# MUTHAYAMMAL ENGINEERING COLLEGE

**(An Autonomous Institution)**

(Approved by AICTE, New Delhi, Accredited by NAAC, NBA & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

## Curriculum/Syllabus

**Programme Code : EC**

**Programme Name : B.E.-Electronics and Communication Engineering**

**Regulation : R-2019**


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Rasipuram - 637 408, Namakkal Dt, Tamil Nadu.

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## INSTITUTION VISION & MISSION

### INSTITUTION VISION

To be a Centre of Excellence in Engineering, Technology and Management on par with International Standards

### INSTITUTION MISSION

- To prepare the students with high professional skills and ethical values
- To impart knowledge through best practices
- To instill a spirit of innovation through Training, Research and Development
- To undertake continuous assessment and remedial measures
- To achieve academic excellence through intellectual, emotional and social stimulation

### INSTITUTION MOTTO

Rural upliftment through Technical Education


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## DEPARTMENT VISION & MISSION

### DEPARTMENT VISION

To empower the electronics and communication engineering students on basics and advanced technologies in both theoretical and experimental practices with research attitude and ethics

### DEPARTMENT MISSION

- To impart need based education in electronics and communication engineering to meet the requirements of academic, industry and society
- To establish the state-of-art laboratories to prepare the students for facing the challenges ahead
- To prepare the students for employment, higher education and research oriented activities

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## DEPARTMENT PROGRAM EDUCATIONAL OBJECTIVES, PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES

### PROGRAM EDUCATIONAL OBJECTIVES

The Electronics and Communication Engineering Graduates should be able to

**PEO1:** Pursue as an engineer with necessary conceptual, analytical and theoretical knowledge in the domain of electronics and communication engineering

**PEO2:** Acquire the practical knowledge through basics and advanced laboratories in the field of electronics and communication engineering

**PEO3:** Demonstrate the leadership skills through entrepreneurship, employment and higher studies and to practice ethical values for the benefit of society and environment

### PROGRAM OUTCOMES

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 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 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. **Lifelong learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

**PROGRAM SPECIFIC OUTCOMES**

**PSO1:** Design and analyze electronic circuits and systems for various applications

**PSO2:** Apply the acquired knowledge and analytical skills for modeling and simulation of advanced communication systems

**PSO3:** Ascertain the use of software and hardware tools for developing variety of electronics and communication systems

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## B.E. –ELECTRONICS AND COMMUNICATION ENGINEERING

## GROUPING OF COURSES

## Regulation-2019

### 1. Humanities and Social Sciences including Management Courses (HS)

| S. No. | Course Code | Course Title | Category | Contact Hours | Instruction Hours/ Week | | | C |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | |
| 1 | 19HSS01 | Business English | HS | 2 | 2 | 0 | 0 | 2 |
| 2 | 19HSS03 | Life Skills and Workplace Psychology | HS | 2 | 2 | 0 | 0 | 2 |
| 3 | 19HSS02 | English Communicative Skills Laboratory | HS | 2 | 0 | 0 | 2 | 1 |
| 4 | 19HSS04 | Technical English For Engineers | HS | 2 | 2 | 0 | 0 | 2 |
| 5 | 19HSS05 | Communicative English for Engineers | HS | 2 | 2 | 0 | 0 | 2 |
| 6 | 19HSS06 | Basics of Japanese Language | HS | 2 | 2 | 0 | 0 | 2 |
| 7 | 19HSS07 | Basics of French Language | HS | 2 | 2 | 0 | 0 | 2 |
| 8 | 19HSS08 | Professional Ethics and Human Values | HS | 3 | 3 | 0 | 0 | 3 |

### 2. Basic Science Courses (BS)

| S. No. | Course Code | Course Title | Category | Contact Hours | Instruction Hours/Week | | | C |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | |
| 1 | 19BSS01 | Engineering Physics | BS | 3 | 3 | 0 | 0 | 3 |
| 2 | 19BSS02 | Physics and Chemistry Laboratory | BS | 2 | 0 | 0 | 2 | 1 |
| 3 | 19BSS03 | Bio and Nanomaterials Sciences | BS | 3 | 3 | 0 | 0 | 3 |
| 4 | 19BSS04 | Material Sciences | BS | 3 | 3 | 0 | 0 | 3 |
| 5 | 19BSS05 | Physics fir Mechanical Engineers | BS | 3 | 3 | 0 | 0 | 3 |
| 6 | 19BSS11 | Engineering Chemistry | BS | 3 | 3 | 0 | 0 | 3 |
| 7 | 19BSS12 | Environmental Science and Engineering | BS | 3 | 3 | 0 | 0 | 3 |
| 8 | 19BSS13 | Organic Chemistry | BS | 3 | 3 | 0 | 0 | 3 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9 | 19BSS14 | Physical Chemistry | BS | 3 | 3 | 0 | 0 | 3 |
| 10 | 19BSS15 | Applied Chemistry | BS | 3 | 3 | 0 | 0 | 3 |
| 11 | 19BSS16 | Organic Chemistry Laboratory | BS | 2 | 0 | 0 | 2 | 1 |
| 12 | 19BSS17 | Physical Chemistry Laboratory | BS | 2 | 0 | 0 | 2 | 1 |
| 13 | 19BSS21 | Algebra and Calculus | BS | 4 | 3 | 1 | 0 | 4 |
| 14 | 19BSS22 | Differential Equations and Vector Analysis | BS | 4 | 3 | 1 | 0 | 4 |
| 15 | 19BSS23 | Transform and Partial Differential Equations | BS | 4 | 3 | 1 | 0 | 4 |
| 16 | 19BSS24 | Discrete Mathematics | BS | 4 | 3 | 1 | 0 | 4 |
| 17 | 19BSS25 | Statistical and Queuing Model | BS | 4 | 3 | 1 | 0 | 4 |
| 18 | 19BSS26 | Numerical Methods | BS | 4 | 3 | 1 | 0 | 4 |
| 19 | 19BSS27 | Probability and Random Processes | BS | 4 | 3 | 1 | 0 | 4 |
| 20 | 19BSS28 | Statistic and Numerical Methods | BS | 4 | 3 | 1 | 0 | 4 |

### 3. General Engineering Science Courses (GES)

| S. No. | Course Code | Course Title | Category | Contact Hours | Instruction Hours/Week | | | C |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | |
| 1 | 19GES01 | Programming for Problem Solving Using C | GES | 3 | 3 | 0 | 0 | 3 |
| 2 | 19GES02 | Programming for Problem Solving Technique | GES | 3 | 3 | 0 | 0 | 3 |
| 3 | 19GES03 | Programming in C Laboratory | GES | 2 | 0 | 0 | 2 | 1 |
| 4 | 19GES04 | Programming in C and Python Laboratory | GES | 2 | 0 | 0 | 2 | 1 |
| 5 | 19GES05 | Electrical and Electronic Sciences | GES | 3 | 3 | 0 | 0 | 3 |
| 6 | 19GES06 | Mechanical and Building Sciences | GES | 3 | 3 | 0 | 0 | 3 |
| 7 | 19GES07 | Computer Aided Drafting Laboratory | GES | 2 | 0 | 0 | 2 | 1 |
| 8 | 19GES08 | Python Programming | GES | 3 | 3 | 0 | 0 | 3 |
| 9 | 19GES09 | Programming in Python Laboratory | GES | 2 | 0 | 0 | 2 | 1 |
| 10 | 19GES10 | Soft Skills Laboratory | GES | 2 | 0 | 0 | 2 | 1 |
| 11 | 19GES11 | Electronic Devices | GES | 3 | 3 | 0 | 0 | 3 |
| 12 | 19GES12 | Electronic Simulation Laboratory | GES | 2 | 0 | 0 | 2 | 1 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 13 | 19GES13 | Electric Circuits | GES | 3 | 2 | 1 | 0 | 3 |
| 14 | 19GES14 | Electric Circuits Laboratory | GES | 2 | 0 | 0 | 2 | 1 |
| 15 | 19GES15 | Manufacturing Process | GES | 3 | 3 | 0 | 0 | 3 |
| 16 | 19GES16 | Manufacturing Process Laboratory | GES | 2 | 0 | 0 | 2 | 1 |
| 17 | 19GES17 | Mechanical and Building Sciences Laboratory | GES | 2 | 0 | 0 | 2 | 1 |
| 18 | 19GES18 | Construction Materials | GES | 3 | 3 | 0 | 0 | 3 |
| 19 | 19GES19 | Concepts in Product Design | GES | 3 | 3 | 0 | 0 | 3 |
| 20 | 19GES20 | Renewable Energy Sources | GES | 3 | 3 | 0 | 0 | 3 |
| 21 | 19GES21 | Electrical Drives and Control | GES | 3 | 3 | 0 | 0 | 3 |
| 22 | 19GES22 | Electrical Drives and Control Laboratory | GES | 2 | 0 | 0 | 2 | 1 |
| 23 | 19GES23 | Analog and digital communication | GES | 3 | 3 | 0 | 0 | 3 |
| 24 | 19GES24 | Digital Principles and System Design | GES | 3 | 3 | 0 | 0 | 3 |
| 25 | 19GES25 | Digital Principles and System Design Laboratory | GES | 2 | 0 | 0 | 2 | 1 |
| 26 | 19GES26 | Engineering Drawing | GES | 5 | 1 | 0 | 4 | 3 |
| 27 | 19GES27 | Engineering Geology | GES | 3 | 3 | 0 | 0 | 3 |
| 28 | 19GES28 | Engineering Mechanics | GES | 4 | 3 | 1 | 0 | 4 |
| 29 | 19GES29 | Wireless Communication | GES | 4 | 3 | 1 | 0 | 4 |
| 30 | 19GES30 | Electronics and Microprocessor | GES | 3 | 3 | 0 | 0 | 3 |
| 31 | 19GES31 | Electronics and Microprocessor Laboratory | GES | 2 | 0 | 0 | 2 | 1 |
| 32 | 19GES32 | Data Structures using Python | GES | 3 | 3 | 0 | 0 | 3 |

**4. Professional Core (PC):**

| S. No. | Course Code | Course Title | Category | Contact Hours | Instruction Hours/week | | | C |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | |
| 1. | 19ECC01 | Electric Network Analysis and Machines | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | 19ECC02 | Signals and Systems | PC | 4 | 3 | 1 | 0 | 4 |
| 3. | 19ECC03 | Analog Electronics | PC | 4 | 3 | 1 | 0 | 4 |
| 4. | 19ECC04 | Digital System Design | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 19ECC05 | Electromagnetic Fields | PC | 3 | 3 | 0 | 0 | 3 |
| 6. | 19ECC06 | Analog Communication Systems | PC | 3 | 3 | 0 | 0 | 3 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7. | 19ECC07 | Microcontroller Based System Design | PC | 3 | 3 | 0 | 0 | 3 |
| 8. | 19ECC08 | Antenna Systems Engineering | PC | 4 | 3 | 1 | 0 | 4 |
| 9. | 19ECC09 | Digital Signal Processing | PC | 4 | 3 | 1 | 0 | 4 |
| 10. | 19ECC10 | Digital Communication Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 11. | 19ECC11 | Microwave Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 12. | 19ECC12 | VLSI Circuit Design | PC | 3 | 3 | 0 | 0 | 3 |
| 13. | 19ECC13 | Computer Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 14. | 19ECC14 | Control Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 15. | 19ECC15 | Embedded Systems & RTOS | PC | 3 | 3 | 0 | 0 | 3 |
| 16. | 19ECC16 | NEMS and MEMS Technology | PC | 3 | 3 | 0 | 0 | 3 |
| 17. | 19ECC17 | Digital Image Processing | PE | 3 | 3 | 0 | 0 | 3 |
| 18. | 19ECC18 | Analog Electronics Laboratory | PC | 2 | 0 | 0 | 2 | 1 |
| 19. | 19ECC19 | Digital System Design Laboratory | PC | 2 | 0 | 0 | 2 | 1 |
| 20. | 19ECC20 | Analog Communication Systems Laboratory | PC | 2 | 0 | 0 | 2 | 1 |
| 21. | 19ECC21 | Microcontroller Based System Design Laboratory | PC | 2 | 0 | 0 | 2 | 1 |
| 22. | 19ECC22 | Signal Processing Laboratory | PC | 2 | 0 | 0 | 2 | 1 |
| 23. | 19ECC23 | Digital Communication Systems Laboratory | PC | 2 | 0 | 0 | 2 | 1 |
| 24. | 19ECC24 | Microwave Engineering Laboratory | PC | 2 | 0 | 0 | 2 | 1 |
| 25. | 19ECC25 | VLSI Design Laboratory | PC | 2 | 0 | 0 | 2 | 1 |
| 26. | 19ECC26 | Embedded Systems Laboratory | PC | 2 | 0 | 0 | 2 | 1 |
| 27. | 19ECC27 | Digital Image Processing Laboratory | PC | 2 | 0 | 0 | 2 | 1 |

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**5. Professional Electives (PE):**

| S.No. | Course Code | Course Title | Category | Contact Hours | Instruction Hours/week | | | C |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | |
| 1. | 19ECE01 | Radar and Navigational Aids | PE | 3 | 3 | 0 | 0 | 3 |
| 2. | 19ECE02 | Electromagnetic Interference And Compatibility | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 19ECE03 | Sensors and Transducers | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 19ECE04 | High Speed Networks | PE | 3 | 3 | 0 | 0 | 3 |
| 5. | 19ECE05 | Wireless Sensor Networks | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | 19ECE06 | Telecommunication Switching Networks | PE | 3 | 3 | 0 | 0 | 3 |
| 7. | 19ECE07 | Cognitive Radio Networks | PE | 3 | 3 | 0 | 0 | 3 |
| 8. | 19ECE08 | Mobile Ad-Hoc Networks | PE | 3 | 3 | 0 | 0 | 3 |
| 9. | 19ECE09 | Biomedical Engineering | PE | 3 | 3 | 0 | 0 | 3 |
| 10. | 19ECE10 | Bio Signal and Image Processing | PE | 3 | 3 | 0 | 0 | 3 |
| 11. | 19ECE11 | Bio Sensors & Bio MEMS | PE | 3 | 3 | 0 | 0 | 3 |
| 12. | 19ECE12 | Pattern Recognition and AI Techniques | PE | 3 | 3 | 0 | 0 | 3 |
| 13. | 19ECE13 | Soft Computing | PE | 3 | 3 | 0 | 0 | 3 |
| 14. | 19ECE14 | Wireless Communication | PE | 3 | 3 | 0 | 0 | 3 |
| 15. | 19ECE15 | Satellite Communication | PE | 3 | 3 | 0 | 0 | 3 |
| 16. | 19ECE16 | Optical Fiber Communication | PE | 3 | 3 | 0 | 0 | 3 |
| 17. | 19ECE17 | AI and Machine Learning | PE | 3 | 3 | 0 | 0 | 3 |
| 18. | 19ECE18 | Optoelectronic Devices | PE | 3 | 3 | 0 | 0 | 3 |
| 19. | 19ECE19 | Nanoelectronics | PE | 3 | 3 | 0 | 0 | 3 |
| 20. | 19ECE20 | ASIC Design | PE | 3 | 3 | 0 | 0 | 3 |
| 21. | 19ECE21 | Low Power VLSI Design | PE | 3 | 3 | 0 | 0 | 3 |
| 22. | 19ECE22 | Reconfigurable Computing using FPGAs | PE | 3 | 3 | 0 | 0 | 3 |
| 23. | 19ECE23 | System on Chip Design | PE | 3 | 3 | 0 | 0 | 3 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 24. | 19ECE24 | Computer Architecture and organization | PE | 3 | 3 | 0 | 0 | 3 |
| 25. | 19ECE25 | Internet of Things | PE | 3 | 3 | 0 | 0 | 3 |
| 26. | 19ECE26 | Automotive Electronics | PE | 3 | 3 | 0 | 0 | 3 |
| 27. | 19ECE27 | Electronic Instrumentations and Measurement Techniques | PE | 3 | 3 | 0 | 0 | 3 |

**6. Employability Enhancement Courses (EEC) :**

| S.No. | Course Code | Course Title | Category | Contact Hours | Instruction Hours/week | | | C |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | |
| 1. | 19ECP01 | Project Work Phase - I | EEC | 10 | 0 | 0 | 10 | 5 |
| 2. | 19ECP02 | Project Work Phase -II | EEC | 18 | 0 | 0 | 18 | 9 |
| 3. | 19ECP03 | Presentation Skill and Technical Seminar | EEC | 2 | 0 | 0 | 2 | 1 |
| 4. | 19ECP04 | Internship | EEC | 0 | 0 | 0 | 0 | 1 |

**7. Mandatory Courses (MC) :**

| S.No. | Course Code | Course Title | Category | Contact Hours | Instruction Hours/week | | | C |
|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | |
| 1. | 19ECM01 | Indian Constitution | MC | 2 | 2 | 0 | 0 | 0 |
| 2. | 19ECM02 | Essence of Indian Traditional Knowledge | MC | 2 | 2 | 0 | 0 | 0 |

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## B.E. –ELECTRONICS AND COMMUNICATION ENGINEERING

## CREDIT SUMMARY

**Regulation-2019**

| S.No | Subject Area | CREDITS AS PER SEMESTER | | | | | | | | Total Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | |
| 1 | HS | 3 | 2 | - | - | - | - | 3 | - | 8 |
| 2 | BS | 11 | 10 | 4 | 4 | - | - | - | - | 29 |
| 3 | GES | 7 | 8 | 1 | 3 | - | - | - | - | 19 |
| 4 | PC | - | - | 19 | 17 | 21 | 11 | - | - | 68 |
| 5 | PE | - | - | - | - | - | 6 | 6 | - | 12 |
| 6 | OE | - | - | - | - | - | 3 | 6 | - | 9 |
| 7 | EEC | - | - | - | - | - | 1 | 5 | 10 | 16 |
| Total | | 21 | 20 | 24 | 24 | 21 | 21 | 20 | 10 | 161 |

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| | |
|---|---|
| Department | Electronics and Communication Engineering |
| Programme | B.E. |

**SEMESTER - I**

| Sl. No. | Course Code | Course Name | Hours/ Week | | | Credit | Contact Hours |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | |
| **THEORY** | | | | | | | |
| 1. | 19HSS01 | Business English | 2 | 0 | 0 | 2 | 2 |
| 2. | 19BSS21 | Algebra and Calculus | 3 | 1 | 0 | 4 | 4 |
| 3. | 19BSS01 | Engineering Physics | 3 | 0 | 0 | 3 | 3 |
| 4. | 19BSS11 | Engineering Chemistry | 3 | 0 | 0 | 3 | 3 |
| 5. | 19GES02 | Programming for Problem Solving Technique | 3 | 0 | 0 | 3 | 3 |
| 6. | 19GES06 | Mechanical and Building Sciences | 3 | 0 | 0 | 3 | 3 |
| **PRACTICALS** | | | | | | | |
| 7. | 19BSS02 | Physics and Chemistry Laboratory | 0 | 0 | 2 | 1 | 2 |
| 8. | 19GES03 | Programming in C Laboratory | 0 | 0 | 2 | 1 | 2 |
| 9. | 19HSS02 | English Communicative Skills Laboratory | 0 | 0 | 2 | 1 | 2 |
| 10. | 19ECM01 | Induction Training | 2 | 0 | 0 | 0 | 2 |
| | | **Total Credits** | | | | 21 | |

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|---|---|
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**SEMESTER - II**

| Sl. No. | Course Code | Course Name | Hours/ Week | | | Credit | Contact Hours |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | |
| **THEORY** | | | | | | | |
| 1. | 19HSS03 | Life Skills and Workplace Psychology | 2 | 0 | 0 | 2 | 3 |
| 2. | 19BSS22 | Differential Equations and Vector Analysis | 3 | 1 | 0 | 4 | 4 |
| 3. | 19BSS03 | Bio and Nanomaterials Sciences | 3 | 0 | 0 | 3 | 3 |
| 4. | 19BSS12 | Environmental Science and Engineering | 3 | 0 | 0 | 3 | 3 |
| 5. | 19GES19 | Concepts in Product Design | 3 | 0 | 0 | 3 | 3 |
| 6. | 19GES11 | Electronic Devices | 3 | 0 | 0 | 3 | 3 |
| **PRACTICALS** | | | | | | | |
| 7. | 19GES12 | Electronic Simulation Laboratory | 0 | 0 | 2 | 1 | 2 |
| 8. | 19GES09 | Programming in Python Laboratory | 0 | 0 | 2 | 1 | 2 |
| | | | | | | | |
| | | **Total Credits** | | | | 20 | |

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|---|---|
| Department | Electronics and Communication Engineering |
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**SEMESTER - III**

| Sl. No. | Course Code | Course Name | Hours / Week | | | Credit | Contact Hours |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | |
| **THEORY** | | | | | | | |
| 1. | 19BSS23 | Transform and Partial Differential Equations | 3 | 1 | 0 | 4 | 4 |
| 2. | 19ECC01 | Electric Network Analysis and Machines | 3 | 0 | 0 | 3 | 3 |
| 3. | 19ECC02 | Signals and Systems | 3 | 1 | 0 | 4 | 4 |
| 4. | 19ECC03 | Analog Electronics | 3 | 1 | 0 | 4 | 4 |
| 5. | 19ECC04 | Digital System Design | 3 | 0 | 0 | 3 | 3 |
| 6. | 19ECC05 | Electromagnetic Fields | 3 | 0 | 0 | 3 | 3 |
| **PRACTICALS** | | | | | | | |
| 7. | 19ECC18 | Analog Electronics Laboratory | 0 | 0 | 2 | 1 | 2 |
| 8. | 19ECC19 | Digital System Design Laboratory | 0 | 0 | 2 | 1 | 2 |
| 9. | 19GES10 | Soft Skills Laboratory | 0 | 0 | 2 | 1 | 2 |
| | | **Total Credits** | | | | **24** | |

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| Programme | B.E. |

**SEMESTER – IV**

| Sl. No. | Course Code | Course Name | Hours/ Week | | | Credit | Contact Hours |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | |
| **THEORY** | | | | | | | |
| 1. | 19BSS25 | Statistical and Queuing Model | 3 | 1 | 0 | 4 | 4 |
| 2. | 19ECC06 | Analog Communication Systems | 3 | 0 | 0 | 3 | 3 |
| 3. | 19ECC07 | Microcontroller Based System Design | 3 | 0 | 0 | 3 | 3 |
| 4. | 19ECC08 | Antenna Systems Engineering | 3 | 1 | 0 | 4 | 4 |
| 5. | 19ECC09 | Digital Signal Processing | 3 | 1 | 0 | 4 | 4 |
| 6. | 19GES32 | Data Structures using Python | 3 | 0 | 0 | 3 | 3 |
| **PRACTICALS** | | | | | | | |
| 6. | 19ECC20 | Analog Communication Systems Laboratory | 0 | 0 | 2 | 1 | 2 |
| 7. | 19ECC21 | Microcontroller Based System Design Laboratory | 0 | 0 | 2 | 1 | 2 |
| 8. | 19ECC22 | Signal Processing Laboratory | 0 | 0 | 2 | 1 | 2 |
| | | **Total Credits** | | | | **24** | |

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|---|---|---|

| | |
|---|---|
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| Programme | B.E. |

**SEMESTER – V**

| Sl. No. | Course Code | Course Name | Hours/ Week | | | Credit | Contact Hours |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | |
| **THEORY** | | | | | | | |
| 1. | 19ECC10 | Digital Communication Systems | 3 | 0 | 0 | 3 | 3 |
| 2. | 19ECC11 | Microwave Engineering | 3 | 0 | 0 | 3 | 3 |
| 3. | 19ECC12 | VLSI Circuit Design | 3 | 0 | 0 | 3 | 3 |
| 4. | 19ECC13 | Computer Networks | 3 | 0 | 0 | 3 | 3 |
| 5. | 19ECC14 | Control Engineering | 3 | 0 | 0 | 3 | 3 |
| 6. | | Professional Elective I | 3 | 0 | 0 | 3 | 3 |
| **PRACTICALS** | | | | | | | |
| 7. | 19ECC23 | Digital Communication Systems Laboratory | 0 | 0 | 2 | 1 | 2 |
| 8. | 19ECC24 | Microwave Engineering Laboratory | 0 | 0 | 2 | 1 | 2 |
| 9. | 19ECC25 | VLSI Design Laboratory | 0 | 0 | 2 | 1 | 2 |
| | | **Total Credits** | | | | **21** | |

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| | |
|---|---|
| Department | Electronics and Communication Engineering |
| Programme | B.E. |

**SEMESTER – VI**

| Sl. No. | Course Code | Course Name | Hours/ Week | | | Credit | Contact Hours |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | |
| **THEORY** | | | | | | | |
| 1. | 19ECC15 | Embedded Systems & RTOS | 3 | 0 | 0 | 3 | 3 |
| 2. | 19ECC16 | NEMS and MEMS Technology | 3 | 0 | 0 | 3 | 3 |
| 3. | 19ECC17 | Digital Image Processing | 3 | 0 | 0 | 3 | 3 |
| 4. | | Professional Elective II | 3 | 0 | 0 | 3 | 3 |
| 5. | | Professional Elective III | 3 | 0 | 0 | 3 | 3 |
| 6. | | Open Elective I | 3 | 0 | 0 | 3 | 3 |
| 7. | | Mandatory Course I | 2 | 0 | 0 | 0 | 2 |
| **PRACTICALS** | | | | | | | |
| 8. | 19ECC26 | Embedded Systems Laboratory | 0 | 0 | 2 | 1 | 2 |
| 9. | 19ECC27 | Digital Image Processing Laboratory | 0 | 0 | 2 | 1 | 2 |
| 10. | 19ECP03 | Presentation Skill and Technical Seminar | 2 | 0 | 0 | 1 | 2 |
| | | **Total Credits** | | | | **21** | |

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|---|---|---|

| Department | Electronics and Communication Engineering |
|---|---|
| Programme | B.E. |

**SEMESTER – VII**

| Sl. No. | Course Code | Course Name | Hours/ Week | | | Credit | Contact Hours |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | |
| **THEORY** | | | | | | | |
| 1. | 19HSS08 | Professional Ethics and Human Values | 3 | 0 | 0 | 3 | 3 |
| 2. | | Professional Elective IV | 3 | 0 | 0 | 3 | 3 |
| 3. | | Professional Elective V | 3 | 0 | 0 | 3 | 3 |
| 4. | | Open Elective II | 3 | 0 | 0 | 3 | 3 |
| 5. | | Open Elective III | 3 | 0 | 0 | 3 | 3 |
| 6. | | Mandatory Course II | 2 | 0 | 0 | 0 | 2 |
| **PRACTICALS** | | | | | | | |
| 7. | 19ECP01 | Project Work Phase I | 0 | 0 | 10 | 5 | 10 |
| | | | **Total Credits** | | | **20** | |

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|---|---|---|

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|---|---|
| Programme | B.E. |

**SEMESTER – VIII**

| Sl. No. | Course Code | Course Name | Hours/ Week | | | Credit | Contact Hours |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | |
| **PRACTICALS** | | | | | | | |
| 1. | 19ECP02 | Project Work Phase II | 0 | 0 | 18 | 9 | 18 |
| 2. | 19ECP04 | Internship | 0 | 0 | 0 | 1 | |
| | | | **Total Credits** | | | **10** | |

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| 19ECC01 | ELECTRIC NETWORK ANALYSIS AND MACHINES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To Learn Circuit Laws and Theorems.
2 To Know the Fundamentals of Various Circuit Components and Parameters.
3 To analyze the Different Electric Circuit Models.
4 To Familiarize the Electric Machines and its Applications.
5 To understand the constructional features of electric machines

**COURSE OUTCOMES** :

CO1 Solve problems on RL, RC and RLC DC transient circuit.

CO2 Relate the phase relation between the components in complex domain for a given circuit/waveform.

CO3 Solve a.c. circuit problems using Laplace Transform technique

CO4 Analyze the frequency response and performance parameters of circuits with L and C.

CO5 Explain constructional features and applications of various machines.

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | | | | x | | x | x | x | x | |
| CO2 | x | x | x | x | | | | | x | | x | | x | | x |
| CO3 | x | x | x | x | x | | | | x | | | x | x | x | |
| CO4 | x | x | x | | x | | | | x | | | | x | | x |
| CO5 | x | x | x | | | | | | x | | x | x | | | |

**COURSE CONTENTS** :

**UNIT I THEOREMS AND DC TRANSIENT ANALYSIS** 9 Hrs

Current and Voltage Laws, Node and Mesh Analysis; Theorems: Superposition, Thevenin and Norton, Maximum power transfer, Reciprocity, Tellegens, Compensation and Milliman's - **RL and RC Circuits:** Source free circuit, Properties of Exponential Response and Step function functions, Natural and Forced Response, Driven RL and RC circuits; **RLC Circuits:** Source free, damped and underdamped parallel RLC circuit, Critical Damping, Source free series RLC, Complete Response and lossless Circuits.

**UNIT II SINUSOIDAL AND STEADY STATE POWER ANALYSIS** 9 Hrs

**Steady State Analysis :**Characteristic , Forced Response to Sinusoidal functions, Phasor Relationship for passive components, Impedance and Admittance, Application of network theorems; **Power Analysis:** Instantaneous , Average and RMS, Power and Power factor; Introduction Magnetically Coupled Circuits.

**UNIT III APPLICATION OF LAPLACE TRANSFORM TO CIRCUIT ANALYSIS** 9 Hrs

**Complex frequency and LT:** complex frequency, Damped Sinusoidal forcing function, introduction to Laplace Transform and Inverse Transform techniques; **S-Domain:** Impedance and Admittance, Application Nodal and Mesh Analysis, Concept of Poles, Zeros and transfer function.

**UNIT IV NETWORK TOPOLOGY AND TWO PORT NETWORK** 9 Hrs

**Graph Theory**: Incidence, Tie Set and Cut matrix formulation; **Two port Network:** One port network, Impedance Parameter, Admittance Parameter, Transmission line, Hybrid Parameter and their inter- relationship; **Frequency**

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**Response:** Resonant Frequency of circuits with L and C, Quality Factor and Bandwidth, Frequency and Magnitude scaling.

**UNIT V ELECTRIC MACHINES** **9 Hrs**

Introduction to Transformers – Ideal Transformer – Construction and Operational Features of DC Machines – EMF and Torque Equation – Characteristics of DC Motor – Synchronous Machines: Construction, Equations and Characteristics – Induction Motors: Construction and Applications.

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | W.H.Hayt, J.E.Kimmerly and S.M.Durbin | Engineering circuit analysis | McGraw Hill Education private limited. | 2013 |
| T2 | Charles K Alexander, Mathew N.O Sadiku | Fundamentals of Electric circuits | McGraw Hill | 2004 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | M.E. Van Valkenburg | Network Analysis | Pearson Education | 2015 |
| R2 | Mahmood Nahvi and JoselphEdminister | Electric Circuits | Schaum's Outline series. | 2004. |
| R3 | D. Roy Choudhury | Networks and Systems | New Age International Publications | 1998 |
| R4 | S. K. Bhattacharya | Basic Electrical and Electronics Engineering | Pearson Education; First edition | 2011 |
| R5 | D P Kothari and I J Nagrath | Basic Electrical and Electronics Engineering | McGraw Hill Education (India) Private Limited | 2014 |

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| 19ECC02 | SIGNALS AND SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**COURSE OBJECTIVES** :

1. To Understand the Basic Properties of Signal & Systems and the Various Methods of Classification.
2. To Learn Laplace Transform &Fourier Transform and Their Properties.
3. To Learn Continuous Time LTI System.
4. To know Z transform & DTFT and their properties.
5. To characterize LTI systems in the Time domain and various Transform domains.

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Classify the given system is linear/causal/statics |
| CO2 | Interpret to represent the CT signal in Fourier series and transformers |
| CO3 | Analyze the capability of LTI system in time domain and frequency domain |
| CO4 | Estimate frequency components present in a deterministic DT signal |
| CO5 | Illustrate the concept of transfer function and determine the magnitude and phase response of LTI system |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | X | X | | | | | | X | | | X | |
| CO2 | X | X | X | X | X | | | | | | X | X | | X | |
| CO3 | X | X | X | X | X | | | | | | X | | | X | X |
| CO4 | X | X | X | X | X | | | | | | X | X | | X | X |
| CO5 | X | X | X | X | X | | | | | | X | | | X | X |

**COURSE CONTENTS** :

**UNIT I SIGNALS AND SYSTEMS** 12 Hrs

Signals-Classification of signals- Continuous –time and Discrete time signals, Deterministic and random signal, even and odd signals, periodic and aperiodic signals, energy and power signals. Basic Continuous –time and Discrete time signals- step, impulse, Ramp, Exponential, sinusoidal ,Exponentially damped sinusoidal signals. Pulse- Properties of Impulse Signal, Transformation of independent variables, Basic operations on signals- amplitude scaling ,addition, multiplication, differentiation and integration, Systems- Classification of systems - Static & Dynamic, Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non causal, Stable & Unstable.

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

Fourier Series Analysis- Trigonometric Fourier Series- Polar Fourier Series Representation- Exponential Form of Fourier Series, Spectrum of Continuous Time (CT Signal), Properties of Fourier Series, Fourier Transform in CT Signal Analysis- Conditions for the Existence of Fourier Transform- Frequency Spectrum using Fourier Transform- Properties of Fourier Transform, Laplace Transform in CT Signal Analysis- Properties of Region of Convergence- Properties of Laplace Transform

**UNIT III LINEARTIMEINVARIANT CONTINUOUS TIME SYSTEMS** 12 Hrs

Differential Equation- Block Diagram Representation- Impulse Response- Step response- Stability, Convolution Integrals- Properties of Convolution Integrals- Graphical Method Procedure to Perform Convolution, Fourier and Laplace Transforms in Analysis of CT Systems, Laplace Transform in Analyzing Electrical Network

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

DTFT– Properties of DTFT, Discrete Time Fourier series – Definition, properties, Sampling theorem, Z Transform- The region of convergence for Z transform, The inverse Z transform, Properties of Z Transform, the unilateral Z

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transform , Geometric evaluation of the Fourier transform from the pole zero plot, The relationship between Z transform and DTFT.

**UNIT V LINEAR TIMEINVARIANT-DISCRETETIME SYSTEMS** **12 Hrs**

Difference Equation- Block Diagram Representation- Impulse Response- Convolution Sum- Discrete Fourier Series- Z Transform, Analysis of Recursive and Non-recursive System.

**Total Hours: 60**

**TEXT BOOKS :**

| S.No. | AUTHOR(S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Alan V. Oppenheim, Alan S. Willsky | Signals and Systems | Pearson education | 2015 |
| T2 | P. Ramakrishna Rao | Signals and Systems | McGraw Hill | 2013 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | B P Lathi | Signals and Systems | B S Publisher | 2001 |
| R2 | Nagrath ,Sharan | Signals and Systems | McGraw Hill | 2009 |
| R3 | S.Salivahanan, N.Sureshkumar and A.Vallavaraj | Signals and Systems | Tata McGraw Hill | 2011 |
| R4 | D.GaneshRao,SathishTunga | Signals and Systems | Pearson | 2011 |
| R5 | S.Haykin,B.VanVeen | Signals and Systems | John Willey &Sons,New York | 1999 |

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| 19ECC03 | ANALOG ELECTRONICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**COURSEOBJECTIVES :**

1. To Study about Transistor Amplifiers
2. To Understand the Concept of Current Mirrors and Differential Amplifiers
3. To Discuss feedback circuits and oscillators.
4. To Study Tuned Amplifiers.
5. To Gain the Knowledge on Power Amplifiers.

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Illustrate BJT and FET biasing circuits for various configurations |
| CO2 | Derive the parameters of current mirrors and differential amplifiers |
| CO3 | Construct feedback amplifiers and oscillators |
| CO4 | Design tuned amplifiers |
| CO5 | Analyze the characteristics of power amplifiers |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | x | | | | | | | x | | x | x | x |
| CO2 | x | x | x | x | | | | | | | x | | x | x | x |
| CO3 | x | x | x | x | x | | | | | | x | | x | x | x |
| CO4 | x | x | x | x | x | | | | | | x | | x | x | x |
| CO5 | x | x | x | x | x | | | | | | x | | x | x | x |

**COURSE CONTENTS :**

**UNIT I BJT AND FET AMPLIFIERS** 12Hrs

Biasing Methods for BJT and MOSFET - Transistor Amplification Actions – Small Signal Models and Operations of BJT and MOSFET - BJT Amplifier Configurations: CE, CC, CB - MOSFET Amplifier Configurations: CS, CD, CG.

**UNIT II IC AND DIFFERENTIAL AMPLIFIERS** 12 Hrs

IC Biasing: Current Source, Current Mirrors, Current Steering Circuits - Basic Gain Cell - Cascode Amplifiers - BJT & MOSFET Differential Amplifiers - Common Mode Rejection - DC Offset - Differential Amplifier with a Current Mirror - Frequency Response of Amplifiers.

**UNIT III FEEDBACK AND OSCILLATORS** 12 Hrs

Feedback Concept - Properties - Feedback Amplifiers - Stability Analysis - Condition for Oscillation - Sinusoidal Oscillators: Op Amp - RC Oscillators and LC Oscillators - Multivibrators

**UNIT IV TUNED AMPLIFIERS** 12 Hrs

Principle of Tuned Amplifiers - Inductor Losses - Amplifiers with Multiple Tuned Circuits - Cascode and CC-CB Cascade Amplifiers - Synchronous Tuning and Stagger Tuning.

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**UNIT V POWER AMPLIFIERS** **12 Hrs**

Class A, Class B and Class AB Amplifiers - Class C Amplifier - IC Power Amplifiers: Fixed Gain IC Power Amplifier, Bridge Amplifier - Class D Amplifier.

**Total Hours: 60 Hrs**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Adel .S. Sedra, Kenneth C. Smith | Micro Electronic Circuits | Oxford University Press | 2013 |
| T2 | David A. Bell | Electronic Devices and Circuits | Oxford Higher Education Press | 2010 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Donald .A. Neamen | Electronic Circuit Analysis and Design | Tata McGraw Hill | 2009 |
| R2 | BehzadRazavi | Design of Analog CMOS Integrated Circuits | Tata McGraw Hill, | 2007 |
| R3 | Paul Gray, Hurst, Lewis, Meyer | Analysis and Design of Analog Integrated Circuits | John Willey & Sons | 2005 |
| R4 | Robert L. Boylestad and Louis Nasheresky | Electronic Devices and Circuit Theory | Pearson Education / PHI | 2008 |
| R5 | S. Salivahanan, N. Suresh Kumar and A. Vallavaraj | Electronic Devices and Circuits | TMH | 2007 |

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| 19ECC04 | DIGITAL SYSTEM DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1. To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
2. To outline the formal procedures for the analysis and design of combinational circuits
3. To outline the formal procedures for the analysis and design of sequential circuits
4. To illustrate the concept of synchronous and asynchronous sequential circuits
5. To introduce the concept of VHDL and programmable logic devices.

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Demonstrate simplification of Boolean expressions |
| CO2 | Design combinational logic circuits |
| CO3 | Design sequential logic circuits |
| CO4 | Analyze state machines for the given specifications |
| CO5 | Design Logic Memories and built VHDL Program |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | x | | | | | | | x | | x | | |
| CO2 | x | x | x | x | | | | | | | x | x | x | | |
| CO3 | x | x | x | x | x | | | | | | x | x | x | x | x |
| CO4 | x | x | x | x | x | | | | | | x | x | x | x | x |
| CO5 | x | x | x | x | x | | | | | | x | x | x | x | x |

**COURSE CONTENTS** :

**UNIT I BASIC CONCEPTS OF DIGITAL SYSTEMS AND LOGIC FAMILIES** 9 Hrs

Review of Number systems, Number Representation, Boolean algebra, Boolean postulates and laws - De-Morgan's Theorem - Principle of Duality, Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map and Tabulation method. Digital Logic Families- TTL, ECL, CMOS.

**UNIT II COMBINATIONAL CIRCUITS** 9 Hrs

Realization of combinational logic using gates, Design of combinational circuits : Adder, Subtractor, Parallel adder Subtractor, Carry look ahead adder, Magnitude Comparator, Parity generator and checker, Encoder, Decoder, Multiplexer, De-Multiplexer - Function realization using Multiplexer, Decoder - Code converters.

**UNIT III SEQUENTIAL CIRCUITS** 9 Hrs

Flip-flops - SR, JK, D and T- Master-Slave – Triggering - Characteristic table and equation – Application table – Asynchronous and synchronous counters - Shift registers - Types – Universal shift registers – Ring counter – Johnson Counters- Serial adder / Subtractor.

**UNIT IV SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS** 9 Hrs

Mealy and Moore models – State diagram - State table – State minimization – State assignment - Excitation table - Design of Synchronous sequential circuits: Counters and Sequence generators- Circuit implementation - Asynchronous sequential circuits - Hazards and Races, Hazard free combinational circuits.

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**UNIT V PROGRAMMABLE LOGIC DEVICES MEMORY AND VHDL** 9 Hrs

Memories: ROM, PROM, EPROM, PLA, PLD, FPGA – VHDL Programming: RTL Design – Combinational Logic – Types – Operators – Packages – Sequential Circuits – Sub Programs – Testbenches. (Examples: adders, counters, flip flops, FSM, Multiplexers / De-Multiplexers).

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR(S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Morris Mano M. and Michael D. Ciletti | Digital Design | Pearson Education | 2013 |
| T2 | Donald D.Givone, | Digital Principles and Design | Tata Mc-Graw Hill Publishing company limited, New Delhi | 2002 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Thomas L. Floyd | Digital Fundamentals | Pearson Education Inc | 2011 |
| R2 | Charles H. Roth Jr, | Fundamentals of Logic Design | Jaico Publishing House | 2003 |
| R3 | Leach D, Malvino A P &Saha | Digital Principles and Applications | Tata McGraw-Hill Publishing Company | 2014 |
| R4 | John F. Wakerly, | Digital Design Principles and Practices | Pearson Education | 2007 |
| R5 | John.M Yarbrough | Digital Logic Applications and Design | Thomson – VikasPublishing House | 2002 |
| R6 | Charles H.Roth Jr. | Digital System Design using VHDL | Thomson Learning | 2008 |

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| 19ECC05 | ELECTROMAGNETIC FILELDS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To analyze fields and potentials due to static charges
2 To evaluate static magnetic fields
3 To understand the relation between the fields under time varying situations
4 To give knowledge on the transmission line at Radio frequencies
5 To understand the principles of propagation of uniform plane waves

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain the fundamental concepts of Electrostatics |
| CO2 | Explain the basic concepts of Magnetostatics |
| CO3 | Demonstrate the relation between the fields under time varying situations |
| CO4 | Analyze the transmission lines at Radio frequencies |
| CO5 | Analyze the propagation of uniform plane waves |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | | | x | | | | | | | | x |
| CO2 | x | x | x | | | | x | | | | | | | | x |
| CO3 | x | x | x | x | x | | | | | | | | | x | x |
| CO4 | x | x | x | x | x | | | | | | x | x | | x | x |
| CO5 | x | x | x | x | x | | | | | | x | x | | x | x |

**COURSE CONTENTS** :

**UNIT I ELECTROSTATICS** **9 Hrs**

Review of vector algebra and 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, Helmholtz's theorem.- Electric field, Coulomb's law, Electric potential, Electric flux density and dielectric constant, Boundary conditions, Capacitance- Parallel plate capacitors, Electrostatic energy.

**UNIT II MAGNETOSTATICS** **9 Hrs**

Lorentz force equation, 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 III TIME-VARYING FIELDS AND MAXWELL's EQUATIONS** **9 Hrs**

Faraday's law- Maxwell's Second Equation in integral form from Faraday's Law- Displacement current – Ampere's circuital law in integral form, Equation expressed in point form -Maxwell's four equations in integral form and differential form - Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields.

**UNIT IV TRANSMISSION LINES AT RADIO FREQUENCIES** **9 Hrs**

Transmission line parameters- General solutions of transmission line –Wavelength, velocity of propagation - Waveform distortion – The distortion less line- Reflections on a line not terminated in Z0 - Reflection coefficient - Reflection factor and reflection loss - Standing Waves, Nodes, Standing wave Ratio- Smith chart and its application – Single stub matching using Smith chart..

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**UNIT V PLANE ELECTROMAGNETIC WAVES** **9 Hrs**

Uniform Plane Waves – Maxwell's equation in Phasor form – Wave equation in Phasor form – Plane waves in free space and in a homogenous material - Wave equation for a conducting medium – Propagation in good conductors –, Skin effect. Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary.

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR(S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | W.H. Hayt and J.A. Buck | Engineering Electromagnetics | TATA McGraw-Hill | 2007 |
| T2 | John D Ryder | Networks, Lines and Fields | Prentice Hall India | 2010 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | G.S.N Raju | Electromagnetic Field Theory and Transmission Lines | Pearson Education | 2005 |
| R2 | Umesh Sinha | Transmission Lines and Networks | SatyaPrakashan (Tech. India), New Delhi | 2010 |
| R3 | D.K. Cheng | Field and wave electromagnetics | Pearson (India) | 1989 |
| R4 | M.N.O. Sadiku and S.V. Kulkarni | Principles of Electromagnetics | Oxford (Asian Edition) | 2015 |
| R5 | Simon Ramo, John R. Whinnery, Theodore Van Duzer | Fields and Waves in Communication Electronics | John Wiley | 1994 |

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| 19ECC06 | ANALOG COMMUNICATION SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSEOBJECTIVES** : The course should enable the students to:

1 To understand the concept of amplitude modulation
2 To describe the concepts of angle modulation techniques.
3 To study the analysis in noise performance of continuous wave modulations
4 To discuss the influence of noise over the performance of analog modulation schemes.
5 To know the applications of analog communication techniques

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain the behavior of amplitude modulation and detection schemes |
| CO2 | Analyze the various features of angle modulation and demodulation techniques |
| CO3 | Illustrate the influence of noise over the analog modulation schemes |
| CO4 | Discuss the noise performance in AM and FM systems |
| CO5 | Demonstrate the applications of analog communication techniques |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | | | | | | | | | | X | | |
| CO2 | X | X | X | | | | | | | | X | | X | | |
| CO3 | X | X | X | X | | | | | | | X | | X | | |
| CO4 | X | X | X | X | X | | | | X | | X | X | X | X | X |
| CO5 | X | X | X | X | X | | | | X | | X | X | X | X | X |

**COURSE CONTENTS** :

**UNIT I AMPLITUDE MODULATION** 9 Hrs

Modulation - Need for Modulation, Principles of Amplitude Modulation: AM Envelope - Modulation Index - Frequency Spectrum and Bandwidth, Need for Frequency Translation, AM Modulator: DSBSCSSB- VSB Modulators, AM Transmitter, Comparison of AM Modulation Systems, AM Demodulators: DSBSC- SSB, AM Receiver: TRF Receiver- Super Heterodyne Receiver- AM Peak Detector.

**UNIT II ANGLE MODULATION** 9 Hrs

Angle Modulation Types - Phase and Frequency Modulation, Narrow Band FM and Wideband FM, Transmission Bandwidth of FM signals, FM Modulator: Generation of FM by Parameter Variation Method - Armstrong's Indirect Method, PM Modulator, FM Demodulator : Frequency Discriminator - Foster Seeley Discriminator - Balanced Slope Detector, Block Diagram of FM Double Conversion Receiver, PLL as FM Demodulator – PM Demodulator.

**UNIT III RANDOM PROCESS / NOISE THEORY** 9 Hrs

Review of Probability Theory, Random Variables / Random Process, Gaussian Process, PSD Sequence of Pulse, PSD Sequence of Digital Data, Transmission of Random Process Through Linear Systems, Weiner Holph Filter, Noise: Shot Noise - Thermal Noise and White Noise - Narrow Band Noise - Noise Equivalent Bandwidth - Noise Temperature - Noise Figure.

**UNIT IV NOISE PERFORMANCE OF CW MODULATION SYSTEMS** 9 Hrs

Noise in DSBSC Systems, Noise in SSBSC System, Noise in FM System - FM Threshold Effect, Preemphasis and De-emphasis in FM: Capture Effect – Threshold Effect, Comparison of Performances.

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**UNIT V APPLICATIONS OF ANALOG COMMUNICATION SYSTEM** 9 Hrs

Radio Transmitter and Receiver, Power Amplifier, Impedance Matching Network, Radio Receiver, Stereophonic FM Broadcasting, Voice Coders, Channel Vocoder, Linear Predictive Coder, Mobile Telephone Communication-Cellular Concept.

**Total Hours: 45**

**TEXT BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Herbert Taub, Donald L Schilling and Goutamsoha | Principles of Communication Systems | Tata McGraw Hill | 2014 |
| T2 | Wayne Tomasi | Electronic Communication Systems | Pearson education in south Asia print | 2011 |

**REFERENCE BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Simon Haykin | Communication Systems | John Wiley & Sons | 2001 |
| R2 | R.P Singh and S.D.Sapre | Communication Systems - Analog and Digital". . 2007 | Tata McGraw Hill | 2007 |
| R3 | Bruce Carlson | Communication Systems | Tata McGraw Hill | 2011 |
| R4 | B.P.Lathi | Modern Digital and Analog Communication Systems | Oxford Press | 2007 |
| R5 | John G. Proakis, MasoudSalehi | Fundamentals of Communication Systems | Pearson Education | 2006 |

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| 19ECC07 | MICROCONTROLLER BASED SYSTEM DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSEOBJECTIVES :**

1 To understand an architecture of 8051 Microcontroller and its programming methods.
2 To provide the various I/O devices interfacing with 8051
3 To Provide Information on PIC Microcontroller and its nature of Programming
4 To Understand the ARM Microcontrollers.
5 To impart knowledge on ARM Cortex programming

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Describe the 8051 Microcontroller Architecture and Programming Techniques. |
| CO2 | Explain I/O devices interfacing with 8051 Microcontroller. |
| CO3 | Discuss the PIC Microcontroller Architecture and its Programming. |
| CO4 | Summarize the ARM 32 Bit Microcontroller and its features. |
| CO5 | Explain the ARM cortex M3 Programming Techniques. |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | | | | | | | | | | | X | |
| CO2 | X | X | X | | | | | | | | | | | X | |
| CO3 | X | X | X | X | X | | | | X | | X | X | | X | |
| CO4 | X | X | X | X | X | | | | X | | X | X | | X | |
| CO5 | X | X | X | X | X | | | | X | | X | X | | X | |

**COURSE CONTENTS :**

**UNIT I 8051 MICROCONTROLLER** **9 Hrs**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits – Instruction set - Addressing modes - Assembly language programming.

**UNIT II 8051 MICROCONTROLLER INTERFACING** **9 Hrs**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform.

**UNIT III PIC MICROCONTROLLER** **9 Hrs**

Introduction to PIC Microcontrollers features of PIC family microcontrollers, architecture and pipelining, program memory considerations, addressing modes, CPU registers, Instruction set, and simple operations.

**UNIT IV ARM-32 BIT MICROCONTROLLER** **9 Hrs**

Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence.

**UNIT V ARM CORTEX M3 PROGRAMMING** **9 Hrs**

Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly language Programming.

**Total Hours: 45**

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**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay | The 8051 Microcontroller and Embedded Systems: Using Assembly and C | Pearson Education | 2011 |
| T2 | MykePredko | Programming& Customizing the PIC Microcontroller | Tata McGraw Hill | 2008 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Joseph Yiu | The Definitive Guide to the ARM Cortex-M3 | Newnes, (Elsevier) | 2010 |
| R2 | Kenneth J. Ayala | The 8051 Microcontroller | Thomsan Learning | 2004 |
| R3 | Martin P. Bates | PIC Microcontrollers | Elsevier Science & Technology | 2011 |
| R4 | Dr. Yifeng Zhu | Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C | E-Man Press LLC | 2015 |
| R5 | Trevor Martin | The Designer's Guide to the Cortex-M Processor Family | Elsevier Science & Technology | 2013 |

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| 19ECC08 | ANTENNA SYSTEMS ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**COURSE OBJECTIVES** :

1 To introduce antenna fundamentals and basic terminologies
2 To study various antenna arrays
3 To give a thorough understanding of aperture and slot antennas
4 To understand special purpose antennas and measurement of antenna parameter
5 To deal with the different types of propagation of radio waves

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain the various types of antenna parameters |
| CO2 | Analyze the antenna arrays and frequency independent antennas |
| CO3 | Explain the radiation mechanism of aperture and horn antenna |
| CO4 | Illustrate special antennas and measurement techniques |
| CO5 | Explain the various types of atmospheric layers and wave propagation through it |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | | | | | | | | | | | | |
| CO2 | X | X | X | X | | X | | | | | X | | | | |
| CO3 | X | X | X | X | X | X | | X | | | X | | | | X |
| CO4 | X | X | X | X | X | X | | X | | | X | X | | X | X |
| CO5 | X | X | X | X | X | X | | X | | | X | X | | X | X |

**COURSE CONTENTS** :

**UNIT I ANTENNA FUNDAMENTALS** 12 Hrs

Radiation from antenna, Basic antenna parameters – Radiation pattern, Radiation intensity, Beam area, Beam solid angle, Band width, Beam width , Directivity, Gain, Antenna aperture, Effective height, Effective aperture, Radiation Resistance, Input Impedance, Matching – Baluns, Polarization, Polarization mismatch, Antenna noise temperature, Radiation from Half wave dipole, Folded dipole.

**UNIT II ANTENNA ARRAYS** 12 Hrs

Antenna Arrays, Expression for electric field from two element and N element Array: Broad-side array and End-Fire array - Pattern Multiplication- Concept of Adaptive array and Binomial array.

**UNIT III APERTURE AND SLOT ANTENNAS** 12 Hrs

Uniqueness theorem, Radiation from an elemental area of a plane wave (Huygen's Source), Radiation from rectangular apertures, Horn antenna -Types , Parabolic reflector antennas and its feed systems, Aperture blockage, Slot antennas, Method of feeding slot antennas-Microstrip antennas – Radiation mechanism – Application, Numerical tool for antenna analysis.

**UNIT IV SPECIAL ANTENNAS AND ANTENNA MEASUREMENTS** 12 Hrs

Yagi-Uda Antenna - Principle of frequency independent antennas –Spiral antenna, Helical antenna, Log Periodic Dipole Array - Reconfigurable antenna, Active antenna, Antenna Measurements - Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR, Directivity

**UNIT V PROPAGATION OF RADIO WAVES** 12 Hrs

Modes of propagation , Structure of atmosphere , Ground wave propagation , Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth concept Sky wave propagation – Virtual height,

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critical frequency , Maximum usable frequency – Skip distance, Fading , Multi hop propagation.

**Total Hours: 60**

**TEXT BOOKS :**

| S.No. | AUTHOR(S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | John D Kraus | Antennas for all Applications | McGraw Hill | 2005 |
| T2 | R.E.Collin | Antennas and Radiowave Propagation | McGraw Hill | 1985 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Constantine.A.Balanis | Antenna Theory Analysis and Design | Wiley Student Edition, | 2006 |
| R2 | Robert S.Elliott | Antenna Theory and Design | Wiley Student Edition | 2006 |
| R3 | Rajeswari Chatterjee | Antenna Theory and Practice | New Age International Publishers | 2006 |
| R4 | S. Drabowitch | Modern Antennas | Modern Antennas | 2007 |
| R5 | Edward C.Jordan and Keith G.Balmain | Electromagnetic Waves and Radiating Systems | Prentice Hall of India | 2006 |

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| 19ECC09 | Digital Signal Processing | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**COURSE OBJECTIVES :**

1 To study DFT and its applications,

2 To design techniques for IIR and FIR filters

3 To study the fundamentals of multi rate filters, finite word length effects applications

4 To design of digital signal processors systems for given specifications and applications

5 To understand the architecture of DSP Processors

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Explain the concept of Discrete Fourier Transform for computation of linear filtering and correlation |
| CO2 | Design IIR filters using Impulse Invariant Techniques and Bilinear Transformation Method. |
| CO3 | Design linear phase FIR filters using Windowing Techniques and sampling method |
| CO4 | Analyze the effects of Finite word length on digital filters |
| CO5 | Understand the concept of sampling rate conversation of digital signals and Describe the architecture of DSP processor |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | x | x | | | | | | x | | | x | x |
| CO2 | x | x | x | x | x | | | | | | x | | | x | x |
| CO3 | x | x | x | x | x | | | | | | x | | | x | x |
| CO4 | x | x | x | x | x | | | | | | x | x | | x | x |
| CO5 | x | x | x | x | x | | | | | | x | x | | x | x |

**COURSE CONTENTS :**

**UNIT I FOURIER ANALYSIS OF DISCRETE TIME SIGNALS** 9 Hrs

Introduction –Discrete Fourier Transform (DFT) – Properties of DFT – Efficient computation of the DFT: FFT algorithms – Radix 2 FFT algorithms: Decimation in Time and Decimation in Frequency – Applications of DFT algorithms in Linear filtering and correlation.

**UNIT II DESIGN OF IIR FILTER** 9 Hrs

Design of IIR filters from Analog filters – Frequency Transformation in the analog domain – IIR filters Design: Butterworth filters, Chebyshev filters.-Approximation of derivatives, Impulse invariance method, Bilinear transformation. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations

**UNIT III DESIGN OF FIR FILTER** 9Hrs

Design of FIR filters – Symmetric and Anti symmetric FIR filters – Design of Linear Phase FIR filters: Windowing Techniques (Rectangular, Hamming, Hanning), Frequency sampling method, FIR filter structures - linear phase structure, direct form realizations

**UNIT IV FINITE WORDLENGTH EFFECTS** 9Hrs

Fixed point and floating point number representations – ADC –Quantization- Truncation and Rounding errors - Quantization noise – coefficient quantization error – Product quantization error - Overflow error – Round off noise power - limit cycle oscillations due to product round off and overflow errors – Principle of scaling.

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**UNIT V** **MULTIRATE AND DIGITAL SIGNAL PROCESSORS** 9Hrs

Basic Multirate Operations – Decimation and Interpolation – Fractional sampling rate alteration – Interconnection of building blocks – The poly phase representation – Efficient structure of Decimation and Interpolation filters DSP functionalities - circular buffering – DSP architecture – Fixed and Floating point architecture principles – Programming – Application examples

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | John G Proakis, Dimitris G Manolakis. | 'Digital Signal Processing Principles, Algorithms and Application', | Pearson | 2014. |
| T2 | B. Venkataraman i& M.Bhaskar | Digital Signal Processor Architecture, Programming and Application | McGraw-Hill | 2014 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | S.K.Mitra | Digital Signal Processing: A Computer based approach | McGraw-Hill | 2011 |
| R2 | Mark Owen | Practical Signal Processing | Cambridge University Press | 2012 |
| R3 | Alan V Oppenheim, Ronald W Schafer, John R Back | Discrete Time Signal Processing | Pearson | 2013 |
| R4 | P.RameshBabu | Digital Signal Processing' | Scitech | 2015 |
| R5 | Sen M.Kuo, WoonSengGan Avtar Singh, S.Srinivasan | Digital Signal Processing Architectures, Implementations, and Applications' | Pearson Education | 2005 |

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| 19ECC10 | DIGITAL COMMUNICATION SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSEOBJECTIVES** : The course should enable the students to:

1 To learn and understand the process of sampling, quantization and coding that are fundamental to the digital transmission of analog signals
2 To understand Baseband and Passband transmission systems.
3 To know about Error control coding
4 To study the wireless channel models

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Demonstrate the concept of sampling and various wave form coding schemes. |
| CO2 | Examine the baseband transmission system using Nyquist criterion |
| CO3 | Relate the features of various data transmission schemes |
| CO4 | Compute the different types of error control coding noise |
| CO5 | Explain the concept of channel modeling and fading in wireless communication. |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | | | | | | | | | | x | x | x | |
| CO2 | x | x | x | | | | | | | | x | | | | x |
| CO3 | x | x | x | x | x | | | | | | x | x | x | x | x |
| CO4 | x | x | | x | x | | | | | | | x | | | x |
| CO5 | x | | x | x | x | | | | | | x | x | | x | x |

**COURSE CONTENTS** :

**UNIT I** **Sampling process and wave form coding** 9 Hrs

Basic elements of a digital communication system-Sampling Theorem - Sampling and signal recovery -PAM, PCM -Channel noise and error- Quantization Noise-SNR -TDM -DM– ADM Linear prediction. - DPCM

**UNIT II** **Baseband Pulse Transmission** 9 Hrs

Discrete PAM signals - Matched filter - Intersymbol Interference- Nyquist's criterion for Distortion less Transmission- Correlative coding –Baseband M-ary PAM systems -Adaptive Equalization-Eye patterns

**UNIT III** **Pass band transmission** 9 Hrs

Gram-Schmidt Orthogonalization Procedure; Geometric Interpretation of Signals; Correlation Receiver-Introduction to digital modulation schemes- Generation, Detection, BW,PSD of ASK, FSK, PSK, DPSK, QPSK, Comparison of digital modulation systems - Carrier and symbol synchronization.

**UNIT IV** **Error Control Coding** 9 Hrs

Channel coding theorem -Linear block codes - Cyclic codes –Convolutional codes - Maximum likelihood decoding - Viterbi Algorithm- Trellis coded modulation.

**UNIT V** **Wireless Channel Models** 9 Hrs

Basic cellular concepts- propagation effects-Fading- Channel models- statistical characterization of multipath channels, Delay spread and Doppler spread, classification of multipath channels. Diversity techniques.

**Total Hours: 45**

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**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | John G.Proakis | Digital Communication | McGraw Hill | 2008 |
| T2 | Simon Haykins | Communication Systems | John Wiley | 2000 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Bernard Sklar | Digital Communication, Fundamentals and Application | Pearson Education Asia | 2001 |
| R2 | Taub& Schilling | Principle of Communication Systems | Tata McGraw-Hill | 2003 |
| R3 | Singh, R.P. &Sapre, S.D | Communication Systems: Analog & Digital | Tata McGraw-Hill | 2000 |
| R4 | Sam K.Shanmugam | Analog& Digital Communication | John Wiley | |
| R5 | Bruce Carlson | Principles of Digital Communication | Tata McGraw Hill | 2008 |

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| 19ECC11 | MICROWAVE ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To understand wave propagation in guided system
2 To impart knowledge on the propagation of waves through wave guides
3 To inculcate the basics of network parameters at microwave frequency
4 To understand microwave generation and device
5 To deal with the microwave measurement techniques

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain wave propagation in guided systems |
| CO2 | Demonstrate wave propagation in rectangular wave guides |
| CO3 | Analyze the network at microwave frequencies |
| CO4 | Illustrate the various microwave generators |
| CO5 | Use microwave test bench and measuring instruments |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | X | | | | | | | | | | X | X |
| CO2 | X | X | X | X | X | | | | | | X | | | X | X |
| CO3 | X | X | | X | X | X | | | | | X | X | | | X |
| CO4 | X | X | | | | X | | | | | | | | | X |
| CO5 | X | X | X | | X | | | | | | X | X | | | X |

**COURSE CONTENTS** :

**UNIT I GUIDED WAVES** 9 Hrs

Guided waves: Waves between parallel planes – Transverse Electric waves and Transverse Magnetic waves – Characteristics of Transverse Electric and Transverse Magnetic Waves – Transverse Electromagnetic waves – Velocities of propagation –Wave impedance.

**UNIT II WAVEGUIDES** 9 Hrs

Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves in Rectangular Waveguides – Characteristic of TE and TM Waves – Cutoff wavelength and phase velocity – Impossibility of TEM waves in waveguides – Dominant mode in rectangular waveguide, Transverse Electric and Transverse Magnetic waves in Circular guides – Excitation of modes.

**UNIT III TWO PORT NETWORK THEORY** 9 Hrs

Review of Low frequency parameters: Impedance, Admittance, Hybrid and ABCD parameters, Different types of interconnection of Two port networks, High Frequency parameters, Formulation of S parameters, Properties of S parameters and its proof, Reciprocal and lossless Network, RF behavior of Resistors, Capacitors and Inductors

**UNIT IV MICROWAVE DEVICES AND GENERATORS** 9 Hrs

Attenuators, Directional couplers, E-plane , H-Plane and Magic Tee, Circulator, Isolator, Gunn diode oscillator, High frequency effects in vacuum Tubes, Theory and application of Two cavity Klystron, Reflex Klystron oscillator, Traveling wave tube amplifier -Magnetron oscillator using Cylindrical Cavity.

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**UNIT V MICROWAVE MEASUREMENTS** **9 Hrs**

Measuring Instruments : Principle of operation and application of VSWR meter, Power meter, Spectrum analyzer, Network analyzer, Measurement of Impedance, Frequency, Power, VSWR, Dielectric constant, Attenuation, S-parameters.

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR(S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | E. C. Jordan and K.G. Balmain | Electromagnetic Waves and Radiating Systems | Prentice Hall India | 2006 |
| T2 | Robert E Colin | Foundations for Microwave Engineering | John Wiley & Sons | |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | G.S.N Raju | Electromagnetic Field Theory and Transmission Lines | Pearson Education | 2005 |
| R2 | Simon Ramo, John R. Whinnery, Theodore Van Duzer | Fields and Waves in Communication Electronics | John Wiley | 1994 |
| R3 | David M. Pozar | Microwave Engineering | Wiley India (P) Ltd | 2011 |
| R4 | Annapurna Das and Sisir K Das | Microwave Engineering | Tata McGraw Hill | 2004 |
| R5 | Liao, S.Y | Microwave Devices & Circuits | Prentice Hall of India | 2006 |

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| 19ECC12 | VLSI CIRCUIT DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To study the Characteristics of MOS, CMOS transistors.
2 To learn CMOS process technology
3 To learn techniques of chip design using programmable devices
4 To learn the concepts of designing VLSI Subsystems.
5 To learn the concepts of modeling a digital system using Hardware Description Language

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain the various IC fabrication methods |
| CO2 | Design the Layout of simple MOS circuit using Lambda based design rules |
| CO3 | Apply the Lambda based design rules for subsystem design |
| CO4 | Interpret various FPGA architectures |
| CO5 | Design digital circuits using Verilog HDL |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | | X | | | | X | | X | | X | | |
| CO2 | X | X | X | X | X | | | | X | | X | | X | X | X |
| CO3 | X | X | X | X | X | | | | X | | X | | X | X | X |
| CO4 | X | X | X | | X | | | | X | | X | X | X | | |
| CO5 | X | X | X | X | X | | | | X | | X | X | X | X | X |

**COURSE CONTENTS** :

**UNIT I MOS TRANSISTOR THEORY** **9 Hrs**

MOSFET– Enhancement mode & Depletion mode – Fabrication – NMOS, PMOS – CMOS fabrication – P-well, N-well, Twin-Tub, SOI – CMOS Process Enhancements – Interconnects, Circuit elements-CMOS Latch Up and Prevention

**UNIT II MOS CIRCUITS AND DESIGN** 9 Hrs

Basic Electrical properties of MOS circuits – Ideal I-V Characteristics, C-V Characteristics DC Equations, Second Order Effects– Basic circuit concepts-Sheet resistance-Area Capacitances-Capacitance calculations-Inverter delays– Scaling of MOS Devices –Scaling Models and Scaling Factors MOS layers – Design Rules-Need for Design Rules-CMOS Lambda Based Design Rules-Stick Diagram and Layout for CMOS Inverter.

**UNIT III SUBSYSTEM DESIGN & LAYOUT** **9 Hrs**

Switch Logic – Pass transistors and transmission gates – Power: Dynamic Power, Static Power - Two input NMOS, CMOS gates: NOT– NAND– NOR gates – Other forms of CMOS logic – Static CMOS logic-Dynamic CMOS logic – Clocked CMOS logic - Precharged domino CMOS logic – Structured design of simple Combinational logic design– Multiplexers – Clocked sequential circuits – Two phase clocking - Charge storage - Dynamic register element –Dynamic shift register

**UNIT IV PROGRAMMABLE LOGIC DEVICES** **9 Hrs**

Programmable Logic Devices – PLA , PAL – Finite State Machine design using PLA – Introduction to FPGA – FPGA Design flow –Architecture – FPGA devices: Xilinx XC 4000 – Altera cyclone III - FPGA Interconnect Routing Procedures

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**UNIT V VERILOG HDL DESIGN PROGRAMMING** 9 Hrs

Basic concepts: VLSI Design flow, Modeling – Structural Gate Level Modeling, Switch Level Modeling ,Behavioral and RTL Modeling - Design Examples: Combinational Logic – Multiplexer, Binary Decoder, Comparator, Sequential logic- Flip Flops, Registers, and Counters, Memory

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Douglas A.Pucknell, K. Eshragian | Basic VLSI Design | PHI | 2009 |
| T2 | Neil.H.E.Weste, KamaranEshraghian | Principles of CMOS VLSI Design | Addison Wesley Publications | 2005 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | SamirPalnitkar | Verilog HDL–Guide to Digital design and synthesis | PearsonEducation | 2009 |
| R2 | WayneWolf | ModernVLSIDesign | PearsonEducation | 2003 |
| R3 | EugeneD.Fabricius | IntroductiontoVLSIDesign | TataMcGrawHill | 1990 |
| R4 | John P.Uyemura | Introduction to VLSI circuits and Systems | John Wiley and Sons | 2005 |
| R5 | KeshabK.Parhi | VLSI Digital Signal Processing Systems. Design and Implementation | John Wiley | 2007 |

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| 19ECC13 | COMPUTER NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
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**COURSEOBJECTIVES**

1 Understand the division of network functionalities into layers.

2 Be familiar with the components required to build different types of networks Be exposed to the required functionality at each layer.

3 Learn the flow control and congestion control algorithms.

4 Introduce advanced networking concepts and applications.

5 Understand the electronic mail and web services

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Illustrate the components required to build different types of networks. |
| CO2 | Choose the media access techniques. |
| CO3 | Explain various routing protocols. |
| CO4 | Show the flow of information from one node to another node in Transport layer. |
| CO5 | Explain tradition applications like Emails, HTTP and Webservices |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | x | | | x | | x | | | x | x |
| CO2 | x | x | x | | x | x | | | x | | x | | | | x |
| CO3 | | x | x | | x | x | | | x | | x | | | x | x |
| CO4 | | x | x | x | x | x | | | x | | x | x | | x | x |
| CO5 | | x | x | x | x | x | | | x | | x | x | | x | x |

**COURSE CONTENTS** :

**UNIT I FUNDAMENTALS AND CONCEPT OF LAYERING** **9 Hrs**

Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Performance : – Interface & Service – Service Primitives. Reference models – OSI – TCP/IP.

**UNIT II MEDIA ACCESS** **9 Hrs**

Media access control – Ethernet (802.3) – Wireless LANs – 802.11 – Bluetooth – Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP,ICMP )

**UNIT III ROUTING** **9 Hrs**

Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6),Network layer – Routing – Shortest path routing, Flooding, DistanceVector Routing, Link State Routing, RIP, OSPF, Routing for mobile hosts.

**UNIT IV TRANSPORT LAYER** **9 Hrs**

Transport Layer – TCP & UDP. Application layer –FTP, DNS,Electronic mail, MIME, SNMP. Introduction to World Wide Web. Congestion avoidance (DEC bit, RED) – QoS – Application requirements.

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**UNIT V APPLICATION LAYER** 9 Hrs

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP.

**Total Hours : 45**

**TEXT BOOKS**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Larry L. Peterson, Bruce S. Davie | Computer Networks: A Systems Approach | Morgan Kaufmann Publishers | 2011 |
| T2 | Keshav | An Engineering Approach to Computer Networks | Addison Wesley | 1998 |

**REFERENCE BOOKS**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | James F. Kurose, Keith W. Ross | Computer Networking – A Top-Down Approach Featuring the Internet | Pearson Education, | 2009 |
| R2 | Nader. F. Mir | Computer and Communication Networks | Pearson Prentice Hall Publishers | 2010 |
| R3 | Ying-Dar Lin, Ren-Hung Hwang, Fred Baker | Computer Networks: An Open Source Approach | McGraw Hill Publisher, | 2011 |
| R4 | Behrouz A. Forouzan | Data communication and Networking | Tata McGraw Hill | 2011 |
| R5 | William Stallings | Computer Networking with Internet Protocols | Prentice-Hall | 2004 |

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| 19ECC14 | CONTROL ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSEOBJECTIVES** : The course should enable the students to:

1 To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
2 To assess the system performance using time domain analysis and methods for improving it
3 To assess the system performance using frequency domain analysis and techniques for improving the performance
4 To design various controllers and compensators to improve system performance
5 To introduce state variable representation of physical systems.

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain different types of systems and their algebraic equations |
| CO2 | Predict the transient performance parameters of the system for standard input signals |
| CO3 | Analyze the nature of stability of the system in frequency domain |
| CO4 | Analyze stability and control design techniques. |
| CO5 | Analyze state space and variable models. |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | | | | | | | | | | | | | |
| CO2 | x | x | x | x | | | | | | | | | | x | x |
| CO3 | x | x | x | x | | | | | | | x | x | | x | x |
| CO4 | x | x | x | x | x | | | | | | x | x | | x | x |
| CO5 | x | x | x | x | x | | | | | | x | x | | x | x |

**COURSE CONTENTS** :

**UNIT I SYSTEMS AND THEIR REPRESENTATION** **9 Hrs**

Concepts of control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchro's – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs - Transfer function of DC generator and motor .

**UNIT II TIME RESPONSE ANALYSIS** **9 Hrs**

Standard test signals -Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error - Effects of P, PI, PID modes of feedback control –Time response analysis using MATLAB (only simulation).

**UNIT III FREQUENCY RESPONSE ANALYSIS** **9 Hrs**

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications- Analysis using MATLAB (only simulation).

**UNIT IV STABILITY ANALYSIS &CLASSICAL CONTROL DESIGN TECHNIQUES** **9 Hrs**

Characteristics equation – Routh Hurwitz criterion – Root locus construction-Nyquist stability criterion-applications of Nyquist criterion to find the stability – Lag, lead and lag-lead networks – Lag/Lead compensator design using bode plots.

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**UNIT V STATE SPACE &VARIABLE ANALYSIS OF CONTINUOUS SYSTEMS** 9 Hrs

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability – Effect of state feedback. State Transition Matrix and its Properties.

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | M. Gopal | Control Systems, Principles and Design | Tata McGraw Hill | 2012 |
| T2 | S.K.Bhattacharya | Control System Engineering | Pearson education | 2013 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Nise | Control Systems Engineering | John wiley, 6th Edition. | 2011 |
| R2 | Richard C. Dorf and Robert H. Bishop | Modern Control Systems | Pearson Prentice Hall | 2012 |
| R3 | Benjamin C. Kuo | Automatic Control systems | PHI press | 2010 |
| R4 | K. Ogata | Modern Control Engineering | PHI press | 2012 |
| R5 | S.N.Sivanandam, S.N.Deepa | Control System Engineering using Mat Lab | Vikas Publishing | 2012 |

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| 19ECC15 | EMBEDDED SYSTEMS AND RTOS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSEOBJECTIVES :**

1 To understand the basic concepts of embedded systems.
2 To provide different architectural features of embedded systems
3 To understand the goal embedded systems in real time design applications
4 To Understand the concepts of Real Time Operating System.

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Explain the basic concepts of embedded systems. |
| CO2 | Illustrate the different architectural features of embedded systems |
| CO3 | Identify the Embedded Firmware components. |
| CO4 | Summarize the concepts of Real Time Operating System |
| CO5 | Demonstrate the embedded system application |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | | | | | x | | | | | | |
| CO2 | x | x | x | | | | | | x | | x | | x | x | x |
| CO3 | x | x | x | x | x | | | | x | | x | | x | x | x |
| CO4 | x | x | x | x | x | | | | x | | x | x | x | x | x |
| CO5 | x | x | x | x | x | | | | x | | x | x | | x | x |

**COURSE CONTENTS :**

**UNIT I INTRODUCTION** — 9 Hrs

Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

**UNIT II TYPICAL EMBEDDED SYSTEM** — 9 Hrs

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators.

**UNIT III EMBEDDED FIRMWARE** — 9 Hrs

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

**UNIT IV REAL TIME OPERATING SYSTEMS** — 9 Hrs

Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, asks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency, Defining Semaphores, Operations and Use, Defining Message Queue.

**UNIT V RTOS BASED EMBEDDED SYSTEM DESIGN** — 9 Hrs

Case Studies of RTOS RT Linux, MicroC/OS-II, Vx Works: Digital camera, washing machine, cell phones, home security systems, finger print identifiers, printers, automated teller machine, software modem, audio player.

**Total Hours: 45**

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**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Shibu K.V | Introduction to Embedded Systems | Tata McGraw Hill | 2009 |
| T2 | David E. Simon | An Embedded Software Primer | Pearson Education | 2009 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Dr. K.V. K. K. Prasad | Embedded Real Time System: Concepts, Design and Programming | Dreamtech | 2014 |
| R2 | Rajkamal | Embedded Systems: Architecture, Programming and Design | Tata McGraw Hill | 2015 |
| R3 | Frank Vahid, Tony Givargis | Embedded System Design – A Unified Hardware/Software Introduction | John Wiley & Sons | 2002 |
| R4 | Abraham Silberchatz, Peter B. Galvin, Greg Gagne | Operating System Principles | Wiley Student Edition | 2015 |
| R5 | Qing Li | Real Time Concepts for Embedded Systems | Elsevier | 2011 |

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| 19ECC16 | NEMS AND MEMS TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSEOBJECTIVES :**

1 To introduce the concepts of Micro and Nano Electromechanical devices
2 To know the fabrication process of Microsystems
3 To know the design concepts of Micro Sensors and Micro Actuators
4 To introduce the concepts of Quantum Mechanics and Nano systems

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Explain various materials used in MEMS and NEMS Systems. |
| CO2 | Summarize the fabrication steps of MEMS. |
| CO3 | Demonstrate various Micro Sensors. |
| CO4 | Write the designing techniques of Micro Actuators. |
| CO5 | Explain the Quantum Mechanics concepts. |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | | | | | | | | | | X | | |
| CO2 | X | X | X | X | | | | | | | | | X | | |
| CO3 | X | X | X | X | | | | | | | | | X | | X |
| CO4 | X | X | X | X | | | | | | | | | X | | X |
| CO5 | X | X | X | X | | | | | | | | | X | | X |

**COURSE CONTENTS :**

**UNIT I INTRODUCTION TO MEMS AND NEMS** — 9 Hrs

Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectro-mechanical Systems, Applications of Micro and Nanoelectro-mechanical systems, Materials for MEMS and NEMS: Silicon, silicon compounds, polymers, metals.

**UNIT II MEMS FABRICATION TECHNOLOGIES** — 9 Hrs

Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA.

**UNIT III MICRO SENSORS** — 9 Hrs

MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester.

**UNIT IV MICRO ACTUATORS** — 9 Hrs

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces, Case Study: RF Switch Design using EDA tools.

**UNIT V NANO DEVICES** — 9 Hrs

Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor, Simulation of Nano-devices.

**Total Hours: 45**

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**TEXT BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Marc Madou | Fundamentals of Microfabrication | CRC press | 1997 |
| T2 | Stephen D. Senturia | Micro system Design | Kluwer Academic Publishers | 2001 |

**REFERENCE BOOKS**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Tai Ran Hsu | MEMS and Microsystems Design and Manufacture | Tata Mcraw Hill | 2002 |
| R2 | Chang Liu | Foundations of MEMS | Pearson Education India limited | 2006 |
| R3 | Sergey Edward Lyshevski | MEMS and NEMS: Systems, Devices, and Structures | CRC Press | 2002 |
| R4 | Cornelius T. Leondes | MEMS and NEMS Handbook Techniques and Applications | Sprinzer | 2006 |
| R5 | Mohamed Gad-el-Hak | The MEMS Handbook | CRC Press | 2005 |

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| 19ECC17 | DIGITAL IMAGE PROCESSING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSEOBJECTIVES :**

1. Learn digital image fundamentals.
2. Be exposed to simple image processing techniques.
3. Be familiar with image compression and segmentation techniques.
4. Learn to represent image in form of features
5. Understand the concept of image analysis

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Explain the fundamentals of image processing |
| CO2 | Apply image processing enhancement techniques in both the spatial and frequency domain |
| CO3 | Apply image processing segmentation and restoration techniques |
| CO4 | Develop algorithms for image compression |
| CO5 | Explain the image analysis techniques |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | | | | x | | | | | x | x |
| CO2 | x | x | x | | x | | | | x | | | | | x | x |
| CO3 | x | x | x | | x | | | | x | | | | | x | x |
| CO4 | x | x | x | | x | | | | x | | | | | x | x |
| CO5 | x | x | x | x | x | | | | x | | | | | x | x |

**COURSE CONTENTS :**

**UNIT I DIGITAL IMAGE FUNDAMALENTS** **9 Hrs**

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - color image processing – RGB color model – HSV Color model, Image Transform –DFT –DCT-Walsh Transform-KL Transform

**UNIT II IMAGE ENHANCEMENT** **9 Hrs**

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.

**UNIT III IMAGE RESTORATION AND SEGMENTATION** **9 Hrs**

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation-Active Contour model - Morphological processing- erosion, dilation ,opening and closing.

**UNIT IV WAVELETS AND IMAGE COMPRESSION** **9 Hrs**

Wavelets – Subband coding – Multi resolution expansions - Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards - JPEG- MPEG, Vector Quantization.

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**UNIT V IMAGE REPRESENTATION AND RECOGNITION** 9 Hrs

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes – Artificial Neural Network – Activation Function –Network Architecture – Perceptron- Neural Network based classifier - Case Study of Real Time Applications.

**Total Hour 45**

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**TEXT BOOKS**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Rafael C. Gonzales, Richard E. Woods, | Digital Image Processing. | Pearson education | 2010. |
| T2 | A.K. Jain | Fundamentals of Digital Image Processing. | Prentice Hall India | 1988 |

**REFERENCE BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Madhuri.A. Joshi, | Digital Image Processing – an algorithmic approach | PHI Publisher | 2006 |
| R2 | S.Sridher | Digital Image Processing | Oxford University Press | 2011 |
| R3 | Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, | Digital Image Processing using MATLAB | Tata McGraw Hill Pvt. Ltd., | 2011 |
| R4 | Willliam K Pratt, | Digital Image Processing | John Willey | 2002 |
| R5 | Malay K. Pakhira, | Digital Image Processing and Pattern Recognition | PHI Learning Pvt. Ltd. | 2011 |

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| 19ECC18 | ANALOG ELECTRONICS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES** :

1 To Study about Transistor Amplifiers
2 To Design the Differential Amplifiers
3 To Discuss feedback circuits and oscillators.
4 To Study Multistage amplifier and Tuned Amplifiers

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Illustrate BJT and FET Amplifiers Configurations and its Biasing Circuits. |
| CO2 | Demonstrate the Differential Amplifier |
| CO3 | Design Feedback Amplifiers and Oscillators. |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | X | X | | | | X | X | X | | X | X | X |
| CO2 | X | X | X | X | X | | | | X | X | X | | X | X | X |
| CO3 | X | X | X | X | X | | | | X | X | X | | X | X | X |

**COURSE CONTENTS** :

| EXP. No. | NAME OF THE EXPERIMENT | SKILL LEVEL |
|---|---|---|
| 1 | Frequency Response of Common Emitter amplifier | S1 |
| 2 | Frequency Response of Common Source amplifier | S1 |
| 3 | Frequency Response of Multistage amplifier | S1 |
| 4 | Design Differential Amplifier with a Current Mirror | S1 |
| 5 | Frequency response of feedback amplifier circuit-current series | S1 |
| 6 | Frequency response of feedback amplifier circuit- voltage shunt | S1 |
| 7 | Design of RC phase Shift Oscillator circuit using BJT | S2 |
| 8 | Conduct an Experiment of Wien Bridge Oscillator circuit using BJT | S2 |
| 9 | Design Tuned Amplifier using BJT | S2 |
| 10 | Design Double Tuned Amplifier using BJT | S2 |
| 11 | Design of MonostableMultivibrators | S2 |
| 12 | Design of AstableMultivibrators | S2 |

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**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Robert L. Boylestad and Louis Nasheresky | Electronic Devices and Circuit Theory | Pearson Education / PHI | 2008 |
| R2 | S. Salivahanan, N. Suresh Kumar and A. Vallavaraj | Electronic Devices and Circuits | TMH | 2007 |

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| 19ECC19 | DIGITAL SYSTEMDESIGN LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**OBJECTIVES** :

1 To outline the formal procedures for the analysis and design of combinational circuits
2 To outline the formal procedures for the analysis and design of sequential circuits
3 To illustrate the concept of synchronous and asynchronous sequential circuits
4 To introduce the concept of VHDL and programmable logic devices.

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Design combinational circuits using ICs |
| CO2 | Design sequence circuits using ICs |
| CO3 | Apply the programming concepts of Verilog HDL for combinational and sequential circuits |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | | | | | x | x | x | x | x | x |
| CO2 | x | x | x | x | x | | | | | x | x | x | x | x | x |
| CO3 | x | x | x | x | x | | | | | x | x | x | x | x | x |

**COURSE CONTENTS** :

| EXP. No. | NAME OF THE EXPERIMENT | SKILL LEVEL |
|---|---|---|
| 1 | Realization of Gates using Universal Building Block (NAND only) | S1 |
| 2 | Design and implementation of Adders and Subtractors | S1 |
| 3 | Design and implementation of Code Converters | S1 |
| 4 | Design and implementation of Parity Generator and Checker | S1 |
| 5 | Design and implementation of 4-Bit Magnitude Comparator | S1 |
| 6 | Design and implementation of Multiplexer and De-multiplexer | S1 |
| 7 | Design and implementation of Encoders and Decoders | S1 |
| 8 | Design and implementation of Asynchronous Counters | S1 |
| 9 | Design and implementation of Synchronous Counters | S1 |
| 10 | Design and implementation of Shift registers | S1 |
| 11 | Design and implementation of combinational circuits using Verilog HDL | S1 |
| 12 | Design and implementation of sequential circuit using Verilog HDL | S1 |

**REFERENCE BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Morris Mano M. and Michael D. Ciletti | Digital Design | Pearson Education | 2013 |
| R2 | Donald D.Givone, | Digital Principles and Design | Tata Mc-Graw Hill Publishing company limited, New Delhi | 2002 |

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| 19ECC20 | ANALOG COMMUNICATION SYSTEMS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSEOBJECTIVES** : The course should enable the students to:

1 Study the Amplitude and Frequency modulation and demodulation.

2 Study the characteristics of AM and FM receivers

3 Design and Analysis of amplitude modulation and demodulation using MATLAB

4 Design and Analysis of frequency modulation and demodulation using MATLAB

**COURSE OUTCOMES** : :

| | |
|---|---|
| CO1 | Evaluate amplitude modulation parameters |
| CO2 | Design frequency modulation circuits |
| CO3 | Analyze thecharacteristics of AM and FM receivers |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | | | | x | x | | | | x | x |
| CO2 | x | x | x | x | x | | | | x | x | | x | | x | x |
| CO3 | x | x | x | x | x | | | | x | x | | x | | x | x |

**COURSE CONTENTS** :

| EXP. No. | NAME OF THE EXPERIMENT | SKILL LEVEL |
|---|---|---|
| 1 | Amplitude Modulation and Demodulation | S1 |
| 2 | Frequency Modulation and Demodulation (using IC 565) | S1 |
| 3 | Estimation of noise Power Spectral Density (PSD) in Analog Communication | S1 |
| 4 | Mixer Stage Using Discrete Components | S1 |
| 5 | IF Tuned Amplifier | S1 |
| 6 | Analysis of AM wave using Spectrum Analyzer | S1 |
| 7 | Analysis of FM wave using Spectrum Analyzer | S1 |
| 8 | Characteristics of AM receiver (Selectivity & Sensitivity). | S1 |
| 9 | Characteristics of FM receiver (Selectivity & Sensitivity). | S1 |
| 10 | Preemphasis and Deemphasis | S1 |
| 11 | Analog modulation and demodulation using MATLAB | S2 |
| 12 | Frequency modulation and demodulation using MATLAB | S2 |

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**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Simon Haykin | Communication Systems | John Wiley & Sons | 2001 |
| R2 | R.P Singh and S.D.Sapre | Communication Systems - Analog and Digital | Tata McGraw Hill | 2007 |

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| 19ECC21 | MICROCONTROLLER BASED SYSTEM DESIGN LABAROTARY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES :**

1 To understand an architecture of 8051 Microcontroller and its programming methods.
2 To provide the various I/O devices interfacing with 8051
3 To Provide Information on PIC Microcontroller and its nature of Programming
4 To Understand the ARM Microcontrollers.

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Explain the 8051 Microcontroller Architecture and Programming Techniques. |
| CO2 | Demonstrate I/O devices interfacing with 8051 Microcontroller. |
| CO3 | Design microcontroller-based projects. |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | X | X | | | | X | X | X | | X | X | X |
| CO2 | X | X | X | X | X | | | | X | X | X | | X | X | X |
| CO3 | X | X | X | X | X | | | | X | X | X | | X | X | X |

**COURSE CONTENTS :**

| EXP. No. | NAME OF THE EXPERIMENT | SKILL LEVEL |
|---|---|---|
| 1 | Study the Architecture of 8051 Microcontroller | S1 |
| 2 | Apply an 8051 Assembly Language Program to add 8-bit numbers | S2 |
| 3 | Apply an 8051 Assembly Language Program to find average of 8-bit numbers. | S2 |
| 4 | Apply an 8051 Assembly Language Program to find a maximum number from a given 8-bit series numbers. | S2 |
| 5 | Apply an 8051 Assembly Language Program to find a minimum number from a given 8-bit series numbers. | S2 |
| 6 | Apply an 8051 Assembly Language Program to Arrange the given ten 8-bit numbers in ascending order. | S2 |
| 7 | Analyze an Interfacing of LED with Microcontroller 8051 or PIC. | S2 |
| 8 | Analyze an Interfacing of Seven Segment Display with Microcontroller 8051 or PIC. | S2 |
| 9 | Analyze an Interfacing of LCD with Microcontroller 8051 or PIC. | S2 |
| 10 | Analyze an Interfacing of Stepper Motor with Microcontroller 8051 or PIC. | S2 |
| 11 | Analyze an Interfacing of DC Motor with Microcontroller 8051 or PIC. | S2 |
| 12 | Design a Mini Project based on Microcontroller | S2 |

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**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay | The 8051 Microcontroller and Embedded Systems: Using Assembly and C | Pearson Education | 2011 |
| R2 | Kenneth J. Ayala | The 8051 Microcontroller | Thomsan Learning | 2004 |

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| 19ECC22 | SIGNAL PROCESSING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES** :

1 To perform basic signal processing operations such as Linear Convolution, Circular Convolution, and Frequency analysis in MATLAB
2 To implement FIR and IIR filters in MATLAB
3 To implement FIR and IIR filters in DSP Processor
4 To study the architecture of DSP processor

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Demonstrate their abilities towards MATLAB based implementation of various DSP systems |
| CO2 | Design and Implement the FIR and IIR Filters in MATLAB for performing filtering operation |
| CO3 | Analyze the architecture of a DSP Processor |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | x | x | | | | x | x | | x | | | x |
| CO2 | x | x | x | x | x | | | | x | x | | x | | x | x |
| CO3 | x | x | x | x | x | | | | x | x | | x | | x | x |

**COURSE CONTENTS** :

| EXP. No. | NAME OF THE EXPERIMENT | SKILL LEVEL |
|---|---|---|
| 1 | Generation of elementary Discrete-Time sequences in MATLAB | S1 |
| 2 | Linear and Circular convolutions in MATLAB | S1 |
| 3 | Auto correlation and Cross Correlation in MATLAB | S1 |
| 4 | Frequency Analysis of DFT in MATLAB | S1 |
| 5 | Sampling and effect of Aliasing in MATLAB | S1 |
| 6 | Implementation of sampling rate conversion by decimation, interpolation and a rational factor in MATLAB | S2 |
| 7 | Study of architecture of Digital Signal Processor in DSP Processor | S1 |
| 8 | Perform MAC operation using various addressing modes in DSP Processor | S1 |
| 9 | Generation of standard waveforms in DSP Processor | S1 |
| 10 | Design and implementation of IIR filter for real time applications in DSP Processor | S1 |
| 11 | Design and implementation of FIR filter for real time applications in DSP Processor | S1 |
| 12 | Implement an Up-sampling and Down-sampling operation in DSP Processor | S2 |

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**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Robert J. Schilling, Sandra L Harris | Fundamentals of Digital Signal Processing Using MATLAB | Cengage Learning | 2011 |
| R2 | B. Venkataramani and M.Bhaskar | Digital Signal Processors | Tata McGraw-Hill Education | 2011 |

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| 19ECC23 | DIGITAL COMMUNICATION SYSTEMS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSEOBJECTIVES** : The course should enable the students to:

1 Understand different forms of pulse modulation schemes and implement using hardware kits
2 Understand different forms of pulse demodulation schemes and implement using hardware kits
3 Know about line coding schemes
4 Understand MATLAB and write the program and simulate the digital modulation and demodulation schemes.

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

| | |
|---|---|
| CO1 | Explain the signal sampling and reconstruction techniques |
| CO2 | Demonstrate the analog pulse modulation and demodulation circuits |
| CO3 | Design digital modulation and demodulation system using MATLAB |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | | | | | | | x | x | x | | | x | x |
| CO2 | x | x | x | x | x | | | | x | x | x | x | | x | x |
| CO3 | x | x | x | x | x | | | | x | x | x | x | | x | x |

**COURSE CONTENTS** :

| EXP. No. | NAME OF THE EXPERIMENT | SKILL LEVEL |
|---|---|---|
| 1 | Signal Sampling and Reconstruction | S2 |
| 2 | Hardware implementation of Pulse Amplitude Modulation and demodulation | S1 |
| 3 | Hardware implementation of Pulse Position Modulation and demodulation and Pulse Width Modulation and demodulation | S1 |
| 4 | Hardware implementation of Pulse Code Modulation and Delta Modulation | S1 |
| 5 | Hardware implementation of TDM | S1 |
| 6 | Simulation of error control coding schemes | S2 |
| 7 | Simulation of line coding schemes using MATLAB | S2 |
| 8 | Simulation of DM and ADM using MATLAB | S2 |
| 9 | Simulation of Amplitude Shift Keying (ASK) and Frequency Shift Keying (FSK) using MATLAB | S2 |
| 10 | Simulation of Phase Shift Keying (PSK) and Quadrature Phase Shift Keying (QPSK) using MATLAB | S2 |
| 11 | Implementing Convolutional Encoder/Decoder using MATLAB. | S2 |
| 12 | Implementing Viterbi Algorithm using MATLAB Communication link simulation | S2 |

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**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | John G.Proakis | Digital Communication | McGraw Hill | 2008 |
| R2 | Simon Haykins | Communication Systems | John Wiley | 2000 |

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| 19ECC24 | MICROWAVE ENGINEERING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES** :

1 To inculcate the basics of network parameters at microwave frequency
2 To understand the characteristics of microwave device
3 To deal with the microwave measurement techniques

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Demonstrate the characteristics of microwave services. |
| CO2 | Demonstrate the characteristics of microwave device. |
| CO3 | Analyze the radiation parameters of microwave antenna. |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | | | | x | | | | x | x | | | | x | x |
| CO2 | x | x | x | x | x | x | | | x | x | x | | | x | x |
| CO3 | x | x | x | x | x | x | | x | x | x | x | | x | x | x |

**COURSE CONTENTS** :

| EXP. No. | NAME OF THE EXPERIMENT | SKILL LEVEL |
|---|---|---|
| 1 | Measurement of Frequency and Wavelength | S2 |
| 2 | Gunn diode characteristics | S2 |
| 3 | Reflex klystron characteristics | S2 |
| 4 | Measurement of VSWR | S2 |
| 5 | Directional Coupler Characteristics. | S2 |
| 6 | Radiation Pattern of Horn Antenna. | S2 |
| 7 | Radiation Pattern of Parabolic Antenna. | S2 |
| 8 | S-parameter Measurement of Isolator and Circulator | S2 |
| 9 | Characteristics of Magic Tee | S2 |
| 10 | Measurement of Attenuation | S2 |

**REFERENCE BOOKS** :

| S. No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Annapurna Das and Sisir K Das | Microwave Engineering | Tata McGraw Hill | 2004 |
| R2 | Liao, S.Y | Microwave Devices & Circuits | Prentice Hall of India | 2006 |

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| 19ECC25 | VLSI DESIGN LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES** :

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

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Write HDL code for digital integrated circuits. |
| CO2 | Demonstrate fusing of logic modules into FPGA Boards. |
| CO3 | Design a miniproject using EDA tool. |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | | | | x | x | x | | | x | x |
| CO2 | x | x | x | x | x | | | | x | x | x | | | x | x |
| CO3 | x | x | x | x | x | | | | x | x | x | x | | x | x |

**COURSE CONTENTS** :

| EXP. No. | NAME OF THE EXPERIMENT | SKILL LEVEL |
|---|---|---|
| 1. | Study of Xilinx simulation and synthesis tool. | S1 |
| 2. | Design and Simulation of combinatorial logic Circuit Using VERILOG HDL<br>Basic Logic gates<br>Adders – Half adder, full adder,<br>Multiplexer and demultiplexer<br>Encoder and Decoder<br>Multiplier | S2 |
| 3. | Design and simulation of Sequential logic circuit using VERILOG HDL<br>Flip-flops<br>Counters<br>Shift registers | S2 |
| 4 | CMOS Circuit design using Tanner tools<br>CMOS inverter<br>CMOS NAND and NOR Gates<br>CMOS D Latch | S2 |
| 5 | Mini Project | S2 |

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**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | JayaramBhasker | Verilog HDL Synthesis: A Practical Prime | Star Galaxy | 2004 |
| R2 | J. M. Rabaey, A. Chandrakasan and B. Nikolic | Digital Integrated Circuits- A Design Perspective | PHI | 2003 |

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| 19ECC26 | EMBEDDED SYSTEMS LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES :**

1 To understand the basic concepts of embedded systems.
2 To provide different architectural features of embedded systems
3 To understand the goal embedded systems in real time design applications
4 To Understand the concepts of Real Time Operating System.

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Explain the architecture of ARM processor |
| CO2 | Demonstrate the interfacing technique |
| CO3 | Design a real time clock |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | | | | x | x | | | | x | x |
| CO2 | x | x | x | | x | | | | x | x | | | | x | x |
| CO3 | x | x | x | | x | | | | x | x | | | | x | x |

**COURSE CONTENTS :**

| EXP. No. | NAME OF THE EXPERIMENT | SKILL LEVEL |
|---|---|---|
| 1 | Study of ARM Processor | S1 |
| 2 | Interface switches and LEDs | S2 |
| 3 | Interface LCD | S2 |
| 4 | Interface 4*4 Matrix Keyboard | S2 |
| 5 | Analyze an Interfacing of Stepper Motor | S2 |
| 6 | Analyze an Interfacing of 7 segment displays | S2 |
| 7 | Analyze an Interfacing of Analog to Digital Converter. | S2 |
| 8 | Analyze an Interfacing Digital to Analog Converter | S2 |
| 9 | Analyze an Implementation of Real Time Clock | S2 |
| 10 | Analyze and makeMini Project | S2 |

**REFERENCE BOOKS :**

| S.No | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Shibu K.V | Introduction to Embedded Systems | Tata McGraw Hill | 2009 |
| R2 | David E. Simon | An Embedded Software Primer | Pearson Education | 2009 |

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| 19ECC27 | DIGITAL IMAGE PROCESSING LABORATORY | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES :**

1 Learn digital image fundamentals.
2 Be exposed to simple image processing techniques.
3 Be familiar with image enhancement and segmentation techniques.
4 Be familiar with morphological and image transform.

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Perform the image enhancement and edge detection |
| CO2 | Implement Morphological operation |
| CO3 | Demonstrate image transform and Color image processing |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | | X | | | | X | X | | | | X | X |
| CO2 | X | X | X | | X | | | | X | X | | | | X | X |
| CO3 | X | X | X | | X | | | | X | X | | | | X | X |

**COURSE CONTENTS :**

| EXP. No. | NAME OF THE EXPERIMENT | SKILL LEVEL |
|---|---|---|
| 1 | Program to enhance image using image arithmetic and logical operations. | S2 |
| 2 | Program for image enhancement using histogram equalization. | S2 |
| 3 | Program for image enhancement using Image Negative and Gray level slicin | S2 |
| 4 | Program to filter an image using averaging low pass filter in spatial domain and median filter. | S2 |
| 5 | Program for smooth an image using low pass filter in frequency domain.(Butterworth lpf) | S2 |
| 6 | Program for smooth an image using high pass filter in frequency domain.(Butterworth hpf) | S2 |
| 7 | Program for morphological image operations-erosion, dilation, opening &closing. | S2 |
| 8 | Program for edge detection algorithm. | S2 |
| 9 | To fill the region of interest for the image. | S2 |
| 10 | Program of sharpen image using gradient mask. | S2 |
| 11 | Program color image processing | S2 |
| 12 | To program image transforms | S2 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Rafael C. Gonzales, Richard E. Woods | Digital Image Processing. | Pearson Education | 2010 |
| R2 | A.K. Jain | Fundamentals of Digital Image Processing. | Prentice Hall India | 1988 |

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| 19ECE01 | RADAR AND NAVIGATIONAL AIDS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** : The course should enable the students to:

1 To study RADAR theory.
2 To study and learn different types of RADAR and their working principle.
3 To study RADAR signal detection methods.
4 To study RADAR Navigation techniques
5 To understand the advanced navigation system

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain basic concept of radar system |
| CO2 | Classify various types of radar |
| CO3 | Explain the types of tracking in radar system |
| CO4 | Describe various navigation techniques. |
| CO5 | Explain various types of advanced navigation systems. |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | | | | | | | | | | | | x | | |
| CO2 | x | | | | | | x | | | | | | x | | |
| CO3 | x | x | x | x | x | | x | | | | | | | | |
| CO4 | x | x | x | x | x | | x | | | | x | x | | x | |
| CO5 | x | x | x | x | x | | x | | | | x | x | | x | x |

**COURSE CONTENTS** :

**UNIT I BASIC CONCEPTS AND RADAR EQUATIONS** 9 Hrs

Introduction to radar, Radar equation, Radar Block diagram and Operation, Radar Frequencies millimeter and sub millimeter waves, Application of Radars, Range performance of radars, System losses and propagation effects.

**UNIT II CW, FM CW AND MTI RADAR** 9 Hrs

Introduction to MTI and Doppler radar: Delay Line canceller - Moving Target Detector- Pulse Doppler Radar-CW Radar – FMCW Radar- Multiple or staggered Pulse Repetition Frequencies, MTI radar Processor, Types of MTI.

**UNIT III TRACKING RADAR** 9 Hrs

Tracking Radar and its types- Conical scan and Sequential lobbing, Mono-pulse Tracking, Tracking in range, Automatic tracking with surveillance Radar (ADT).

**UNIT IV RADAR CLUTTER AND BASIC NAVIGATIONAL RADAR SYSTEM** 9 Hrs

Introduction to Radar Clutter - Types, Surface clutter radar equation, Four Methods of navigation, Radio direction Finding, Types of Radar Antennas, Automatic directional finders, VHF Omni directional Range (VOR).

**UNIT V ADVANCED NAVIGATIONAL SYSTEM** 9 Hrs

Hyperbolic system of Navigation, LORAN (Long Range Navigation) , Decca navigation system, DME (Distance Measurement Equipment) , TACAN (Tactical Air Navigation), Omega Navigation system, Navistar Global positioning system.

**Total Hours: 45**

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**TEXT BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Skolnik, M | Introduction to Radar Systems | Tata McGraw-Hill, | 2001 |
| T2 | G S N Raju | Radar Engineering and Fundamentals of Navigational Aids | IK International Publishers | 2008 |

**REFERENCE BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Peyton Z. Peebles | Radar Principles | John Wiley | 2004 |
| R2 | J.C Toomay | Principles of Radar | PHI | 2004 |
| R3 | Nadow Levanon | Radar Principals | John Wiley and Sons | 1989 |
| R4 | Brookener | Radar Technology | Artech Hons | 1986 |
| R5 | Sen, A.K. & Bhattacharya, A.B. | Radar System and Radar Aids to Navigation | Khanna Publishers | 1988 |

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**19ECE02 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY**

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

**COURSE OBJECTIVES :**

1 To tutor the basics of EMI, EMC
2 To instill knowledge on the EMI coupling mechanism
3 To introduce various mitigation techniques
4 To introduce various EMI standards.
5 To impart comprehensive insight about various EMC test and measurement techniques

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Explain the basic concept of EMI and EMC. |
| CO2 | Explain the EMI coupling mechanism. |
| CO3 | Apply the mitigation techniques, to provide EMI shielding |
| CO4 | Design a system with EMI standards. |
| CO5 | Test the EMI shielding effectiveness. |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | | | | | | | | | | | | | | |
| CO2 | X | | | X | X | | | | | | X | | | | |
| CO3 | X | X | X | X | X | | X | X | | | X | | | X | |
| CO4 | X | X | | X | | X | X | X | | | X | X | X | X | X |
| CO5 | X | X | X | X | X | | X | X | | | X | X | X | X | X |

**COURSE CONTENTS :**

**UNIT I BASIC EMI/EMC THEORY** **9 Hrs**

Introduction to EMI and EMC - Intra and inter system EMI - Elements of Interference - Sources and Victims of EMI, Conducted and Radiated EMI emission and susceptibility - Radiation hazards to humans - EMC Engineering Application.

**UNIT II COUPLING MECHANISM** **9 Hrs**

Electromagnetic field sources and Coupling paths - Coupling via the supply network, Common mode coupling, Differential mode coupling, Impedance coupling, Inductive and Capacitive coupling, Radiative coupling, Ground loop coupling - Cable related emissions and coupling - Transient sources - Automotive transients.

**UNIT III EMI MITIGATION TECHNIQUES** **9 Hrs**

Working principle of Shielding and Murphy's Law - LF Magnetic shielding - Apertures and shielding effectiveness - Choice of Materials for H, E, and free space fields - Gasketting and sealing - PCB Level shielding - Principle of Grounding, Transient protection.

**UNIT IV STANDARDS AND REGULATION** **9 Hrs**

Need for Standards - Generic/General Standards for Residential and Industrial environment - Basic Standards - Product Standards - National and International EMI Standardizing Organizations: IEC, ANSI, FCC, AS/NZS, CISPR, BSI, CENELEC, ACEC and MIL461E Standards.

**UNIT V EMI TEST METHODS AND INSTRUMENTATION** **9 Hrs**

Fundamental considerations - EMI Shielding effectiveness tests - Open field test - TEM cell for immunity test - Shielded chamber , Shielded anechoic chamber, EMI test receivers, Spectrum analyzer, EMI test wave simulators - EMI coupling networks - Line impedance stabilization networks - Feed through capacitors – Antennas - Current probes.

**Total Hours: 45**

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**TEXT BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Clayton Paul | Introduction to Electromagnetic Compatibility | Wiley Interscience | 2006 |
| T2 | V Prasad Kodali | Engineering Electromagnetic Compatibility | IEEE Press, Newyork | 2001 |

**REFERENCE BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Henry W. Ott | Electromagnetic Compatibility Engineering | John Wiley & Sons Inc, Newyork | 2009 |
| R2 | Daryl Gerke and William Kimmel | EDN's Designer's Guide to Electromagnetic Compatibility | Elsevier Science & Technology Books | 2002 |
| R3 | W Scott Bennett | Control and Measurement of Unintentional Electromagnetic Radiation | John Wiley & Sons Inc., | 1997 |
| R4 | Kenneth L Kaise | The Electromagnetic Compatibility Handbook | CRC Press | 2004 |
| R5 | Bernhard Keiser | Principles of Electro-magnetic Compatibility | Artech House | 1987 |

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| 19ECE03 | SENSORS AND TRANSDUCERS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To discuss need of transducers, their classification, advantages and disadvantages.
2 To discuss working of different types of transducers and sensors..
3 To discuss recent trends in sensor technology and their selection.
4 To discuss basics of signal conditioning and signal conditioning equipment.
5 To discuss configuration of Data Acquisition System and data conversion.

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Classify sensors for various application. |
| CO2 | Design a system using various sensors. |
| CO3 | Choose proper sensors for the required application. |
| CO4 | Discuss basics of Pressure and temperature sensors. |
| CO5 | Design a real time project using DAQ system. |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | | | | | | | | | | X | | | | X |
| CO2 | X | X | X | X | | | | | | | X | | X | | X |
| CO3 | X | | | X | X | | | | | | X | | X | | X |
| CO4 | X | | X | | X | | | | | | X | X | X | | X |
| CO5 | X | X | X | X | X | | | | | | X | X | X | X | X |

**COURSE CONTENTS** :

**UNIT I INTRODUCTION** 9 Hrs

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

**UNIT II MOTION, PROXIMITY AND RANGING SENSORS** 9 Hrs

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR). Recent Trends – Smart Pressure Transmitters

**UNIT III FORCE, MAGNETIC AND HEADING SENSORS** 9 Hrs

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

**UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS** 9 Hrs

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

**UNIT V SIGNAL CONDITIONING and DAQ SYSTEMS** 9 Hrs

Introduction, Functions of Signal Conditioning Equipment ,Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

**Total Hours: 45**

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**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Ernest O Doebelin | Measurement Systems – Applications and Design | McGraw-Hill International Edition | 2009 |
| T2 | Sawney A K and Puneet Sawney | A Course in Mechanical Measurements and Instrumentation and Control | 12th edition, Dhanpat Rai & Co, New Delhi | 2013 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Patranabis D | Sensors and Transducers | PHI, New Delhi | 2010 |
| R2 | John Turner and Martyn Hill | Instrumentation for Engineers and Scientists | Oxford Science Publications | 1999 |
| R3 | Richard Zurawski | Industrial Communication Technology Handbook | CRC Press | 2015 |
| R4 | D.V.S. Moorthy | Transducers and Instrumentation | Prentice Hall of India Pvt Ltd | 2007 |
| R5 | Kalsi HS | Electronic Instrumentation | Tata McGraw Hill | 2004 |

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| 19ECE04 | HIGH SPEED NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To have an insight into the various High speed Networks.
2 To understand Queuing Analysis , Queuing Models.
3 To gain knowledge of the TCP , ATM
4 To know the integrated and differentiated services

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Describe various High speed Networks. |
| CO2 | Analyze congestion using Queuing Models.. |
| CO3 | Explain the concept of congestion control. |
| CO4 | Explain integrated and differentiated services |
| CO5 | Describe about Bluetooth protocol stacks. |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | | | | | | x | | | | x |
| CO2 | x | x | x | | x | x | | | | | x | | | | x |
| CO3 | | x | x | | x | x | | | | | x | | | x | x |
| CO4 | | x | x | x | x | | | | | | x | x | | x | x |
| CO5 | | x | x | x | x | x | | | | | x | x | | x | x |

**COURSE CONTENTS** :

**UNIT I HIGH SPEED NETWORKS** 9 Hrs

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL, High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11

**UNIT II CONGESTION AND TRAFFIC MANAGEMENT** 9 Hrs

Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

**UNIT III TCP AND ATM CONGESTION CONTROL** 9 Hrs

TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponentiai RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management.

**UNIT IV INTEGRATED AND DIFFERENTIATED SERVICES** 9 Hrs

Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services

**UNIT V BLUE TOOTH TECHNOLOGY** 9 Hrs

The Blue tooth module – Protocol stack Part I: Antennas – Radio interface – Base band – The Link controller – The Link Manager – The Host controller interface The Blue tooth module – Protocol stack Part II: Logical link control and adaptation protocol – RFCOMM – Service discovery protocol – Wireless access protocol.

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**TEXT BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | William Stallings | High Speed Networks and Internet | Pearson Education | 2002 |
| T2 | Sumit Kasera | ATM Networks | Tata McGraw - Hill | 2002 |

**REFERENCE BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | William Stallings | ISDN and Broadband ISDN with Frame Relay and ATM | Pearson Education | 2002 |
| R2 | Leon Gracia | Communication Networks | Tata McGraw | 2000 |
| R3 | Irvan Pepelnjk, Jim Guichard, Jeff Apcar | MPLS and VPN architecture | Cisco Press | 2003 |
| R4 | Jennifer Bray | Bluetooth | Prentice Hall | 2007 |
| R5 | Behrouz Forouzan | Introduction to Data Communication and Networking | Tata Mc-Graw Hill | 1996 |

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| 19ECE05 | WIRELESS SENSOR NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** : The course should enable the students to:

1 To understand the concepts of wireless sensor networks
2 To understand the MAC protocols for WSN
3 To understand routing and data gathering protocols
4 To get exposure on sensor network security, its platform and tools

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain the architecture and protocol stacks of WSN |
| CO2 | Apply the appropriate MAC layer protocols for WSN |
| CO3 | Apply the appropriate routing and data gathering protocols for WSN |
| CO4 | Explain security issues in WSN |
| CO5 | Design a Wireless Sensor Network |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | | X | X | | | X | | | | | | |
| CO2 | X | X | X | | X | X | | | X | | X | | | X | X |
| CO3 | | X | X | | X | X | | | X | | X | | | X | X |
| CO4 | | X | X | X | X | X | | | X | | X | X | X | X | X |
| CO5 | | X | X | X | X | X | | | X | | X | X | X | X | X |

**COURSE CONTENTS** :

**UNIT I INTRODUCTION TO WIRELESS SENSOR NETWORKS** **9 Hrs**

Introduction, Advantages of Sensor, Applications of Wireless Sensor Networks, WSN Standards, IEEE 802.15.4, Zigbee. Network Architectures and Protocol Stack – Network architectures for WSN, classification of WSN, protocol stack for WSN. Wireless Sensor Technology - Sensor Node Technology, Hardware and Software, Sensor Taxonomy

**UNIT II MEDIUM ACCESS CONTROL PROTOCOLS FOR WIRELESS SENSOR NETWORKS** **9 Hrs**

Fundamentals of MAC Protocols, MAC Protocols for WSNs, Contention-Based protocols: Power Aware Multi-Access with Signaling - Data-Gathering MAC, Contention-Free Protocols: Low- Energy Adaptive Clustering Hierarchy, B-MAC, S-MAC. Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol. Dissemination Protocol for Large Sensor Network.

**UNIT III ROUTING AND DATA GATHERING PROTOCOLS** **9 Hrs**

Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

**UNIT IV SENSOR NETWORK SECURITY** **9 Hrs**

Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.

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**UNIT V SENSOR NETWORK PLATFORMS AND TOOLS** 9 Hrs

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – Tiny OS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM. Programming beyond individual nodes – State centric programming.

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Kazem Sohraby, Daniel Minoli and Taieb Znati | Wireless Sensor Networks Technology, Protocols, and Applications | John Wiley & Sons | 2007 |
| T2 | Holger Karl and Andreas Willig | Protocols and Architectures for Wireless Sensor Networks | John Wiley & Sons, Ltd | 2005 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Jun Zheng, Abbas Jamalipour | Wireless Sensor Networks: A Networking Perspective | Wiley | 2009 |
| R2 | Ian F. Akyildiz, Mehmet Can Vuran | Wireless Sensor Networks | Wiley | 2010 |
| R3 | Ibrahiem M. M. El Emary, S. Ramakrishnan | Wireless Sensor Networks: From Theory to Applications | CRC Press , Taylor & Francis Group | 2013 |
| R4 | Raghavendra, Cauligi S, Sivalingam, Krishna M., ZantiTaieb | Wireless Sensor Network | Springer | 2004 |
| R5 | Feng Zhao, Leonidas Guibas | Wireless Sensor Network | Elsevier | 2004 |

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| 19ECE06 | TELECOMMUNICATION SWITCHING NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** : The course should enable the students to:

1 To understand the concepts of Telecommunication switching systems
2 To acquire knowledge about Telephone networks
3 To understand signaling in Telecommunication switching system.
4 To get exposure on digital switching and ISDN
5 To understand the components of ISDN

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain various Telecommunication switching systems |
| CO2 | Describe the concept of Telephone networks. |
| CO3 | Distinguishing various signaling used in telecommunication switching system. |
| CO4 | Explain digital switching techniques. |
| CO5 | Explain various components of ISDN |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | | | | | | x | | | | x |
| CO2 | | x | x | | x | x | | | | | x | | | | x |
| CO3 | | x | x | | x | x | | | | | x | | | x | x |
| CO4 | x | x | x | x | x | x | | | | | x | x | | x | x |
| CO5 | | x | x | x | x | x | | | | | x | x | | x | x |

**COURSE CONTENTS** :

**UNIT I INTRODUCTION TO TELECOMMUNICATION SWITCHING SYSTEMS** 9 Hrs

Switching system functions, Elements of switching network configuration, stronger switching components, principles of cross bar switching, Electronic space division switching, Time division switching, Combination switching, telephone numbering and Routing, use of Tandem switches in Local area connectivity.

**UNIT II TELEPHONE NETWORKS** 9 Hrs

Subscriber loop systems, switching hierarchy and routing, transmission plan, numbering plan, charging plans.

**UNIT III SIGNALLING IN TELECOMMUNICATION SYSTEMS** 9 Hrs

Introduction, purpose of signaling, in channel signaling, common channel 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, functional signaling, Object-oriented signaling.

**UNIT IV DIGITAL SWITCHING** 9 Hrs

Switching Functions, Space Division Switching, Time Division Switching, two-dimensional Switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Cross-Connect Systems, Digital Switching in an Analog Environment. Elements of SS7 signaling.

**UNIT V INTEGRATED SERVICES DIGITAL NETWORKS** 9 Hrs

Introduction, motivation, ISDN interfaces, functional grouping, reference points, protocol architecture, signaling, numbering, BISDN, DSL Technology: ADSL, Cable Modem, Traditional Cable Networks, HFC Networks, CMTS and DOCSIS. SONET: Devices, Frame, Frame Transmission.

**Total Hours: 45**

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**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Thiagarajan Viswanathan, Manav Bhatnagar | Telecommunication switching system and networks | PHI | 2015 |
| T2 | Wayne Tomasi | Advanced electronic communications systems | PHI | 2004 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | J. Bellamy | Digital telephony | John Wiley | 2001 |
| R2 | J E Flood | Telecommunication switching, Traffic and Networks | Pearson | 2010 |
| R3 | Jyrki T. J. Penttinen | The Telecommunications Handbook: Engineering Guidelines for Fixed, Mobile and Satellite Systems | Wiley | 2015 |
| R4 | Roger L. | Fundamentals of Telecommunications | John Wiley & Sons | 2010 |
| R5 | R.A.Thomson | Telephone switching Systems | Artech House Publishers | 2000 |

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| 19ECE07 | COGNITIVE RADIO NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES :**

1 Provide highly reliable communications whenever and wherever needed and to utilize the radio spectrum efficiently by intelligently exploiting licensed spectrum.
2 To obtain useful information about their surrounding environment with the primary users and the appearance of spectrum holes.
3 Understand the concepts of wireless networks and next generation networks
4 To address the attacks and categorize the attacks according to the layers.
5 To understand the security issues

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Explain the basics of SDR and how it evolves from SDR to Cognitive Radio. |
| CO2 | Identify various spectrum sensing techniques and algorithms. |
| CO3 | Explain the architecture of cognitive radios |
| CO4 | Design a MAC layer Protocol |
| CO5 | Explain security issues and its counter measures in CRN |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | | | | x | | x | | | | x |
| CO2 | x | x | x | | x | | | | x | | x | | | x | x |
| CO3 | | x | x | | x | | | | x | | x | | | | x |
| CO4 | | x | x | x | x | x | | | x | | x | x | | | x |
| CO5 | | x | x | x | x | x | | | x | | x | x | | x | x |

**COURSE CONTENTS :**

**UNIT I INTRODUCTION TO COGNITIVE RADIO** **9 Hrs**

Introduction, Software Defined Radio: Architecture, Digital Signal Processor and SDR Baseband architecture, Reconfigurable, Wireless Communication Systems, Digital Radio Processing, Cognitive Radio: Cognitive radio Framework, Functions , Paradigms of Cognitive Radio.

**UNIT II SPECTRUM SENSING** **9 Hrs**

Introduction, Spectrum Sensing, Multiband Spectrum Sensing, Sensing Techniques, Other algorithms, Comparison, Performance Measure and Design Trade Offs : Receiver operating characteristics, Throughput Performance measure Fundamental limits and trade-offs.

**UNIT III INTRODUCTION TOCOGNITIVE RADIOS** **9 Hrs**

Architecture–Digital Signal Processor and SDR Baseband architecture – Reconfigurable Wireless Communication Systems – Digital Radio Processing –Cognitive Radio: Cognitive radio Framework – Functions – Paradigms of Cognitive Radio

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**UNIT IV MAC PROTOCOLS AND NETWORK LAYER DESIGN** **9 Hrs**

Functionality of MAC protocol in spectrum access, classification, Inter frame spacing and MAC challenges, QOS, Spectrum sharing in CRAHN, CRAHN models, CSMA/CA based MAC protocols for CRAHN, Routing in CRN, Centralized and Distributed protocols, Geographical Protocol.

**UNIT V TRUSTED COGNITIVE RADIO NETWORKS** **9 Hrs**

Trust for CRN: Fundamentals, Models, Effects of Trust Management, Security properties in CRN, Route Disruption attacks, Jamming attacks, PU Emulation attacks.

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**TEXT BOOKS:**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Mohamed Ibnkahla | Cooperative Cognitive Radio Networks:The complete Spectrum Cycle | CRC Press | 2014 |
| T2 | Ahamed Khattab, Dmitri Perkins ,Bagdy Byoumi | Cognitive Radio Networks from Theory to practice | Springer-Verlag New York | 2013 |

**REFERENCE BOOKS:**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Kwang– Cheng Chen and Ramjee Prasad | Cognitive Radio Networks | Wiley Publishing | 2009 |
| R2 | Alexander M.Wyglinski, Maziar Nekovee, ThomasHou | Cognitive Radio Communications and Networks | Elsevier | 2009 |
| R3 | Markus Dillinger, Kambiz Madani, Nancy Alonistioti | Software Defined Radio | John Wiley | 2003 |
| R4 | Huseyin Arslan | Cognitive Radio, SDR and Adaptive System | Springer | 2007 |
| R5 | Alexander M. Wyglinski, Maziarnekovee,Y. Thomas Hu | Cognitive Radio Communication and Networks | Elsevier | 2010 |

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| 19ECE08 | MOBILE ADHOC NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To understand the wireless ad-hoc networks, and their impact on protocol design
2 To develop MAC and routing protocols for mobile ad-hoc networks
3 To develop efficient protocols for mobile ad-hoc networks
4 To gain knowledge on the cross layer Mobile IP networks
5 To understand the cross layer adhoc networks

**COURSE OUTCOMES** :

| | |
|---|---|
| **CO1** | Classify MAC layer routing protocol. |
| **CO2** | Identify the issues and challenges in providing QoS. |
| **CO3** | Explain the energy management schemes of ad-hoc networks. |
| **CO4** | Design a secured Transport layer protocol |
| **CO5** | Design a cross layer Ad hoc network |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | X | | | X | | | | | | X | | | X | |
| CO2 | | X | | | X | | | | | | X | | | X | |
| CO3 | | X | X | X | X | X | | | X | | X | | | X | X |
| CO4 | X | X | X | X | X | X | | | X | | X | X | | X | X |
| CO5 | X | X | X | X | X | X | | | X | | X | X | | X | X |

**COURSE CONTENTS:**

**UNIT I ROUTING** **9 Hrs**

Cellular and Ad hoc wireless networks – Issues of MAC layer and Routing – Proactive, Reactive and Hybrid Routing protocols – Multicast Routing – Tree based and Mesh based protocols – Multicast with Quality of Service Provision.

**UNIT II QUALITY OF SERVICE** **9 Hrs**

Real-time traffic support – Issues and challenges in providing QoS – Classification of QoS Solutions – MAC layer classifications – QoS Aware Routing Protocols – Ticket based and Predictive location based QoS Routing Protocols.

**UNIT III ENERGY MANAGEMENT AD HOC NETWORKS** **9 Hrs**

Need for Energy Management – Classification of Energy Management Schemes Battery Management and Transmission Power Management Schemes – Network Layer and Data Link Layer Solutions – System power Management schemes.

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**UNIT IV** **END-END DELIVERY AND SECURITY** **9 Hrs**

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

**UNIT V** **CROSS LAYER DESIGN AND INTEGRATION OF ADHOC FOR 4G** **9 Hrs**

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of ad hoc with Mobile IP networks.

**TEXT BOOKS:**

| S.No | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | C.Siva Ram Murthy and B.S.Manoj | Ad hoc Wireless Networks Architectures and protocols, 2nd edition | Pearson Education | 2007 |
| T2 | Charles E. Perkins | Ad hoc Networking | Addison – Wesley | 2000 |

**REFERENCE BOOKS:**

| S. No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic | Mobile ad hoc networking | Wiley-IEEE press | 2004 |
| R2 | Mohammad Ilyas, | The handbook of ad hoc wireless networks. | CRC press | 2002 |
| R3 | T. Camp, J. Boleng, and V. Davies | A Survey of Mobility Models for Ad Hoc Network. | | 2002 |
| R4 | Fekri M. Abduljalil and Shrikant K. Bodhe | A survey of integrating IP mobility protocols and Mobile Ad hoc networks. | IEEE communication Survey and tutorials, | 2007 |
| R5 | V.T. Raisinhani and S.Iyer | Cross layer design optimization in wireless protocol stacks. | Comp. communication, Volume 27, Issue 8, Pages 720-724 | 2004 |

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| 19ECE09 | BIO MEDICAL ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To Understand the Human physiology and components of biomedical system
2 To get exposed to electro physiological parameter measurements
3 To get exposed to non-electro physiological parameter measurements
4 To Understand the concept of medical imaging
5 To Understand the principle of operation of Therapeutic equipments

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain the Human physiology and components of biomedical system |
| CO2 | Analyze the electro physiological parameter measurements |
| CO3 | Analyze the non - electro physiological parameter measurements |
| CO4 | Explain the medical imaging and biotelemetry systems |
| CO5 | Explain the principles of operation of Therapeutic equipments |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | | | | | | | | | | x | |
| CO2 | x | x | x | x | | | | | | | | x | | x | |
| CO3 | x | x | x | x | | x | | | | | | x | | x | |
| CO4 | x | x | x | x | x | x | | | | | | x | | x | |
| CO5 | x | x | x | x | x | x | | | | | | x | | x | |

**COURSE CONTENTS** :

**UNIT I PHYSIOLOGY AND TRANSDUCERS** — 9 Hrs

Cell and its structure - Resting and Action Potential - Nervous system: Functional organization of the nervous system - Structure of nervous system, neurons - synapse - transmitters and neural communication - Cardiovascular system - respiratory system , Basic components of a biomedical system .Transducers - selection criteria – Piezo electric, ultrasonic transducers ,Temperature measurements , Fibre optic temperature sensors.

**UNIT II ELECTRO – PHYSIOLOGICAL MEASUREMENTS** — 9 Hrs

Electrodes - Limb electrodes-floating electrodes - pregelled disposable electrodes - micro- needle and surface electrodes - Amplifiers: Preamplifiers- differential amplifiers- chopper amplifiers -Isolation amplifier. Physiological measurements-ECG, EEG, EMG, ERG - Lead systems and recording methods-Typical waveforms. Electrical safety in medical environment: shock hazards-leakage current.

**UNIT III NON-ELECTRICAL PARAMETER MEASUREMENTS** — 9 Hrs

Measurement of blood pressure -Cardiac output -Heart rate-Heart sounds-Pulmonary function measurements – spirometer -Photo Plethysmography- Body Plethysmography-Blood Gas analyzers - pH of blood -measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements.

**UNIT IV MEDICAL IMAGING AND BIOTELEMETRY** — 9 Hrs

Radio graphic and fluoroscopic techniques -Computer tomography-Magnetic Resonance Imaging - Ultrasonography-A mode, B mode ,M mode- Endoscopy-Thermography-Different types of biotelemetry systems and patient monitoring-Wireless Telemetry, single channel, multi channel, multi patient and implantable telemetry systems.

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**UNIT V ASSISTING AND THERAPEUTIC EQUIPMENTS** 9 Hrs

Pacemakers-External and internal pacemakers-Defibrillators-DC defibrillator, implantable defibrillators-Ventilators -Nerve and muscle stimulators -TENS-Surgical diathermy machine, safety aspects in Electro surgical units- Heart Lung machine- Audiometers-Dialysers-Lithotripsy.

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | R.S.Khandpur | Hand Book of Bio-Medical instrumentation | Tata McGraw Hill Publishing Co Ltd | 2004 |
| T2 | Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer | Bio-Medical Instrumentation and Measurements | Pearson Education | 2002 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | M.Arumugam | Bio-Medical Instrumentation | Anuradha Agencies | 2003 |
| R2 | L.A. Geddes and L.E.Baker | Principles of Applied Bio-Medical Instrumentation | John Wiley & Sons | 1975 |
| R3 | J.Webster | Medical Instrumentation | John Wiley & Sons | 1995 |
| R4 | William R Hendee, E. Russell Ritenour | Medical Imaging Physics | John Wiley & Sons | 2002 |
| R5 | Paul Suetens | Fundamentals of Medical Imaging | Cambridge University press | 2009 |

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| 19ECE10 | BIO SIGNAL AND IMAGE PROCESSING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES :**

1. To learn the nature of various biomedical signals and its analysis.
2. To study adaptive filters and their applications in biomedical signal processing.
3. Discuss digital image fundamentals and image Transforms
4. Apply image enhancement Techniques.
5. Apply image restoration and segmentation techniques

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Analyze various bio signals |
| CO2 | Design adaptive filter for bio signal processing |
| CO3 | Discuss digital image fundamentals and image Transforms |
| CO4 | Explain image enhancement techniques |
| CO5 | Analyze filters used for image restoration and segmentation |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | | x | | x | | | | | | x | | | x | |
| CO2 | x | x | | | x | | | | | | x | | | x | |
| CO3 | x | x | x | x | x | | | | | | x | | | x | |
| CO4 | x | x | x | x | x | | | | | | x | x | | x | |
| CO5 | x | x | x | x | | | | | | | x | x | | x | |

**COURSE CONTENTS :**

**UNIT I INTRODUCTION TO BIOMEDICAL SIGNALS:** 9 Hrs

The nature of biomedical signals, the action potential, objectives of biomedical signal analysis. Difficulties in biomedical signal analysis, computer aided diagnosis. Neurological signal processing: The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis. EMG, ERG & EOG signal characteristic and analysis

**UNIT II ADAPTIVE FILTERS:** 9 Hrs

Principle of an adaptive filter, the steepest descent algorithm, adaptive noise canceller, cancellation of 60 Hz interference in electrocardiography, applications of adaptive filters. Canceling donor - heart interference in heart-transplant electrocardiography, Cancellation of ECG signal from the electrical activity of the chest muscles, canceling of maternal ECG in fetal ECG, Cancellation of High frequency noise in Electro – surgery

**UNIT III DIGITAL IMAGE FUNDAMALENT** 9 Hrs

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - color image processing – RGB color model – HSV Color model, Image Transform –DFT –DCT-Walsh Transform-KL Transform

**UNIT IV IMAGE ENHANCEMENT** 9 Hrs

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.

**UNIT V IMAGE RESTORATION AND SEGMENTATION** 9 Hrs

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of

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Discontinuities–Edge Linking and Boundary detection – Region based segmentation-Active Contour model - Morphological processing- erosion, dilation , opening and closing.

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Rafael C. Gonzales, Richard E. Woods | Digital Image Processing. | Pearson education | 2010. |
| T2 | D.C.Reddy | Biomedical Signal Processing- principles and techniques | Tata McGraw-Hill | 2005 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | S.Sridher | Digital Image Processing | Oxford University Press | 2011 |
| R2 | A.K. Jain | Fundamentals of Digital Image Processing. | Prentice Hall India | 1988 |
| R3 | Akay M, | Biomedical Signal Processing | Academic Press | 1994 |
| R4 | Rangaraj M. Rangayyan | Biomedical Signal Analysis | IEEE Press | 2001 |
| R5 | Raghuveer M. Rao and Ajit S. Bopardikar, | Wavelet Transforms | Pearson | 1998 |

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| 19ECE11 | BIO SENSORS AND BIO MEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES :**

1. The components used for various biosensors and biosensor family.
2. The Principle of Different Types of Transducers.
3. The Applications of biosensors in different field.
4. To know about the driving force behind bio-medical applications, soft and hard fabrication techniques.
5. To be able to understand the soft polymers, physical properties etc.,

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Explain various biosensors and their biomolecule ingredients |
| CO2 | Describe the operation of Transducer used in Biosensors |
| CO3 | Select proper Biosensors for the applications such as health care, agriculture and environment |
| CO4 | Explain the biomems fabrication technique. |
| CO5 | Concept of microfluidic sensors and actuators. |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | | x | x | | | x | | | x | | | | | |
| CO2 | x | x | x | x | | | x | | | | | | | | |
| CO3 | x | x | x | x | | | x | | | x | | x | x | | |
| CO4 | x | | x | x | | | | | | x | | x | x | | x |
| CO5 | x | x | x | x | | | | | | x | | x | x | | x |

**COURSE CONTENTS :**

**UNIT I SIGNALS AND SYSTEMS** 9 Hrs

**INTRODUCTION:** Biosensors, Advantages and limitations, various components of biosensors, the growing of biosensor. The biosensor family, the biomolecule ingredients, proteins, enzymes complexes, enzymes kinetics, the proteins of the immune systems.

**UNIT II TRANSDUCERS IN BIOSENSORS:** 9 Hrs

Various types of transducers; principles and applications - Calorimetric, optical, potentiometric / amperometric conductrometric / resistormetric, piezoelectric, semiconductor, impedimetric, mechanical and molecular electronics based transducers. Chemiluminescences - based biosensors.

**UNIT III APPLICATION AND USES OF BIOSENSORS:** 9 Hrs

Biosensors in clinical chemistry, medicine and health care, biosensors for veterinary, agriculture and food. Biosensors for personal diabetes management, application of biosensors to environmental samples. Biochips and their application to genomics.

**UNIT IV INTRODUCTION TO BIOMEMS** 9Hrs

The driving force behind biomedical applications, bio-compatiability, Silicon fabrication: Hard fabrication considerations, lithography, etching techniques, Thin film deposition process, ion implantation, substrate bonding introduction, Biomaterials, soft lithography, micromolding, smart polymers & hydrogels, nanomedicine, thick film technologies, polymers, physical properties, copolymers

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**UNIT V** **MICROFLUIDIC PRINCIPLES & SENSORS:** 9Hrs

Introduction, transport process, electrokinetic phenomena, microvalves, micromixers, micropumps, sensor principles & microsensors: Introduction, fabrication, basic sensors, optical fibres, piezoelectricity, SAW devices, electrochemical detection, applications to medicine.

**Total Hours: 45**

**TEXT BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Graham Ramsay, | Commercial Biosensors, | John Wiley and son, | 1998 |
| T2 | Steven Salitreman, | Fundamentals of BioMEMS & Medical Microdevices, | Cengage Learning India | 2006 |

**REFERENCE BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Alert Berg, | Miniaturized systems for chemical analysis & synthesis | Elsevier | 2003 |
| R2 | Murthy D V S. | Transducers and Instrumentation, | Prentice Hal | 1995 |
| R3 | Mauro Ferrari | Biomems and Biomedical Nanotechnology | Springer | 2006 |
| R4 | Albert Folch | Introduction to BioMEMS | CRC Press | 2003 |
| R5 | Steven S.Saliterman | Fundamental of BioMEMS and Microdrvices | SPIE Press | 2005 |

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| 19ECE12 | PATTERN RECOGNITION AND AI TECHNIQUES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

1. To understand the concepts of random process and pattern Recognition
2. To gain knowledge on biological neuron and analogy to the artificial neuron model
3. To have basic knowledge in the fundamental concepts of Artificial Intelligence
4. To have a thorough understanding about the agent design.
5. To understand problem solving, planning and learning methods of Artificial Intelligence

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Apply statistical decision making for Pattern Recognition |
| CO2 | Explain the concepts of artificial intelligence and neural network |
| CO3 | Explain problem solving techniques using AI |
| CO4 | Ability to apply problem solving methods to solve engineering problems |
| CO5 | Choose proper planning method for Pattern Recognition |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | | | | | | | | | x | | | x | |
| CO2 | x | | x | x | x | | | | | | x | | | x | |
| CO3 | x | x | | | x | | | | | | x | | | x | |
| CO4 | x | | x | x | x | | | | | | x | x | | x | |
| CO5 | x | x | x | x | x | | | | | | x | x | | x | |

**COURSE CONTENTS** :

**UNIT I INTRODUCTION TO PATTERN RECOGNITION** 9 Hrs

**Random Variables-**Binomial distribution, Poission distribution Continuous Random variables uniform density, exponential density, normal density

**Statistical Decision Making:** Introduction, Bayes' theorem, multiple features, conditionally independent features, Decision boundaries: Two Dimensional decision boundaries

**Clustering:** Introduction, Hierarchical clustering-agglomerative, single linkage, average linkage, ward's method. Partitional clustering-Forgy's, k-means,

**UNIT II ARTIFICIAL NEURAL NETWORK** 9 Hrs

Biological Neural Network introduction to artificial neural network, model of a neuron, Types of activation function, neural networks viewed as directed graphs, architectural graph of a neuron with feedback, Network Architectures, Artificial intelligence and Neural Networks. Back propagation Neural Network

**UNIT III INTRODUCTION AND PROBLEM SOLVING** 9 Hrs

Definition of AI-Intelligent Agents- Problem Solving-Searching-Uninformed and Informed Search Strategies-Heuristic Search-Constraint Satisfaction Problems-Game Playing.

**UNIT IV KNOWLEDGE REPRESENTATION AND REASONING** 9 Hrs

First order logic- Syntax and Semantics of FOL- Using FOL - Inference in FOL- Reasoning: Unification and Lifting – Forward Chaining - Backward Chaining- Resolution.

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**UNIT V PLANNING** 9 Hrs

Planning- Representation for planning-Partial order planning-Conditional planning- Execution monitoring and Re planning – Continuous Planning – Multi-Agent Planning.

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Earl Gose, Richard Johnsonbaugh Steve Jost, | Pattern Recognition & Image Analysis, | Prentice Hall of India | 2002 |
| T2 | Stuart Russel and Peter Norvig | Artificial Intelligence-A Modern Approach | Second Edition Prentice Hall International | 2010 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | B Yegnanarayana, | Artificial Neural Networks, | PHI | 2001 |
| R2 | Satish Kumar, | Neural Networks | Tata Megraw-hill | 2009 |
| R3 | Elain Rich and Kevin Knight | Artificial Intelligence | Tata McGraw Hill | 2003 |
| R4 | Nils J.Nilsson | Artificial Intelligence - A New Synthesis | Harcourt Asia PTE Ltd, Morgan Kaufmann | 2003 |
| R5 | Patrick Henry Winston | Artificial Intelligence | Addison Wesley | 2004 |

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| 19ECE13 | SOFT COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To provide adequate knowledge about neural networks
2 To teach about the concept of fuzzy involved in various systems
3 To provide adequate knowledge about genetic algorithm
4 To gain knowledge on Hybrid Computing Techniques
5 To provide adequate knowledge to modeling the system

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Describe basics of ANN and its learning algorithms |
| CO2 | Explain the Fuzzy logic concept |
| CO3 | Differentiate the Traditional algorithms and Genetic algorithms |
| CO4 | Develop hybrid Computing Techniques |
| CO5 | Solve the real time problems with MATLAB tool box |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | | | | | | | | | x | | | x | |
| CO2 | x | x | | | x | | | | | | x | | | x | |
| CO3 | x | x | | x | x | | | | | | x | | | x | x |
| CO4 | x | x | x | x | x | | | | | | x | x | | x | x |
| CO5 | x | x | x | x | x | | | | | | x | x | | x | x |

**COURSE CONTENTS** :

**UNIT I INTRODUCTION TO SOFT COMPUTING** 9 Hrs

Soft Computing Constituents-From Conventional AI to Computational Intelligence- Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks - basic models - important technologies - applications.

**UNIT II BASIC CONCEPTS OF FUZZY LOGIC** 9 Hrs

Introduction to fuzzy logic, Classical sets and Fuzzy sets, Fuzzy relations, Membership function: Features of membership function, Fuzzification, Methods of membership value assignments- Fuzzy rules and reasoning: Fuzzy if-then rules. Fuzzy Inference Systems (FIS): Introduction– Methods of FIS: Mamdani, Sugeno and Tsukamoto. Defuzzification: Lambda-Cuts for fuzzy sets and fuzzy relations, Defuzzification methods.

**UNIT III GENETIC ALGORITHM AND SEARCH SPACE** 9 Hrs

General genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multilevel optimization – real life problem- advances in GA.

**UNIT IV HYBRID SOFT COMPUTING TECHNIQUES** 9 Hrs

Hybrid systems – Neuro Fuzzy – Neuro Genetic – fuzzy Genetic hybrids- GA based weight determination and applications- fuzzy BPN – simplified fuzzy ARTMAP.

**UNIT V PROGRAMMING AND APPLICATIONS** 9 Hrs

Using Neural Network toolbox – Using Fuzzy Logic toolbox- Using Genetic Algorithm & directed search toolbox. Application: Printed Character Recognition, Optimization of travelling salesman problem using genetic algorithm approach.

**Total Hours:** 45

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**TEXT BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | S.N.Sivanandam, S.N.Deepa, | Principles of Soft Computing - I | Wiley | 2014 |
| T2 | Rajasekaran.S and VijayalakshmiPai.G.A | Neural Networks, Fuzzy Logic and Genetic Algorithms | PHI | 2011 |

**REFERENCE BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Timothy J.Ross | Fuzzy Logic with Engineering applications | John Wiley and Sons | 2010 |
| R2 | Davis E.Goldberg | Genetic Algorithms: Search, Optimization and Machine Learning | Addison Wesley, N.Y. | 1989 |
| R3 | Samir Roy, Udit Chakraborty | Introduction to Soft Computing Neuro Fuzzy and Genetic Algorithms | Pearson. | 2013 |
| R4 | J.S.R.Jang, C.T.Sun, E.Mizutani | Neuro – Fuzzy and Soft Computing | PHI Learning Pvt. Ltd.. | 2012 |
| R5 | G.J.Klir and B.Yuan | Fuzzy Sets and Fuzzy Logic: Theory and Applications | PHI | 1995 |

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| 19ECE14 | WIRELESS COMMUNICATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** : The course should enable the students to:

1 Introduce the concepts of wireless / mobile communication using cellular environment.
2 Know about the various propagation models, coding.
3 Understand multi access techniques used in the mobile communication.
4 To introduce various wireless network systems and standards.
5 Know wireless system and its standards

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Test the wireless communication systems |
| CO2 | Apply the concepts of mobile radio propagation models |
| CO3 | Show the design parameters for base and mobile stations |
| CO4 | Identify Multiple access techniques. |
| CO5 | Use the latest wireless technologies and standards |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | | | | x | | | | | | | | x | x |
| CO2 | x | x | | | | | | | | | | | | x | x |
| CO3 | | x | x | x | x | x | | | | | x | | | x | x |
| CO4 | | x | x | x | x | x | | | | | x | x | x | x | x |
| CO5 | | | x | | | x | | | | | x | x | x | x | x |

**COURSE CONTENTS** :

**UNIT I INTRODUCTION TO WIRELESS COMMUNICATION** 9 Hrs

History and evolution of mobile radio communication-Mobile radio systems around the world-Examples of wireless communication-Generations – Frequency reuse – Channel Assignment strategies – Handoff strategies – Interference- Trucking and Grade of service-Improving Coverage and capacity of cellular system

**UNIT II MOBILE RADIO PROPAGATION** 9 Hrs

Radio wave propagation-Free space propagation model – Basic propagation mechanism-Ground reflection model-Knife edge diffraction model-radar cross section model-Practical Link budget design. Indoor and outdoor propagation model.

**UNIT III FADING AND DESIGN PARAMETERS OF BASE AND MOBILE STATION** 9 Hrs

Fading. Multipath propagation. Statistical characterization of multipath fading. Diversity Techniques. Design parameters at the base station: Antenna Location-Spacing-height configuration. Design parameters at the Mobile unit: Directional antennas -Antenna Connection and Location

**UNIT IV MULTIPLE ACCESS SCHEMES** 9 Hrs

Operation principle and working of FDMA-TDMA-CDMA-WCDMA-OFDM -MC-CDMA –SDMA and its comparison

**UNIT V WIRELESS SYSTEMS AND STANDARDS** 9 Hrs

GSM, CDMA - 3G-4G (LTE) - NFC systems-WLAN technology- WLL- Ad hoc networks- Bluetooth-WIFI

**Total Hours: 45**

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**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Andrea Goldsmith | Wireless Communications | Cambridge University Press | 2007 |
| T2 | T.S.Rappaport | Wireless Communications: Principles and Practice | Prentice Hall of India, Third Indian Reprint | 2003 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | P. Muthu Chidambara Nathan | Wireless Communications | PHI, 1st edition | 2008 |
| R2 | Goldsmith | Wireless Communications | Cambridge University Press | 2005 |
| R3 | R. Blake | Wireless Communication Technology | Thomson Delmar, | 2000 |
| R4 | W.C.Y.Lee | Mobile Communications Engineering: Theory and applications | McGraw-Hill International | 1998 |
| R5 | W.C.Y.Lee | Mobile Communication Design Fundamentals | , John Wiley & sons | 1993 |

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| 19ECE15 | SATELLITE COMMUNICATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** : The course should enable the students to:

1 Introduce the basic concept of Satellite Communication.
2 Elaborate the concept and various features of Satellite communication link design model and parameters.
3 Understand Satellite Access Techniques
4 Study on various applications and services of Satellite Communication.
5 Gain knowledge on services rendered by satellite

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain the basic concepts of orbit mechanics and satellite Launching |
| CO2 | Describe about link design between earth station and satellite |
| CO3 | Explain the basic concepts of earth station technology |
| CO4 | Classify various access methods in space segment |
| CO5 | Describe the services rendered by the satellite and its future applications |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | X | X | | | | X | | | | X | X | |
| CO2 | X | X | X | X | X | | X | | X | | | | X | X | X |
| CO3 | X | X | X | X | X | X | X | X | X | | X | | X | X | X |
| CO4 | X | | X | X | X | X | X | X | | | X | X | X | X | X |
| CO5 | X | | X | X | X | X | X | X | X | | X | X | X | X | X |

**COURSE CONTENTS** :

**UNIT I INTRODUCTION TO SATELLITE COMMUNICATION** 9 Hrs

Orbital mechanisms: Origin and Brief History - Basic laws (Kepler's law & Newton's law), Orbital mechanics: Equation of Orbit- Geostationary Orbit- Location of Satellite in Orbit- Orbital Elements, Orbital Perturbations, Look Angle Determination: Elevation and Azimuthal Calculation, Launching Techniques. Satellite subsystems: Attitude and orbit control subsystem, power subsystem, telemetry tracking and command systems, communication subsystems

**UNIT II SATELLITE LINK DESIGN** 9 Hrs

Basic transmission theory, Equivalent isotropic radiated power – Transmission losses – Free-space transmission – Feeder losses – Antenna misalignment losses – Fixed atmospheric and ionospheric losses – Link power budget equation, System Noise: Noise Temperature and Noise Figure – G/T Ratio, Downlink and uplink system design, Design of satellite links for specified C/N.

**UNIT III EARTH SEGMENT** 9 Hrs

Introduction – Receive – Only home TV systems – Outdoor unit – Indoor unit for analog (FM) TV, Master antenna TV system, Community antenna TV system, transmit – Receive earth stations

**UNIT IV SATELLITE ACCESS** 9 Hrs

Analog – digital transmission system- Modulation and Multiplexing, Digital video Broadcast, Types of multiple access: FDMA concepts - Inter modulation and back off - SPADE system- TDMA concept - frame and burst structure - CDMA concept, Comparison of multiple access schemes

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**UNIT V SATELLITE APPLICATIONS** **9 Hrs**

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS) - Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- World space services, Business TV(BTV), GRAMSAT. Specialized services – E –mail, Video conferencing, Internet.

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Dennis Roddy | Satellite Communication | McGraw Hill, | 2006 |
| T2 | Pratt and Bostian | Satellite Communication | John Wiley and Sons | 2007 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Tri. T. Ha | Digital satellite communication system | McGraw Hill | 1990 |
| R2 | Pritchend and Sciulli | Satellite communication systems engineering | PHI Learning | 1986 |
| R3 | Robert M. Gagliendi | Satellite communication | John Wiley and Sons | 1988 |
| R4 | M. Richharia | Satellite communication system design and analysis | Mc-Millan | 1996 |
| R5 | Agarwal, B.N. | Design of Geo Synchronous Space Craft | Prentice Hall | 1986 |

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| 19ECE16 | OPTICAL FIBER COMMUNICATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To introduce the optical fiber transmission link, various optical fiber modes, configurations and structures.
2 To understand the signal degradation factors and fiber Connection.
3 To learn the various optical source, optical receivers
4 To understand the optical fiber measurements and OTDR
5 To discuss basic optical networks and its associated parameters.

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Identify the optical fiber modes. |
| CO2 | Select the optical fibers based on signal degradation factors. |
| CO3 | Identify the optical sources and detectors. |
| CO4 | Examine the optical fiber measurements. |
| CO5 | Identify the optical networks based on system performances. |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | | | | | | | | | | X | | | | |
| CO2 | X | X | X | | | | | | | | X | | X | X | |
| CO3 | X | X | X | | | | | | | | X | | X | X | |
| CO4 | X | X | | X | X | | | | | | X | X | X | X | X |
| CO5 | X | X | X | X | X | | | | | | X | X | | X | X |

**COURSE CONTENTS** :

**UNIT I OVERVIEW OF OPTICAL FIBER COMMUNICATION AND OPTICAL FIBERS** 9 Hrs

Historical development - Elements of Optical Fiber Systems – Basic Optical Laws and Definitions – Optical Fiber Modes and Configurations – Mode Theory for Circular Waveguides – Single Mode Fibers – Graded Index Fiber Structure – Fiber Materials – Fiber Fabrication – Fiber Optic Cables.

**UNIT II SIGNAL DEGRADATION AND CONNECTION OF OPTICAL FIBERS** 9 Hrs

Attenuation : Absorption, Scattering Losses, Bending Losses, Core and Cladding Losses - Signal Distortion in Fibers - Characteristics of Single Mode Fibers – Fiber to Fiber Joints - Fiber splices - Fiber connectors - Fiber couplers - Optical isolators and circulators.

**UNIT III OPTICAL SOURCES AND OPTICAL DETECTORS** 9 Hrs

Light Emitting Diodes – Laser Diodes - Power Launching and Coupling : Source to fiber power Launching – Lensing Scheme for Coupling Improvement – PIN Photodiodes , Avalanche Photodiodes – Photodetector Noise – Detector Response Time – Fundamental Receiver Operation - Optical amplifiers - Optical regeneration

**UNIT IV OPTICAL FIBER MEASUREMENTS** 9 Hrs

Fiber attenuation measurements - Fiber dispersion measurements - Fiber refractive index profile measurements - Fiber cutoff wavelength measurements - Fiber numerical aperture measurements – Fiber diameter measurements - Mode-field diameter for single-mode fiber - Optical Power Measurement - OTDR

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

Basic Networks – SONET / SDH – Operational Principles of WDM - WDM Networks –Wavelength Routed Networks – Optical Ethernet- Nonlinear effects on Network performance – Link Power budget -Rise time budget- Noise Effects on System Performance – Solutions – Optical CDMA – Ultra High Capacity Networks.

**Total Hours: 45**

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**TEXT BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Gerd Keiser | Optical Fiber Communication | Mc Graw -Hill | 2010 |
| T2 | John M. Senior | Optical Fiber Communication | Pearson Education | 2009 |

**REFERENCE BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Govind P.Agrawal | Fiber Optic Communication Systems | John Wiley & Sons | 2004 |
| R2 | Joseph C Patios | Fiber Optical Communications | Prentice Hall International | 2004 |
| R3 | Rajiv Ramasamy & Kumar N.Sivarajan | Optical Networks- A Practical Perspective | Morgan Kauffman | 2002 |
| R4 | Uyless Black | Optical Networks- Third Generation Transport Systems | Pearson Education | 2002 |
| R5 | John Gowar | Optic Communication Systems | Prentice Hall | 1993 |

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| 19ECE17 | ARTIFICIAL INTELIGENCE AND MACHINE LEARNING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES :**

1. To have basic knowledge in the fundamental concepts of Artificial Intelligence, applications of Artificial Intelligence.
2. To have a thorough understanding about the agent design.
3. To understand problem solving, knowledge representation, planning and learning methods of Artificial Intelligence and learning methods of Artificial Intelligence
4. To understand the machine learning theory
5. To implement linear and non-linear learning models

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Identify problem solving methods in AI |
| CO2 | Apply problem solving methods to engineering domains |
| CO3 | Apply problem solving methods to solve computational problems. |
| CO4 | Identify various machine learning theories |
| CO5 | Implement linear and non-linear learning models |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | | x | | x | | | | | | x | | | | |
| CO2 | x | | x | | x | | | | | | x | | | | x |
| CO3 | | x | x | x | x | | | | | | x | x | | x | x |
| CO4 | | x | x | x | x | | | | | | x | x | | x | x |
| CO5 | | x | x | x | x | | | | | | x | x | | x | x |

**COURSE CONTENTS :**

**UNIT I INTRODUCTION AND PROBLEM SOLVING** 9 Hrs

Definition of AI-Intelligent Agents- Problem Solving-Searching-Uninformed and Informed Search Strategies-Heuristic Search-Constraint Satisfaction Problems-Game Playing.

**UNIT II KNOWLEDGE REPRESENTATION AND REASONING** 9 Hrs

First order logic- Syntax and Semantics of FOL- Using FOL - Inference in FOL- Reasoning: Unification and Lifting – Forward Chaining - Backward Chaining- Resolution.

**UNIT III PLANNING** 9 Hrs

Planning- Representation for planning-Partial order planning-Conditional planning- Execution monitoring and Re planning – Continuous Planning – Multi-Agent Planning.

**UNIT IV FOUNDATIONS OF LEARNING** 9 Hrs

Components of learning – learning models – geometric models – probabilistic models – logic models – grouping and grading – learning versus design – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization – generalization bound – approximation generalization tradeoff – bias and variance – learning curve

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**UNIT-V LINEAR MODELS** **9 Hrs**

Linear classification – univariate linear regression – multivariate linear regression – regularized regression – Logistic regression – perceptrons – multilayer neural networks – learning neural networks structures – support vector machines – soft margin SVM – going beyond linearity – generalization and overfitting – regularization – validation

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | P. Flach | Machine Learning: The art and science of algorithms that make sense of data | Cambridge University Press | 2012 |
| T2 | Stuart Russel and Peter Norvig | Artificial Intelligence-A Modern Approach | Prentice Hall International | 2010 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | D. Barber | Bayesian Reasoning and Machine Learning | Cambridge University Press | 2012 |
| R2 | S.Russel and P. Norvig | Artificial Intelligence: A Modern Approach | Prentice Hall | 2009 |
| R3 | Elain Rich and Kevin Knight | Artificial Intelligence | Tata McGraw Hill | 2003 |
| R4 | Nils J.Nilsson | Artificial Intelligence - A New Synthesis | Harcourt Asia PTE Ltd, Morgan Kaufmann | 2003 |
| R5 | Patrick Henry Winston | Artificial Intelligence | Addison Wesley | 2004 |

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| 19ECE18 | OPTOELECTRONIC DEVICES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To know the basics of solid state physics and understand the nature and characteristics of light.
2 To understand different methods of luminescence, display devices and laser types and their applications.
3 To learn the principle of optical detection mechanism in different detection devices.
4 To understand different light modulation techniques and the concepts and applications of optical switching
5 To study the integration process and application of opto electronic integrated circuits in transmitters and receivers.

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Review Solid state semiconductor physics. |
| CO2 | Test the display devices and Lasers. |
| CO3 | Identify different optical detection devices. |
| CO4 | Construct optoelectronic modulators |
| CO5 | Design the optoelectronic integrated circuits |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | | | | | | | | | | | x | | |
| CO2 | x | x | x | x | | | | | | | x | | x | | |
| CO3 | x | x | x | x | | | | | | | x | | x | | x |
| CO4 | x | x | x | x | x | | | | | | x | x | x | x | x |
| CO5 | x | x | x | x | x | | | | | | x | x | x | x | x |

**COURSE CONTENTS** :

**UNIT I ELEMENTS OF LIGHT AND SOLID STATE PHYSICS** 9 Hrs

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 Hrs

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 AND DETECTORS** 9 Hrs

Principle and operation of Photo detector, Thermal detector, Photo Devices, Principle and operation of Photo Conductors, Principle and operation of Photo diodes, Detector Performance, details of the basic physics and operation of solar cells.
Detectors: Photoconductors, photo diodes, PIN , APD ,Photo transistors, solar cells, CCDs, IR and UV detectors

**UNIT IV OPTOELECTRONIC MODULATORS AND SWITCHING DEVICES** 9 Hrs

Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acousto-optic devices, Optical, Switching and Logic Devices, the operation of quantum well electro-absorption modulators and electro-optic modulators

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**UNIT V OPTOELECTRONIC INTEGRATED CIRCUITS** **9 Hrs**

Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices. Designs, demonstrations and projects related to optoelectronic device phenomena.

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Jasprit Singh | Opto Electronics – As Introduction to materials and devices | McGraw-Hill International Edition | 1998 |
| T2 | Bhattacharya | Semiconductor Opto Electronic Devices | Prentice Hall of India Pvt., Ltd., New Delhi | 1995 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | J. Wilson and J.Haukes | Opto Electronics – An Introduction | Prentice Hall of India Pvt., Ltd., New Delhi | 1995 |
| R2 | Xun Li | Optoelectronic Devices: Design, Modeling, and Simulation | Cambridge University Press | 2009 |
| R3 | Tamir T. Grifel and Henry L. Bertoni | Guided wave opto-electronics: Device characterization, analysis and design | Plenium Press | 1995 |
| R4 | S.C Gupta | Optoelectronic Devices and systems | Prentice Hall of India Pvt., Ltd., New Delhi | 2005 |
| R5 | A. K. Ganguly | Optoelectronic Devices and Circuits: Theory and Applications | Alpha Science International Ltd | 2007 |

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| 19ECE19 | NANOELECTRONICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** : The course should enable the students to:

1 Understand the basic concepts involve in this technology for device architecture and interface engineering at atomic.
2 Give a general introduction to different types of conventional and novel nanoelectronic devices
3 Demonstrate how simulation can facilitate learning of fabrication process.
4 Know the functions of microscopy and Spectroscopy.
5 Understand the operation of microscopy and spectroscopy equipments

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Describe the various properties of nanomaterials and materials structure. |
| CO2 | Explain the principles of quantum transport technique and its classification. |
| CO3 | Explain the characteristics of nanoelectronics devices and circuits. |
| CO4 | Describe the nanofabrication processes. |
| CO5 | Demonstrate various microscopy and spectroscopy equipments. |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | | | | | | | | | | | | x | | x |
| CO2 | x | | | | x | | | | | | | | | | |
| CO3 | x | x | x | | x | | | | | | x | | x | | x |
| CO4 | x | x | x | x | x | | | | | | | | | | |
| CO5 | x | x | x | x | x | | | | | | x | | | | |

**COURSE CONTENTS** :

**UNIT I MATERIAL PROPERTIES** **9 Hrs**

Introduction – Crystal, Lattice and Unit Cell – Milier Index – Surface Reconstruction – Reciprocal Space – Schrodinger Equation – Electrostatics – Real Space Basis Set – Orbital Space Basis Set – Band Structure.

**UNIT II QUANTUM TRANSPORT** **9 Hrs**

Wave Function Approach – Landauer's Approach – Fermi's Function – Quantum Mechanical Transmission – Density of States – Green's Function – Self Energy – Coherent Transport – Incoherent Transport – Self Consistent Mean Field Transport – Beyond Mean Field Transport.

**UNIT III DEVICES AND CIRCUITS** **9 Hrs**

Charge Based Devices: Pn-Junction Diode – Zener Diode – Field Effect Transistor: MOSFET, CMOS, Trigate FET, FinFET – Resonant Tunneling Diode; Spin Based Devices: Ferromagnetic Materials – Giant Magnetoresistance Devices – Magnetic Tunneling Devices – Spin Transfer Torque Devices – Memories – Circuits and Systems: Combinational and Sequential.

**UNIT IV NANOFABRICATION** **9 Hrs**

Chemical Safety and Environmental Protection – Substrate – Oxidation and Annealing – Photolithography – Electron Beam Lithography – Nanoimprint Lithography – Physical Vapor Deposition – Chemical Vapor Deposition – Molecular Beam Epitaxy – Atomic Layer Deposition – Etching.

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**UNIT V MICROSCOPY AND SPECTROSCOPY** **9 Hrs**

Scanning Probe Microscopy – Electron Microscopy – Optical Microscopy – Photoemission Spectroscopy – Photo Spectroscopy – Electron Spectroscopy.

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Hassan Raza | Nanoelectronics Fundamentals: Materials, Devices and Systems | Springer International Publishing | 2019 |
| T2 | Karl Goser Peter Glösekötter Jan Dienstuhl | Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices | Springer, Berlin, Heidelberg | 2004 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Shunri Oda, David Ferry | Silicon Nanoelectronics | CRC | 2006 |
| R2 | Wolfgang Fahrner | Nanotechnology and Nanoelectronics: Materials, Devices, Measurement Techniques | Springer | 2005 |
| R3 | Robert Puers, Livio Baldi, Sebastiaan E. van Nooten, Marcel Van de Voorde | Nanoelectronics: Materials, Devices, Applications | Wiley | 2017 |
| R4 | Brajesh Kumar Kaushik | Nanoelectronics: Devices, Circuits and Systems | Elsevier | 2018 |
| R5 | Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio | Introduction to Nanoelectronics Science, Nanotechnology, Engineering, and Applications | Cambridge Press | 2012 |

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| 19ECE20 | ASIC DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To acquire knowledge about various logics of ASICS and CMOS.
2 To acquire knowledge about different types of ASICs design.
3 To study about various types of Programmable ASICs architectures
4 To study about various types of Programmable ASICs interconnects.
5 To understand the concept of floor planning and routing

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain different types of ASICs design rules |
| CO2 | Explain Logic cell architecture and interconnects. |
| CO3 | Design simple logic circuits using ASIC design software |
| CO4 | Explain various ASIC architectures. |
| CO5 | Explain the process of floor planning and routing |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | X | | X | | | | | | X | | X | X | X |
| CO2 | X | X | X | | X | | | | | | X | X | X | X | X |
| CO3 | X | X | X | | X | | | | | | X | X | X | X | X |
| CO4 | X | X | X | | | | | | | | X | X | X | | |
| CO5 | X | X | X | | X | | | | | | X | | X | | |

**COURSE CONTENTS** :

**UNIT I** **INTRODUCTION TO ASICS, CMOS LOGIC, ASIC LIBRARY DESIGN** **9 Hrs**

Types of ASICs - Design flow –CMOS transistors-CMOS Design rules –Combinational logic Cell Sequential logic cell -Transistor as Resistors -Transistor parasitic capacitance –Logical effort -Library cell design –Library architecture-gate array design-standard cell design-data path cell design.

**UNIT II** **PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS** **9 Hrs**

Static RAM -EPROM and EEPROM technology -PREP benchmarks -Actel ACT -Xilinx LCA –Altera FLEX - Altera MAX-DC & AC inputs and outputs –clock input-power input -Xilinx I/O blocks.

**UNIT III** **PROGRAMMABLE ASIC DESIGN SOFTWARE AND LOW LEVEL DESIGN ENTRY** **9 Hrs**

Xilinx LCA -Xilinx EPLD -Altera MAX 5000 and 7000 -Altera MAX 9000 -Altera FLEX –Design systems -Logic Synthesis -Half gate ASIC -Low level design language -PLA tools EDIF-CFI design representation.

**UNIT IV** **ASIC CONSTRUCTION** **9 Hrs**

Performance metric, Flash architecture, Pipelined Architecture, Successive approximation architecture, Time interleaved architecture.

**UNIT V** **FLOOR PLANNING, PLACEMENT AND ROUTING** **9 Hrs**

Floor planning –placement-physical design flow-information formats-Routing-Global routing, detailed routing, special routing.

**Total Hours: 45**

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**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | M.J.S. Smith | Application Specific Integrated Circuits | Pearson Education | 2008 |
| T2 | N. Westle & K. Eshraghian ,Addison – | Principles of CMOS VLSI Design : A System Perspective | Wesley Pub.Co | .1985 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Douglas A. Pucknell & Kamran Eshraghian, | Basic VLSI Design :Systems and Circuits | Prentice Hall of India Private Ltd. , New Delhi , | 1989 |
| R2 | Farzad Nekoogar and Faranak Nekoogar | From ASICs to SOCs: A Practical Approach | Prentice Hall PTR | 2003 |
| R3 | Wayne Wolf | FPGA - Based System Design | Prentice Hall PTR | 2009 |
| R4 | Wai-Kai Chen | Memory, Microprocessor, and ASIC | Prentice Hall | 2006 |
| R5 | Khosrow Golshan | Physical Design Essentials: An Asic Design Implementation Perspective | Prentice Hall | 2007 |

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| 19ECE21 | LOW POWER VLSI DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES :**

1 To understand different sources of power dissipation in CMOS & MIS structure.
2 To understand the different types of low power adders and multipliers.
3 To focus on synthesis of different level low power transforms.
4 To gain knowledge on power estimation techniques.
5 To understand synthesis for low power

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Explain different source of power dissipation and the factors involved in it |
| CO2 | Discuss the power optimization techniques used in adder and multiplier circuit |
| CO3 | Design low power circuits |
| CO4 | Analyze power consumption in VLSI circuits. |
| CO5 | Use software tools for designing low power circuits |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | | | | | | x | | x | | |
| CO2 | x | x | x | x | x | | | | | | x | | x | x | x |
| CO3 | x | x | x | x | x | | | | | | x | | x | x | x |
| CO4 | x | x | x | | x | | | | | | x | x | x | | |
| CO5 | x | x | x | x | x | | | | | | x | x | x | x | x |

**COURSE CONTENTS :**

**UNIT I POWER DISSIPATION** **9 Hrs**

Hierarchy of limits of power – Sources of power consumption – Physics of power dissipation in CMOS FET devices – Basic principle of low power design. Power dissipation in Domino CMOS- Low power VLSI design limits.

**UNIT II POWER OPTIMIZATION** **9 Hrs**

Logic level power optimization – Circuit level low power design – circuit techniques for reducing power consumption in adders and multipliers.

**UNIT III DESIGN OF LOW POWER CIRCUITS** **9 Hrs**

Computer arithmetic techniques for low power system – reducing power consumption in memories – low power clock, Inter connect and layout design – Advanced techniques –Special techniques.

**UNIT IV POWER ESTIMATION** **9 Hrs**

Power Estimation technique – logic power estimation – Simulation power analysis –Probabilistic power analysis. - Signal probability calculation.

**UNIT V SYNTHESIS AND SOFTWARE DESIGN** **9 Hrs**

Synthesis for low power – Behavioral level transform – software design for low power overlap and digital correction.

**Total Hours: 45**

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**TEXT BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Kaushik Roy and S.C.Prasad | Low power CMOS VLSI circuit design | Wiley | 2000 |
| T2 | Kiat Seng Yeo, Kaushik Roy, 2004 | Low voltage, low power VLSI sub systems | Tata McGraw Hill | 2004 |

**REFERENCE BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Gray Yeap. , , | Practical low power digital VLSI design | Springer | 1998 |
| R2 | Dimitrios Soudris, Christians Pignet, Costas Goutis | Designing CMOS Circuits for Low Power | Kluwer | 2002 |
| R3 | J.B.Kulo and J.H Lou | J.B.Kulo and J.H Lou | Wiley | 1999 |
| R4 | A.P.Chandrasekaran and R.W.Broadersen | Low power digital CMOS design | Kluwer | 1995 |
| R5 | Gary Yeap | Practical low power digital VLSI design | Kluwer | 1998 |

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| 19ECE22 | RECONFIGURABLE COMPUTING USING FPGAs | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To familiarize the need and role of Reconfigurable Processor for embedded system applications.
2 To introduce the Reconfigurable Processor technologies.
3 To teach the salient features and architecture of FPGA.
4 To learn the concepts of modeling a digital system using Hardware Description Language
5 To impart the knowledge of Reconfigurable embedded Processor for real time applications.

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain the need of reconfigurable computing and hardware-software co design |
| CO2 | Explain the significance of FPGA technology |
| CO3 | Apply the concept of FPGA technology and understand FPGA architectures. |
| CO4 | Design an application using Verilog HDL |
| CO5 | Explain the up- gradation on reconfigurable computing and SoC design |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | | | | x | | x | | x | x | x |
| CO2 | x | x | x | | x | | | | x | | x | x | x | x | x |
| CO3 | x | x | x | | x | | | | | | x | x | x | x | x |
| CO4 | x | x | x | | | | | | x | | x | x | x | | |
| CO5 | x | x | x | | x | | | | x | | x | | x | | |

**COURSE CONTENTS** :

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

Introduction to reconfigurable processor- Reconfigurable Computing-Programming elements and Programming Tools for Reconfigurable Processors, ASIC design flow- Hardware/Software Co- design- FPAA Architecture overview- recent trends in Reconfigurable Processor & SoC

**UNIT II FPGA TECHNOLOGIES** **9 Hrs**

FPGA Programming technology - Alternative FPGA architectures: MUX Vs LUT based logic blocks – CLB Vs LAB Vs Slices- Fast carry chains- Embedded RAMs- Routing for FPGAs- Circuits and Architectures for Low-Power FPGAs- Physical Design

**UNIT III FPGA ARCHITECTURE** **9 Hrs**

FPGA architecture overview- Challenges of FPGA processor design-Opportunities of FPGA processor design-Designing Soft Core Processors – Designing Hardcore Processors – hardware/software co-simulation- FPGA to multi core embedded computing- FPGA based on- board computer system.

**UNIT IV VERILOG HDL DESIGN PROGRAMMING** **9 Hrs**

Basic concepts: VLSI Design flow, Modeling – Structural Gate Level Modeling, Switch Level Modeling ,Behavioral and RTL Modeling - Design Examples: Combinational Logic – Multiplexer, Binary Decoder, Comparator, Sequential logic- Flip Flops, Registers, and Counters, Memory

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**UNIT V CASE STUDIES** 9 Hrs

Reconfigurable processor based DC motor control- digital filter design- mobile phone development- High Speed Data Acquisition -Image Processing application-controller implementation for mobile robot Crypto-processor

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Nurmi, Jari (Ed.) | Processor Design System-On-Chip Computing for ASICs and FPGAs | Springer | 2007 |
| T2 | Ian Grout | Digital system design with FPGAs and CPLDs | Elsevier | 2008 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Scott Hauck and Andre DeHon | Reconfigurable Computing: The Theory and Practice of FPGA-Based Computation | Morgan Kaufmann | 2008 |
| R2 | Ron Sass and Anderew G.Schmidt | Embedded System design with platform FPGAs: Principles and Practices | Elsevier | 2010 |
| R3 | Steve Kilts | Advanced FPGA Design: Architecture, Implementation, and Optimization | Willey | 2007 |
| R4 | Pierre-Emmanuel Gaillardon | Reconfigurable Logic: Architecture, Tools, and Applications | CRC Press | 2015 |
| R5 | Joao Cardoso, Michael Hübner | "Reconfigurable Computing: From FPGAs to Hardware/Software Codesign | Springer | 2011 |

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| 19ECE23 | SYSTEM ON CHIP DESIGN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To learn System on chip fundamentals
2 To gain knowledge on NOC design
3 To learn the various Computation models of SOCs
4 To understand the performance and power of electronics systems on chip
5 To understand the communication architecture

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain the design concepts of SoC |
| CO2 | Explain the soc models in computation and co design. |
| CO3 | Explain communication and networking of soc |
| CO4 | Design low power NOC circuits |
| CO5 | Apply the NOC/SOC concepts in real time chip implementation |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | x | x | | x | | | | x | | x | | x | x | x |
| CO2 | x | x | x | | x | | | | x | | x | x | x | x | x |
| CO3 | x | x | x | | x | | | | x | | x | x | x | x | x |
| CO4 | x | x | x | | x | | | | x | | x | x | x | | |
| CO5 | x | x | x | | x | | | | x | | x | | x | | |

**COURSE CONTENTS** :

**UNIT I INTRODUCTION** 9 Hrs

Introduction to SoC Design., Platform-Based SoC Design., Multiprocessor SoC and Network on Chip, Low-Power SoC Design

**UNIT II SYSTEM DESIGN WITH MODEL OF COMPUTATION AND CO-DESIGN** 9 Hrs

System Models, Validation and Verification, Hardware/Software Codesign Application Analysis, Synthesis

**UNIT III COMPUTATION–COMMUNICATION PARTITIONING AND NETWORK ON CHIP-BASED SOC** 9 Hrs

Communication System: Current Trend, Separation of Communication and Computation, Communication-Centric SoC Design, Communication Synthesis, Network-Based Design, Network on Chip, Architecture of NoC

**UNIT IV NOC DESIGN** 9 Hrs

Practical Design of NoC, NoC Topology-Analysis Methodology, Energy Exploration, NoC Protocol Design, Low-Power Design for NoC: Low-Power Signaling, On-Chip Serialization, Low-Power Clocking, Low-Power Channel Coding, Low-Power Switch, Low-Power Network on Chip Protocol

**UNIT V NOC /SOC CASE STUDIES** 9 Hrs

Real Chip Implementation-BONE Series-,BONE 1-4, Industrial Implementations-,Intel's Tera-FLOP 80-Core NoC, Intel's Scalable Communication Architecture, Academic Implementations-FAUST, RAW;design case study of SoC – digital camera.

**Total Hours: 45**

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**TEXT BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Hoi-jun yoo, Kangmin Lee, Jun Kyoung kim, | Low power NoC for high performance SoC design | CRC press | 2008 |
| T2 | Vijay K. Madisetti Chonlameth Arpikanondt | A Platform-Centric Approach to System-on-Chip (SOC) Design | Springer | 2005 |

**REFERENCE BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Michael J. Flynn and Wayne Luk | Computer System Design: System-on-Chip | Wiley India Pvt. Ltd | 2011 |
| R2 | Steve Furber | ARM System on Chip Architecture | Addison Wesley Professional | 2000 |
| R3 | Ricardo Reis | Design of System on a Chip: Devices and Components | Springer | 2004 |
| R4 | Jason Andrews | Co-Verification of Hardware and Software for ARM System on Chip Design | Newnes | 2004 |
| R5 | Prakash Rashinkar, Peter Paterson and Leena Singh L | System on Chip Verification – Methodologies and Techniques | Kluwer Academic Publishers | 2001 |

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| 19ECE24 | COMPUTER ARCHITECTURE AND ORGANIZATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** : The course should enable the students to:

1 Brief the historical development of computing machines and basics of computer system design
2 Understand the arithmetic algorithms and circuits needed to process data.
3 Focus on concepts of control unit design and pipelining to speed up the data processing
4 Gain knowledge on the organization of main memory, cache memory and virtual memory
5 Understand the system organization

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Describe the central processing unit focusing on instruction set design and data representation. |
| CO2 | Explain the operation of arithmetic unit |
| CO3 | Explain the design of control unit |
| CO4 | Illustrate various types of memory elements |
| CO5 | Outline the Input/Output and system organization |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | | | | | | | | | X | | | | |
| CO2 | X | X | | X | X | | | | | | X | | | X | |
| CO3 | X | X | X | X | X | | | | | | X | X | X | X | X |
| CO4 | X | X | | | X | | | | | | X | X | X | | X |
| CO5 | X | X | X | X | X | | | | | | | | | | |

**COURSE CONTENTS** :

**UNIT I INTRODUCTION TO COMPUTER ARCHITECTURE AND ORGANIZATION** 9 Hrs

Computing and Computers – Evolution of Computers – System Design – Register Level, Processor Level, CPU Organization, and Data Representation, Fixed –Point Numbers, Floating Point Numbers, Instruction format and instruction types – Addressing modes, Basic I/O operations.

**UNIT II ARITHMETIC UNIT AND DATAPATH DESIGN** 9 Hrs

Addition and subtraction of signed numbers – Design of fast adders – Multiplication of positive numbers – Integer division - Combinational and Sequential ALUs, Carry look ahead adder, Robertson algorithm, Booth's algorithm, non-restoring division algorithm, Floating Point Arithmetic, Coprocessor, Modified booth's Algorithm.

**UNIT III CONTROL UNIT DESIGN** 9 Hrs

Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro programmed control - Pipelining – Basic concepts, Pipeline Processing, Pipeline Design – Data hazards – Instruction hazards – Influence on Instruction sets – Data path and control consideration – Superscalar processors.

**UNIT IV MEMORY ORGANIZATION** 9 Hrs

Random Access Memories, Serial Access Memories, RAM Interfaces, Magnetic Surface Recording, Optical Memories, multilevel memories, Cache memory, Virtual Memory, Memory Allocation, Associative Memory.

**UNIT V INPUT/OUTPUT AND SYSTEM ORGANIZATION** 9 Hrs

Communication methods, Buses, Bus Control, Bus Interfacing, Bus arbitration, IO and system control, IO interface circuits, Handshaking, I/O Systems Speed, Size, Cost, Performance considerations – Accessing I/O Devices – Interrupts, pipeline interrupts, IOP organization, multiprocessors, fault tolerance, RISC and CISC architecture.

**Total Hours: 45**

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**TEXT BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Carl Hamacher,ZvonkoVranesic and SafwatZaky | Computer Organization | McGraw-Hill | 2012 |
| T2 | John P.Hayes | Computer Architecture and Organization | McGraw Hill | 2012 |

**REFERENCE BOOKS** :

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | William Stallings | Computer Organization and Architecture – Designing for Performance | Pearson Education, | 2012 |
| R2 | David A.Patterson and John L.Hennessy | Computer Organization and Design: The hardware / software interface | Morgan Kaufmann | 2014 |
| R3 | P.Pal Chaudhuri | Computer organization and design | Prentice Hall of Indi | 2008 |
| R4 | Miles J. Murdocca and Vincent P. Heuring | Principles of Computer Architecture | Prentice Hall, | 2008 |
| R5 | Parhami | Computer Architecture | Oxford Press | 2005 |

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| 19ECE25 | INTERNET OF THINGS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES :**

1 To understand Smart Objects and IoT Architectures.
2 To learn about various IOT-related protocols.
3 To build simple IoT protocol and IOT technologies
4 To understand network security and IoT applications
5 To gain knowledge on service layer protocols

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Explain the concepts of IOT and its present developments. |
| CO2 | Describe the architecture of IOT |
| CO3 | Apply various wireless technology for IOT |
| CO4 | Design a real time application using IOT |
| CO5 | Design a system using various service layer protocols |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | | | x | x | | | | | | x | | | | |
| CO2 | | | | x | | x | | | | | x | | | | |
| CO3 | | | | x | x | x | | | | | x | | | x | x |
| CO4 | x | | x | x | | x | | | | | x | x | | x | x |
| CO5 | x | | x | x | x | x | | | | | x | x | | x | x |

**COURSE CONTENTS :**

**UNIT I OVERVIEW OF IOT** — 9 Hrs

Introduction, Design Principles for connected Devices, Prototyping for embedded Devices, Prototyping for Physical design.

**UNIT II IOT ARCHITECTURE** — 9 Hrs

Node Structure, Sensing, Processing, Communication, Powering, Networking, Topologies, Layer/Stack architecture, IoT, Standards, Cloud computing for IoT, Bluetooth, Bluetooth Low Energy, beacons.

**UNIT III WIRELESS TECHNOLOGY FOR IOT** — 9 Hrs

WiFi (IEEE 802.11) - Bluetooth/Bluetooth Smart - ZigBee/ZigBee Smart - UWB (IEEE 802.15.4) - 6LoWPAN - Proprietary systems.

**UNIT IV BUILDING IOT WITH RASPBERRY PI** — 9 Hrs

RASPBERRY PI: Physical device - Raspberry Pi Interfaces – Programming- APIs / Packages - Web services.

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**UNIT V SERVICE LAYER PROTOCOLS & SECURITY** 9 Hrs

Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC, 802.15.4, 6LoWPAN, RPL, Application Layer

**TEXT BOOKS:**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Adrian McEwen and Hakim Cassimally | Designing the Internet of Things | Wiley | 2014 |
| T2 | Oliver Hersent, David Boswarthick and Omar Elloumi | The Internet of Things | Wiley | 2016 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Jean - Philippe Vasseur, Adam Dunkels | Interconnecting Smart Objects with IP: The Next Internet | Morgan Kuffmann Publishers | 2010 |
| R2 | Arshdeep Bahga and Vijai Madisetti | A Hands - on Approach "Internet of Things | Universities Press | 2015 |
| R3 | Dieter Uckelmann, Mark Harrison, Mi chahelles, Florian | Architecting the Internet of Things | Springer | 2011 |
| R4 | Michael Margolis | Arduino Cook book, Recipes Begin ,Expand, and Enhance Your Projects | O 'Reilly Media | 2011 |
| R5 | Alexander M. Wyg linski, Maziar nekovee, Y. Thomas Hu | Cognitive Radio Communication and Networks | Elsevier | 2010 |

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| 19ECE26 | AUTOMOTIVE ELECTRONICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES :**

1 To understand the concepts of Automotive Electronics and it's evolution and trends
2 To understand sensors and sensor monitoring mechanisms aligned to automotive systems, different signal conditioning techniques, interfacing techniques and actuator mechanisms.
3 To understand, design and model various automotive control systems using Model based development technique.
4 To understand role of Microcontrollers in ECU design and choice of appropriate Hardware and Software
5 To describe various communication systems, wired and wireless protocols used in vehicle networking.

**COURSE OUTCOMES :**

| | |
|---|---|
| CO1 | Explain an overview of automotive components, subsystems, design cycles |
| CO2 | Design a circuit automotive sensors and actuators |
| CO3 | Choose the proper microcontroller for automotive domain |
| CO4 | Explain the communication protocols relevant to automotive domain |
| CO5 | Design Automotive Control Systems using CAD tools |

**CO – PO MAPPING :**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | | | | | | | | | | | | | | |
| CO2 | x | x | x | x | | | | | | | x | | x | | |
| CO3 | x | x | x | x | | | | | | | x | | x | | |
| CO4 | x | x | x | x | x | | | | | | x | x | | x | |
| CO5 | x | x | x | x | x | | | | | | x | x | | x | |

**COURSE CONTENTS :**

**UNIT I AUTOMOTIVE SYSTEMS, DESIGN CYCLE AND AUTOMOTIVE INDUSTRY OVERVIEW 9 Hrs**

Overview of Automotive Industry: Leading players, automotive supply chain, Global challenges, Role of technology in Automotive Electronics and interdisciplinary design, Tools and processes. Introduction to Modern Automotive Systems and need for electronics in automobiles and application areas of electronic systems in modern automobiles, Spark and Compression Ignition Engines.

**UNIT II AUTOMOTIVE SENSORS AND ACTUATORS 9 Hrs**

Systems Approach to Control and Instrumentation: Concept of a system, Analog and digital systems, Basic measurement systems, Analog and digital signal processing, Sensors, Sensor characteristics, Sensor response, Sensor error, Redundancy of sensors in ECUs, Avoiding redundancy, Sensor modeling, Smart Nodes.

**UNIT III MICROCONTROLLER/MICROPROCESSOR IN AUTOMOTIVE DOMAIN 9 Hrs**

Critical review and overview of development within the automotive context of microprocessors, microcontrollers and digital signal processors (architecture of 8/16 bit microcontrollers with emphasis on Ports, Timer/Counters, Interrupts, Watchdog timers and PWM). Criteria to choose the right microcontroller/processor for various automotive applications. Understanding various architectural attributes relevant to automotive applications

**UNIT IV COMMUNICATION PROTOCOLS, INFOTAINMENT SYSTEMS 9 Hrs**

Communication protocols: Overview of automotive communication protocols, CAN, LIN , Flex Ray, MOST , Ethernet, D2B and DSI, Communication interface with ECUs, Interfacing techniques and Interfacing with infotainment gadgets, Relevance of Protocols such as TCP/IP for automotive applications, Wireless LAN

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standards such as Bluetooth, IEEE 802.11x communication protocols for automotive applications. Infotainment Systems: Application of telematics in automotive domain, Global positioning systems (GPS) and General packet radio service (GPRS).

**UNIT V AUTOMATIVE CONTROL SYSTEM AND MODEL BASED DEVELOPMENT** 9 Hrs

Automotive Control System & Model Based Development: Control system approach in Automotive Electronics, Analog and digital control methods, Modelling of linear systems, System responses, Modelling of Automotive Systems with simple examples. Model based Development: Introduction to MATLAB, Simulink and SIMSCAPE tool boxes.

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Williams. B. Ribbens | Understanding Automotive Electronics | Elsevier Science, Newnes | 2003 |
| T2 | Robert Bosch | Automotive Electronics Handbook | John Wiley and Sons | 2004 |

**REFERENCE BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| R1 | Terence Rybak & Mark Stefika | Automotive Electromagnetic Compatibility (EMC) | Springer | 2004 |
| R2 | Uwe Kieneke and Lars Nielsen | Automotive Control Systems: Engine, Driveline and Vehicle | Springer Verlag | 2005 |
| R3 | Tom Denton | Advanced Automotive Diagnosis | Elsevier | 2006 |
| R4 | G. Meyer, J. Valldorf and W. Gessner | Advanced Microsystems for Automotive Applications | Springer | 2009 |
| R5 | Mehrdad Ebsani, Ali Emadi & Yimin Gao | Modern Electronic Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design | CRC Press | 2009 |

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| 19ECE27 | ELECTRONIC INSTRUMENTATIONS AND MEASUREMENT TECHNIQUES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES** :

1 To introduce the basic functional elements of instrumentation.
2 To introduce the fundamentals of electrical and electronic instruments.
3 To introduce various storage and display devices
4 To introduce various transducers and the data acquisition systems.
5 To understand the concept of recording and display devices

**COURSE OUTCOMES** :

| | |
|---|---|
| CO1 | Explain the operation of various measuring instruments |
| CO2 | Analyze the electric and electronic signals using analyzers |
| CO3 | Analyze waveforms using CRO and DSO |
| CO4 | Apply the interfacing techniques to connect transducers |
| CO5 | Use display and recording instruments |

**CO – PO MAPPING** :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | | | | | | | | | | x | | | | |
| CO2 | x | x | x | x | x | | | | | | x | | | x | |
| CO3 | x | x | | | x | | | | | | x | | | | |
| CO4 | x | x | x | x | x | | | | | | x | | x | x | x |
| CO5 | x | | | | x | | | | | | x | | x | x | x |

**COURSE CONTENTS** :

**UNIT I BASICS OF MEASUREMENTS** 9 Hrs

Basics of Measurements: Accuracy, Precision, resolution, reliability, repeatability, validity, Errors and their analysis, Standards of measurement. Bridge Measurement: DC bridges- wheatstone bridge, AC bridges – Kelvin, Hay, Maxwell, Schering and Wien bridges, Wagner ground Connection. Electronic Instruments for Measuring Basic Parameters: Amplified DC meter, AC Voltmeter, True- RMS responding Voltmeter, Electronic multi-meter, Digital voltmeter, Vector Voltmeter.

**UNIT II SIGNAL ANALYZERS** 9 Hrs

AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications.

**UNIT III CATHODE RAY OSCILLOSCOPE** 9 Hrs

General purpose oscilloscope – Screens for CRT graticules – Vertical & horizontal deflection systems – Delay line – Multiple trace – Dual beam & dual trace – Probes – Oscilloscope techniques – Special oscilloscopes – Storage oscilloscopes – Sampling oscilloscope – DSO.

**UNIT IV DIGITAL DATA ACQUISITION SYSTEM** 9 Hrs

Interfacing of transducers to Electronics Control and Measuring System. Instrumentation Amplifier, Isolation Amplifier. An Introduction to Computer-Controlled Test Systems.IEEE-488 GPIB Bus

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**UNIT V RECORDERS AND DISPLAYS** 9 Hrs

Introduction- electrical indicating instruments, digital instruments, digital display methods, digital display unit. X-Y Plotters, magnetic tape recording , direct , FM , digital recording. – Data loggers. Display devices : LED – LCD – Annunciators, Numerics, Alphanumerics

**Total Hours: 45**

**TEXT BOOKS :**

| S.No. | AUTHOR (S) NAME | TITLE OF THE BOOK | PUBLISHER | YEAR |
|---|---|---|---|---|
| T1 | Albert D. Helfrick and William David Cooper | Modern Electronic Instrumentation and Measurement Techniques | PHI | Latest Edition |
| T2 | H S Kalsi | Electronic Instrumentation | Tata McGraw-Hill Education | Latest Edition |

**REFERENCE BOOKS :**

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