GALGOTIAS UNIVERSITY

# Syllabus of

## B. Tech, Electronics & Communication Engineering

## with specialization in Bio-Medical Engineering

**Name of School:** School of Engineering

**Department:** Electrical, Electronics & Communication Engineering

**Year:** 2021-25

Curriculum

**2021-25**

| **Semester 1** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sl. No | Course Code | Name of the Course | | | | | Assessment Pattern | | |
| | | | L | T | P | C | IA | MTE | ETE |
| 1 | BBS01T1001 | Multi Variable Calculus | 3 | 0 | 2 | 4 | 20 | 30 | 100 |
| 2 | BLL01T1003 | Communication Skills | 2 | 0 | 0 | 2 | 10 | 15 | 25 |
| 3 | BCS01T1003 | Programming for Problem Solving – C | 1 | 0 | 4 | 3 | 10 | 15 | 25 |
| 4 | BBS01T1002 | Semi-conductor Physics | 2 | 0 | 2 | 3 | 10 | 15 | 25 |
| 5 | BME01T1001 | Engineering Graphics & Introduction to Digital Fabrication | 1 | 0 | 2 | 2 | 10 | 15 | 25 |
| 6 | BEE01T1003 | Basic Electrical & Electronics Engineering | 2 | 0 | 2 | 3 | 10 | 15 | 25 |
| 7 | BCS01T1002 | AI Fundamental | 2 | 0 | 0 | 2 | 10 | 15 | 25 |
| 8 | BCS01T1001 | Data Analytics Excel Tableau | 0 | 1 | 2 | 2 | 10 | 15 | 25 |
| 9 | BBSUCT1004 | Environmental Sciences (Zero Credit Course) | 2 | 0 | 0 | 0 | 10 | 15 | 25 |
| 10 | BLEUCP1004 | YOGA (Zero Credit Course) | Non-Credit Course | | | | | | |
| | | Total | | | | 21 | | | |
| **Semester II** | | | | | | | | | |
| Sl No | Course Codee | Name of the Course | | | | | Assessment Pattern | | |
| | | | L | T | P | C | IA | MTE | ETE |
| 1 | BBS01T1008 | Biology for Engineers* | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 2 | BEE01T1004 | Embedded system & IOT | 1 | 0 | 2 | 2 | 10 | 15 | 25 |
| 3 | BBS01T1003 | Linear Algebra & Differential Equations | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 4 | BEE01T1005 | Introduction to Digital Systems | 2 | 0 | 2 | 3 | 10 | 15 | 25 |
| 5 | BCS01T1010 | Introduction to Python Programming | 2 | 0 | 2 | 3 | 10 | 15 | 25 |
| 6 | BEE01T1006 | AC & DC Machines | 1 | 0 | 2 | 2 | 10 | 15 | 25 |
| 7 | BEE01T1007 | Analog Circuits | 1 | 0 | 2 | 2 | 10 | 15 | 25 |
| 8 | BLEUCT1003 | Creativity, Innovation & Entrepreneurship | 1 | 0 | 2 | 2 | 10 | 15 | 25 |
| 9 | BLEUCT1002 | Creative & Liberal Arts | 0 | 0 | 2 | 1 | 50 | - | 50 |
| 10 | BEE01T1001 | Electrical Workshop | 1 | 0 | 2 | 2 | 10 | 15 | 25 |
| 11 | BCS01T1011 | Alexa Skilling | 0 | 0 | 2 | 0 | 10 | 15 | 25 |
| | | Total | | | | 23 | | | |

| Semester III | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sl No | Course Code | Name of the Course | | | | | Assessment Pattern | | |
| | | | L | T | P | C | IA | MTE | ETE |
| 1 | BECE2015 | Electronic Devices and Circuits | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 2 | MATH2001 | Functions of Complex Variables and Transforms | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 3 | BTEE2002 | Network Analysis and Synthesis | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 4 | BEE01T2001 | Sensors and Transducers | 2 | 0 | 0 | 1 | 20 | 30 | 50 |
| 5 | BEE01T2002 | Design and Engineering | 2 | 0 | 0 | 2 | 20 | 30 | 50 |
| 6 | BECE2010 | Digital Electronics | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 7 | BECE2012 | Electromagnetic Field Theory | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 8 | BECE2011 | Digital Electronics Lab | 0 | 0 | 2 | 1 | 50 | - | 50 |
| 9 | BEE01P2003 | Engineering Clinic-I | 0 | 0 | 2 | 2 | 50 | - | 50 |
| 10 | SLBT2021 | English Proficiency and Aptitude Building - 3 | 0 | 0 | 2 | 1 | 50 | - | 50 |
| 11 | BEE01P2004 | IoT Lab | 0 | 0 | 2 | 2 | 50 | - | 50 |
| | | Total | | | | 24 | | | |

| Semester IV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sl No | Course Code | Name of the Course | | | | | Assessment Pattern | | |
| | | | L | T | P | C | IA | MTE | ETE |
| 1 | MATH2004 | Probability and Stochastic Process | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 2 | BECE2008 | Integrated Circuits | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 3 | BECE2016 | Signals and Systems | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 4 | ECE417 | Analog and Digital Communication | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 5 | BEE01T2005 | Database Management System | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 6 | BEE01T2006 | Microcontrollers and Embedded System | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 7 | BEEE2001 | Electrical Measurements and Instrumentation | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 8 | BEE01P2007 | Engineering Clinic-2 | 0 | 0 | 2 | 2 | 50 | - | 50 |
| 9 | BECE2009 | Integrated Circuits Lab | 0 | 0 | 2 | 1 | 50 | - | 50 |
| 10 | BLL451 | Logical and Critical reasoning | 0 | 0 | 2 | 1 | 50 | - | 50 |
| 11 | BECE3005 | Microprocessor and Micro Controller Lab | 0 | 0 | 2 | 1 | 50 | - | 50 |
| | | Total | | | | 26 | | | |

| Semester V | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sl No | Course Code | Name of the Course | | | | | Assessment Pattern | | |
| | | | L | T | P | C | IA | MTE | ETE |
| 1 | BEEE3002 | Control System | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 2 | BEE01T3001 | EM Waves | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 3 | BEE01P3002 | Python and Data Structures | 0 | 0 | 2 | 1 | 50 | - | 50 |
| 4 | BECE3020 | Digital Signal Processing | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 5 | ****** | Bio-Medical Instrumentation | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 6 | ******** | Program Elective-I | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 7 | ******** | Program Elective-II | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 8 | BEE01P3003 | Engineering Clinic-3(Industrial Internship) | 0 | 0 | 2 | 2 | 50 | - | 50 |
| 9 | BLL551 | Effective Leadership and Decision Making Skills | 0 | 0 | 2 | 1 | 50 | - | 50 |
| 10 | BECE3021 | Digital Signal Processing Lab | 0 | 0 | 2 | 1 | 50 | - | 50 |
| 11 | BLE601/BLE602/BLE603 | Foreign Language - 1 (German, Japanese, French) *Optional | 0 | 0 | 2 | 0 | 50 | - | 50 |
| 12 | BEE01P3004 | Communication Engineering Lab | 0 | 0 | 2 | 1 | 50 | - | 50 |
| 13 | ******* | Bio-Medical Project-1 | 0 | 0 | 2 | 2 | 50 | - | 50 |
| | | Total | | | | 26 | | | |

| Semester VI | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sl No | Course Code | Name of the Course | | | | | Assessment Pattern | | |
| | | | L | T | P | C | IA | MTE | ETE |
| 1 | BLL601 | Campus to Corporate program | 3 | 0 | 0 | 3 | 50 | - | 50 |
| 2 | BEE01T3005 | Advanced Communication Systems | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 3 | BECE3013 | VLSI Design | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 4 | BEE01T3006 | Image Processing and Pattern Recognition | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 5 | ****** | Bio-Medical Signal Processing | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 6 | ******** | Program Elective-III | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 7 | ******** | Program Elective-IV | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 8 | BEE01P3007 | Design and Innovation Project(Communication Based) | 0 | 0 | 2 | 1 | 50 | - | 50 |
| 9 | BEE01T3008 | Professional Ethics and Human Values | 2 | 0 | 0 | 1 | 50 | - | 50 |
| 10 | BEE01P3009 | VLSI and Embedded Systems Lab | 0 | 0 | 2 | 1 | 50 | - | 50 |
| 11 | ******* | Bio-Medical Project-2 | 0 | 0 | 2 | 2 | 50 | - | 50 |
| | | Total | | | | 26 | | | |

| Semester VII | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sl No | Course Code | Name of the Course | | | | | Assessment Pattern | | |
| | | | L | T | P | C | IA | MTE | ETE |
| 1 | BEE01T4001 | Communication Networks | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 2 | ********* | Microcontroller Application in Bio-Medicals | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 3 | ******** | Open Elective -1 | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 4 | ******** | Program Elective-V | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 5 | ******** | Program Elective-VI | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 6 | ******** | Open Elective-2 | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 7 | BEE01P4002 | Communication Networks Lab | 0 | 0 | 2 | 1 | 50 | - | 50 |
| 8 | BECE9998 | Capstone Design - I | 0 | 0 | 4 | 2 | 50 | - | 50 |
| 9 | ******* | Bio-Medical Project-3 | 0 | 0 | 2 | 2 | 50 | - | 50 |
| | | Total | | | | 23 | | | |

| Semester VIII | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sl No | Course Code | Name of the Course | | | | | Assessment Pattern | | |
| | | | L | T | P | C | IA | MTE | ETE |
| 1 | BECE9999 | Capstone Design - I | 0 | 0 | 4 | 2 | 50 | - | 50 |
| | | Total | | | | 2 | | | |

List of Electives

Elective-1

| Sl No | Course Code | Name of the Electives | | | | | Assessment Pattern | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | IA | MTE | ETE |
| IoT | | | | | | | | | |
| 1 | BECE4501 | Introduction to IoT and its Applications | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 2 | BECE3102 | Automation and Robotics | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 3 | BEE01T4022 | Deep Learning Algorithms | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 4 | BEE01T3021 | Object Oriented Programming | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 5 | BEE01T5021 | Virtual Reality | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 6 | BEE01T5022 | Raspberry Pi and its applications | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 7 | BEE01T2021 | Introduction to Arduino programming and its applications | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 8 | BEE01T4022 | Cloud Computing | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 9 | BEE01T2022 | Python Programming | 3 | 0 | 0 | 3 | 20 | 30 | 50 |

Elective-2

| Sl No | Course Code | Name of the Electives | | | | | Assessment Pattern | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | IA | MTE | ETE |
| Biomedical Engineering and Healthcare | | | | | | | | | |
| 1 | BEE01T2022 | Medical Imaging | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 2 | BEE01T2024 | Biosignal processing | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 3 | BEE01T3022 | Medical Image Processing | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 4 | BEE01T3023 | Biomedical Sensors and Measurement Devices | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 5 | BEE01T3024 | Biomaterials and Artificial Organs | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 6 | BEE01T4023 | Assist Devices | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 7 | BECE4401 | Soft Computing Techniques | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 8 | BEE01T5023 | Hospital Engineering and Informatics Systems | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 9 | BEE01T2025 | Bio-Chemistry | 3 | 0 | 0 | 3 | 20 | 30 | 50 |

Elective – 3

| Sl No | Course Code | Name of the Electives | | | | | Assessment Pattern | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | IA | MTE | ETE |
| VLSI | | | | | | | | | |
| 1 | BEE01T3025 | ASIC Design | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 2 | BEE01T3026 | CAD Algorithms for VLSI Physical Design | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 3 | BEE01T2026 | Digital VLSI Design | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 4 | BECE3104 | Digital System Design using VHDL | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 5 | BEE01T4024 | SoC Design | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 6 | BEE01T4025 | System Verilog | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 7 | BEE01T4026 | Low Power VLSI Design | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 8 | | VLSI Technology | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 9 | BEE01T5024 | VLSI Testing | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 10 | BEE01T5025 | MEMS | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 11 | BEE01T5026 | Memory Design and Testing | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 12 | BEE01T5027 | MOS Transistor Theory | 3 | 0 | 0 | 3 | 20 | 30 | 50 |

Elective – 4

| Sl No | Course Code | Name of the Electives | | | | | Assessment Pattern | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | IA | MTE | ETE |
| Communication and Networking | | | | | | | | | |
| 1 | BECE3103 | Satellite Communication | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 2 | BEE01T3027 | Principles of Secure Communication | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 3 | BEE01T3028 | Microwave Theory and Techniques | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 4 | BECE3204 | Mobile Ad Hoc Networks | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 5 | BECE4402 | Mobile Computing | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 6 | BECE3006 | Microwave Engineering | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 7 | | Information Theory and Coding | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 8 | BEE01T4027 | Radar Guidance and Navigation | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 9 | BECE3016 | Optical Communication | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 10 | BECE3203 | Wireless Sensor Networks | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 11 | BEE01T4028 | Opto Electronics | 3 | 0 | 0 | 3 | 20 | 30 | 50 |

Elective – 5

| Sl No | Course Code | Name of the Electives | | | | | Assessment Pattern | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | IA | MTE | ETE |
| Signal Processing | | | | | | | | | |
| 1 | BEE01T4021 | Image and Video Signal Processing | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 2 | BEE01T5028 | Multimedia Signal Processing and Networking | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 3 | BEE01T3029 | Speech and Audio Processing | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 4 | BEE01T2027 | Machine learning | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 5 | BEE01T2028 | Image Processing using MATLab | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 6 | BEE01T2029 | Introduction to Scilab and its applications | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 7 | BEE01T5029 | Human Computer Interface | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 8 | BEE01T5030 | Advanced Digital Signal Processing | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 9 | BECE4401 | Soft Computing | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 10 | BEE01T5031 | Mixed Signal Circuit Design | 3 | 0 | 0 | 3 | 20 | 30 | 50 |
| 11 | BECE3304 | Neural Networks and Fuzzy Control | 3 | 0 | 0 | 3 | 20 | 30 | 50 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 12 | BEEC3305 | Neural Networks and Deep Learning | 3 | 0 | 0 | 3 | 20 | 30 | 50 |

# Detailed Syllabus

| | | | | |
|---|---|---|---|---|
| Name of The Course | Basic Electrical & Electronics Engineering | | | |
| Course Code | BEE01T1003 | | | |
| Prerequisite | | | | |
| Co-requisite | | | | |
| Anti-requisite | | | | |
| | L | T | P | C |
| | 1 | - | 2 | 2 |

Course Objectives

1. To study Different types of Circuit Elements
2. To study Basic Circuits Laws.
3. To study Basic Concepts of A.C. Circuits

Course Outcomes

Students will be able to

| | |
|---|---|
| CO1 | Understand relationship between different electrical parameters. |
| CO2 | Students will develop an ability to analyse D.C Circuits of different configurations. |
| CO3 | Understand magnetic aspects of electric current. |
| CO4 | Students will develop an ability to analyse A.C. Circuits of different configurations |
| CO5 | Students will develop an ability to analyse Resonance Circuits. |

Continuous Assessment Pattern

| Evaluation Scheme | | | | |
|---|---|---|---|---|
| Theory | | | Practical | Total Marks |
| TAE | CAE | ESE | Cont | |
| 10 | 15 | 25 | 25 | 75 |

Course Content:

| Unit I: D.C. Circuits: 8 Hours | CO Mapping |
|---|---|
| Circuits Elements(R, L, C), Kirchhoff's Laws, Superposition Principle and theorem, Norton's theorem, Thevenin's Theorem, Voltage source, (definition, characteristics of practical source, equivalent current source) Star-Delta transformation | CO1&CO2 |
| Unit II: Magnetic circuits 7 Hours | |
| Flux, mmf, reluctance, analogous electric circuits, simple calculations for composite magnetic circuits. | CO3 |
| Unit III: A. C. Circuits 10 Hours | |
| Periodic functions, average &rms values, Steady state behaviours with sinusoidal excitation, phasor representation, reactance and impedance, Series and Parallel A.C. circuits, resonance, power in A. C. circuits, power factor, Principle of generation of single phase & Three phase voltages. Power in balanced three phase A.C. systems. | CO4& CO5 |

Suggested Reading

1. Textbook of Electrical Engineering, B.L. Theraja, Vol. I & II, Twenty, S. Chand & Co 1997 Second.
2. Basic Electrical Engineering, D C.Kulkshreshtha, McGraw,2012 , First.
3. Introduction to Electrical Engineering, Naidu, Kamakshaia, Tata McGraw Hill, 2000, Third
4. Basic Electrical Engineering, H. Cotton, CBC, 2005, Seventh.
5. Laboratory courses in Electrical Engg, S G Tarnekar, P K Kharbanda, S B Bodkhe, S D Naik, S. Chand & Co, 2010, second.

List of Experiment

| | |
|---|---|
| 1. | To Verify KVL & KCL. |
| 2. | To plot B-H Curve Of Magnetic Material. |
| 3. | Verification Of Line Voltage and Phase Voltage In Three Phase Star Connected Balanced Load. |
| 4. | Study of phase relationship in R-L-C network by computer simulation using P-SIM Software. |
| 5. | Open Ended<br>1) To Study 11 KV distribution Substation (Overview).<br>2) To Study Ferranti Effect.<br>3) To Study different types of FACT Controller.<br>4)To Study Comparison between DC Motor & Induction Motor. |

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | AC & DC Machines | | | | |
| Course Code | BEE01T1007 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | | L | T | P | C |
| | | 2 | - | - | 2 |

Course Objectives

1. To prepare the students to understand basic fundamentals of Electrical Circuits
2. To make the students aware about basic principle of operation of Electrical machines under the Influence of magnetic field.

Course Outcomes

Student will be able to

| | |
|---|---|
| CO1 | Understand Concepts of energy transfer through magnetic coupling. |
| CO2 | Understand working principle of transformer. |
| CO3 | Understand Concepts of D.C machines. |
| CO4 | Understand Operation of A.C machines. |

Continuous Assessment Pattern

| Evaluation Scheme | | | | |
|---|---|---|---|---|
| Theory | | | Practical | Total Marks |
| TAE | CAE | ESE | Cont | |
| 10 | 15 | 25 | ---- | 50 |

Course Content:

| | |
|---|---|
| Unit I:Single Phase Transformers Hours 10 | CO Mapping |
| Introduction, Basic principle, construction of phasor diagram for transformer under no load condition, Transformer on load, EMF equation Phasor diagrams, Equivalent circuit, Losses, Efficiency, Regulation, Open-circuit & short-circuit test. | CO1 &CO2 |
| Unit II: D. C. Machines Hours 10 | |
| Introduction, construction, EMF and Torque equation, classification, self-excitation of D.C. shunt generators, EMF, voltage, current relations in generator and motor, Characteristics, starting and speed control of d. c. motors. | CO3 |
| Unit III: Introduction to AC Motors. Hours10 | |
| Three phase Induction motor Construction, and principle of rotating field, synchronous speed, Rotor current, torque and slip, Principle of Single phaseCapacitor Start motor. | CO4 |

Suggested Reading


1. Basic Electrical Engineering, D C. Kulkshreshtha, McGraw, 2012, First
2. Textbook of Electrical Engineering, B. L. Theraja, Vol. I & II, Twenty, S. Chand & Co., 1997, Second.

3. Introduction to Electrical Engineering, Naidu, Kamakshaia, Tata McGraw Hill, 2000 , Third
4. Basic Electrical Engineering, H. Cotton , CBS, 2005, Seventh.
5. Laboratory courses in Electrical Engg. S. Chand &Co , 2010 ,Second.
6. Electric Machines, Kothari,Nagrath, Tata McGraw Hill, 2006 , ThirdEdition.

| | | | | | |
|---|---|---|---|---|---|
| BEE01T1005 | Introduction to Digital Systems | L | T | P | C |
| | Total Contact Hours | 2 | 0 | 2 | 3 |
| | Prerequisite – Basics of Boolean Algebra and Digital Logic Gates | | | | |
| | Department:-Dept. of Electronics and Communication Engineering. | | | | |

Course Objectives:

1. To familiarize with various Digital IC
2. To understand basic fundamentals of Digital circuits.
3. To prepare for various engineering applications.

Course Outcomes: Student will be able to

1. Solve the problems on Number system codes and their conversions.
2. Identify Digital IC and implement in the circuits.
3. Create, design and simulate canonical logic forms
4. Demonstrate the application of combinational and sequential logic circuits.

Unit-I: Number Systems & Boolean Algebra

Decimal, binary, octal, hexadecimal number system and conversion, binary weighted & non-weighted codes & code conversion, signed numbers, 1s and 2s complement codes, Binary arithmetic, Binary logic functions , Boolean laws, truth tables, associative and distributive properties, De-Morgan's theorems, realization of switching functions using logic gates. Logic families: TTL, ECL, CMOS.

Unit-II: Combinational Logic

Switching equations(Mathematical operations), canonical logic forms, sum of product & product of sums, Karnaugh maps, two, three and four variable Karnaugh maps, simplification of expressions, mixed logic combinational circuits, multiple output functions, QuineMcluskey Methods for 5 variables.

Introduction to combinational circuits, code conversions, decoder, encoder, priority encoder, multiplexers & De-multiplexer, binary adder, Subtractor, BCD adder, carry look ahead adder, Binary comparator, Arithmetic Logic Units.

Unit-III: Sequential Logic & Circuits:

Latch, flip-flops, clocked and edge triggered flip-flops, timing specifications, asynchronous and synchronous counters counter design, Registers, types of registers. Analysis of simple synchronous sequential circuits

Text Books:

| Sr. No. | Title | Author Name | Publisher | Year of Publication | Edition |
|---|---|---|---|---|---|
| 1 | Digital Electronics | R P Jain | McGraw Hill | 2017 | Second |
| 2 | Digital Logic and Computer Design | Morris Mano | PHI | 2017 review | Second |
| 3 | Digital Electronic Principles- | Malvino | PHI | 2011-13 | Seventh |

List of Experiment

- To study the basic logic gates
  - Verify their truth table.
  - Verification of De Morgan's Theorem.

- Verification Of SOP & POS Given Algebraic Expression Using Universal Gates.
- Designing of HALF and Full adder using basic logic gates.
- Design of 4:1 MULTIPLEXER USING GATES.
- Design and Implementation of 1-bit Magnitude Comparator using basic logic gates.
- Design and Verification of S-R Flip-Flop Circuits.
- Realization of 3-bit synchronous counter design For Various Application.
    - Frequency counters
    - Digital clock
    - Time measurement
- Project based learning: Building of LED Series / Seven Segment LED / Display unit.

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Analog Circuits | | | | |
| Course Code | BEE01T1005 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | | L | T | P | C |
| | | 1 | 1 | 2 | 3 |

Course Objectives

1. To familiarize with various electronic components and understand their properties.
2. To understand basic fundamentals of analog circuits.
3. To prepare for various engineering applications.

Course OutcomesStudent will be able to

| | |
|---|---|
| CO1 | Understand the electronics devices. |
| CO2 | Understand electronics circuits and measure their performance parameters |
| CO3 | Create, design and simulateanalog circuits by using diode and transistor |

Continuous Assessment Pattern

| Evaluation Scheme | | | | |
|---|---|---|---|---|
| Theory | | | Practical | Total Marks |
| TAE | CAE | ESE | Cont | |
| 10 | 15 | 25 | 25 | 75 |

Course Content:

| UnitI: PN Junction DiodeHours 8 | CO Mapping |
|---|---|
| Review of PN junction, forward and reverse bias, VI Characteristics, Dynamic Resistance, Equivalent Circuit of diode, Temperature dependence. Diode numerical. Varactor Diode, Tunnel Diodes, LED, LCD | CO1 |
| Unit II: Applications of Diodes&Linear Circuits:Hours 8 | |
| Rectifier with C Filter, Numerical on Rectifiers, Clippers, Clampers, Limiters, Low pass filter, High pass filter with characteristics. | CO2 |
| Unit III:Bipolar Junction Transistor and its application. Hours 8 | |
| Transistor Doping, Transistor action, Current Components, BJT configurations: CE, CC, CB characteristics, Base Width Modulation. Punch Through Effect. DC load line, Fixed Bias Method. Single stage CE transistor as amplifier, BJT as a switch. | CO3, |

Suggested Reading

Text Books:


1. Basic Electronics &Linear circuits: N.N. Bhargava, Tata Mcgraw-Hill, 2013 , Second edition.
2. Electronic Devices & Circuits, Sanjiv Gupta
   Sanjay Gupta, Dhampat Rai Publication,2012

Reference Books:


1. Electronic Devices & Circuits Theory, Robert L. Boylestad, Louis Nashelsky, Pearson India, 2009, Tenth Edition.
2. Integrated Electronics , Jacob Millman, Tata Mcgraw-Hill, 2009, second edition.
3. Microelectronics Circuits, A.S. Sedra& K.C. Smith, Oxford University Press, 2013 , seventh edition.


List of Experiments:

| s.no | List of Experiment | CO Mapping |
|---|---|---|
| 1. | To design clipper & clamper circuits by using basic components. | CO1 & CO2 |
| 2. | To design low pass filter by using basic components. | CO1 & CO2 |
| 3. | To design high pass filter by using basic components | CO1 & CO2 |
| 4. | To verify input characteristics and output characteristics of transistor in common base mode, to find out current gain, voltage gain, power gain. | CO3 |
| 5. | To design CE transistor as an attenuator switch | CO3 |
| 6. | To design CE transistor as an attenuator/using microcap simulation | CO3 |
| 7. | To design fixed bias for transistor. | CO3 |

| | | | | | |
|---|---|---|---|---|---|
| BEE01T1004 | Embedded Technology and IoT | L | T | P | C |
| | Total Contact Hours | 1 | 0 | 2 | 2 |
| | Prerequisite – | | | | |
| | Department:-Dept. of Electronics and Communication Engineering. | | | | |

COURSE OBJECTIVES:

- To provide the awareness of major embedded devices and interfacing devices
- To understand key technologies in Internet of Things.
- To analyze, design or develop parts of an Internet of Things solution for IoT applications.

| Course Outcome (COs) | |
|---|---|
| CO1 | Understand the concept of embedded system, microcontroller, different components of microcontroller and their interactions. |
| CO2 | Recognize and analyze given embedded system design and its performance. |
| CO3 | Identify the programming environment to develop embedded solutions. |
| CO4 | Demonstrate application based competencies in Embedded Programming |
| CO5 | Identify and adopt knowledge of the terminology, requirements and constraints for IoT system development. |
| CO6 | Demonstrate IoT system for smaller applications |

Basic components of Embedded system, Programming Language Classification of Embedded system, Advantage & Disadvantage, Difference between Microprocessor & Microcontroller, Classification based on architecture, Memory Classification, Description of RAM, Description of CPU Registers, Introduction to Embedded C, Difference between C & Embedded C.

Decision making with if statement, If….else statement, Switch statement, GOTO statement, The While and Do – While statements, For statement, Why Functions, Types of Functions, Multi functional program, Return values & their types

UNIT III EMBEDDED SOFTWARE AND HARDWARE INTERFACING

Kiel Compiler, Proteus, Interfacing of LED, Seven segment display, , LCD, Switches, Keyboard, Serial Communication, Sensors

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates

At least SIX experiments needs to be performed

List of Experiments

- Getting started with the Arduino IDE: Serial Communication between Arduino board and PC:-character send and received, Read and display voltage
- Experiments using single and multiple LEDs: Experiments on digital input and digital output on Arduino Uno board and using LED and Buzzer

- Hands on experiments on Interfacing of the LDR,LCD: Experiment on LCD display:-Print numbers, Name, Time etc.
- Experiments using Seven Segment display.
- Experiments using Temperature , IR, Finger print sensors.
- Experiments with Raspberry Pi using LED.
- Experiments on the applications of Buzzer, potentiometer.
- Experiments on Interfacing with Bluetooth devices.
- Design and development of Arduino/Raspberry Pi based system for defined application/ projects.
- Getting started with the Arduino IDE: Serial Communication between Arduino board and PC:-character send and received, Read and display voltage .
- Experiments using single and multiple LEDs: Experiments on digital input and digital output on Arduino Uno board and using LED and Buzzer.
- Hands on experiments on Interfacing of the LDR,LCD: Experiment on LCD display:-Print numbers, Name, Time etc.
- Experiments using Seven Segment display.
- Experiments using Temperature , IR, Finger print sensors.
- Experiments with Raspberry Pi using LED.
- Interfacing of the LDR, IR sensors.
- Experiments on the applications of Buzzer, potentiometer.
- Design and development of Arduino/Raspberry Pi based system for defined application/ projects

| | | | | | |
|---|---|---|---|---|---|
| BEE01T1001 | Electrical Workshop | L | T | P | C |
| | Total Contact Hours | 1 | 0 | 2 | 2 |
| | Prerequisite – | | | | |
| | Department:-Dept. of Electrical Engineering. | | | | |

Course Objectives:

1. To identify the students with commonly used Symbols, abbreviations, materials & tools used in electrical engineering.
2. Analysis of different types of Wiring and other accessories
3. To familiarize the students with commonly usage of measuring equipment
4. To train the students basic repairing process of domestic appliances

Course Outcomes:

1. Course Outcomes: identify tools, symbols & Safety aspects of electrical systems
2. Explain the various types of wiring and other accessories used in house wiring.
3. Measure current, voltage, power and energy in AC/DC circuit.
4. learn the basic repairing process of domestic appliances

Syllabus

Unit I: Electrical Tools and Wiring:

Study of various electrical tools and symbols, Safety aspects of electrical systems, types of cables/wires and switches, fuses & fuse carriers, MCB and ELCB, two-way switches. Household Wiring of power distribution, main switch and energy meter.

Unit II: Measuring Instruments and earthing:

Voltmeter, Ammeter, Wattmeter and Energy meter using in AC and DC supply, Effect of the power factor, Study of electricity bill, uninterruptible power supply, Earthing and grounding, basic repairing process of domestic appliances.

List of experiments

1. INTRODUCTION OF TOOLS, ELECTRICAL MATERIALS, SYMBOLS
2. ABBREVIATIONS AND DEVICES
3. TO STUDY HOUSE WIRING I.E, BATTEN, CLEAT, CASING-CAPING AND CONDUIT WIRINGS.
4. TO STUDY STAIR CASE WIRING (TWO WAY SWITCHES)
5. TO STUDY FLUORESCENT TUBE LIGHT.
6. TO STUDY CIRCUIT OF UPS
7. TO STUDY MOVING IRON, MOVING COIL, ELECTRODYNAMIC ETC.
8. TO STUDY FUSES, MCBS AND IMPORTANCE OF EARTHING.

TO DESIGN AND FABRICATE SINGLE PHASE TRANSFORMER

**Semester III**

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Electronic Devices and Circuits | | | | |
| Course Code | BECE2015 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 3 | 0 | 0 | 3 | |

Course Objectives

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

Course Outcomes

| | |
|---|---|
| CO1 | Realize the transistor biasing methods and Design analog electronic circuits using discrete components |
| CO2 | Design common amplifier circuits and analyze the amplitude and frequency responses |
| CO3 | Design various analog circuits to analyze their responses |
| CO4 | Understand the principle of operation of different Oscillator circuits. |
| CO5 | Understand the principle of operation of various amplifier circuits |
| CO6 | Understand the recent trends and practical applicationsof electronic devices |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Course Content:

| |
|---|
| Unit-1 Introduction 8 hours |
| BJT and BJT Biasing .Hybrid models of CE, CB, CC, configurations – Study of the effect of emitter by- pass condenser at low frequencies - Hybrid – π common emitter transistor model – hybrid π conductance and capacitance – CE short circuit current gain – current gain with resistive load – gain bandwidth product – Study of the effect of un bypassed emitter resister on amplifier performance, Cascode amplifier. HF & LF compensation of RC coupled amplifier. Multistage Amplifiers. |
| Unit-2FET and FET Biasing8 hours |
| FET and FET Biasing. FET Amplifiers: Common source, Common gate and Common drain Amplifiers – problems. Small signal analysis of FET Amplifiers. High Frequency analysis of FET Amplifiers, VMOS & CMOS Concepts. |
| Unit-3Feedback amplifiers 8 hours |
| The feedback concept – Transfer gain with feedback – general characteristics and advantages of negative feedback– analysis of voltage series, Voltage shunt, current series and current shunt feedback amplifiers – Study of the effect of Negative feedback on Gain, Bandwidth, Noise, Distortion, Input and Output impedances with the help of Block Schematic and Mathematical Expressions |
| Unit-4Oscillators 8 hours |
| Sinusoidal oscillators –phase shift oscillator – Wien bridge oscillator – Hartley oscillator – Colpits oscillator – frequency stability, inclusive of design, Crystal oscillators. |
| Unit-5Tuned amplifiers 8 hours |

| |
|---|
| Characteristics of Tuned amplifiers – Analysis of Single tuned, Doubled tuned and stagger tuned amplifiers, Gain – bandwidth product – High frequency effect – neutralization. Power Amplifiers: Classification of amplifiers – class A large signal amplifiers – second harmonic distortion – higher order harmonic generations – computation of Harmonic distortion – Transformer coupled audio power amplifier – efficiency – push - pull amplifier – class B amplifier – class AB operation – Push-Pull circuit with Transistors of Complimentary Symmetry. |
| Unit-6 Recent trends and Application 8 hours |
| Trend of Energy Saving in Electronic Devices, Application of oscillators- springs and damping, shock absorber in cars, Pendulum |

Suggested Reading


1. 1.Jacob. Millman, Christos C.Halkias, ‘Electronic Devices and Circuits’, Tata McGraw Hill Publishing Limited, New Delhi, 2008, ISBN 0070634556, 9780070634558.
2. Jacob Millman and C. Halkias, ‘Integrated Electronics – Analog and Digital Circuits and Systems’, Tata Mc Graw Hill, 2001, ISBN 0074622455, 9780074622452
3. Electronic Devices & Circuits Theory – Robert Boylestad and Louis Nashelsky, 10th EditionPrentice Hall, 2009, ISBN 0135026490, 9780135026496

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Network Analysis and Synthesis | | | | |
| Course Code | BTEE2002 | | | | |
| Prerequisite | Basic Electrical and Electronics Engineering | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 3 | 0 | 0 | 3 | |

Course Objectives

1. To learn the concepts of network analysis in electrical and electronics engineering.
2. To learn linear circuit analysis, graph theory and network theorems.
3. Analyze two port networks using Z, Y, ABCD and h parameters.

Course Outcomes

| | |
|---|---|
| CO1 | Apply the knowledge of graph theory with basic circuital laws and simplify the network using reduction techniques |
| CO2 | Analyze the circuit using Kirchhoff's law and Network simplification theorems |
| CO3 | Infer and evaluate transient response, Steady state response, network functions |
| CO4 | Evaluate two-port network parameters and explain the inter-relationship among parameters for network analysis. |
| CO5 | Synthesize one port network using Foster and Cauer Forms and |
| CO6 | Examine active filter configurations for possible applications in network theory. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Course Content:

| |
|---|
| Unit-1GraphTheory 6 hours |
| Graph of a Network, definitions, tree, co tree , link, basic loop and basic cut set,Incidence matrix, cut set matrix, Tie set matrix Duality, Loop and Nodal methods of analysis. |
| Unit-2Network Theorems (Applications to ac networks) 9 hours |
| Super-position theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Reciprocity theorem. Millman'stheorem, compensation theorem, Tellegen's theorem. |
| Unit-3Network Functions and Transient analysis 11 hours |
| Transform Impedances Network functions of one port and two port networks, concept of poles and zeros, properties of driving point and transfer functions, time response and stability from pole zero plot, transient analysis of ac & dc systems. |
| Unit-4Two Port Networks 10 hours |
| Characterization of LTI two port networks ZY, ABCD and h parameters, reciprocity and symmetry. Inter-relationships between the parameters, inter-connections of two port networks, T & Π Representation. |
| Unit-5Network Synthesis & Filters 9 hours |
| Positive real function; definition and properties; properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms. Image parameters and characteristics impedance, |

| Unit-6 Filters |
| --- |
| Passive and active filter fundamentals, low pass, high pass, (constant K type) filters, and introduction to active filters. |

Suggested Reading

1. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.
2. D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 1999.A.Chakrabarti, “Circuit Theory” DhanpatRai& Co

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Sensors and Transducers | | | | |
| Course Code | BEE01T2001 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 3 | 0 | 0 | 3 | |

Course Objectives

1. To make students familiar with the constructions and working principle of different types of sensors and transducers.
2. To gain an in-depth understanding of the operation of microcontrollers, machine language programming & interfacing techniques with peripheral devices
3. To gain an understanding of applications of microcontroller in designing processor-based automated electronics system.

Course Outcomes

| | |
|---|---|
| CO1 | Apply network theorems for the analysis of electrical circuits |
| CO2 | Obtain the transient response of electrical circuits |
| CO3 | Obtain the steady-state response of electrical circuits |
| CO4 | Analyze circuits in the sinusoidal steady-state (single-phase and three-phase). |
| CO5 | Analyze two port circuit behavior. |
| CO6 | Analyze the sensors used in IoT applications |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Course Content:

| |
|---|
| UNIT-I: TRANSDUCERS 8-HOURS |
| Introduction to transducer, classification and characteristics of transducers, Resistive Transducers: principle of resistive strain gauge, signal conditioning circuit, Displacement Transducers: L.V.D.T, applications. Temperature Transducers: resistance temperature detectors (RTD), thermocouple. pressure transducers: diaphragm pressure transducer. |
| UNIT-II: SENSORS 8-HOURS |
| Introduction to sensors , classification, difference between transducer and sensors, Radiation Sensors: LDR, photodiodes - construction and response. Capacitive Sensor : stretched diaphragm type – microphone - construction and characteristics, ultrasonic sensor, optical sensor, magnetic sensor, sensor interface: signal processing ,introduction to smart sensor . |
| UNIT-III: MICROCONTROLLER 8-HOURS |
| Introduction to single chip microcontrollers, 8051-architecture –instruction sets , addressing modes, memory organizations, assembly language programming, programming interrupts, timers and serial communication . |
| UNIT-IV: IOT & EMBEDDED SYSTEM 8-HOURS |

| |
|---|
| Introduction to IoT, physical design of IoT, logical design of IoT- functional blocks of IoT, challenges in IoT. introduction to embedded system ,difference between CISC and RISC Architecture, embedded system design methodologies, embedded controller design for communication, digital control. |
| UNIT-V: INTERFACING 8-HOURS |
| Sensors interfacing with embedded controller, ADC, DAC ,LCD, weather monitoring system, water monitoring system, line follower robot ,distance sensor interface . |
| UNIT-VI Sensor used in industry for IoT Application Development 6 hrs |
| Temperature Sensor,Proximity sensos, Water Quality sensors, Gas Sensors, Smoke sensors, IR sensors, Motion Detection sensors |

Suggested Reading


1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation' Dhanpat Rai and Co 2004.
2. D.V.S.Murty ,Transducers and instrumentations , 2nd edition, Prentice Hall of India,2012.
3. Mohammad Ali Mazidi and Janice Gillispie Maszidi "The 8051 Microcontroller and Embedded Systems" Pearson education, 2003, ISBN- 9788131710265, 2ndEdition
4. D. Patranabis, Sensors and Transducers, 2nd edition, Prentice Hall of India, 2010. E.A.
5. Microcontrollers: Architecture, Programming, Interfacing and System Design" ,Raj Kamal, "Pearson Education, 2005.
6. "The 8051 Microcontroller Architecture, Programming & Applications", 2e Kenneth .Ayala ;, Penram International, 1996 / Thomson Learning 2005.

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Design and Engineering | | | | |
| Course Code | BEE01T2002 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 3 | 0 | 0 | 3 | |

Course Objectives

1. To excite the student on creative design and its significance;
2. To make the student aware of the processes involved in design;
3. To make the student understand the interesting interaction of various segments of humanities, sciences and engineering in the evolution of a design;
4. To get an exposure as to how to engineer a design.

Course Outcomes

| | |
|---|---|
| CO1 | Realize the different elements involved in good engineering designs and apply them in practice when called for. |
| CO2 | Explain the product oriented and user oriented aspects that make the design a success. |
| CO3 | Implement innovative designs incorporating different segments of knowledge gained. |
| CO4 | Analyse the existing resources and select the apt resources and modern design tools. |
| CO5 | Illustrate the perspective of design covering function, cost, environmental sensitivity, safety and other factors other than engineering analysis. |
| CO6 | Explain the Engineering Design created proficiently to the society. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Course Content:

| |
|---|
| Unit-1 Introduction 8 hours |
| Design and its objectives; Design constraints, Design functions, Design means and Design from; Role of Science, Engineering and Technology in design; Engineering as a business proposition; Functional and Strength Designs. Design form, function and strength; |
| Unit-2Design process 8 hours |
| Design process- Different stages in design and their significance; Defining the design space; Analogies and “thinking outside of the box”; Quality function deployment-meeting what the customer wants; Evaluation and choosing of a design. |
| Unit-3Prototyping8 hours |
| Prototyping- rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design; Cost analysis. Engineering the Design – from prototype to product; Planning, Scheduling, Supply chains, Inventory, handling, manufacturing/ construction operations; storage, packaging, shipping, marketing, feedback on design. |
| Unit-4 Design Attributes 8 hours |
| Product Centered and User Centered design, Product centered attributes and user centered attributes; Value engineering, concurrent engineering and reverse engineering in design; Culture based Design. |
| Unit-5 Modular Design 8 hours |
| Modular Design, design optimization, Intelligent and autonomous products, User interfaces, communication between products; autonomous products, internet of things; human psychology and the advanced products. IPR, product liability. |

| | |
|---|---|
| Unit–6 Technology Trends in Engineering Design | 8 Hours |
| Introduction: Digital Twins, Artificial Intelligence, Robotics, 3D Printing, Generative Design | |

Suggested Reading


1. Balmer, R. T., Keat, W. D., Wise, G., and Kosky, P., Exploring Engineering, Third Edition: An Introduction to Engineering and Design - [Part 3 - Chapters 17 to 27], ISBN-13: 978-0124158917 ISBN-10: 0124158919
2. Dym, C. L., Little, P. and Orwin, E. J., Engineering Design - A Project based introduction- Wiley, ISBN-978-1-118-32458-5
3. Eastman, C. M. (Ed.), Design for X Concurrent engineering imperatives, 1996, ISBN 978-94-011-3985-4 Springer

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Digital Electronics | | | | |
| Course Code | BECE2010 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 3 | 0 | 0 | 3 | |

Course Objectives

1. To present the Digital fundamentals, Boolean algebra and its applications in digital systems
2. To familiarize with the design of various combinational digital circuits using logic gates
3. To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
4. To explain the various semiconductor memories and related technology
5. To introduce the electronic circuits involved in the making of logic gates

Course Outcomes

| | |
|---|---|
| CO1 | Design and analyze combinational logic circuits |
| CO2 | Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder |
| CO3 | Understand Logic Families and Design memories |
| CO4 | Design & analyze synchronous sequential logic circuits |
| CO5 | Use HDL & appropriate EDA tools for digital logic design and simulation |
| CO6 | Design application specific simple digital circuits. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Course Content:

| |
|---|
| Unit-1 Introduction 8 hours |
| Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion. |
| Unit-2MSI devices 8 hours |
| MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU. |
| Unit-3Sequential Logic Design 8 hours |
| Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation. |
| Unit-4Logic Families and Semiconductor Memories 8 hours |
| Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices. |
| Unit-5 VLSI Design flow 8 hours |

| |
|---|
| VLSI Design flow: Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits. |
| Unit 6 |
| Design and Implementation of Application specific digital circuits. Introduction of Microprocessors. |

Suggested Reading

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, “VHDL”, Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, “Digital Electronics- An introduction to theory and practice”, PHI, 2nd edition ,2006.
4. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989
5. Charles Roth, “Digital System Design using VHDL”, Tata McGraw Hill 2nd edition 2012.

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Electromagnetic Field Theory | | | | |
| Course Code | BECE2012 | | | | |
| Prerequisite | Physics | | | | |
| Corequisite | Physics | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

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

Course Outcomes

| | |
|---|---|
| CO1 | Apply coordinate systems and transformation techniques to solve problems on Electromagnetic Field Theory |
| CO2 | Apply the concept of static electric field and solve problems on boundary value problems. |
| CO3 | Analyze the concept of static magnetic field and solve problems using Biot - Savart's Law, Ampere's circuit law, Maxwell's equation. |
| CO4 | Understands magnetic forces, magnetic dipole and magnetic boundary conditions. |
| CO5 | Understands the time-varying Electromagnetic Field and derivation of Maxwell's equations. |
| CO6 | Understand the applications of Electromagnetism in Daily Life. |

| |
|---|
| Unit-1 Coordinate Systems and Transformation 8 hours |
| Coordinate Systems and Transformation : Basics of Vectors: Addition, subtraction and multiplications; Cartesian, Cylindrical, Spherical transformation. Vector calculus: Differential length, area and volume, line surface and volume integrals, Del operator, Gradient, Divergence of a vector, Divergence theorem, Curl of a vector, Stokes's theorem, Laplacian of a scalar. |
| Unit-2 Electrostatic fields 8 hours |
| Electrostatic fields: Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausses' Law- Maxwell's equation, Electric dipole and flux line, Energy density in electrostatic fields, Electric field in material space: Properties of materials, convection and conduction currents, conductors, polarization in dielectrics, Dielectric-constants, Continuity equation and relaxation time, boundary conditions, Electrostatic boundary value problems: Poisson's and Laplace's equations., Methods of Images. |
| Unit-3Magneto statics 8 hours |
| Magneto statics : Magneto-static fields, Biot - Savart's Law, Ampere's circuit law, Maxwell's equation, Application of ampere's law, Magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, magnetic scalar and vector potential. |
| Unit-4Magnetic forces 8 hours |
| Magnetic forces: Materials and devices, Forces due to magnetic field, Magnetic torque and moment, a magnetic dipole. Magnetization in materials, Magnetic boundary conditions, Inductors and inductances, Magnetic energy. |
| Unit-5Time-varying Fields8 hours |
| Time-varying Fields: Maxwell's equation, Faraday's Law, transformer and motional electromotive forces, Displacement current, Maxwell's equation in final form, Power and the pointing vector. Basics of Transmission lines. |

| Unit-6 Applications of Electromagnetism 6 hrs |
|---|
| Household Application, Industrial Application, Magnetic Levitation Trains, Communication System, medical Systems |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Suggested Reading


1. Principles of Electromagnetics N. O. Sadiku, Oxford University Press Inc
2. Engineering Electromagnetics W H Hayt, J A Buck, McGraw Hill Education
3. Electromagnetic Waves, R.K. Shevgaonkar, Tata McGraw Hill India, 2005
4. Electromagnetics with Applications, Kraus and Fleish, Edition McGraw Hill International Editions, Fifth Edition, 1999

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Digital Electronics Lab | | | | |
| Course Code | BECE2011 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 0 | 0 | 2 | 1 | |

Course Objectives

Students will learn and understand the Basics of digital electronics and able to design basic logic circuits, combinational and sequential circuits.

Course Outcomes

| | |
|---|---|
| CO1 | Understanding of Digital Binary System and implementation of Gates |
| CO2 | Design the Sequential circuits with the help of combinational circuits and feedback element |
| CO3 | Design data selector circuits with the help of universal Gates |
| CO4 | Design the flip –flop and counters. |
| CO5 | Design the counters with the help of sequential circuit and basic Gates. |
| CO6 | Implement the projects using the digital ICs and electronics components |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 50 | - | 50 | 100 |

List of Experiments:

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, Concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.
2. Implementation of the given Boolean function using logic gates in both SOP and POS forms.
3. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
4. Implementation and verification of Decoder using logic gates.
5. Implementation and verification of Encoder using logic gates.
6. Implementation of 4:1 multiplexer using logic gates.
7. Implementation of 1:4 demultiplexer using logic gates.
8. Implementation of 4-bit parallel adder using 7483 IC.
9. Design, and verify the 4-bit synchronous counter.
10. Design, and verify the 4-bit asynchronous counter.
11. Implementation of Mini Project using digital integrated circuits and other components.

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Engineering Clinic-I | | | | |
| Course Code | BEE01P2003 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 0 | 0 | 4 | 2 | |

Course Objectives

1. To study basic electronic components
2. To observe characteristics of electronic devices

Course Outcomes

| | |
|---|---|
| CO1 | Plot the characteristics of semiconductor diodes and transistors to understand their behaviour. |
| CO2 | Design, construct and test amplifier circuits and interpret the results |
| CO3 | Operate electronic test equipment and hardware tools to characterize the behaviour of devices and circuits |
| CO4 | Operate electronic test equipment and software tools to characterize the behaviour of devices and circuits |
| CO5 | Design and test the Diode clippers, clampers and rectifiers. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 50 | - | 50 | 100 |

List of Experiments:
1. Study of Instruments and components
2. V-I Characteristics of Si and Ge Diodes
3. Zener Diode Characteristics and Zener Diode as Voltage Regulator
4. Clippers and clampers
5. Half Wave and Full Wave Rectifiers
6. BJT Characteristics
7. FET Characteristics
8. BJT Biasing
9. FET Biasing
10. BJT as an Amplifier
11. UJT characteristics

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | IoT Lab | | | | |
| Course Code | BEE01P2004 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 0 | 0 | 2 | 2 | |

Course Objectives

1.To create an environment for research, design, development and testing of IoT solutions, in the field of energy management, communication systems, distributed sensor devices and advanced user interfaces
2.To provide a large-scale IoT system for the collection of information from the environment and its transfer to a server, as well as the skills necessary for the development of control logics, processing and display of data
3.To this end, IoT Laboratory is equipped with devices for the monitoring of energy consumption of electrical appliances, sensors for the monitoring of environmental parameters such as temperature and humidity and the communication infrastructure necessary to deliver the acquired information to a server

Course Outcomes

| | |
|---|---|
| CO1 | Investigate a variety of emerging devices and technologies such as smart sensing, pervasive connectivity, virtual interfaces & ubiquitous computing and their potential applications in consumer, retail, healthcare and industrial contexts |
| CO2 | Collaborate on research with industry partners to address significant and complex challenges surrounding IoT technologies and applications |
| CO3 | This may be used as a platform for conducting consultancy work required by government/Private organizations in around NCR |
| CO4 | Enable faculty learning, research and hands-on experimentation to discover and demonstrate the promise of the Internet of Things |
| CO5 | Provide students unique interdisciplinary learning and innovation experiences with IoT technologies |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 50 | - | 50 | 100 |

List of Experiments:
1. Exercise on Eclipse IoT Project.
2. Experiments on few Eclipse IoT Projects.
3. Any Experiment on architecture of Iot Toolkit.
4. Exercise on smart object API Gateway service reference implementation in IoT Toolkit.
5. Experiment on HTTP-to-CoAP semantic mapping Proxy in IoT Toolkit.
6. Experiment on Gate way as a service deployment in IoT Toolkit.
7. Experiment on application framework and embedded software agents for IoT Toolkit.
8. Exercise on working principle of Rasberry Pi.
9. Experiment on connectivity of Rasberry Pi with existing system components.

**Semester IV**

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Integrated Circuits | | | | |
| Course Code | BECE2008 | | | | |
| Prerequisite | Analog electronics | | | | |
| Corequisite | Analog electronics | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

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

Course Outcomes

| | |
|---|---|
| CO1 | Illustrate the AC, DC characteristics and compensation techniques of Operational Amplifier |
| CO2 | Realize the applications of Operational Amplifiers |
| CO3 | Clarify and Analyze the working of Analog Multipliers and PLL |
| CO4 | Classify and realize the working principle of various converter circuits using Op-Amps |
| CO5 | Demonstrate the function of various signal generators and Waveform Shaping Circuits |
| CO6 | Analyse the performance of Operational Amplifier Circuits. |

Course Content:

| |
|---|
| Unit-1 Introduction 8 hours |
| Analysis of difference amplifiers, Monolithic IC operational amplifiers, specifications, frequency response of op-amp,, slew rate and methods of improving slew rate, Linear and Nonlinear Circuits using operational amplifiers and their analysis, Inverting and Non inverting Amplifiers. |
| Unit-2 |
| Differentiator, Integrator, Voltage to Current convertor, Low pass, high pass, band pass filters, comparator, Multi-vibrator and Schmitt trigger, Triangle wave generator, Precision rectifier, Log and Antilog amplifiers, Non-linear function generator, Sine wave Oscillators. |
| Unit-3 |
| Analysis of four quadrant and variable trans-conductance multipliers, Voltage controlled Oscillator, Closed loop analysis of PLL, Frequency synthesizers, Compander ICs. |
| Unit-4 |
| Analog switches, High speed sample and hold circuits and sample and hold IC's, Types of D/A converter-Current driven DAC, Switches for DAC, A/D converter, Flash, Single slope, Dual slope, Successive approximation, Voltage to Time and Voltage to frequency converters. |
| Unit-5 |
| Wave shaping circuits, Multivibrator- Monostable&Bistable, Schmitt Trigger circuits, IC 555 Timer, Application of IC 555, Switched capacitor filter, Frequency to Voltage converters. |
| Unit 6 |
| Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Optocouplers and fibre optic IC. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Suggested Reading


1. Sergio Franco, " Design with operational amplifiers and analog integrated circuits ", McGraw Hill, 2002, ISBN 0070530440, 9780070530447
2. Ramakant A. Gayakwad, " OP - AMP and Linear IC's ", 4th Edition, Prentice Hall, 2000, ISBN 0132808684, 9780132808682
3. Botkar K.R., " Integrated Circuits ", Khanna Publishers, 1996. Taub and Schilling, " Digital Integrated Electronics ", Tata McGraw-Hill Education, 2004, ISBN 0070265089, 9780070265080
4. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill, 2001, ISBN 0074622455, 9780074622452

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Signals and Systems | | | | |
| Course Code | BECE2016 | | | | |
| Prerequisite | Engineering Mathematics | | | | |
| Corequisite | | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

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

Course Outcomes

| | |
|---|---|
| CO1 | Understand various types of signals, classify, analyze and perform various operations on them. |
| CO2 | Classify the systems and realize their responses |
| CO3 | Analyze the response of continuous time systems using Fourier transforms |
| CO4 | Use Laplace and Z transform techniques as tool for System analysis |
| CO5 | Analyze the continuous and discrete time system functions |
| CO6 | Understand the application of Sampling Theorem, Multirate Signal Processing and their applications in real-world problems |

Course Content:

| |
|---|
| Unit-1 Introduction 8 hours |
| Signals and systems as seen in everydaylife, and in various branches of engineering and science. Types of signals and their representations: continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random, one dimensional/ multidimensional; Basic Signals: unit impulse, unit step, unit ramp, exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals (including transformations of independent variables) |
| Unit-2 Classification of Systems 8 hours |
| Classification, linearity, time-invariance and causality, impulse response, characterization of linear time-invariant (LTI) systems, unit sample response, convolution summation, step response of discrete time systems, stability, convolution integral, co-relations, signal energy and energy spectral density, signal power and power spectral density, properties of power spectral density. |
| Unit-3 Fourier Series and Transforms 8 hours |
| Continuous-time Fourier series: Periodic signals and their properties, exponential and trigonometric FS representation of periodic signals, convergence, FS of standard periodic signals, salient properties of Fourier series, Definition, conditions of existence of FT, properties, magnitude and phase spectra, Parseval's theorem, Inverse FT, Discrete time Fourier transform (DTFT), inverse DTFT, convergence, properties and theorems, Comparison between continuous time FT and DTFT. |
| Unit-4 Laplace Transforms and Z Transforms 8 hours |
| One-sided LT of some common signals, important theorems and properties of LT, inverse LT, solutions of differential equations using LT, Bilateral LT, Regions of convergence (ROC), One sided and Bilateral Z-transforms, ZT of some common signals, ROC, Properties and theorems, solution of difference equations using one-sided ZT, s- to z-plane mapping |
| Unit-5 Analysis of LTI systems 8 hours |
| Analysis of first order and second order systems, continuous-time (CT) system analysis using LT, system functions of CT systems, poles and zeros, block diagram representations; discrete-time system functions, block diagram representation, illustration of the concepts of system bandwidth and rise time through the analysis of a first order CT low pass filter |

| Unit 6 Multirate Signal Processing 8 hours |
|---|
| Sampling and data reconstruction process, Multirate Signal Processing, Sampling, Sampling rate conversion, introduction to compressive sensing. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Suggested Reading


1. Signals and Systems, Robert, TMH
2. Signals and Systems by Oppenheim &Wilsky
3. P. Ramakrishna Rao, `Signal and Systems' 2008 Ed., Tata McGraw Hill, New Delhi
4. Linear Signals and Systems by B. P. Lathi

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Analog and Digital Communication | | | | |
| Course Code | ECE417 | | | | |
| Prerequisite | Signals and Systems, Digital System Design | | | | |
| Corequisite | | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Outcomes

| | |
|---|---|
| CO1 | Analyze and compare different analog modulation schemes for their efficiency and bandwidth |
| CO2 | Analyze the behavior of a communication system in presence of noise |
| CO3 | Investigate pulsed modulation system and analyze their system performance |
| CO4 | Analyze different digital modulation schemes and can compute the bit error performance |
| CO5 | Analyze Source and Error control coding. |
| CO6 | Utilize multi-user radio communication |
| Unit-1 Introduction Review of signals and systems 8 hours | |
| Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals. | |
| Unit-2 Probability and random process 8 hours | |
| Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and Deemphasis, Threshold effect in angle modulation. | |
| Unit-3Pulse modulation 8 hours | |
| Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM),Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers. | |
| Unit-4Elements of Detection Theory 8 hours | |
| Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion. | |
| Unit-5Pass band Digital Modulation schemes 8 hours | |
| Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying. Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels. | |
| UNIT 6 MULTI-USER RADIO COMMUNICATION 8 hrs | |
| Advanced Mobile Phone System (AMPS) – Global System for Mobile Communications (GSM) – Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Hand – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth. | |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Suggested Reading

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
6. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000

| | | | | |
|---|---|---|---|---|
| Name of The Course | Data Base Management System | | | |
| Course Code | BEE01T2005 | | | |
| Prerequisite | | | | |
| Corequisite | | | | |
| Antirequisite | | | | |
| | L | T | P | C |
| | 3 | 0 | 0 | 3 |

Course Objectives:

The scope of the course is Database System concepts and major application areas. The objective is to understand various data models and to develop the relational model of database including the rigorous practice of query language, SQL. The emphasis is to apply the concepts to wide range of applications.

Course Outcomes

| | |
|---|---|
| CO1 | Understand the relational database theory, application of database system in real life. |
| CO2 | Describe DBMS architecture, physical and logical database designs, database modeling, relational, hierarchical and network models. |
| CO3 | Learn and apply Structured query language (SQL) for database definition and database manipulation. |
| CO4 | Illustrate relational database theory, and be able to write relational algebra expressions for queries. |
| CO5 | Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database. |
| CO6 | Illustrate the Concept of stored procedures and functions. |

Course Content:

| | | |
|---|---|---|
| Unit I | Introduction: | 10 Hrs |
| Introduction: An overview of database management system, database system Vs file system, Database system concept and architecture, data model schema and instances, data independence and database language and interfaces, data definitions language, DML. | | |
| Unit II | Data Model and ER Diagram | 8 Hrs |
| Data Modeling using the Entity Relationship Model:<br>ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model. | | |
| Unit III | Relational data Model | 7 Hrs |
| Relational data model concepts, integrity constraints, entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus. | | |
| Unit IV | Database Language | 8 Hrs |
| Introduction on SQL: Characteristics of SQL, advantage of SQL. SQL data type and literals. Types of SQL commands. SQL operators and their procedure. Tables, views and indexes. Queries and sub queries. Aggregate functions. Insert, update and delete operations, Joins, Unions, Intersection, Minus. | | |
| Unit V | Data Base Normalization | 7 Hrs |
| Functional dependencies, normal forms, first, second, third normal forms, BCNF | | |
| Unit VI Database modifications using SQL. 6 hrs | | |
| Database modifications using SQL. . PL/SQL: Basic Concepts-SQL within PL/SQL- Cursors -Concept of stored procedures and functions-packages-Triggers. | | |
| | | |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Suggested Reading


1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill
2. Date C J, " An Introduction to Database Systems", Addision Wesley
3. Elmasri, Navathe, " Fudamentals of Database Systems", Addision Wesley
4. O'Neil, Databases, Elsevier Pub.
5. Leon & Leon,"Database Management Systems", Vikas Publishing House
6. Bipin C. Desai, " An Introduction to Database Systems", Galgotia Publications
7. Majumdar & Bhattacharya, "Database Management System", TMH (14)

| | | | | | |
|---|---|---|---|---|---|
| BEE01T2006 | Microcontroller and Embedded System | L | T | P | C |
| Version1.0 | Date of Approval: | 3 | 0 | 0 | 3 |
| Pre-requisites//Exposure | Digital Electronics | | | | |
| co-requisites | | | | | |

Course Objectives

1. To gain an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques with peripheral devices
2. To learn the concept of designing computer organization and architecture
3. To gain an understanding of applications of microprocessors in designing processor-based automated electronics system.

Course Outcomes

At the end of the Course, the student will be able to

CO1: Recall and apply the basic concept of digital fundamentals to Microprocessor based personal computer system.
CO2: Identify the detailed s/w & h/w structure of the Microprocessor.
CO3: Illustrate how the different peripherals are interfaced with Microprocessor.
CO4: Distinguish and analyze the properties of Microprocessors & Microcontrollers.
CO5: Analyze the data transfer information through serial & parallel ports.
CO6: Recent trends in microprocessor and challenges in memory management

Text Books

1. Barry B Brey, The intel microprocessor: architecture, programming and interfacing, Prentice hall of India, NewDelhi, 2003.ISBN-0138027455, 4th Edition

2. Mohammad Ali Mazidi and Janice GillispieMaszidi "The 8051 Microcontroller and Embedded Systems" Pearson education, 2003, ISBN- 9788131710265, 2ndEdition

Reference Books

1. Kenneth J. Ayla, "The 8051 Micro controller", Thomson learning, 3rd edition, 2004, ISBN-140186158X

2. Alan Clements, "Principles of Computer Hardware", OxfordUniversity Press, 3rd Edition, 2003, ISBN-9780198564539

Course Content

Unit I: Introduction 6 lecture hours

Introduction to Microprocessors, Microcontrollers and system design – Assembly and High-Level language programming – System Development Environment: assembler, compiler and integrated development environment.

Unit II: 8086 Microprocessor 6 lecture hours

Architecture and Programming of 8086 microprocessor: pipelining, Instruction sets, addressing modes – Memory addressing, decoding and Memory interfacing – Interrupts and interrupts handling.

Unit III: I/O and Bus Interfacing 9 lecture hours

Interfacing methods – 8255 PPI interface, 8254 timer interface, 8259 PIC and DMA controller interface – Bus Interface: electrical characteristics, interfacing ISA bus, EISA, PCI bus, LPT, USB and RS232 interface.

Unit IV:8051 Microcontroller 9 lecture hours

Introduction to single chip Microcontrollers, Intel MCS-51 family features –8051/8031-architecture – 8051 assembly language programming, addressing modes – Programming interrupts, timers and serial communication – system design with 8051.

Application of microprocessor and Microcontrollers in data acquisition systems, process control, signal processing, data communication and distributed computing and networking.

Unit V: Introduction to Embedded Systems, Microprocessors and Microcontrollers 9 lecture hours

System level interfacing design; Advanced Microprocessor Architectures- 286, 486, Pentium; Microcontrollers 8051 systems; Introduction to RISC processors; ARM microcontrollers; Embedded system design methodologies, embedded controller design for communication, digital control.

Unit VI: Application and latest trends in microprocessor and embedded systems

| | | | | | |
|---|---|---|---|---|---|
| BEEE2001 | **Electrical Measurements and Instrumentation** | L | T | P | C |
| Version1.0 | Date of Approval: | 3 | 0 | 0 | 3 |
| Pre-requisites//Exposure | Basic Electrical and Electronics Engineering | | | | |
| co-requisites | | | | | |

Course Objectives

This course is designed to provide knowledge and understanding about the instruments used in physical quantity measurement especially used in industries and in our laboratories. Furthermore, it provides a foundation for subsequent study in Instrumentation.

1. To know the necessity of different measuring instruments and their design principle
2. To understand the working principle of different measuring instruments and technical solutions to handle different errors.
3. To learn the architecture and working principle of advanced measuring instrument and their applications.

Course Outcomes

At the end of the Course, the student will be able to

CO1 Apply physical principles to study the construction and working principle of different analog instruments and analyze the errors takes place in measurements. (K3- Apply)

CO2 Apply the physical principle to study the working of instrument transformers and measurement of speed, frequency and power factor. (K3- Apply)

CO3 Apply the bridge balance principle to measure the electrical parameter's (Resistance, Inductance and Capacitance). (K3- Apply)

CO4 Apply balasitic principles and potentiometric principles to measure the iron losses. (K3- Apply)

CO5 Examine the waveforms using analyzers and oscilloscopes. (K3- Apply)

CO6 Relate the measurements to the real time application(K3-aap)

Text Books

T1. E.W. Golding & F.C. Widdis, "Electrical Measurement &Measuring Instrument", A.W. Wheeler& Co. Pvt. Ltd. India.

T2. A.K. Sawhney,"Electrical & Electronic Measurement & Instrument", DhanpatRai& Sons

Reference Books

R1.Forest K. Harries,"ElectricalMeasurement",Willey Eastern Pvt. Ltd. India

Course Content

Unit I:Philosophy of Measurement & Analog Measurement of Electrical Quantities 13 lecture hours

Unit& dimensions, standards, Errors, Characteristics of Instruments and measurement system, basics of statistical analysis. PMMC instrument, DC ammeter, DC voltmeter, Ohm meter, Moving Iron instrument, Electrodynamic Wattmeter, errors and remedies, Three Phase Wattmeter, Power in three phase system, Energy meter.

Unit II: Measurement: Instrument Transformer 5 lecture hours

Instrument Transformer and their applications in the extension of instrument range, Introduction to measurement of speed, frequency and power factor.

Unit III: Measurement of Parameters 8 lecture hours

Different methods of measuring low, medium and high resistances, measurement of inductance & capacitance with the help of AC Bridges- Wheatstone, Kelvin, Maxwell, Hay's, Anderson, Owen, Heaviside, Campbell, Schering, Wien bridges, Wagner Earthing device, Q Meter, Application of bridges in the measurement inductance and capacitance in electrical appliances.

Unit IV : AC Potentiometer & Magnetic Measurement 5 Lecture hours

Polar type & Co-ordinate type AC potentiometers, application of AC Potentiometers in electrical measurement, Application of Potentiometers to the magnetic measurement. Ballistic Galvanometer, Flux meter.

Unit V: Digital Measurement of Electrical Quantities & Cathode Ray Oscilloscope 9 Lecture hours

Concept of digital measurement, Digital voltmeter, Frequency meter, Power Analyzer and Harmonics Analyzer, Electronic Multimeter. CRT, wave form display, time base, dual trace oscilloscope, Measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Sampling Oscilloscope, DSO, DSO applications.

Unit VI: Introduction to application of sensors and transducer 6 Lecture hours

Various sensor and transducer used in power stations, smart grids.

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Integrated Circuits Lab | | | | |
| Course Code | BECE2009 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 0 | 0 | 2 | 2 | |

Course Objectives

The student should be able to:

1. To acquire the basic knowledge of special function IC. At the end of the course,
2. Design oscillators and amplifiers using operational amplifiers.
3. Design filters using Opamp and perform experiment on frequency response.

Course Outcomes

| | |
|---|---|
| CO1 | To design various types of amplifier using Op-amp. |
| CO2 | To design waveform generation circuits. |
| CO3 | To design basic timer and analog and digital circuits. |
| CO4 | To design simple logic circuits using digital ICs |
| CO5 | To design various types of Analog Integated Circuits. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 50 | - | 50 | 100 |

List of Experiments:

1. Operational Amplifiers (IC741)-Characteristics and Application.
2. Waveform Generation using Op-Amp (IC741).
3. Applications of Timer IC555.
4. Design of Active filters.
5. Study and application of PLL IC’s
6. Design of binary adder and subtractor.
7. Design of counters.
8. Study of multiplexer and demultiplexer /decoders.
9. Implementation of combinational logic circuits.
10. Study of DAC and ADC
11. Op-Amp voltage Regulator- IC 723.

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Microprocessor and Micro Controller Lab | | | | |
| Course Code | BECE3005 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 0 | 0 | 2 | 2 | |

Course Objectives

1. To expose students to the operation of typical microprocessor (8085) trainer kit.
2. To prepare the students to be able to solve different problems by developing different programs.
3. To develop the quality of assessing and analyzing the obtained data.

Course Outcomes

| | |
|---|---|
| CO1 | Write assembly language, C and C++ programs for arithmetic operations using Pentium processor based system |
| CO2 | Write 8051 assembly language programs to control inbuilt timer and communication modules. CO3 Interface ADC and DAC modules with microprocessor based system. |
| CO3 | Implement DSP functions using ARM processor. |
| CO4 | To work on modules like stepper motor. |
| CO5 | To verify and understand interfacing units. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 50 | - | 50 | 100 |

List of Experiments:

1. Write a simple program for arithmetic operations – addition, subtraction, multiplication and division of 16 – bit number. (8086 Program)
2. Write a simple program for string operations like string concatenation, swapping. Write a program for interfacing LCD with 8086 and display a message.
3. Write a program for performing simple arithmetic operations. (8051 Programming)
4. Write a simple program for flashing LEDs using software delays, timers and interrupts. Write a program for interfacing Seven Segment Display and LCD with 8051 and display messages.
5. Write a program for interfacing Keypad with 8051 and display keypad input on LCD.
6. Write a program for square waveform generation, with different frequencies and duty cycles.
7. Write a program for serial communication through UART using polling and interrupt methods.
8. Write a program for interfacing ADC 0804 with 8051.
9. Write a program for Pulse Width Modulation using on-chip PWM and analog I/O modules.
10. Write a program for interfacing Seven Segment Display and LCD to ARM processor.
11. Write a program to interface ARM processor with PC using Tera - Term.
12. Write a program to generate various waveforms
13. Write a program for flashing LEDs using timers and interrupts.

**Semester V**

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Control Systems | | | | |
| Course Code | BEEE3002 | | | | |
| Prerequisite | Signals and Systems | | | | |
| Corequisite | | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

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

Course Outcomes

| | |
|---|---|
| CO1 | Identify the various control system components and their representations. |
| CO2 | Analyze the various time domain parameters |
| CO3 | Analysis the various frequency response plots and its system. |
| CO4 | Apply the concepts of various system stability criterions. |
| CO5 | Design various transfer functions of digital control system using state variable models. |
| CO6 | To perform stability analysis of non linear control systems. |

Course Content:

| |
|---|
| Unit-1 Introduction 8 hours |
| Control System: Terminology and Basic Structure-Feed forward and Feedback control theoryElectrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system |
| Unit-2 Transient response8 hours |
| Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD, PI,PID control systems |
| Unit-3Closed loop frequency response 8 hours |
| Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation |
| Unit-4 Concept of stability 8 hours |
| Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion. |
| Unit-5 State variable representation 8 hours |
| State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback. |
| Unit-6 Non linear Systems 8 hours |
| Effects of zeros, minimum and non-minimum phase systems. Linearization of nonlinear systems. Application of basic filter design to Navigation and Movement. Stability Analysis of non linear control systems. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Text Book (s)

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

Reference Book (s)

1. K. Ogata, ‗‗Modern Control Engineering‘, 5th edition, PHI, 2012. 3. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.

2. Benjamin.C.Kuo, ―Automatic control systems‖, Prentice Hall of India, 7th Edition,1995.

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | EM Waves | | | | |
| Course Code | BEE01T3001 | | | | |
| Prerequisite | Electromagnetic Fields | | | | |
| Corequisite | | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives

1. To introduce the basic mathematical concepts related to electromagnetic vector fields.
2. To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
3. To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
4. To impart knowledge on the concepts of Faraday‘s law, induced emf and Maxwell‘s equations.
5. To impart knowledge on the concepts of Concepts of electromagnetic waves andTransmission lines.

Course Outcomes

| | |
|---|---|
| CO1 | Analyze transmission lines and estimate voltage and current at any point on transmission line for different load conditions. |
| CO2 | Provide solution to real life plane wave problems for various boundary conditions. |
| CO3 | Analyze the field equations for the wave propagation in special cases such as lossy and low loss dielectric media. |
| CO4 | Visualize TE and TM mode patterns of field distributions in a rectangular wave-guide. |
| CO5 | Understand and analyze radiation by antennas. |
| CO6 | Explicate the recent advances in theory and applications of EM waves |

Course Content

| |
|---|
| Unit-1 Transmission Lines 8 hours |
| Introduction, Concept of distributed elements, Equations of voltage and current, Standing waves and impedance transformation, Lossless and low-loss transmission lines, Power transfer on a transmission line, Analysis of transmission line in terms of admittances, Transmission line calculations with the help of Smith chart, Applications of transmission line, Impedance matching using transmission lines. |
| Unit-2 Maxwell’s Equations 8 hours |
| Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss’s law, Ampere’s Circuital law, Faraday’s law of Electromagnetic induction. Maxwell’s equations, Surface charge and surface current, Boundary conditions at media interface. |
| Unit-3 Uniform Plane 8 hours |
| WaveHomogeneous unbound medium, Wave equation for time harmonic fields, Solution of the wave equation, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity of a wave, Power flow and Poynting vector. |
| Unit-4 Plane Waves at Media Interface 8 hours |
| Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction of waves at dielectric interface, Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary. |
| Unit-5 Waveguides 8 hours |
| Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic(TM) mode, Cut-off frequency, Phase velocity and dispersion. Transverse Electromagnetic (TEM) mode, Analysis of waveguide-general approach, Rectangular waveguides. |

| Unit-6 Recent Trends 5 hours |
| --- |
| Novel Waveguide technologies and its future systems. |

Text Book / Reference :

1. R. K. Shevgaonkar, “Electromagnetic Waves”, Tata McGraw Hill, 2005.
2. D. K. Cheng, “Field and Wave Electromagnetics”, Addison-Wesley, 1989.
3. M. N.O. Sadiku, “Elements of Electromagnetics”, Oxford University Press, 2007.
4. C. A. Balanis, “Advanced Engineering Electromagnetics”, John Wiley & Sons, 2012.
5. C. A. Balanis, “Antenna Theory: Analysis and Design”, John Wiley & Sons, 2005.

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Digital Signal Processing | | | | |
| Course Code | BECE3020 | | | | |
| Prerequisite | Signals and systems | | | | |
| Corequisite | Signals and systems | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives

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

Course Outcomes

| | |
|---|---|
| CO1 | Apply digital signal processing fundamentals and Acquire the knowledge of representation of discrete-time signals in the frequency domain, using z-transform and discrete Fourier transform. |
| CO2 | Design and Analyze FIR filters with desired frequency responses. |
| CO3 | Design and Analyze IIR filters with desired frequency responses. |
| CO4 | Realize FIR/IIR Filter structure and analyze the effects quantization errors in analog to digital conversion of signals |
| CO5 | Understand architecture of DSP Processors, Compressive sensing, Multirate Signal Processing and their applications in real-world problems |
| CO6 | Apply signal processing techniques to solve real time problems |

Text Book (s)

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

Reference Book (s)

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

Course Content:

| | |
|---|---|
| Unit-1 Introduction | 8 hours |
| Discrete and Fast Fourier Transforms: Introduction to DSP, DTFT, Relationship between DFT and other transforms DFT, Properties of DFT, Circular Convolution, DFT as a Linear Transformation, Fast Fourier Transform, Computing an Inverse DFT by doing a Direct DFT. Review of z transform and inverse Z transform. | |
| Unit-2Finite Impulse Response Filters | 8 hours |
| Finite Impulse Response Filters:- Magnitude and phase response of a digital filters, Frequency response of linear phase FIR filters, Design Techniques for FIR filters. | |
| Unit-3Infinite Impulse Response Filters | 8 hours |

| |
|---|
| Infinite Impulse Response Filters:-IIR filter Design by Approximation of Derivatives, Impulse Invariant Method, Bilinear Transformation, Butterworth filters, Chebyshev Filters and Frequency Transformation. |
| Unit-4Realization of Digital Filters 8 hours |
| Realization of Digital Filters: Basic Structures for IIR Systems, Basic Structures for FIR system. Effects of Finite Word Length in Digital Filters: Introduction, Rounding and Truncation Errors, Quantization effects in analog to digital conversion of signals |
| Unit-5 Multi Rate Signal Processing 8 hours |
| Introduction to wavelets, Multirate Signal Processing, Sampling, Sampling rate conversion, introduction to compressive sensing. |
| Unit-6 DSP Processors 5 hours |
| Architecture of DSP Processors & applications: Harward architecture, pipelining, Multiplier-accumulator (MAC) hardware, architectures of fixed and floating point (TMSC6000) DSP processors. Applications |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Bio-Medical Instrumentaion | | | | |
| Course Code | ********** | | | | |
| Prerequisite | EMI | | | | |
| Corequisite | | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives

The course has the following objectives:

● To introduce an fundamentals of transducers as applicable to physiology

● To explore the human body parameter measurements setups

● To make the students understand the basic concepts of forensic techniques. ● To give basic ideas about how multimedia evidences are useful in crime investigation.

Course Outcomes

| | |
|---|---|
| CO1 | Understand the physiology of biomedical system |
| CO2 | Measure biomedical and physiological information |
| CO3 | Discuss the application of Electronics in diagnostics and therapeutic area |
| CO4 | Examine the waveforms using analyzers and oscilloscopes |
| CO5 | Know the artificial body parts and its application |
| CO6 | Relate the measurements to the real time application in medical field |

Text Book (s)

1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PH

Reference Book (s)

1. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
2. 2. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.

Course Content:

**UNIT I**

**Transducers** - Classification, selection of transducers, circuit based on transduction. Temperature transducers – Displacement transducer - Pressure transducer - catheter tip transducers. Photoelectric transducers - Flow transducers - Piezoelectric transducers and their applications, Biological receptors and receptor characteristics.

**UNIT II**

Reference electrodes, The pO2 electrodes, Membrane electrodes, Blood gas analysis, Transcutaneous pO2 and pCO2 transducers, Fiber optic chemical transducer, Ion specific electrodes, Ionic content of blood, ISFET for glucose, urea.

**UNIT III**

Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG),

Electrooculogram (EOG), Electroretinogram (ERG), Recording Electrodes – Electrode-tissue interface, polarization, skin contact impedance, motion artifacts, Silver-Silver Chloride electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes of EMG, Electrical conductivity of electrode jellies and creams, microelectrodes, Needle electrodes.

**UNIT IV**

Principle of dialysis, Artificial kidney, Types, function and working of dialysis, Performance analysis of dialysis, Membranes used for hemodialysis, Block diagram and working of hemodialysis machine, Portable kidney machine – working and flow diagram.

**UNIT V**

Physiological effects of electrical currents, macroshock and microshock, preventive measures to reduce shock hazards, Leakage current, isolation of patient circuits, safety of electrically susceptible patients, radiation hazards and safety, shielding, open ground problem and earthing methods.

**UNIT-VI**

Current trends in the field of the Bio-Medical instrumentaions

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Communication Engineering Lab | | | | |
| Course Code | BEE01P3004 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 0 | 0 | 2 | 1 | |

Course Objectives

1. To practice the basic theories of Analog communication system and experiments as it is a key analysis tool of engineering design.
2. To give a specific design problem to the students, which after completion they will verify.

Course Outcomes

| | |
|---|---|
| CO1 | Generate AM and FM signals and evaluate their performance. |
| CO2 | Perform signal sampling by determining the sampling rates for baseband signals and reconstruct the signals. |
| CO3 | Generate digital modulation signals for ASK, PSK and FSK and perform their detection. |
| CO4 | Simulate MSK, DPSK, QPSK and DEPSK schemes and estimate their BER. |
| CO5 | Study and analyse about communication. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 50 | - | 50 | 100 |

List of Experiments:
1. Fourier Synthesis
2. AM Transmitter & Receiver
3. FM Transmitter & Receiver
4. AM/FM Radio Receiver
5. Analog signal sampling & Reconstruction
6. Generation & Detection of PAM/PWM/PPM
7. Generation & Detection of PCM
8. Generation & Detection of DM/SIGMA DELTA/ ADM
9. Baseband digital data transmission
10. Data conditioning & Reconditioning
11. Generation & Detection of BPSK/DPSK/DEPSK
12. Simulation of digital modulation schemes.

**Semester VI**

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Advanced Communication Systems | | | | |
| Course Code | BEE01T3005 | | | | |
| Prerequisite | Analog and Digital Communication | | | | |
| Corequisite | | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

The student will learn and understand

1. Analog and digital communication systems, and their design parameters
2. Role of Digital Modulation and encoding techniques in different application.
3. the concept of Spread Spectrum techniques and Multiple Access Techniques.
4. The features and architectures used in 4G and 5G communication

Course Outcomes

| | |
|---|---|
| CO1 | To analyze the design parameters of analog and Digital communication systems |
| CO2 | To apply the different modulation and encoding techniques to according to the need of application. |
| CO3 | To apply spread spectrum techniques to secure communication in network. |
| CO4 | To analyse the noise in coherent receiver and understand diversity techniques. |
| CO5 | To understand the Emerging Trends in Communication including 4G, WiMax, and 5G |
| CO6 | Explain and address the challenges in communication networks. |

Course Content:

| |
|---|
| Unit-1 Introduction 8 hours |
| Introduction to different communications systems and their applications, Mathematical Models of Communication Channel, Designing parameters of analog and digital communication systems. |
| Unit-2 Digital Modulation Techniques 8 hours |
| Digital Modulation Techniques, BPSK, QPSK, Temporal waveform encoders, Multi carrier modulation schemes, OFDM, Wavelet based OFDM, QAM |
| Unit-3 Multiple Access techniques 8 hours |
| Introduction, Generation of PN Sequences, Properties of PN Sequences DS and FH spread spectrum, CDMA system based on FH and DS spread spectrum signals, Applications, Introduction to Multiple Access Techniques |
| Unit-4Coherent Systems and Diversity Techniques: 8 hours |
| Coherent receiver, Homodyne and heterodyne detection, noise in coherent receiver, Fading, Diversity Techniques, Quality of service (QoS) |
| Unit-5 Introduction to 4G: 8 hours |
| Status and Key Technologies,4G WIRELESS SYSTEM FEATURES, 4G Network Structure, protocol stack architecture, WIMAX System Architecture, Limitation of 4G. |
| Unit-6 Evolution towards 5G 8 hours |
| Evolution towards 5G. Challenges in 5G Networks, Emerging Trends in 5G Networks |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Suggested Reading

1. Andrew J Viterbi, “CDMA Principles of spread spectrum communications”, Addition Wesley, (1995).
2. J S Lee and L E Miller, “CDMA systems engineering handbook”, Artech House, (1998).
3. Marvin K Simon, Jim K Omura, Robert A Scholtz, Bary Klevit, “Spread Spectrum Communications”, (1995).
4. Sergio Verdu, “Multiuser Detection”, Cambridge University Press, (1998).
5. Andrew S Tanenbaum, “Computer Networks”, Prentice Hall of India.
6. J.G.Proakis,” Digital Communication (4/e)”, McGraw- Hill, 2001
7. S. Haykin, “Communication systems (4/e)”, John Wiley, 2001
8. B.P. Lathi, Zhi Ding, “Modern Digital and Analog Communication Systems (4/e)”, Oxford university Press, 2010

| | | | | |
|---|---|---|---|---|
| Name of The Course | VLSI Design | | | |
| Course Code | BECE3013 | | | |
| Pre-requisite | Semiconductor Devices, Integrated Circuits, Digital Design | | | |
| Co-requisite | | | | |
| Anti-requisite | | | | |
| | L | T | P | C |
| | 3 | 0 | 0 | 3 |

Course Objectives:

1. To bring both Circuits and System views on design together.
2. Study the fundamental concepts and structures of designing digital VLSI systems include CMOS devices and circuits.
3. Understand standard CMOS fabrication processes, CMOS design rules, static and dynamic logic structures, interconnect analysis.
4. It offers a profound understanding of the design of complex digital VLSI circuits, computer aided simulation and synthesis tool for hardware design.

Course Outcomes

| | |
|---|---|
| CO1 | Utilize the subject knowledge in specifying the technological problems for evolving cellular technology. |
| CO2 | Be able to use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnect. |
| CO3 | Have an understanding of the characteristics of CMOS circuit construction and the comparison between different state-of-the-art CMOS technologies and processes. |
| CO4 | Be able to design and solve complex problems. |
| CO5 | Be able to complete a significant VLSI design project having a set of objective criteria and design constraints. |
| CO6 | Design and analyse architectures and functional blocks. |

| |
|---|
| Unit-1 Integrated Circuit: Fabrication And Characteristics 7 hours |
| Integrated circuit technology, basic monolithic integrated circuits, epitaxial growth, Masking and etching, diffusion of impurities, transistors for monolithic circuits, monolithic diodes, Integrated resistors, Integrated capacitors and inductors, monolithic circuit layout, additional isolation methods, LSI and MSI, the metal semiconductor contacts. |
| Unit-2 Introduction to MOS Transistor 8 Hours |
| The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS, Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitances, Numerical and spice simulations. |
| Unit-3 MOS Inverters: Static and Switching Characteristic, Interconnect Effects 10 Hours |
| Introduction, Resistive-Load Inverter, Inverters with n-Type MOSFET Load, CMOS Inverter, Delay-Time Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters, Numerical and spice simulations |
| Unit-4 Combinational and Sequential MOS Logic Circuits 7 Hours |
| Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, High-Performance Dynamic CMOS Circuits, Introduction, MOS Logic Circuits with Depletion nMOS Loads, CMOS Logic Circuits, Complex Logic Circuits, CMOS Transmission Gates (Pass Gates), Introduction, Behavior of Bistable Elements, The SR Latch Circuit, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-Flop |

| Unit-5 Memories and VLSI Design Methodologies 7 Hours |
|---|
| Introduction, Read-Only Memory (ROM) Circuits, Static Read-Write Memory (SRAM) Circuits, Dynamic Read-Write Memory (DRAM) Circuits Introduction, VLSI Design Flow, Design Hierarchy, Concepts of Regularity, Modularity and Locality, VLSI Design Styles, Design Quality, Packaging Technology, Computer-Aided Design Technology |
| UNIT 6 IMPLEMENTATION STRATEGIES 6 |
| Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Suggested Reading


1. S.M.Sze, “VLSI technology”, 2nd Edition, Tata McGraw Hill Education, 2003, ISBN 9780070582910
2. Sung-Mo Kang & Yusuf Leblebici, “CMOS Digital
3. Integrated Circuits – Analysis and Design”, 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.
4. N. Weste and K. Eshranghian, "Principles of CMOS VLSI Design", Addison Wesley, 1998.
5. Jacob Backer, Harry W. Li and David E. Boyce, " CMOS Circuit Design, Layout and Simulation ", Prentice Hall of India, 1998.
6. L.Glaser and D. Dobberpuhl, "The Design and Analysis of VLSI, Circuits”, Addison Wesley 1993.
7. Randel& Geiger, “ VLSI Analog and Digital Circuit Design Techniques” McGraw- Hill,1990.
8. John P. Uyemura, "Introduction to VLSI Circuits and Systems," John Wiley & Sons, ,Inc, 2002.

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Bio-Medical Signal Processing | | | | |
| Course Code | ********** | | | | |
| Prerequisite | Signals and Systems and DSP | | | | |
| Corequisite | | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives

The course has the following objectives:

1. Understand the mathematical principles of continuous and digital signal processing. Apply knowledge of math, engineering and science to identify, formulate, and solve problems in these areas
2. Apply knowledge of math, engineering and science to understand the principle of biomedical signal processing.
3. Understand how to apply specific mathematical techniques to solve problems in the areas of biomedical signals (e.g., calculation of an ECG spectrum using Fourier Series and calculation of Heart Rate Variability using Fourier Transforms).

Course Outcomes

| | |
|---|---|
| CO1 | Develop a thorough understanding on basics of digital signals and biological signals |
| CO2 | understands the basics of signal pre-processing and digital filtering |
| CO3 | Develop a thorough understanding on basics of ECG and EEG feature extraction. |
| CO4 | Develop a thorough understanding on basics of ECG pattern recognition and classification algorithms. |
| CO5 | Use the computer software (like MATLAB) for signal processing for real bio-medical signals |
| CO6 | Relate the DSP to the real time application in medical field |

Text Book (s)

. Digital signal processing, Proakis (PHI)
2. Signal Analysis By R. P. Singh , Second edition Tata McGraw – Hill
3. Engineering Electronics By Mauro R Prentice – Hall
4. Malmivuo, J. and Plonsey, R. Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields, Oxford University Press, New York, 1995.

**D C Reddy, McGraw Hill, Biomedical Signal Processing.**

## Reference Book (s)

1. Biomedical signal processing: Metin Akay (academic press)
2. Biomedical signal processing: Tompkins (academic press)
3. Theory and application of digital signal processing: Rabiner and Gold, EEE Publication.Course Content:

Unit I.

Z transform introduction, definition, convergence. Inverse Z transforms, Analysis of discrete time systems using Z transforms. Solutions of differential equations. Transfer functions and stability.

Unit II.
Fourier transform for continuous signals. Energy spectrum, Properties (without proof), Gibbs phenomena, Auto and cross correlation. Discrete Fourier transforms. Properties (without proof), Inverse DFT, introduction to FFT

Unit III.
IIR & FIR Filters, Low pass, High Pass, Band Pass Filters using windows – Kaiser Windows. Sampling Theorem, aliasing Nyquist criteria, ADC's and DAC's.

Unit IV.
Digital signals and systems: Classification of systems causal, time varying, time invariant, lumped. Introduction to digital signals systems. Convolution, Auto-correlation and cross correlation , Use of Matlab signal processing toolbox on various real bio - medical signals.

Unit V.
Introduction, Characteristics of Bio - Signals, Types of Signals, Measurement, Transformation. and reduction, computation of signal parameters that are diagnostically significant, stationary and non - stationary bio - signals, Application areas of Bio -Signals analysis - EEG, ECG, Phonocardiogram, Spiro Gram, Evoked Signals.

UNIT-VI
Current trends in the field of the Bio-Medical signal processing

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | VLSI and Embedded Systems Lab | | | | |
| Course Code | BEE01P3009 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 0 | 0 | 2 | 1 | |

Part-A: VLSI Lab Course Objective:

1. To design and draw the internal structure of the various digital integrated circuits
2. To develop VHDL/Verilog HDL source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary synthesizer.
3. To verify the logical operations of the digital ICs (Hardware) in the laboratory.

Course Outcomes

| | |
|---|---|
| CO1 | Design and draw the internal structure of the various digital integrated circuits |
| CO2 | Develop VHDL/Verilog HDL source code, perform simulation using relevant simulator andanalyze the obtained simulation results using necessary synthesizer. |
| CO3 | Understand serial communication, port RTOS on microcontroller. |
| CO4 | Use embedded C for reading data from port pins. |
| CO5 | Understand the interfacing of data I/O devices with microcontroller. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 50 | - | 50 | 100 |

List of Experiments:

VHDL/ Verilog HDL

1. Realization of Logic Gates.
2. 3- to - 8Decoder- 74138.
3. 8 x 1 Multiplexer-74151 and 2 x 4 De-multiplexer-74155.
4. 4-Bit Comparator-7485.
5. D Flip-Flop-7474.
6. Decade counter-7490.

7. Shift registers-7495.
8. ALU Design.

Part-B: Embedded Systems Lab

1.Write a program to toggle all the led to port and with some time delay using ARM7 PO1, PO2 PSO1
2 .Write a program to interface LCD with ARM7 PO1, PO2 PSO1
3 .Write a program to interface 4*4 matrix keypad with ARM7
4 .Write a program for interfacing LED and PWM and to verify the output in the ARM7
5 .Write a program to interface Stepper motor with ARM7
6 .Write a program for interfacing of DC motor with ARM7 PO1, PO2, PO3 PSO1 7 Write a program to study and characteristics of the programmable gain amplifier (PGA)
8 .Write a Program realization of low pass, high pass and band pass filters and their characteristics
9 .Write a program to interface ADC and DAC with
10. Digital function implementation using digital blocks A. Counter for blinking LED B. PWW C. Digital buffer and digital inverter
11 .Write a program to verify Timer operation in different modes
12 .Write a Program to interface stepper motor with PSOC

**Semester VII**

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Data Communication and Networking | | | | |
| Course Code | BEE01T4002 | | | | |
| Prerequisite | | | | | |
| Corequisite | | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Outcomes

| | |
|---|---|
| CO1 | Understand and explain the concept of Data Communication and networks, layered architectureand theirapplications. |
| CO2 | Differentiate between Analog and Digital Signals, Guided and Unguided Media |
| CO3 | Understand the data communication link considering elementary concepts of data link layer protocols for error detection and correction. |
| CO4 | Understand the data flow in network layer and differentiate between unicast and multicast routing protocols. |
| CO5 | Estimate the congestion control mechanism to improve quality of services in networking applications |
| CO6 | Understand and analyzes the security issues in network |

Course Content:

| |
|---|
| Unit-1 Introduction 8 hours |
| Introduction to Data Communication, Network Criteria, Physical Structures, Network Models, Categories of Networks, Protocols and Standards, The OSI Model, TCP/IP Protocol suit, Addressing |
| Unit-2 Physical Layer and Media 8 hours |
| Analog and Digital Signals, Transmission Impairments, Multiplexing, Guided and Unguided Media, Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks, Structure of Switch. |
| Unit-3 : Data Link Layer 8 hours |
| Introduction, Types of Errors, Detection Versus Corrections, Block Coding, Framing, Flow and Error Control, Multiple Access, CSMA, CSMA/CD, CSMA/CA, IEEE Standards, Data Link Layer, Physical Layer, MAC Sublayer, IEEE 802.11, Blue Tooth, Passive Hubs, Repeaters, Active Hubs, Bridges, Routers, Two Layer Switches, Three Layer Switches |
| Unit-4 Network Layer 8 hours |
| IPv4 Addressing, IPv6 Addressing, Address Mapping, Delivering, Forwarding, Unicast Routing Protocols, Multicast Routing Protocols |

| | |
|---|---|
| Unit-5 Transport Layer | 8 hours |
| Process-to-Process Delivery, User Datagram Protocol (UDP), TCP, Data Traffic, Congestion, Congestion Control, QoS in Switched Networks | |
| Unit-6 Security | 3 hours |
| Symmetric-Key Cryptography, Asymmetric-Key Cryptography, Security Services | |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Microcontroller Application in Bio-Medical Engineering | | | | |
| Course Code | ********** | | | | |
| Prerequisite | Microcontroller and Embedded systems | | | | |
| Corequisite | | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Outcomes:

1. Interface external device like sensors, memory, keyboard etc with the microprocessor as well as microcontroller
2. Control the different physical parameter.
3. They will be able to write program in assembly language and C language.
4. Know about the timer's application in the microcontroller.
5. Know about the microcontrollers in embedded biomedical applications
6. Know about the recent advancement in the microcontrollers.

Text Books

1. Micro controllers & its applications by B.S. Chhabra, Dhanpat Rai Pub. Co., India

2. 8051mC, Scott Mackenizie, PHI, Englewood Cliffs, New Jersey.

3. Myke Predko,'Programnming & Customizing the 8051 Microcontroller,' Tata

McGraw-Hill Pub. Co. Ltd., New Delhi.

Reference Books:

1. 8051 m C Architecture Programming & Applications, K.J. Ayata: Penram International

Publishers, India.

2. S.K. Venkata Ram,'Advanced Microprocessor & Microcontrollers, Luxmi Pub. Pvt. Ltd., New

Delhi

Course Content:

Unit 1

Introduction: 8051, Comparison with microprocessor, pin diagram explanation, internal

diagram 8051.

Unit 2

Instruction Set: Addressing mode, data transfer instruction, logical, arithmetic instruction,

bit instruction, branching instruction.

Unit 3

Timers: Mode of timers, simple programming, generation of square wave.

8051 connection to RS 232

Interrupts: Interrupt priority in 8051, generation of waveforms using interrupt, serial interface using interrupt.

Unit 4

Interfacing of memory, intelligent LCD, 8255, ADC, DAC, LED display.

Unit 5

Applications: Introduction to DSP processor, Applications of microcontrollers and computers in biomedical engineering, microcontrollers in embedded biomedical applications.

Unit VI

Study the advanced microcontroller

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Communication Networks Lab | | | | |
| Course Code | BEE01P4002 | | | | |
| Prerequisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 0 | 0 | 2 | 1 | |

Course Objectives

1. To understand the working principle of various communication protocols.
2. To analyze the various routing algorithms.
3. To know the concept of data transfer between nodes.

Course Outcomes

| | |
|---|---|
| CO1 | Understand fundamental underlying principles of computer networking |
| CO2 | Understand details and functionality of layered network architecture. |
| CO3 | Apply mathematical foundations to solve computational problems in computer networking |
| CO4 | Analyze performance of various communication protocols. |
| CO5 | Compare routing algorithms and Practice packet /file transmission between nodes. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 50 | - | 50 | 100 |

List of Experiments:

1. PC to PC Communication Parallel Communication using 8 bit parallel cable Serial communication using RS 232C
2. Ethernet LAN protocol: To create scenario and study the performance of CSMA/CD protocol through simulation
3. Token bus and token ring protocols: To create scenario and study the performance of token bus and token ring protocols through simulation
4. Wireless LAN protocols: To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
5. Implementation and study of stop and wait protocol
6. Implementation and study of Goback-N and selective repeat protocols
7. Implementation of distance vector routing algorithm
8. Implementation of Link state routing algorithm
9. Implementation of Data encryption and decryption
10. Transfer of files from PC to PC using Windows / Unix socket processing

**Elective Baskets**

1. **Communication and Networking**

| | | | | |
|---|---|---|---|---|
| Name of The Course | Satellite Communication | | | |
| Course Code | BECE3103 | | | |
| Prerequisite | Analog and Digital Communication | | | |
| Co-requisite | | | | |
| Anti-requisite | | | | |
| | L | T | P | C |
| | 3 | 0 | 0 | 3 |

Course Objectives

Satellite Communication Systems provide vital and economical fixed and mobile communication services over very large coverage areas of land, sea and air. In this course, you will learn the fundamentals and the techniques for the design and analysis of satellite communication systems.

Course Outcomes

| | |
|---|---|
| CO1 | Explain the fundamentals of satellite communication systems |
| CO2 | Design a satellite communication link under specified characteristics. |
| CO3 | Explain the modulation and multiplexing techniques in satellite communication. |
| CO4 | Describe propagation effects and their impact on satellite-earth links |
| CO5 | Demonstrate the working of satellite based systems. |
| CO6 | To conduct a simulation-based design project requiring some independent reading, programming |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Course Content:

| |
|---|
| Unit I:Basic Knowledge:. 6 Hours |
| Elements of Satellite Communication Orbital mechanics look angle and orbit determination, launches & launch vehicle, orbital effects, Geostationary Orbit |
| Unit II: Satellite subsystems 10 Hours |
| Sub Systems: Satellite subsystems, attitude and orbit control systems, TTC&M, communication subsystem, satellite antenna satellite link design: basic transmission theory, system noise temperature and G/T ratio, downlink design, uplink design, satellite systems using small earth station, design for specified C/N. |
| Unit III:Different modulation schemes: 8 Hours |
| Modulation and multiplexing techniques for satellite links: FM, pre-emphasis and de-emphasis, S/N ratios for FM video transmission, digital transmission, digital modulation and demodulation, TDM. Multiple access techniques. |
| Unit IV: Error control for digital satellite links: 8 Hours |

| |
|---|
| Error control for digital satellite links: error detection and correction, channel capacity, error control coding schemes. Propagation effects and their impact on satellite-earth links: attenuation and depolarization, atmospheric absorption, rain, cloud and ice effects etc. |
| Unit V: Introduction of various satellite systems 8 Hours |
| Introduction of various satellite systems: VSAT, low earth orbit and non-geostationary, direct broadcast satellite television and radio, satellite navigation and the global positioning systems. |
| Unit VI Satellite Applications 6 hours |
| Satellite Applications: Satellite mobile services, VSAT, GPS, Radarsat, Direct broadcast satellites (DBS)-Direct to home Broadcast (DTH) |

Suggested Reading


1. Satellite Communications / Dennis Roddy / McGraw-Hill (T)
2. Satellite Communications / Pratt, Bostian, Allnutt / John Wiley & Sons. (T)
3. Digital Satellite Communications/ Tri T. Ha./ McGraw-Hill. (R )

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Principles of Secure Communication | | | | |
| Course Code | EEC505 | | | | |
| Prerequisite | Digital communication system | | | | |
| Corequisite | Digital communication system | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

1. To understand the communication systems and various methods of communication system.
2. To understand the ways to provide security to communication systems.

Course Outcomes

| | |
|---|---|
| CO1 | Understanding of the various types of spread spectrum techniques for secure communication. |
| CO2 | Slow and fast frequency hopping, performance of FHSS in AWGN Channel. |
| CO3 | Analyze the various cryptographic techniques and Apply the Encryption standards like DES, AES. |
| CO4 | Understanding the principle of Block Cipher and Encryption Standards. |
| CO5 | Knowing current network authentication applications, PKI, Web security and their vulnerabilities that are exploited by intentional and unintentional attacks. |
| CO6 | Understand password management |

Course Content

| |
|---|
| Unit-1 Introduction 8 hours |
| Model of Spread Spectrum digital communication system, direct sequence spread spectrum signal, error rate, performance of the decoder, processing gain and jamming margin, uncoded DSSS signals, applications of DSSS signals in anti-jamming, Code division multiple access and multipath channels, effect of pulsed interference on DSSS systems, Generation of PN sequences using m sequence and Gold sequences, narrowband interference in DSSS systems, acquisition and tracking of DSSS system. |
| Unit-2 |
| Basic concepts of Frequency Hopping, slow and fast frequency hopping, performance of FHSS in AWGN Channel, FHSS in CDMA system, Time hopping and hybrid Spread spectrum system, acquisition and tracking of FH SS systems. |
| Unit-3 |
| Classical encryption techniques, Symmetric cipher model, cryptography and cryptanalysts, Substitution techniques, transposition techniques. |
| Unit-4 |
| Block cipher principle, data encryption standard (DES), strength of DES, differential and linear cryptanalysts, block cipher design principles, Finite fields, simplified advanced encryption standard (S-AES), multiple encryption and triple DES, Block cipher modes of operation, stream ciphers and RC4 algorithm. |

| Unit-5 |
| --- |
| Prime numbers, Fermat and Euler's theorem, Chinese remainder theorem, discrete algorithms, principles of public key cryptosystems, RSA algorithm, key management Diffie-Hellman key exchange, message authentication requirements and functions. |
| Unit-6 |
| Intruders: Intrusion techniques, Intrusion detection,Statistical anomaly detection, Rule based intrusion detection, Distributed intrusion detection, Honey pot, Intrusion detection exchange format. password management: Password protection, password selection strategies. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
| --- | --- | --- | --- |
| 20 | 30 | 50 | 100 |

Suggested Reading

1. Digital Communication by Simon Haykin, Wiley.1 st edition ISBN 978-1-1185-4405-1,

2. Cryptography and Network Security by W. Stallings 5th Ed., PHI ISBN-10: 0136097049 ISBN-13: 978-0136097044.

3. Cryptography and secure Communications by M.Y. Rhee, Mc Graw Hill, ISBN-10: 0071125027; ISBN-13: 978-0071125024.

4. Communication System Security by LidongChen,Guang Gong, ISBN 9781439840368-CAT# K11870.

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Microwave Engineering | | | | |
| Course Code | BECE3006 | | | | |
| Prerequisite | Electromagnetic field theory | | | | |
| Corequisite | | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

1. Concept of scattering parameters used to characterize devices and system behavior.
2. The high frequency behavior of circuit and network elements as well as the analysis and the design of active and passive microwave devices.

| | |
|---|---|
| CO1 | Illustrate the basic concepts of microwave transmission lines. |
| CO2 | Identify and use microwave guides and components. |
| CO3 | Apply the conceptual knowledge of microwave solid state technology and traveling wave tube techniques |
| CO4 | Distinguish between microwave solid state and technology and traveling wave tube techniques |
| CO5 | Demonstrate and evaluate the microwave measurement techniques. |
| CO6 | Analyze the application of Microwaves in various fields |

Course Content:

| |
|---|
| Unit-1 Introduction 8 hours |
| Microwave frequency, Applications of Microwave, microwave transmission line, Introduction to Micro strip Transmission line (TL), Coupled TL, Strip TL, Coupled Strip Line, Coplanar TL. |
| Unit-2Microwave waveguides and components 8 hours |
| Rectangular Wave Guide: Field Components, TE, TM Modes, Dominant (TE10) mode, Power Transmission, Power losses, Excitation of modes, Circular Waveguides:<br>TE, TM modes, Microwave cavities (Resonators), Scattering matrix- The transmission matrix, Passive microwave devices: Microwave Hybrid Circuits, E Plane Tee, H plane Tee and Magic Tee , Terminations, Attenuators, Phase Shifters, Directional Couplers: Two Hole directional couplers, S Matrix of a Directional coupler, Hybrid Couplers, Isolators, Circulators. |
| Unit-3Microwave waveguides and components 8 hours |
| Rectangular Wave Guide: Field Components, TE, TM Modes, Dominant (TE10) mode, Power Transmission, Power losses, Excitation of modes, Circular Waveguides:<br>TE, TM modes, Microwave cavities (Resonators), Scattering matrix- The transmission matrix, Passive microwave devices: Microwave Hybrid Circuits, E Plane Tee, H plane Tee and Magic Tee , Terminations, Attenuators, Phase Shifters, Directional Couplers: Two Hole directional couplers, S Matrix of a Directional coupler, Hybrid Couplers, Isolators, Circulators. |
| Unit-4Microwave linear-beam tubes (O TYPE) and microwave crossed-field tubes 8 hours |
| Klystrons, Reentrant Cavities, Velocity-Modulation Process, Bunching Process, Output Power and Beam Loading, Multicavity Klystron Amplifiers, Beam-Current Density, Output Current Output Power of Two-Cavity Klystron, Reflex Klystrons, Velocity Modulation, Power Output and Efficiency, Helix Traveling-Wave Tubes (TWTs), Slow-Wave structures, Amplification Process, Convection Current, Axial Electric Field, Wave |

| |
|---|
| Modes, Gain Consideration, Microwave Crossed-Field Tubes , Magnetron Oscillators, Cylindrical Magnetron, Coaxial Magnetron, Tunable Magnetron , Backward wave Oscillators |
| Unit-5Microwave Measurements 8 hours |
| Introduction, Microwave Measurements devices: Slotted line carriage, Tunable detectors, VSWR Meter, microwave power measurements techniques, frequency measurement, wavelength measurements, Impedance and Refection coefficient measurements, VSWR, Insertion and attenuation measurements: Power ratio method, RF substitution method, VSWR measurements (Low and High) |
| Unit-6 Applications of Microwave 6 hours |
| Introduction to the applications of Microwave in communication, Remote Sensing, Spectroscopy. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Suggested Reading

1.D.M.Pozar, “Microwave engineering”, John Wiley, 3/e, 2005
2.Samuel Y.Liao, “Microwave Devices and Circuits”, 3/e, PHI, New Delhi,1987.
3.ober.E.Collin, “Foundations of Microwave Engineering”, John Wiley, 3/e, 2001
4.Annapurna Dasand S,.K.Das, “Microwave Engineering”, Tata Mc Graw-Hill, New Delhi, 2000
5. R.Chatterjee, “Microwave Engineering”, Affiliated East west Press PVT Ltd, 2001
6. O.P.Gandhi, “Microwave Engineering”, Pergamon Press, NY, 1983

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|---|---|---|---|---|---|
| Name of The Course | Mobile Computing | | | | |
| Course Code | | | | | |
| Prerequisite | | | | | |
| Corequisite | | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

This course introduces the fundamental concepts and principles in mobile computing technology. This course includes wireless networking, GSM & GPRS technology, data management, routing algorithm and security issues in mobile computing. The course provides opportunities for the students to understand and analyze the functions of various components associated with the above technologies,
the major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications. This course also provides an opportunity for students to understand the key components and technologies involved and to gain hands-on experiences in building mobile applications.

Course Outcomes

| | |
|---|---|
| CO1 | Apply the knowledge of wireless and mobile communications systems |
| CO2 | Examine the MAC issues and demonstrate wireless networking principles, for various applications |
| CO3 | Describe GSM architecture, operation and services offered by GSM networks |
| CO4 | Understand GPRS architecture, operation and services offered by GPRS networks |
| CO5 | Analyze the performance of various routing protocols and security issues associated with mobile computing |
| CO6 | Security Issues and Recent Trends |

Reference Books:


1. Jochen Schiller, *Mobile Communications*, Second Edition, Pearson Education, 2003.
2. Asoke K Talukder and Roopa R. Yavagal, *Mobile Computing – Technology, Applicationsand Service Creation*; TMH Pub., New Delhi, 2006
3. C D M Cordeiro, D. P. Agarwal, *Adhoc and Sensor Networks: Theory and applications*, World Scientific, 2006.


Course Content:

| | |
|---|---|
| Unit-1 Introduction | 8 hours |
| Introduction of mobile computing, overview of wireless telephony: cellular concept, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, Multiple access techniques like Frequency division multiple access (FDMA), Time division multiple access (TDMA), Code division multiple access (CDMA), Space division multiple access (SDMA). | |
| Unit-2 Wireless Networking | 8 hours |
| Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications. | |
| Unit-3 GSM | 8 hours |
| GSM Architecture, GSM Entities ,Call Routing in GSM, GSM Addresses and Identifiers, Network Aspects in GSM , GSM Frequency Allocation, Authentication and Security, Mobile Computing over SMS, Short Message (SMS) , Value Added Services through SMS, Accessing the SMS Bearer | |

| | |
|---|---|
| Unit-4 GPRS | 8 hours |
| GPRS andpacket Architecture GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS , Application for GPRS, Limitation of GPRS, Billing and Charging in GPRS, MMS , GPRS. Applications, Spread – Spectrum Technology, Data management and various issues in mobile computing environment. | |
| Unit-5 Routing Protocols | 8 hours |
| Routing Protocols: Adhoc Network Routing Protocols, Destination Sequenced Distance Vector Algorithm, Cluster Based Gateway Switch Routing, Dynamic Source Routing, Adhoc on-demand Routing, Location Aided Routing, Zonal Routing Algorithm. | |
| Unit 6- Security Issues and Recent Trends | |
| Mobile Computing Security Issues, Authentication, Encryption, Cryptographic Tools: Hash, Message Authentication Code (MAC), Digital Signature, Certificate. Secure Socket Layer (SSL).Recent trends on mobile computing and future networks | |

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|---|---|---|---|---|---|
| Name of The Course | Mobile Ad Hoc Networks | | | | |
| Course Code | BECE3204 | | | | |
| Pre-requisite | Wireless Communication | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

1. To gain an in-depth understanding the concepts of wireless ad-hoc networks.
2. To learn and understand the current and emerging trends in Wireless Networks.
3. Design ad-hoc network for the heterogeneous environment
4. "Hands-on experience in designing and implementing ad hoc network functionality using network simulation tools and Pocket PCs"

Course Outcomes

| | |
|---|---|
| CO1 | Explain the architecture, organization and operation of ad-hoc networks |
| CO2 | Construct ad-hoc network anywhere on temporary basis |
| CO3 | Design ad-hoc network for the heterogeneous environment |
| CO4 | Have an understanding of the principles of mobile ad hoc networks (MANETs) |
| CO5 | Distinguish between infrastructure-based networks |
| CO6 | Explain 5G technologies |

Text Book (s)

1. "C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", 1st Edition, Prentice Hall, PTR, 2006, ISBN 9788131706886"
2. C. K. Toh, "Ad Hoc Mobile Wireless Networks: Protocols and Systems", 1st Edition, Pearson, 2007, ISBN 9788131715109
3. Mobile Ad Hoc Networking by Stefano Basagni ,Marco Conti , Silvia Giordano , Ivan Stojmenovic
4. Mobile and Wireless Communication Networks by Guy Pujolle IFIP 19th World Computer Congress

Reference Book (s)

1. "Charles E. Perkins, "Ad Hoc Networking", 1st Edition, Pearson, 2008, ISBN 9788131720967"
2. Mohammed Ilyas, "The Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems", 1st Edition, CRC press, 2004, ISBN 9780849319686.
3. "Mobile Ad-hoc and Sensor Networks: Second International Conference, MSN 2006, Hong Kong,China, December 13-15, 2006, Proceedings"
4. Mobile Agents in Networking and Distributed Computing by Jiannong Cao, Sajal Kumar

| |
|---|
| Unit-1 Introduction to Wireless Ad Hoc Networks 9 hours |
| Introduction to cellular and ad hoc wireless networks, applications of ad hoc networks, issues in ad hoc wireless networks – medium access scheme, routing, multicasting, transport layer protocols, pricing scheme, quality of service provisioning, self organization, security, address and security discovery, energy management, scalability, deployment considerations, ad hoc wireless Internet. |
| Unit-2Medium Access Control Protocol 9 Hours |
| Issues in Designing a MAC Protocol for ad hoc wireless networks, design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention based Protocols, Contention based Protocols with Reservation mechanism, Contention Based MAC Protocols with Scheduling Mechanisms, Other MAC protocols. |
| Unit-3 Routing Protocol 9 Hours |
| Design issues and classification, Table-driven, On-demand and Hybrid routing protocols, Routing protocols with efficient flooding mechanisms, Hierarchical and power-aware routing protocols. |
| Unit-4Multicasting Protocol 8 Hours |
| "Design issues and operation, Architecture Reference Model, classification, Tree-based and Mesh-Based Protocols, Energy-Efficient Multicasting, Multicasting with Quality of Service Guarantee.Quality of Service: Issues and challenges in providing QoS, Classification of QoSsolutions." |
| Unit-5Energy Management 6 Hours |
| Need, classification of battery management schemes, Transmission power management schemes, System power management schemes. |
| Unit 6 Recent Trends and Technologies |
| New Generation Technology for Best QOS and 5G Technology. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Information Theory and Coding | | | | |
| Course Code | | | | | |
| Pre-requisite | Analog and Digital Communication | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:
The student will be able

1. To understand the fundamental concept of entropy and information as they are used in communications.
2. To identify the implications and consequences of fundamental theories and laws of information theory and coding with reference to the application in modern communication and computer systems.
3. To design different encoders using the different coding schemes like Huffman Coding, Shannaon Fano Coding, Cyclic codes, etc.,

Course Outcomes

| | |
|---|---|
| CO1 | Understand the concept of information and entropy |
| CO2 | To design different encoders using the different coding schemes |
| CO3 | Apply error control techniques |
| CO4 | To calculate syndrome using cylic code |
| CO5 | To apply compression techniques to text and images. |
| CO6 | Model the Entropy, Joint Entropy and Conditional Entropy, Relative Entropy and Mutual Information, Relationship Between Entropy and Mutual Information |

Text Book (s)

5. "C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", 1st Edition, Prentice Hall, PTR, 2006, ISBN 9788131706886"
6. C. K. Toh, "Ad Hoc Mobile Wireless Networks: Protocols and Systems", 1st Edition, Pearson, 2007, ISBN 9788131715109
7. Mobile Ad Hoc Networking by Stefano Basagni ,Marco Conti , Silvia Giordano , Ivan Stojmenovic
8. Mobile and Wireless Communication Networks by Guy Pujolle IFIP 19th World Computer Congress

Reference Book (s)

5. "Charles E. Perkins, "Ad Hoc Networking", 1st Edition, Pearson, 2008, ISBN 9788131720967"
6. Mohammed Ilyas, "The Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems", 1st Edition, CRC press, 2004, ISBN 9780849319686.
7. "Mobile Ad-hoc and Sensor Networks: Second International Conference, MSN 2006, Hong Kong,China, December 13-15, 2006, Proceedings"
8. Mobile Agents in Networking and Distributed Computing by Jiannong Cao, Sajal Kumar

| |
|---|
| Unit-1 Basics of information theory 9 hours |
| Basics of information theory: Information,Entropy, Information rate, Joint and conditional entropies, Mutual information – Discrete memoryless channels ,BSC, BEC, Channel capacity, Shannon limit. |
| Unit-2 Techniques of coding 9 Hours |
| Techniques of coding: classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding, Line coding. |
| Unit-3 Error control coding 9 Hours |
| Error control coding: block and cyclic codes: Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding – Single parity codes, Hamming codes, Repetition codes – Linear block codes |
| Unit-4Cyclic codes 8 Hours |
| Cyclic codes – Syndrome calculation, Encoder and decoder, CRC, Convolutional codes: Introduction, code tree, trellis, state diagram,Encoding ,Decoding |
| Unit-5Compression Techniques 6 Hours |
| Principles, Text compression, Static Huffman Coding, Dynamic Huffman coding, Arithmetic coding, Image Compression, Graphics Interchange format, Tagged Image File Format, Introduction to JPEG standards. |
| Unit 6 |
| Application of coding techniques in data compression,audio and Video Coding. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Wireless Sensor Networks | | | | |
| Course Code | BECE3203 | | | | |
| Pre-requisite | Computer Networks | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

1. To identify communication protocols employed in WSNs
2. To explain usefulness of OSI model for Communication System Design
3. To select the appropriate technology to implement a WSN.
4. To design a WSN

Course Outcomes

| | |
|---|---|
| CO1 | Know Basics challenges and technologies in Wireless Sensors Network. |
| CO2 | Understand Various Architectures and Protocols of Wireless network. |
| CO3 | Know Various Topology and Tools of Wireless Network. |
| CO4 | Analyze the problems related to sensor networks. |
| CO5 | Different communication protocols and their usefulness in different applications |
| CO6 | Perform case studies |

Text Book (s)

1. Holger Karl & Andreas Willig, “” Protocols And Architectures for Wireless Sensor Networks”” , John Wiley, 2005”
2. “Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach””, Elsevier, 2007”
3. Yang, Shuang-Hua , “Wireless Sensor Networks”
4. Fahmy, Hossam Mahmoud Ahmad, “Wireless Sensor Networks”

Reference Book (s)

1. “KazemSohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks- Technology, Protocols, And Applications”, John Wiley, 2007”
2. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003
3. “Wireless Sensor Networks: Technology, Protocols and Applications” by KazemSohrab
4. “Fundamentals of Wireless Sensor Networks: Theory and Practice (WSE)” by WaltenegusDargie and Christian Poellabauer”

| |
|---|
| Unit-1 Overview Of Wireless Sensor Networks 4 hours |
| Overview of Wireless Sensor Networks, Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor |
| Unit-2 Architectures 9 Hours |
| “Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture – Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.” |
| Unit-3 Networking Sensors 9 hours |

| |
|---|
| “Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts – S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing,Geographic Routing.” |
| Unit-4 Infrastructure Establishment 9 hours |
| “Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.” |
| Unit-5 Sensor Network Platforms And Tools 9 Hours |
| “Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.” |
| Unit-6 Applications of WSN 8 hours |
| Applications of WSN: WSN Applications – Home Control – Building Automation – Industrial Automation – Medical Applications – Reconfigurable Sensor Networks – Highway Monitoring – Military Applications – Civil and Environmental Engineering Applications – Wildfire Instrumentation – Habitat Monitoring – Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard – Target detection and tracking – Contour/edge detection – Field sampling. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Optical Communication | | | | |
| Course Code | BECE3016 | | | | |
| Pre-requisite | Optoelectronics, Electromagnetic Field Theory | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

1. Discuss the technology developments in Optical Communication with major emphasis on related theory/analysis of technical characteristics of Optical Fiber/Components, Systems and Network nodes to enable the design and selection of proper Functional modules/Building blocks intended for practical network application

2. Impart practical network knowledge based on Optical Communication Network Evolution viz. SONET in terms of Network Elements/Architecture, Network Management, Protection(Reliability),Synchronization

3. Introduce all- optical signal processing based on Optical components and related network functions based on Multi wavelength Optical layers, with Assignment& Routing algorithms along with associated Network architecture. Introduce advanced topics on Photonic packet switching, Optical Transport Network(OTN).

Course Outcomes

| | |
|---|---|
| CO1 | Recall basic laws of optical physics. Distinguish between the various modes of operation of Optical fibers. Identify the various causes for signal degradation. Calculate the various types of losses occurring in transmission of energy. |
| CO2 | Categorize the types of sources of light on basis of physical construction and principle of operation and describe the various phenomenon involved in the conversion of electrical energy into light energy. |
| CO3 | Explain the operation of optical receiver. Identify the various effects introducing noise in the system and evaluate the performance of digital receiver by calculating the probability of error. |
| CO4 | Define and apply the Wavelength Division Multiplexing. (WDM) principles and concepts. |
| CO5 | Discuss the basic applications of optical amplifiers like Erbium Doped Fiber Amplifier (EDFA). Look into the widely used networks like SONET/SDH. |
| CO6 | Understand the practically used optical networks |

Text Book (s)


1. Gerd Keiser, “Optical Fiber Communication” McGraw -Hill International, Singapore, 3rd edition, 2000

2. Rajiv Ramaswami, Kumar N. Sivaranjan, “Optical Networks A practical perspective”, 2nd edition, Elsevier, 2004


Reference Book (s)


1. Djafar K. Mynbaev, Lowell L. Scheiner, “Fiber-Optic Communications Technology”, 1st edition, Pearson Education, 2001
2. John Powers, “An Introduction to Fiber optic Systems”, 2nd edition, IrwinMcGraw Hill, 1999

3. J.Gowar, “Optical Communication System”, 2nd edition, Prentice Hall of India, 2001

| |
|---|
| Unit-1 Introduction to Optical Fiber Communication 9 hours |
| Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication. Fiber materials, Photonic Crystal Fibers. Spectral characteristics. Optical Fiber wave guide: Structure, Single and Multimode operation; Attenuation, Material and wave guide dispersion |
| Unit-2 Optical Sources and Transmission Characteristics of Optical Fibers 9 Hours |
| Light Emitting Diode; principle, structures, power and efficiency, coupling to fibers. Laser diodes; principle, double hetero structure, gain and index guiding, distributed lasers. Attenuation, absorption, scattering losses, bending loss, dispersion, Intra model dispersion, Inter model dispersion |
| Unit-3 Optical Detectors and Optical Receiver 7 Hours |
| Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors. Optical Receiver Operation, eye diagrams, signal to noise ratio |
| Unit-4 Point-to-point link and Wavelength Division Multiplexing 7 hours |
| Building blocks; Multiplexing; Intensity Modulation/Direct Detection system; Principle of Regeneration; WDM link, Optical amplifiers; EDFA, SOA, Raman amplifier, Fabry-Perot filters. Dispersion compensation and management, Link analysis and Bit-Error-Rate calculation. |
| Unit-5 WDM Concepts and Optical Network 8 Hours |
| LAN, MAN, WAN; Topologies: bus, star, ring; WDM concepts, overview of WDM operation principles, WDM standards, Ethernet; FDDI; Telecom networking: SDH/SONET. Different forms of access networks: Telephony; ISDN; Cable TV; Broadcast and Switched Networks; HFC networks; FTTC and FTTH networks; All optical networks |
| Unit 6 Practical Optical Networks 6hours |
| Intelligent Optical Network (ION), FDDI, FTTH, Business -Drivers for Next Generation Optical Networks. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

### 3. VLSI Basket

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Digital System design using VHDL | | | | |
| Course Code | BECE3104 | | | | |
| Prerequisite | Digital Design | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | L | T | P | C | |
| | 3 | 0 | 0 | 3 | |

Course Objectives

1.To gain an in-depth understanding of VHDL and to realize different circuits using it both sequential and combinational

2.To learn the concept of memories and how they are designed using VHDL.

3. To gain an understanding of applications of VHDL in PLDs and Field Programmable Logic Arrays (FPGAs).

Course Outcomes

| | |
|---|---|
| CO1 | Explain VHDL as a programming language. |
| CO2 | Design the combinational and sequential logic circuits using VHDL. |
| CO3 | Design Programmable logic devices(PLDs) and Networks of Arithmetic operations. |
| CO4 | Gain proficiency with VHDL software package and utilize software package to solve problems on a wide range of digital logic circuits. |
| CO5 | Explain VHDL as a programming language. |
| CO6 | Illustrate the latest trends adapted in Digital System Design |

Continuous Assessment Pattern:

| Internal Assessment (IA) | Mid Term Exam (MTE) | End Term Exam (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Course Content:

| |
|---|
| Unit I:Introduction 7 Hours |
| Introduction to Hardware Description Languages (HDL) And HDL Based Design, VHDL- Variables, Signals And Constants, Arrays, VHDL Operators, VHDL Functions, VHDL Procedures, Packages And Libraries, VHDL Description Of Combinational Networks, Modeling Flip-Flops Using VHDL, VHDL Models For A Multiplexer, Compilation And Simulation Of VHDL Code, Modeling A Sequential Machine, VHDL Model For A Counter. |
| Unit II:VHDL Synthesis and Models 8 Hours |
| Attributes, Transport and Inertial delays, Operator overloading, Multivalued logic and signal resolution, IEEE-1164 standard logic, Generics, Generate statements, Synthesis of VHDL code, Synthesis examples, Files and TEXTIO. Introduction to data path and control path synthesis. |

| |
|---|
| Unit III:Digital Design with State Machine Charts 7 Hours |
| State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines, Asynchronous state machine based design. |
| Unit IV: Programmable Logic devices (PLDs): 9Hours |
| Designing with programmable logic devices: Read-only memories (ROM, EPROM, EEPROM/FLASH), Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner. Design of networks for arithmetic operations: Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, and Design of a binary divider. |
| Unit V:Field Programmable Gate Arrays (FPGA) 8 Hours |
| "Xilinx 3000 series FPGAs, Designing with FPGAs, Xilinx 4000 series FPGAs, using a one-hot state assignment, Altera complexprogrammable logicdevices (CPLDs), Altera FELX 10K series COLDs. Representation of floating-point numbers, Floating-point multiplication, Other floating-point operations." |
| Unit-6 Latest Trends in Digital System Design 7 Hours |
| Deep Learning with INT8 optimization on Xilinx Devices, Xilinx ISE Design Suite – FPGA, Complex programmable logic devices (CPLDs), Altera FELX 10K series CPLDs. Representation of floating-point numbers, Floating-point multiplication, Other floating-point operations" |

**4. IoT Basket**

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Introduction to IoT and its Applications | | | | |
| Course Code | BECE4501 | | | | |
| Prerequisite | Microprocessor and Microcontrollers | | | | |
| Corequisite | | | | | |
| Antirequisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

Students will understand the concepts of Internet of Things and develop IoT based systems for various applications.

Course Outcomes

| | |
|---|---|
| CO1 | Understand the concepts of Internet of Things |
| CO2 | Analyze basic protocols in wireless sensor network |
| CO3 | Realize various domain specific IoT applications and be able to analyse their performance |
| CO4 | Implement basic IoT applications using embedded platform |
| CO5 | Recognise the various data acquisition units and Actuators and their effective utilization in developing IoT Architectrures. |
| CO6 | Recognize the latest trends in IoT based system development |

Text Books &Reference Books:


1. RajkumarBuyya, Amir VahidDastjerdi, “Internet of Things Principles and Paradigms “ Copyright © 2016 Elsevier Inc.
2. ArshdeepBahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015. 2. Manoel Carlos Ramon, “Intel® Galileo and Intel® Galileo Gen
3. API Features and Arduino Projects for Linux Programmers”, Apress, 2014.
4. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.


Course Content:

| | | |
|---|---|---|
| Unit-1 | Introduction to IoT | 7 hours |

| |
|---|
| The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related, Standardization, Recommendations on Research Topics. |
| Unit-2 Network & Communication aspects 7 hours |
| Background/Related Work – OpenIoT Architecture for IoT/Cloud Convergence - Scheduling Process and IoT Services Lifecycle – Scheduling and Resource Management - Validating Applications and Use Cases – Future Research Directions |
| Unit-3 Challenges in IoT 7 hours |
| Introduction – Background and Related Work - Device/Cloud Collaboration Framework – Powerful Smart Mobile Devices – Runtime Adaptation Engine – Privacy-Protection Solution – Applications of Device/Cloud Collaboration - Context – Aware Proactive Suggestion – Semantic QA Cache – Image and Speech Recognition.- Future Work |
| Unit-4 Domain specific applications of IoT 7 hours |
| Principles, Architectures, and Applications: Introduction – Motivating Scenario – Definitions and Characteristics. - Reference Architecture – Applications – Research Directions and Enablers.- Commercial Products - Case Study |
| Unit-5 Developing IoT based Systems 7 hours |
| Introduction – Scenario - Architecture Overview- Sensors – The Gateway – Data Transmission |
| Unit 6 Recent Trends in IoT 7 Hours |
| Introduction of Blockchain, Big data, *SaaS(*Software- As-a-Service), IoT based Smart Homes, Smart Cities, IoT based Healthcare systems. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Automation and Robotics | | | | |
| Course Code | BECE3102 | | | | |
| Pre-requisite | IoT, Electronic System Design | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

1. To provide the student with basic knowledge and skills associated with robot control.
2. Demonstrate an ability to apply spatial transformation to obtain forward kinematics equation of robot manipulators.
3. Demonstrate an ability to perform kinematics and inverse kinematics analysis of robot systems.
4. Demonstrate knowledge of robot controllers.
5. To develop the student's knowledge in various robot structures and their workspace.

Course Outcomes

| | |
|---|---|
| CO1 | Explain Basic Robotic model & its applications. |
| CO2 | Differentiate types of control and the standardization for some robotic system. K4 |
| CO3 | Critically evaluate robots for particular applications. |
| CO4 | Analyze particular industrial applications and evaluate possible solutions in terms of automated dedicated/flexible) or mixed manual/automated systems. |
| CO5 | Realize the design problem and preliminary consideration of Industrial automation. |
| CO6 | Application of recent trends in robotics |

Text Book (s)


1. Mikell P Grover et. al. "Industrial Robots: Technology, Programming and Applications", 2nd Edition, Tata McGraw Hill, 1980, ISBN 9781259006210.
2. Robert J. Schilling, "Fundamentals of Robotics-Analysis and Control", PHI Learning, 2009, ISBN 9788120310476 ( Unit-II and Unit-III)


Reference Book (s)


1. K.S. Fu, Ralph Gonzalez, C.S.G. Lee, "Robotics: control, sensing, vision and Intelligence", 1st Edition,TataMcgraw-Hill, 2008, ISBN 9780070265103

| |
|---|
| Unit-1INTRODUCTION ROBOTICS 7 hours |
| Robotics – Basic components – Classification – Performance characteristics – Actuators- Electric actuator-DC motor horse power calculation, magneto-astrictive hydraulic and pneumatic actuators. Sensors and vision systems: Different types of robot transducers and sensors – Tactile sensors – Proximity and range sensors – ultrasonic sensor-touch sensors-slip sensors-sensor calibration- vision systems. |
| Unit-2ROBOT CONTROL 7 Hours |
| Control of robot manipulators- state equations-constant solutions-linear feedback systems-single axis PID control- PD gravity control- computed torque control- variable structure control- Impedance control. |
| Unit-3END EFFECTORS 7 Hours |
| End effectors and tools– types – Mechanical grippers – Vacuum cups – Magnetic grippers – Robot end effectors interface, work space analysis work envelope-workspace fixtures-pick and place operation-continuous path motion-interpolated motion-straight line motion. |
| Unit-4ROBOT MOTION ANALYSIS 7 Hours |
| Robot motion analysis and control: Manipulator kinematics –forward and inverse kinematics- arm equation-link coordinates-Homogeneous transformations and rotations and Robot dynamics |
| Unit-5ROBOT APPLICATIONS 6 Hours |
| Industrial and Non industrial robots, Robots for welding, painting and assembly – Remote Controlled robots – Robots for nuclear, thermal and chemical plants – Industrial automation – Typical examples of automated industries |
| Unit 6 Recent development in Robotics 4 hours |
| Recent development in AI based Robotics, Machine Learning Robotics, IOT based Robotics Cloud based Robotics. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

4. **Signal Processing Basket**

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Neural Networks and Fuzzy Control | | | | |
| Course Code | EEC506 | | | | |
| Pre-requisite | Control Systems | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

1. Get the exposure to Artificial Neural Networks & Fuzzy Logic.
2. Understand the importance of tolerance of imprecision and uncertainty for design of robust &low cost intelligent machines
3. Explore the functional components of neural network classifiers or controllers, and the functional components of fuzzy logic classifiers or controllers
4. Develop and implement a basic trainable neural network or a fuzzy logic system for a typical control, computing application or biomedical application

Course Outcomes

| | |
|---|---|
| CO1 | Identify and describe Fuzzy Logic and Artificial Neural Network techniques in building intelligent machines. |
| CO2 | Apply Artificial Neural Network & Fuzzy Logic models to handle uncertainty and solve engineering problems. |
| CO3 | Understanding of fuzzy relation rule and aggregations |
| CO4 | Understand concept of classical and fuzzy sets, fuzzification and defuzzification |
| CO5 | Recognize the feasibility of applying a Neuro-Fuzzy model for a particular problem |
| CO6 | Effectively use modern software tools to solve real life problems using a soft computing approach and evaluate various soft computing approaches for a given problem. |

| |
|---|
| Unit-1Introduction to Artificial Neural Network9 hours |
| Artificial neural networks and their biological motivation – Terminology – Models of neuron –Topology – characteristics of artificial neural networks – types of activation functions – learning methods – error correction learning – Hebbian learning – Perceptron – XOR Problem –Perceptron learning rule convergence theorem – Adaline. |
| Unit-2Feed-forward and Recurrent Neural Networks12 Hours |

| |
|---|
| "Architecture: perceptron model, solution, single layer artificial neural network, multilayer perceptron model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications; Recurrent neural networks: Linear auto associator – Bi-directional associative memory – Hopfield neural network." |
| Unit-3Fuzzy Logic & Fuzzy Sets 9 Hours |
| Introduction to Fuzzy Logic, Classical and Fuzzy Sets, Membership Function ,Membership Grade, Universe of Discourse, Linguistic Variables, Operations on Fuzzy Sets: Intersections, Unions, Negation, Product, Difference, Properties of Classical set and Fuzzy sets, Fuzzy vs Probability, Fuzzy Arithmetic, Fuzzy Numbers. |
| Unit-4Fuzzy Relations & Aggregations 9 Hours |
| Essential Elements of Fuzzy Systems, Classical Inference Rule, Classical Implications and Fuzzy Implications, Crisp Relation and Fuzzy Relations, Composition of fuzzy relations, Cylindrical Extension and Projection. Fuzzy IF-THEN rules, Inference: Scaling and Clipping Method, Aggregation, Fuzzy rule based Model: Mamdani Model, TSK model, Fuzzy Propositions, De-fuzzification: MOM, COA |
| Unit-5Fuzzy Optimization and Neuro Fuzzy Systems 6 Hours |
| Fuzzy optimization –one-dimensional optimization. Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks. |
| Unit 6:Recent trends and Applications 5 hours |
| Recent trends in Soft computing, Neuro-Fuzzy Systems, SVM, Application of Fuzzy Logic in Medicine, Economics, Industry etc. |

Continuous Assessment Pattern

| Internal Assessment (IA) | Mid Term Test (MTE) | End Term Test (ETE) | Total Marks |
|---|---|---|---|
| 20 | 30 | 50 | 100 |

Suggested reading

Text Book (s)


1. Ross, Timothy J. Fuzzy logic with engineering applications. John Wiley & Sons, 2009
2. Yegnanarayana, B. Artificial neural networks. PHI Learning Pvt. Ltd., 2004
3. Stamatios V. Kartalopoulos, Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications 1st Edition
4. S. Rajasekaran, Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications.
5. Aaron M. Tenenbaum, YedidyahLangsam and Moshe J. Augenstein “Data Structures Using C and C++” , PHI, 1996."
6. Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with applications”, McGraw Hill, 2007.
7. "Kosko, B, “Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence”, PrenticeHall, NewDelhi, 2004"
8. "Timothy J Ross, “Fuzzy Logic with Engineering Applications”,John Willey and Sons, West Sussex, England, 2005."

| | | | | | |
|---|---|---|---|---|---|
| Name of The Course | Soft Computing | | | | |
| Course Code | BECE4401 | | | | |
| Pre-requisite | | | | | |
| Co-requisite | | | | | |
| Anti-requisite | | | | | |
| | | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Outcomes

| | |
|---|---|
| CO1 | Identify and describe soft computing techniques and their roles in building intelligent machines |
| CO2 | To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations |
| CO3 | Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications |
| CO4 | Comprehend the fuzzy logic and reasoning to handle uncertainty and solve engineering problems, genetic algorithms to combinatorial optimization problems and neural networks to pattern classification and regression problems |
| CO5 | Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic |
| CO6 | Effectively use modern software tools to solve real life problems using a soft computing approach and evaluate various soft computing approaches for a given problem. |

Course Overview & Objectives

This course will cover fundamental concepts used in Soft computing. The concepts of Fuzzy logic (FL) will be covered first, followed by Artificial Neural Networks (ANNs) and optimization techniques using Genetic Algorithm (GA). Applications of Soft Computing techniques to solve a number of real life problems will be covered to have hands on practices.

Course Content

| |
|---|
| Unit I: Introduction to Artificial Neural Network 9 hours |
| Introduction Soft computing, Soft vs Hard computing,Techniques in Soft Computing,overview of biological Neuro-system, Artificial neural networks,characteristics and terminology of ANN, Models of neuron, Topology,types of activation functions;Perceptron: XOR Problem, Perception learning rule convergence theorem; Adaline. |
| Unit II: Feedforward and Recurrent Neural Networks 9 hours |
| Architecture of neural network: single layer artificial neural network, multilayer ANN, Learning, Types of Learning: Supervised, Unsupervised and Reinforcement Learning, Perceptron learning Algorithm, back propagation learning methods, back propagation algorithm, factors affecting backpropagation training, applications; Recurrent neural networks: Linear auto associator, Bi-directional associative memory – Hopfield neural network, K mean Clustering Algorithm |
| Unit III: Fuzzy Logic & Fuzzy Sets 8 hours |
| Introduction to Fuzzy Logic, Classical and Fuzzy Sets, Membership Function,Membership Grade, Universe of Discourse, Linguistic Variables, Operations on Fuzzy Sets: Intersections, Unions, Negation, Product, Difference, Properties of Classical set and Fuzzy sets, Fuzzy vs Probability, Fuzzy Arithmetic, Fuzzy Numbers. |
| Unit IV: Fuzzy Relations & Aggregations 9 hours |
| Essential Elements of Fuzzy Systems, Classical Inference Rule, Classical Implications and Fuzzy Implications, Crisp Relation and Fuzzy Relations, Composition of fuzzy relations, Cylindrical Extension and Projection. Fuzzy IF-THEN rules, Inference: Scaling and Clipping Method, Aggregation, Fuzzy rule-based Model: Mamdani Model, TSK mode, Defuzzification: MOM, COA |
| Unit V: Genetic algorithm: 9 hours |

| |
|---|
| Genetic Algorithm: An Overview, Implementation of GAfundamentals, basic genetic concepts, working principle,Population initialization, Fitness function, encoding, Operators of GA: Selection, Crossover/Recombination, Mutations, Mutation Operators, Applications Areas of GA |
| Unit VI:Recent trends and Applications 5 hours |
| Recent trends in Soft computing, Neuro-Fuzzy Systems, SVM, Application of Fuzzy Logic in Medicine, Economics, Industry etc. |

Text Books


1. Ross, Timothy J. *Fuzzy logic with engineering applications*. John Wiley & Sons, 2009.
2. Yegnanarayana, B. *Artificial neural networks*. PHI Learning Pvt. Ltd., 2004.
3. Goldberg, David E., and John H. Holland. *Genetic algorithms in Search, Optimization & Machine Learning*. Pearson Education ,2009


Reference Books


1. Zurada, Jacek M. *Introduction to artificial neural systems*, West St. Paul, 1992.
2. Hagan, Martin T., Howard B. Demuth, and Mark H. Beale. *Neural network design*. Boston: Pws Pub., 1996.
3. Haykin, Simon. *Neural networks: a comprehensive foundation*. Prentice Hall PTR, 1994.
4. Passino, Kevin M., and Stephen Yurkovich. *Fuzzy control*. Vol. 42. Menlo Park, CA: Addison-Wesley, 1998.