**GE8077** **TOTAL QUALITY MANAGEMENT** **L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION** **9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

**UNIT II TQM PRINCIPLES** **9**

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I** **9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II** **9**

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY MANAGEMENT SYSTEM** **9**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration- **ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXT BOOK:**

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

**REFERENCES:**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO9001-2015 standards

| EC8093 | DIGITAL IMAGE PROCESSING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

**UNIT I DIGITAL IMAGE FUNDAMENTALS 9**

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

**UNIT II IMAGE ENHANCEMENT 9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

**UNIT III IMAGE RESTORATION 9**

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

**UNIT IV IMAGE SEGMENTATION 9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

**UNIT V IMAGE COMPRESSION AND RECOGNITION 9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

**TOTAL 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the students should be able to:**

- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

**TEXT BOOKS:**


1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson, Third Edition, 2010.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson, 2002.


**REFERENCES:**


1. Kenneth R. Castleman, 'Digital Image Processing', Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, 'Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.
3. D,E. Dudgeon and RM. Mersereau, 'Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, 'Digital Image Processing', John Wiley, New York, 2002
5. Milan Sonka et al 'Image processing, analysis and machine vision', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999


**TL8004 SPREAD SPECTRUM COMMUNICATION**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the basics of spread spectrum communication systems.
- To understand the way in which spread spectrum is applied to CDMA.
- To understand the performance of spread spectrum techniques

**UNIT I PERFORMANCE CHARACTERIZATION OF DIGITAL DATA TRANSMISSION 9**

Detection of binary signals in AWGN - Quadrature multiplexed signalling schemes - Signalling through band limited channels - Equalization of digital data transmission system - Realization imperfections - Degradations in performance. Communication in the presence of pulse noise jamming - Low probability detection scheme - Direct Sequence Spread Spectrum (DSSS) and Frequency Hop Spread Spectrum Systems and examples of Spread Spectrum Systems.

**UNIT II SPREAD SPECTRUM SYSTEMS 9**

Direct sequence spread spectrum methods employing BPSK, QPSK and MSK - Frequency Hop spread spectrum methods - Coherent slow frequency Hop technique - Non coherent slow and fast frequency Hop spread spectrum techniques - Hybrid DS/FH spread spectrum - Complex envelope representation of spread spectrum systems.

**UNIT III BINARY SHIFT REGISTER SEQUENCES FOR SPREAD SPECTRUM SYSTEMS 9**

Definition - PN sequence generator fundamentals - Maximal length sequences - Properties, Power spectrum and Polynomial tables for maximal length sequences - Gold codes - Rapid Acquisition systems - Non-linear code generators.

**UNIT IV SYNCHRONIZATION OF SPREAD SPECTRUM SYSTEMS 9**

Optimal tracking of wideband signals - Early-late tracking loops - Code tracking loops for FHSS - Optimum synchronization techniques - Multiple dwell and sequential detectors - Synchronization using a matched filter - Synchronization by estimating the received spreading code.

**UNIT V PERFORMANCE OF SPREAD SPECTRUM SYSTEM 9**

Systems communications models - Performance without coding under AWGN and different jamming environments - spread spectrum systems performances with forward error correction - Block coding - Convolutional coding and specific error correcting codes - Inter leaving - Random coding bounds.

**TOTAL : 45PERIODS**

**OUTCOMES:**

- To be able to arrive at detailed specifications of the spread spectrum systems.
- To design the spread spectrum based systems for CDMA.
- To be able to evaluate the performance of spread spectrum based systems

**TEXT BOOKS:**


1. Dixon R C, "Spread Spectrum Systems", Wiley Interscience, 1976. (unit-1&2)
2. Rodger E. Ziemer, Roger L. Peterson, David E. Borth Introduction to Spread Spectrum Communications Pearson 1995. (unit-3,4&5)


**REFERENCE:**


1. Ziemer "Introduction to Spread Spectrum Communications" 1st edition, Pearson 2013.


| | | L | T | P | C |
|---|---|---|---|---|---|
| **TL8005** | **MICRO ELECTRO MECHANICAL SYSTEMS** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To educate on the rudiments of micro fabrication techniques.
- To introduce various sensors and actuators.
- To introduce different materials used for MEMS.
- To educate on the application of MEMS to disciplines beyond Electrical and Mechanical engineering.
- To understand about the concept of MEMS switching capacitor

**UNIT I INTRODUCTION 9**

Historical perspective – Silicon microelectronics – MEMS –sensors and actuators– Introduction to micro sensors– Microfabrication– MEMS examples – Application of MEMS.

**UNIT II MEMS MATERIALS 9**

Metal and metal alloys – Semiconductors, polymers, ceramic materials, composite materials – Piezo resistance – Piezo electricity – Pyro electricity – Properties of thin films.

**UNIT III MICROELECTRONIC TECHNOLOGY FOR MEMS - I 9**

MEMS and IC fabrication cycle: Silicon wafer fabrication – Crystal growth –Monolithic Processing-Monolithic mounting-Evaporation – Types – Spin casting – Oxidation of silicon – Dry,Wet.

**UNIT IV MICROELECTRONIC TECHNOLOGY FOR MEMS – II 9**

Lithography: Photo-resist – Pattern transfer – Etching – Wet ,dry – doping Semiconductors-metallization - bonding and packaging – Bulk Micromachining for silicon based MEMS.

**UNIT V MEMS SWITCH DESIGN 9**

RF MEMS switches: Introduction – Switch parameters – Basics of switching – Application areas of RF MEMS – Electrostatic switching –MEMS switched capacitors– Voltage switches – Reconfigurable MEMS networks, antennas.

**TOTAL:45PERIODS**

**OUTCOMES:**

**After studying this course, the student would be able to:**

- Analyze the operation of micro devices, micro systems and their applications.
- Design the micro devices, micro system using the MEMS fabrication process.
- Understand the necessity of MEMS in thrust areas like sensors and actuators..
- Understand the principles of energy transduction, sensing and actuation on a microscopic scale.
- Design the principles of micro fabrication to the development of micro mechanical devices.

**TEXT BOOKS:**

1. Julian Gardner Vijay Vardan K Osama O A Microsensors, MEMS and Smart Devices John wiley and sons 2002. (unit-1&2)
2. Tai Ran Hsu Mems and Microsystems Design Tata McGraw-Hill 2002. (unit-3,4&5)

**REFERENCES:**

1. Fukuda T Menz W Micro Mechanical Systems Principles and Technology Elsevier 2002
2. Rai Choudary P MEMS and MOEMS Technology and Applications SPIE Press 2000
3. Gabriel M RebeizRF MEMS theory,Design and Technology John wiley and sons 2003
4. Vijay vardan K Vinoy K J Jose KARF MEMS and their Applications John wiley and sons 2003

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CS8792** | **CRYPTOGRAPHY AND NETWORK SECURITY** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

**UNIT I INTRODUCTION 9**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography).- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

**UNIT II SYMMETRIC CRYPTOGRAPHY 9**

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS**:** SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.

**UNIT III PUBLIC KEY CRYPTOGRAPHY 9**

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

**UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY 9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

**UNIT V SECURITY PRACTICE AND SYSTEM SECURITY 9**

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

**TOTAL 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
- Apply the different cryptographic operations of symmetric cryptographic algorithms
- Apply the different cryptographic operations of public key cryptography
- Apply the various Authentication schemes to simulate different applications.
- Understand various Security practices and System security standards

**TEXT BOOK:**

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.

**REFERENCES**

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd YEAR
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

| | | L | T | P | C |
|---|---|---|---|---|---|
| **TL8006** | **BLUETOOTH TECHNOLOGY** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To understand the bluetooth networks, architecture and various telephone networks standards.
- To understand the bluetooth standards and various bluetooth channels.
- To understand how bluetooth devices operate in the frequency band.
- To understand the concept of zigbee networks.
- To understand about the concept of Hold mode and Sniff mode

**UNIT I THE BLUETOOTH MODULE 9**

Introduction – Overview – The bluetooth module – Antennas – Base band – Introduction to bluetooth device address – Masters, slaves, and pico nets – System timing – Physical links – Bluetooth packet structure – Logical channels – Frequency hopping

**UNIT II THE LINK CONTROLLER 9**

The link controller – Link control protocol – Link controller operation – Pico net, scatter net operation – Master/Slave role switching – Base band/Link controller architectural overview – Link manager – The host controller interface

**UNIT III THE BLUETOOTH HOST 9**

The bluetooth host – Logical link control and adaptation protocol – RFCOMM – The service discovery protocol – The wireless access protocol – OBEX and IrDA telephony control protocol

**UNIT IV CROSS LAYER FUNCTIONS 9**

Cross layer functions – Encryption and security – Low power operations – Controlling low power modes –Hold mode – Sniff mode – Park mode – Quality of service – Managing bluetooth devices

**UNIT V ZIGBEE NETWORKS 9**

Zigbee communication basics – Zigbee network layers and their functions – Zigbee MAC series – MAC frame format – Transceiver building block – Receiver sensitivity – 2.4 GHz and 868/915 MHz operation – FCC regulations – Applications – Home automation – Healthcare Industrial automation.

**TOTAL:45PERIODS**

**OUTCOMES:**

- Explain the process of linkage between the bluetooth devices.
- Identify the protocols which have been used to transfer the datas from bluetooth host.
- Explain the encryption process used in Bluetooth data transfer.
- Analyze the concept of zigbee protocols

**TEXT BOOK:**

1. Jennifer Bray Charles F Sturman Bluetooth: Connect Without Cables Pearson Education, Second Edition 2002.(For Unit 1,2,3,4 & 5)

**REFERENCE:**

1. David Kammer Gordon McNutt Brain Senese Jennifer Bray Bluetooth Application Developer's Guide Syngress Media.

**GE8075 INTELLECTUAL PROPERTY RIGHTS L T P C**
**3 0 0 3**

**OBJECTIVE:**

- To give an idea about IPR, registration and its enforcement.

**UNIT I INTRODUCTION 9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

**UNIT II REGISTRATION OF IPRs 10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

**UNIT III AGREEMENTS AND LEGISLATIONS 10**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

**UNIT IV DIGITAL PRODUCTS AND LAW 9**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

**UNIT V ENFORCEMENT OF IPRs 7**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

**TOTAL : 45 PERIODS**

**OUTCOME:**

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

**TEXT BOOKS**


1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, “Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002


**REFERENCES**


1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.


| TL8007 | TELECOMMUNICATION NETWORK MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the concept of network management standards.
- To design the common management information service element model.
- To understand the various concept of information modelling.
- To analyze the concept of SNMPv1 and SNMPv2 protocol.
- To analyze the concept of examples of network management

**UNIT I FOUNDATIONS 9**

Network management standards–network management model– organization model– information model abstract syntax notation 1 (ASN.1) – encoding structure– macros–functional model. Network management application functional requirements:Configuration management– fault management–performance management–Error correlation technology– security management– accounting management– common management–report management– polity based management–service level management–management service–community definitions– capturing the requirements– simple and formal approaches–semi formal and formal notations.

**UNIT II COMMON MANAGEMENT INFORMATION SERVICE ELEMENT 9**

CMISE model–service definitions–errors–scooping and filtering features– synchronization–functional units– association services– common management information protocol specification.

**UNIT III INFORMATION MODELING FOR TMN 9**

Rationale for information modeling–management information model–object oriented modeling paradigm– structure of management information–managed object class definition–management information base.

**UNIT IV SIMPLE NETWORK MANAGEMENT PROTOCOL 9**

SNMPv1: managed networks–SNMP models– organization model–information model–SNMPv2 communication model–functional model–major changes in SNMPv2–structure of management information, MIB–SNMPv2 protocol– compatibility with SNMPv1– SNMPv3– architecture–applications–MIB security, remote monitoring–SMI and MIB– RMQN1 and RMON2.

**UNIT V NETWORK MANAGEMENT EXAMPLES 9**

ATM integrated local management interface–ATM MIB–M1– M2–M3– M4– interfaces–ATM digital exchange interface management–digita1 subscriber loop and asymmetric DSL technologies–ADSL configuration management–performance management Network management tools: Network statistics management–network management system–management platform case studies: OPENVIEW–ALMAP.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**After studying this course, the student would be able to:**

- Design and analyze of fault management.
- Analyze the common management information protocol specifications.
- Design and analyze of management information model.
- Design the simple network management protocol.
- Design the various types of network management tools

**TEXT BOOKS:**


1. Mani Subramanian Network Management: Principles and Practice Pearson Education, Second edition 2010 (unit-1&2)
2. Lakshmi G Raman Fundamentals of Telecommunications Network Management Wiley 1999 (unit-3,4&5)


**REFERENCES:**


1. Henry Haojin Wang, " Telecommunications Network Management", McGraw-Hill, 1999
2. Salah Aidarous Thomas Plevyak Telecommunication Network Management: Technologies and Implementations Wiley 1997

**TL8008** **ADVANCED ELECTRONIC SYSTEM DESIGN** **L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To learn design of RF amplifiers using transistors.
- To learn modern Power Supplies using SCR and SMPS technology
- To learn about signal shielding & grounding techniques and study of A/D and D/A Converters.
- To learn knowledge about fabrication of PCBs using CAD

**UNIT I INTRODUCTION TO RF DESIGN 9**

RF behaviour of passive components, Chip components and circuit board considerations, Review of transmission lines, Impedance and admittance transformation, Parallel and series connection of networks, ABCD and scattering parameters, Analysis of amplifier using scattering parameter. RF filter – Basic resonator and filter configurations – Butterworth and Chebyshev filters. Implementation of microstrip filter design. Band pass filter and cascading of band pass filter elements.

**UNIT II RF TRANSISTOR AMPLIFIER DESIGN 9**

Impedance matching using discrete components. Microstrip line matching networks. Amplifier classes of operation and biasing networks – Amplifier power gain, Unilateral design ($S_{12} = 0$) – Simple input and output matching networks – Bilateral design - Stability circle and conditional stability, Simultaneous conjugate matching for unconditionally stable transistors. Broadband amplifiers, High power amplifiers and multistage amplifiers.

**UNIT III DESIGN OF POWER SUPPLIES 9**

DC power supply design using transistors and SCRs, Design of crowbar and foldback protection circuits, Switched mode power supplies, Forward, flyback, buck and boost converters, Design of transformers and control circuits for SMPS.

**UNIT IV DESIGN OF DATA ACQUISITION SYSTEMS 9**

Amplification of Low level signals, Grounding, Shielding and Guarding techniques, Dual slope, quad slope and high speed A/D converters, Microprocessors Compatible A/D converters, Multiplying A/D converters and Logarithmic A/D converters, Sample and Hold, Design of two and four wire transmitters.

**UNIT V DESIGN OF PRINTED CIRCUIT BOARDS 9**

Introduction to technology of printed circuit boards (PCB), General lay out and rules and parameters, PCB design rules for Digital, High Frequency, Analog, Power Electronics and Microwave circuits, Computer Aided design of PCBs.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- To design RF system
- To design modern power supplies
- To design data acquisition system

**TEXT BOOKS:**

1. Reinhold Luduig and Pavel Bretchko, RF Circuit Design – Theory and Applications, Pearson Education, 2000. (For unit-1,2)
2. Sydney Soclof, Applications of Analog Integrated Circuits, Prentice Hall of India, 1990. (For unit-3)
3. Walter C.Bosshart, Printed Circuit Boards – Design and Technology, TMH, 1983. (For unit-4,5)

**REFERENCES:**

1. Keith H.Billings, Handbook of Switched Mode Supplies, McGraw-Hill Publishing Co., 1989
2. Michael Jaacob, Applications and Design with Analog Integrated Circuits, Prentice Hall of India, 1991.
3. Otmar Kigenstein, Switched Mode Power Supplies in Practice, John Wiley and Sons, 1989.

| EC8071 | COGNITIVE RADIO | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The student should be made:**

- To understand the evolving software defined radio and cognitive radio techniques and their essential functionalities
- To study the basic architecture and standard for cognitive radio
- To understand the physical, MAC and Network layer design of cognitive radio
- To expose the student to evolving applications and advanced features of cognitive radio

**UNIT I INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIVE RADIO 9**

Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.

**UNIT II COGNITIVE RADIO ARCHITECTURE 9**

Cognition cycle – orient, plan, decide and act phases, Organization, SDR as a platform for Cognitive Radio – Hardware and Software Architectures, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.

**UNIT III SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS 9**

Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio.

**UNIT IV MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO 9**

MAC for cognitive radios – Polling, ALOHA, slotted ALOHA, CSMA, CSMA / CA, Network layer design – routing in cognitive radios, flow control and error control techniques.

**UNIT V ADVANCED TOPICS IN COGNITIVE RADIO 9**

Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Gain knowledge on the design principles on software defined radio and cognitive radio
- Develop the ability to design and implement algorithms for cognitive radio spectrum sensing and dynamic spectrum access
- Build experiments and projects with real time wireless applications
- Apply the knowledge of advanced features of cognitive radio for real world applications

**TEXT BOOKS:**


1. Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, "Cognitive Radio Communications and Networks", Academic Press, Elsevier, 2010. (unit I -IV)
2. Huseyin Arslan (Ed.), "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007. (5)


**REFERENCES:**


1. Bruce Fette, "Cognitive Radio Technology", Newnes, 2006.
2. Kwang-Cheng Chen, Ramjee Prasad, " Cognitive Radio Networks", John Wiley and Sons, 2009.
3. Ezio Biglieri, Professor Andrea J. Goldsmith, Dr Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor, "Principles of Cognitive Radio" , Cambridge University Press, 2012.


**TL8009 MULTIMEDIA COMPRESSION TECHNIQUES**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

To provide in-depth knowledge about

- Data Compression
- Text Compression and Audio Compression
- Image and Video Compression

**UNIT I INTRODUCTION** **9**

Special features of Multimedia–Graphics and Image Data Representations-Fundamental Concepts in Video and Digital Audio–Storage requirements for multimedia applications - Need for Compression-Taxonomy of compression techniques–Overview of source coding, source models, scalar and vector quantization theory–Evaluation techniques–Error analysis and Methodologies

**UNIT II TEXT COMPRESSION** **9**

Compaction techniques–Huffmann coding–Adaptive Huffmann Coding–Arithmatic coding – Dictionary techniques–LZW family algorithms.

**UNIT III AUDIO COMPRESSION** **9**

Audio compression techniques - μ-Law and A-Law companding. Speech compression-waveform codecs -source codecs-hybrid codecs-Shorten compressor–Basic sub-band coding–Application to speech coding–G.722–Application to audio coding –MPEG audio, progressive encoding for audio–Silence compression, speech compression techniques–Formant and CELP Vocoders.

**UNIT IV IMAGE COMPRESSION** **9**

Predictive techniques–DM, PCM, DPCM: Optimal Predictors and Optimal Quantization–Contour based compression–Transform Coding–JPEG Standard–Sub-band coding algorithms: Design of Filter banks–Wavelet based compression: Implementation using filters–EZW, SPIHT coders – JPEG 2000 standards–JBIG, JBIG2 Standards

**UNIT V VIDEO COMPRESSION 9**

Video compression techniques and standards–MPEG VideoCoding I: MPEG–1 and 2 MPEG Video Coding II: MPEG–4 and 7–Motion estimation and compensation techniques–H.261 Standard–DVI technology–PLV performance–DVI real time compression–Packet Video.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**After studying this course,** Students will be able to

- Explain Scalar quantization theory and Rate distribution Theory
- Understand different coding techniques
- Describe Contour based compression and Motion estimation techniques

**TEXT BOOKS:**

1. Khalid Sayood: Introduction to Data Compression, Morgan Kauffman Harcourt India,2nd Edition, 2000. (For unit-1&2)
2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,"Satellite Communication",2nd Edition,Wiley Publications,2002 (For unit-3,4&5)

**REFERENCES**

1. David Salomon : Data Compression–The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001
2. Yun Q.Shi, Huifang Sun : Image and Video Compression for MultimediaEngineering - Fundamentals, Algorithms & Standards, CRC press, 2003.
3. Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.
4. Mark Nelson : Data compression, BPB Publishers, New Delhi,1998.
5. Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1st Edition, 2003.
6. Watkinson,J : Compression in Video and Audio, Focal press,London.1995.
7. Jan Vozer : Video Compression for Multimedia, AP Profes, NewYork, 1995.

| TL8071 | RADAR AND NAVIGATIONAL AIDS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To apply Doppler principle to radars and hence detect moving targets, cluster, also to understand tracking radars
- To refresh principles of antennas and propagation as related to radars, also study of transmitters and receivers.
- To understand principles of navigation, in addition to approach and landing aids as related to navigation

**UNIT I INTRODUCTION TO RADAR EQUATION 9**

Introduction- Basic Radar –The simple form of the Radar Equation- Radar Block Diagram- Radar Frequencies –Applications of Radar – The Origins of Radar - Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm- Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency- Antenna Parameters- System losses – Other Radar Equation Considerations.

**UNIT II MTI AND PULSE DOPPLER RADAR 9**

Introduction to Doppler and MTI Radar- Delay –Line Cancellers- Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) – Pulse Doppler Radar – Other Doppler Radar Topics- Tracking with Radar –Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy - Low-Angle Tracking - Tracking in Range - Other Tracking Radar Topics - Comparison of Trackers - Automatic Tracking with Surveillance Radars (ADT).

**UNIT III DETECTION OF SIGNALS IN NOISE 9**

Matched –Filter Receiver –Detection Criteria – Detectors –-Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - The Radar operator - Signal Management - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas – Phase Shifters - Frequency-Scan Arrays

**Radar Transmitters and Receivers -** Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources – Other aspects of Radar Transmitter.**-** The Radar Receiver - Receiver noise Figure – Super heterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.

**UNIT IV RADIO DIRECTION AND RANGES 9**

Introduction - Four methods of Navigation .**-** The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders – The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders **-** The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR – Recent Developments.

**Hyperbolic Systems of Navigation (Loran and Decca) -** Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System -Decca Receivers - Range and Accuracy of Decca - The Omega System.

**UNIT V SATELLITE NAVIGATION SYSTEM 9**

Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment **-** Instrument Landing System - Ground Controlled Approach System - Microwave Landing System(MLS) The Doppler Effect - Beam Configurations -Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems. Inertial Navigation **-** Principles of Operation - Navigation Over the Earth– Components of an Inertial Navigation System - Earth Coordinate Mechanization - Strapped-Down Systems - Accuracy of Inertial Navigation Systems-The Transit System - Navstar Global Positioning System (GPS).

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**After studying this course,** Students will be able to

- Explain principles of navigation, in addition to approach and landing aids as related to navigation
- Derive and discuss the Range equation and the nature of detection.
- Describe about the navigation systems using the satellite.

**TEXT BOOKS:**


1. Merrill I. Skolnik ," Introduction to Radar Systems", 3rd Edition Tata Mc Graw-Hill 2003.. (For unit-1&2)
2. N.S.Nagaraja, “Elements of Electronic Navigation Systems”, 2nd Edition, TMH, 2000. (For unit-3,4&5)


**REFERENCES**


1. Peyton Z. Peebles:, "Radar Principles", John Wiley, 2004

2. J.C Toomay, " Principles of Radar", 2nd Edition –PHI, 2004

| GE8072 | FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

**UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9**

**Global Trends Analysis and Product decision -** Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends **- Introduction to Product Development Methodologies and Management -** Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies **-** Product Life Cycle – Product Development Planning and Management.

**UNIT II REQUIREMENTS AND SYSTEM DESIGN 9**

**Requirement Engineering -** Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - **System Design & Modeling -** Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

**UNIT III DESIGN AND TESTING 9**

**Conceptualization -** Industrial Design and User Interface Design - Introduction to Concept generation Techniques – **Challenges in Integration of Engineering Disciplines** - Concept Screening & Evaluation - **Detailed Design -** Component Design and Verification – **Mechanical, Electronics and Software Subsystems** - High Level Design/Low Level Design of S/W Program **-** Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – **Prototyping -** Introduction to Rapid Prototyping and Rapid Manufacturing - **System Integration, Testing, Certification and Documentation**

**UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9**

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - **Sustenance -**Maintenance and Repair – Enhancements - **Product EoL -** Obsolescence Management – Configuration Management - EoL Disposal

**UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9**

**The Industry -** Engineering Services Industry - Product Development in Industry versus Academia –**The IPD Essentials -** Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

**TEXTBOOKS:**

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

**REFERENCES:**

1. Hiriyappa B, “Corporate Strategy – Managing the Business”, Author House, 2013.
2. Peter F Drucker, “People and Performance”, Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, “Enterprise Resource Planning – Concepts”, Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013

**GE8071 DISASTER MANAGEMENT L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

**UNIT I INTRODUCTION TO DISASTERS 9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj

Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

**UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**The students will be able to**

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

**TEXTBOOKS:**


1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423 (For unit-1,2)
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361(For unit-3)
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011 (For unit-4)
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.(For unit-5)


**REFERENCES**


1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.


| TL8010 | BROADBAND COMMUNICATIONS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

The student should be made :

- Discuss and analyze the latest technologies in broadband communications including wireless components
- Analyze different techniques and technologies required for the development of broadband communications
- Discuss the recent development of fiber-optic communication and next generation Internet protocols in current and emerging broadband communications

**UNIT I INTRODUCTION AND OVERVIEW 9**

X.25, Frame relay, Integration of Transmission and Switching, Analog and Digital switching, Principles of ISDN, Architecture, ISDN standards, ISDN interface and Functions, ISDN protocol architecture, ISDN connections, Addressing, Interworking.

**UNIT II B-ISDN SERVICES AND PROTOCOL 9**

B-ISDN protocols -User plane, management plane, control plane, signaling plane, Other aspects of B-ISDN: Broadcast service aspects, Network aspects and user network interface aspects, SONET- An overview.

**UNIT III TQM TOOLS AND TECHNIQUES I 9**

Overview, Virtual channels, Virtual paths, VP & VC switching, ATM cells, Header format, Generic flow control, Header error control, Transmission of ATM cells, Adaptation layer, AAL services and protocols. ATM switching building blocks, Input, Output buffering, Central buffering, Performance aspects of buffering switching networks.

**UNIT IV TQM TOOLS AND TECHNIQUES II 9**

Broad band Access network: Design-Requirements, and topology, Backbone network: design-requirement and topologies.

**UNIT V QUALITY SYSTEMS 9**

Introduction to Broadband Wireless, Evolution of Broadband Wireless; Fixed & Mobile Broadband Wireless; WiMAX and Other Broadband Wireless Technologies: overview.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Gain complete knowledge about Basics of ISDN and B-ISDN
- The knowledge about the concept of ATM Switching and transmission.
- T the concept SONET and its operations.
- The Design of broadband networks.
- Knowledge on broad band technologies

**TEXT BOOKS:**


1. William Stallings, “ISDN and Broadband ISDN with Frame and ATM”, Pearson 4th edition, 2009.(For Unit 1 & 2)
2. Robert C Newman “Broadband Communications”, Prentice Hall, 2002. (For Unit 3,4 & 5)


**REFERENCES:**


1. J Jeffrey G. Andrews, ArunabhaGhosh&RiasMuhamed, “Fundamentals of WiMAX: Understanding Broadband Wireless Networking”, Prentice Hall, 2007
2. John R Vacca, “Wireless Broadband Networks Handbook”, Tata McGrawHill
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

| TL8011 | COMMUNICATION SYSTEMS AND SIMULATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

The student should be made :

- To generate and test the properties of random variables and random processes
- To understand Channel, filter and noise models of Communication systems
- To analyze a receiver based on estimation of various parameters like SNR, BER etc.,
- To Analyze cellular radio system as case studies through simulation.

**UNIT I INTRODUCTION TO SIMULATION 9**

Concept of Simulation and Modeling, Roles of Simulation, Types of Simulation Limits of Simulation, Mapping a problem into a simulation Model, real time Simulation, Efficient Simulation Techniques.

**UNIT II SIMULATION OF RANDOM VARIABLES AND RANDOM PROCESS 9**

Generation of random numbers and sequence, Gaussian and uniform random numbers Correlated random sequences, Testing of random numbers generators Random process models-Markov and ARMA Sequences.

**UNIT III MODELING OF COMMUNICATION SYSTEMS 9**

Modeling of Individual Communication block - Channel Model - Filter Model - Noise and Fading Model - Receiver Model.

**UNIT IV ESTIMATION OF PERFORMANCE MEASURE 9**

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V SIMULATION OF CELLULAR RADIO SYSTEM 9**

System level Description Modeling a Cellular Communication System - Simulation Methodology - Processing the Simulation Results.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Provide a comprehensive coverage on Simulation Concept, Random numbers and random variables generation, modeling of channel, noise, fading and receiver and performance evaluation in terms of probability of error and bit error rate

**TEXT BOOK:**

1. Jeruchim M.C, Philip Balboan and Sam Shanmugam K, “Simulation of Communication System, modeling methodology and techniques”, Plenum Press, New York, 2009.(For Unit 1,2,3,4 & 5)

**REFERENCES:**

1. Law M, and DavideKelton W, “Simulation Modeling and Analysis”, McGraw Hill Inc., New York, 2010.
2. William H. Tranter, K. Sam Shanmugam, Theodore S. Rappaport, Kurt L. Kosbar , “Principles of Communication System Simulation with Wireless Application”, Pearson Education Private Limited, 2010.

**TL8012** **L T P C**

**ON-CHIP COMMUNICATION ARCHITECTURES** **3 0 0 3**

**OBJECTIVES:**

- To understand the basic concepts of bus-based communication architectures and standards
- Provide an understanding of the concepts and building blocks of System-on-Chip (SoC) design
- To understand the concepts and building blocks of Network-on-Chip (NoC) design
- Provide an understanding of emerging on-chip interconnect technologies

**UNIT I BASIC CONCEPTS OF BUS-BASED COMMUNICATION ARCHITECTURES 9**

Terminology, Characteristics of Bus-Based Communication Architectures, Data Transfer Modes, Bus Topology Types, Physical Implementation Of Bus Wires, Types of On-Chip Communication Architectures.

**UNIT II ON-CHIP COMMUNICATION ARCHITECTURE STANDARDS 9**

Standard On-Chip Bus-Based Communication Architectures: AMBA 2.0, AMBA3.0, IBM CoreConnect, STMicroelectronics STBus, Sonics SMART Interconnect, OpenCores Wishbone, Altera Avalon, Socket-Based On-Chip Bus Interface Standards: Open Core Protocol.

**UNIT III SYSTEM ON CHIP 9**

System design methodologies: System on Board (SoB) – System on Chip (SoC) - Generic SoC Architecture Components: Generic SoC Block Diagram - Subsystems of an SoC - Platform-Based SoC Design: Concept of the Platform, Types of Platforms: Processor-Centric Platform, Application-Specific Platform ,Fully Programmable Platform, Communication-Centric Platform.

**UNIT IV NETWORKS-ON-CHIP 9**

Network Topology - Switching Strategies - Routing Algorithms- Flow Control - Clocking Schemes - Quality of Service - NoC Architectures.

**UNIT V EMERGING ON-CHIP INTERCONNECT TECHNOLOGIES 9**

Optical Interconnects (OIs) -Use of OIs for On-Chip Communication - RF/Wireless Interconnects - Use of RF/Wireless Interconnects for On-Chip Communication – Carbon Nanotube (CNT) Interconnects - Circuit Parameters for Isolated Single-Walled Carbon Nanotubes (SWCNTS) - Circuit Parameters for a Bundle of SWCNTs - Comparison between Copper and SWCNT-Bundles - Using CNTs for On-Chip Communication.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student would be able to:**

- Know the various bus-based communication architectures and standards
- Know the concepts and building blocks of System-on-Chip (SoC) and Network on Chip (NoC)
- Know the emerging on-chip interconnect technologies

**TEXT BOOKS:**


1. SudeepPasricha, NikilDutt “On-Chip Communication Architectures: System on Chip Interconnect” Morgan Kaufmann Publishers Inc, 2008. (For unit-1&2)
2. Mishra, Sanjeeb; Rousseau, Vijayakrishnan; Singh, Neeraj Kumar “System on Chip Interfaces for Low Power Design”, Morgan Kaufmann, 2015. (For unit-3,4&5)

**REFERENCES**


1. Hoi-Jun Yoo, Kangmin Lee, Jun Kyong Kim, “Low-Power NoC for High Performance SoC Design”, CRC Press, 2008.
2. Michael J. Flynn, Wayne Luk “Computer System Design: System-on-Chip” Wiley-Blackwell, 2011.


| CS8086 | SOFT COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

**UNIT I INTRODUCTION TO SOFT COMPUTING 9**

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

**UNIT II ARTIFICIAL NEURAL NETWORKS 9**

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

**UNIT III FUZZY SYSTEMS 9**

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

**UNIT IV GENETIC ALGORITHMS 9**

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

**UNIT V HYBRID SYSTEMS 9**

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**Upon completion of this course, the students should be able to**

- Apply suitable soft computing techniques for various applications.
- Integrate various soft computing techniques for complex problems.

**TEXT BOOKS:**

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt.Ltd., 2nd Edition, 2011.
3. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt.Ltd., 2017.

**REFERENCES:**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India, 2002.
2. Kwang H.Lee, “First course on Fuzzy Theory and Applications”, Springer, 2005.
3. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Addison Wesley, 2003.

| | | L | T | P | C |
|---|---|---|---|---|---|
| **TL8013** | **3G AND 4G WIRELESS MOBILE COMMUNICATIONS** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To understand the concepts of CDMA and OFDM
- Provide an understanding of the concepts MIMO and UWB
- To understand the concepts 3G and 4G Wireless Standards
- Provide an understanding of Mobility Management in wireless mobile communications

**UNIT I CDMA and OFDM** **9**

Introduction to CDMA, Walsh codes, Variable tree OVSF, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization, Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues - PAPR, Frequency and Timing Offset Issues.

**UNIT II MIMO** **9**

Introduction to MIMO, MIMO Channel Capacity, SVD and Eigen modes of the MIMO Channel, MIMO Spatial Multiplexing - BLAST, MIMO Diversity - Alamouti, OSTBC, MRT, MIMO – OFDM.

**UNIT III UWB (Ultra wide Band)** **9**

UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train, Bit - Error Rate Performance of UWB.

**UNIT IV 3G and 4G Wireless Standards** **9**

Architectural Review of UMTS and GSM, From UMTS to LTE, From LTE to LTE-Advanced, GSM, GPRS, WCDMA, WiMAX.

**UNIT V Mobility Management** **9**

Transitions Between Mobility Management States - Cell Reselection in RRC_IDLE - Measurements in RRC_CONNECTED - Handover in RRC_CONNECTED.

**TOTAL:45PERIODS**

**OUTCOMES:**

**Upon completion of the course, the student would be able to:**

- Know the concepts of CDMA and OFDM
- Know the concepts the concepts MIMO and UWB
- Acquire knowledge on 3G and 4G Wireless Standards
- Know about the Mobility Management in wireless mobile communications

**TEXT BOOKS:**

1. David Tse and Pramod Viswanath ,"Fundamentals of Wireless Communications" - Cambridge University Press.2005 (For unit -1)
2. Ezio Biglieri, Robert Calderbank, Anthony Constantinides, "MIMO Wireless Communications" – - Cambridge University Press .2010 (For unit -2)
3. Christopher Cox, "An Introduction to LTE: LTE, LTE-Advanced, SAE, VoLTE and 4G Mobile Communications, 2nd Edition, Wiely, 2012. (For unit -3,4&5)

**REFERENCES**

1. Wireless Communications: Principles and Practice -Theodore Rappaport- Prentice Hall. 2002
2. Wireless Communications: Andrea Goldsmith, Cambridge University Press. 2012

| EC8072 | ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the basic concepts of Electromagnetic Interference
- To teach the importance of Electromagnetic Compatible designs
- To explain the existing standards for Electromagnetic Compatibility

**UNIT I EMI/EMC CONCEPTS** **9**

EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission and Susceptibility; Case Histories; Radiation Hazards to humans.

**UNIT II EMI COUPLING PRINCIPLES** **9**

Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling; Near field cable to cable coupling; Field to cable coupling; Power mains and Power supply coupling; Transient EMI, ESD.

**UNIT III EMI CONTROL** **9**

Shielding; EMI Filters; Grounding; Bonding; Isolation transformer; Transient suppressors; EMI Suppression Cables.

**UNIT IV EMC DESIGN FOR CIRCUITS AND PCBS** **9**

Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and cross talk control; Component selection and mounting; PCB trace impedance; Routing; Power distribution decoupling; Zoning; Grounding; VIAs; Terminations.

**UNIT V EMI MEASUREMENTS AND STANDARDS** **9**

Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Line impedance stabilization networks; EMI Rx and spectrum analyzer; Civilian standards - CISPR, FCC, IEC, EN; Military standards-MIL461E/462.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**At the end of the course, the student should be able to:**

- Identify the various types and mechanisms of Electromagnetic Interference
- Propose a suitable EMI mitigation technique
- Describe the various EMC Standards and methods to measure them

**TEXT BOOKS:**

1. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, Newyork, 1996. (For unit I - V)
2. C.R.Paul,"Introduction to Electromagnetic Compatibility" , John Wiley and Sons, Inc, 1992. (For Unit- IV)

**REFERENCES:**

1. C.R.Paul,"Introduction to Electromagnetic Compatibility" , John Wiley and Sons, Inc, 1992.
2. Bemhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Ed, Artech house, Norwood, 1986.
3. Don R. J.White Consultant Incorporate, "Handbook of EMI/EMC", Vol I-V, 1988.

**GE8076 PROFESSIONAL ETHICS IN ENGINEERING LT P C**
**3 0 0 3**

**OBJECTIVE:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES 10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS 9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

**UNIT V GLOBAL ISSUES 8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

**TEXT BOOKS:**

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

**REFERENCES:**


1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, 2009.
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, ‘ Value Education’, Vethathiri publications, Erode, 2011.


**Web sources:**

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

| EC8092 | ADVANCED WIRELESS COMMUNICATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To expose the students to the importance of improving capacity of wireless channel using MIMO
- To enable understanding of channel impairment mitigation using space-time block and Trellis codes
- To teach advanced MIMO system like layered space time codes, MU-MIMO System and MIMO-OFDM systems

**UNIT I CAPACITY OF WIRELESS CHANNELS 9**

The crowded spectrum, need for high data rate, MIMO systems – Array Gain, Diversity Gain, Data Pipes, Spatial MUX, MIMO System Model. MIMO System Capacity – channel known at the TX, Channel unknown to the TX – capacity of deterministic channels, Random channels and frequency selective channels.

**UNIT II RADIO WAVE PROPAGATION 9**

Radio wave propagation – Macroscopic fading- free space and out door, small scale fading Fading measurements – Direct pulse measurements, spread spectrum correlation channel sounding frequency domain channel sounding, Antenna Diversity – Diversity combining methods.

**UNIT III SPACE TIME BLOCK CODES 9**

Delay Diversity scheme, Alamoti space time code – Maximum likelihood decoding maximum ratio combining. Transmit diversity space time block codes for real signal constellation and complex signal constellation - decoding of STBC.

**UNIT IV SPACE TIME TRELLIS CODES 9**

Space time coded systems, space time code word design criteria, design of space time T C on slow fading channels, design of STTC on Fast Fading channels, performance analysis in slow and fast fading channels, effect of imperfect channel estimation and Antenna correlation on performance, comparison of STBC & STTC.

**UNIT V LAYERED SPACE TIME CODES 9**

LST transmitter – Horizontal and Vertical LST receiver – ML Rx, Zero forcing Rx; MMSE Rx, SIC Rx, ZF V-blast Rx- MMSE V-blast Rx, Iterative Rx - capacity of MIMO – OFDM systems – capacity of MIMO multi user systems.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

**The student should be able to:**

- Comprehend and appreciate the significance and role of this course in the present contemporary world
- Apply the knowledge about the importance of MIMO in today's communication
- Appreciate the various methods for improving the data rate of wireless communication system

**REFERENCES:**


1. Mohinder Jankiraman, Space-time codes and MIMO systems, Artech House, Boston, London . www.artech house.com, ISBN 1-58053-865-7-2004
2. Paulraj Rohit Nabar, Dhananjay Gore, Introduction of space time wireless communication systems, Cambridge University Press, 2003.
3. David Tse and Pramod Viswanath, ―Fundamentals of Wireless Communication‖, Cambridge University Press, 2005.
4. Sergio Verdu " Multi User Detection" Cambridge University Press, 1998


| | | L | T | P | C |
|---|---|---|---|---|---|
| **TL8014** | **REMOTE SENSING** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To learn different Components of Remote Sensing.
- To learn modern optical and microwave remote sensing
- To learn knowledge about Filtering AND Application of Remote Sensing

**UNIT I REMOTE SENSING 9**

Definition – Components of Remote Sensing – Energy, Sensor, Interacting Body - Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms – Balloons, Helicopters, Aircraft and Satellites – Synoptivity and Repetivity – Electro Magnetic Radiation (EMR) – EMR spectrum – Visible, Infra Red (IR), Near IR, Middle IR, Thermal IR and Microwave – Black Body Radiation - Planck's law – Stefan-Boltzman law.

**UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIALS 9**

Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective and Raman Scattering – EMR Interaction with Water vapour and ozone – Atmospheric Windows – Significance of Atmospheric windows – EMR interaction with Earth Surface Materials – Radiance, Irradiance, Incident, Reflected, Absorbed and Transmitted Energy– Reflectance – Specular and Diffuse Reflection Surfaces- Spectral Signature – Spectral Signature curves – EMR interaction with water, soil and Earth Surface:Imaging spectrometry and spectral characteristics.

**UNIT III OPTICAL AND MICROWAVE REMOTE SENSING 9**

Satellites - Classification – Based on Orbits and Purpose – Satellite Sensors - Resolution – Description of Multi Spectral Scanning – Along and Across Track Scanners– Description of Sensors in Landsat, SPOT, IRS series – Current Satellites - Radar – Speckle - Back Scattering – Side Looking Airborne Radar – Synthetic Aperture Radar – Radiometer – Geometrical characteristics ; Sonar remote sensing systems.

**UNIT IV MISCELLANEOUS TOPICS 9**

GIS – Components of GIS – Hardware, Software and Organisational Context – Data – Spatial and Non-Spatial – Maps – Types of Maps – Projection – Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparison of Raster and Vector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters.

**UNIT V DESIGN OF PRINTED CIRCUIT BOARDS 9**

Visual Interpretation of Satellite Images – Elements of Interpretation - Interpretation Keys Characteristics of Digital Satellite Image – Image enhancement – Filtering – Classification - Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Urban Applications- Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Water resources – Urban Analysis – Watershed Management – Resources Information Systems. Global positioning system – an introduction.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- To design remote sensing system
- To design printed circuit boards

**TEXT BOOKS:**


1. M.G. Srinivas(Edited by), Remote Sensing Applications, Narosa Publishing House, 2001. (For unit-1&2)
2. Anji Reddy, Remote Sensing and Geographical Information Systems, BS Publications 2001 (For unit-3,4&5)


**REFERENCES:**


1. Jensen, J.R., Remote sensing of the environment, Prentice Hall, 2000.
2. Kang-Tsung Chang,"Introduction to Geograhic Information Systems", TMH, 2002
3. Lillesand T.M. and Kiefer R.W., "Remote Sensing and Image Interpretation", John Wiley and Sons, Inc, New York, 1987
4. Burrough P A, "Principle of GIS for land resource assessment", Oxford Mischael Hord, "Remote Sensing Methods and Applications", John Wiley & Sons, New York, 1986.
5. Singal, "Remote Sensing", Tata McGraw-Hill, New Delhi, 1990.
6. Floyd F. Sabins, Remote sensing, "Principles and interpretation", W H Freeman and Company 1996.

| TL8015 | OPTO ELECTRONIC DEVICES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the basics of solid state physics
- To understand the basics of display devices
- To understand the optical detection devices
- To understand the design of optoelectronics integrated circuits .

**UNIT I ELEMENTS OF LIGHT AND SOLID STATE PHYSICS 9**

Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.

**UNIT II DISPLAY DEVICES AND LASERS 9**

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking, laser applications.

**UNIT III OPTICAL DETECTION DEVICES 9**

Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes, Detector Performance.

**UNIT IV OPTOELECTRONIC MODULATOR 9**

Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.

**UNIT V OPTOELECTRONIC INTEGRATED CIRCUITS 9**

Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- To design display devices
- To design optoelectronics detection devices and modulators.
- To design optoelectronic integrated circuits

**TEXT BOOKS:**


1. Pallab Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., New Delhi, 2006. (For unit-1&2)
2. Jasprit Singh, “Opto Electronics – As Introduction to materials and devices”, McGraw-Hill International Edition, 1998 (For unit-3,4&5)


**REFERENCES**


1. S C Gupta, Opto Electronic Devices and Systems, Prentice Hal of India,2005
2. J. Wilson and J.Haukes, “Opto Electronics – An Introduction”, Prentice Hall, 1995
3. S C Gupta, Opto Electronic Devices and Systems, Prentice Hal of India,2005

| TL8016 | DETECTION AND ESTIMATION THEORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The student should be made to:**

- Use hypothesis testing and Bayesian approaches to formulate and solve problems for signal detection from noisy signals.
- Learn different methods for Channel estimation
- Derive and apply various methods for parameter estimation and signal smoothing

**UNIT I HYPOTHESIS TESTING 9**

Bayes Risk, Minimum Bayes Risk detector, Minimax and Neyman-Pearson testing, Receiver operating characteristics, Composite hypothesis testing, Generalized likelihood ratio tests.

**UNIT II SIGNAL DETECTION APPLICATIONS 9**

Detection of deterministic signals, Matched filter and its performance, Detection of random signals, Energy detector and its performance, Detection of signals with unknown parameters and Sinusoid detection example, Chernoff and related performance bounds.

**UNIT III RANDOM PARAMETER ESTIMATION 9**

Bayesian formulation, Minimum mean squared error and MAP estimation, Linear MMSE estimation, Orthogonality principle, Applications to channel estimation problems.

**UNIT IV MINIMUM VARIANCE UNBIASED ESTIMATION 9**

MVUE criterion, finding MVUE, sufficient statistics, Neyman-fisher factorization, Rao-Blackwell theorem, Cramer-Rao lower bound, Fisher information matrix.

**UNIT V NON-RANDOM PARAMETER ESTIMATION 9**

Least squares estimation, Best linear unbiased estimation, Geometric interpretations, Maximum likelihood Estimation, Efficiency and consistency of estimators and asymptotic properties.

**TOTAL:45 PERIODS**

**OUTCOMES:**

**Upon completion of the course, students will be able to:**

- Solve signal detection problem using hypothesis testing and Bayesian approaches
- Acquire knowledge about basic Estimation Methods
- Gain ability to apply various estimation methods to real application problems

**TEXT BOOK:**

1. H. L. Van Trees, "Detection, Estimation, and Modulation Theory, Part I," John Wiley, 1968(For Unit 1,2,3,4 & 5)

**REFERENCES**

1. H. V. Poor, "An Introduction to Signal Detection and Estimation," Springer, Second Edition, 1998.
2. S. M. Kay, "Fundamentals of Statistical Signal Processing: Detection Theory," Prentice Hall, 1998.
3. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory," Prentice Hall, 1993

| TL8017 | WIRELESS SENSOR NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

The student should be made to:

- Understand the design issues in ad hoc and sensor networks.
- Learn the different types of MAC protocols.

**UNIT I INTRODUCTION 9**

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel - mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor Networks . Design Challenges in Ad hoc and Sensor Networks.

**UNIT II MAC PROTOCOLS FOR ADHOC WIRELESS NETWORKS 9**

Issues in designing a MAC Protocol - Classification of MAC Protocols-Contention based protocols-Contention based protocols with Reservation Mechanisms-Contention based protocols with Scheduling Mechanisms –Multi channel MAC-IEEE 802.11.

**UNIT III ROUTING PROTOCOLS AND TRANSPORT LAYER IN ADHOC WIRELESS NETWORKS 9**

Issues in designing a routing and Transport Layer protocol for Ad hoc networks-proactive routing, reactive routing (on-demand), hybrid routing-Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

**UNIT IV WIRELESS SENSOR NETWORKS(WSNS) AND MAC PROTOCOLS 9**

Single node architecture: hardware and software components of a sensor node -WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC-IEEE 802.15.4.

**UNIT V WSN ROUTING, LOCALIZATION & QOS 9**

Issues in WSN routing –OLSR-Localization –Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

**TOTAL:45 PERIODS**

**OUTCOME:**

**At the end of the course, the student should be able to:**

- Design and implement wireless networks environment for any application using latest protocols and standard.

**TEXT BOOK:**

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ,Prentice Hall Professional Technical Reference, 2008. (For Unit 1,2,3,4 & 5)

**REFERENCES:**

1. Carlos De MoraisCordeiro, Dharma PrakashAgrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.
2. Feng Zhao and LeonidesGuibas, "Wireless Sensor Networks", Elsevier Publication - 2002.
3. Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005

**GE8073 FUNDAMENTALS OF NANOSCIENCE L T P C**
**3 0 0 3**

**OBJECTIVE:**
To learn about basis of nanomaterial science, preparation method, types and application

**UNIT I INTRODUCTION 8**
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

**UNIT II GENERAL METHODS OF PREPARATION 9**
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

**UNIT III NANOMATERIALS 12**
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications-Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

**UNIT IV CHARACTERIZATION TECHNIQUES 9**
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

**UNIT V APPLICATIONS 7**
NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

**TOTAL : 45 PERIODS**

**OUTCOMES:**
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

**TEXT BOOKS:**

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996. (unit-1&2)
2. N John Dinardo, “Nanoscale Charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000. (unit-3,4&5)


**REFERENCES:**

1. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,“The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.