**ANALOG CIRCUITS**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

| | | | |
|---|---|---|---|
| Subject Code | 22EC32 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 3L+1T | SEE Marks | 50 |
| Number of Lecture Hours | 50 | Exam Hours | 03 |

**CREDITS-04**

**Course Objectives:** This course will enable students to:

1. Understand and analyze the AC and DC operation of BJT & FET.
2. Understand the basic concepts of operational amplifier.
3. Understand and analyze the AC and DC operation of Op-Amp.
4. Study and design the various Op-Amp applications.

| **Module -1** | **Teaching Hours** |
|---|---|
| **BJT Biasing:** Introduction, Operating point, Fixed bias configuration, Voltage divider bias configuration. ( **Text1: 4.1-4.3, 4.5**)<br>**BJT AC analysis:** Introduction, BJT transistor modeling, The re transistor model: Common emitter fixed bias configuration, Voltage divider bias configuration. The Hybrid Equivalent model, Approximate hybrid equivalent circuit: Fixed bias configuration, Voltage divider bias configuration. ( **Text1: 5.1, 5.3, 5.4-5.6, 5.19, 5.20**)<br>**Field effect transistors:** Introduction, Construction and Characteristics of JFETs, Transfer characteristics, Depletion type MOSFET, Enhancement type MOSFET.<br>( **Text1: 6.1-6.3, 6.7, 6.8**)<br>**JFET biasing:** Fixed bias configuration, Voltage divider bias configuration. ( **Text1: 7.2, 7.4)**<br>**JFET small signal model**: Introduction, JFET small signal model, Fixed bias configuration, Voltage divider configuration. ( **Text1: 8.1-8.3, 8.5**) | **10 Hours** |
| **Module -2** | |
| **Operational amplifier parameters and performance:** Introduction, Ideal and practical operational amplifiers, Basic Op-Amp internal circuitry, Input, output & supply voltages, Offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations. (**Text2: 2.1-2.6)**<br>**Op-Amps as DC/AC amplifiers: Introduction**, Biasing Op-Amps, Direct coupled voltage follower, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers and Difference amplifier, Instrumentation amplifier, Capacitor-coupled voltage follower, Capacitor-coupled noninverting amplifier, Capacitor-coupled inverting amplifier. (**Text2: 3.1-3.4, 3.6-3.8, 4.1,4.3,4.5**) | **10 Hours** |
| **Module -3** | |
| **Op-Amp applications:** Voltage sources, Current sources and current sinks, Zero Crossing detector**,** Inverting Schmitt trigger circuit, Differentiating Circuit, Integrator Circuit, Precision rectifiers. (**Text2: 7.1, 7.2, 8.2, 8.3, 8.6, 8.7, 9.1, 9.2**) | **10 Hours** |
| **Module -4** | |
| **More applications:** Limiting circuits, Clamping circuits, Sample and hold circuits. **(Text2: 9.3, 9.4, 9.6**)<br>Sinusoidal oscillators: Feedback concepts, Phase shift oscillator, Colpitts and Hartley Oscillators, Wein bridge oscillator. (**Text1: 14.1 Text2: 11.1-11.3)** | **10 Hours** |

| | |
|---|---|
| **Active Filters:** Filter types and characteristics, First order and Second order active low-pass and High pass filters, Band-pass filters and Notch filters. (**Text2: 12.1-12.3, 12.5, 12.6**) | |
| **Module -5** | |
| **Voltage Regulator:** Introduction, Series Op-Amp regulator, IC voltage regulators, 723 general purpose regulators. (**Text3: 6.1-6.4**)<br>**555 timers**: Introduction, Description of functional diagram, Monostable operation and Astable operation. (**Text3: 8.1-8.4**)<br>**Phase locked loop:** Introduction**,** Basic Principles, Phase detector/comparator, Voltage Controlled Oscillator (VCO). (**Text3**: **9.1-9.4**)<br>**D-A and A-D converters**: Introduction, Weighted resistor DAC, R-2R ladder DAC, ADC using Successive approximation. (**Text3: 10.1, 10.2.1, 10.2.2, 10.3.4**) | **10 Hours** |
| **Course Outcomes:** After studying this course, students will be able to:<br>CO-1-Analyze DC and AC operation of BJT and JFET biasing circuits.<br>CO-2-Explain the characteristics of Op-Amp and design the AC and DC amplifiers using Op-Amp.<br>CO-3-Develop linear applications and Switching circuits.<br>CO-4-Develop the signal processing circuits, sinusoidal oscillators and active filters using Op-Amp.<br>CO-5- Build voltage regulator, 555 timer- based applications, phase locked loop and data Converters using Op-Amp. | |
| **Text Books:**<br>1. Robert L. Boylestad and Louis Nashelsky, "Electronics Devices and Circuit Theory", Pearson, 10th Edition, 2012, ISBN: 978-81-317-6459-6.<br>2. David A. Bell, "Operational Amplifiers and Linear ICs", Oxford University Press, 3rd Edition, 2011.<br>3. D. Roy Choudhury and Shail B. Jain, "Linear Integrated Circuits", New Age International Publishers, 4th Edition, 2010, ISBN 978-81-224-3098-1. | |
| **Reference Books:**<br>1. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008.<br>2. Jacob Millman, Christos C Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw-Hill Education, 2nd Edition, 2007.<br>3. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson, 4th Edition, 2015. | |

| **COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N)** | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | N | Y | N | N |
| **CO2** | Y | Y | Y | N | N | N |
| **CO3** | Y | Y | Y | N | N | N |
| **CO4** | Y | Y | Y | N | N | N |
| **CO5** | Y | Y | Y | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | - | - | 1 | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 2 | - | - | - | 1 | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 2 | - | - | - | 1 | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 2 | - | - | - | 1 | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 2 | - | - | - | 1 | - | - | - | - | - | 3 | - | - |

**DIGITAL SYSTEM DESIGN**

[As per NEP, Outcome Based Education (OBE), and Choice Based Credit System (CBCS) Scheme

SEMESTER-III

| | | | |
|---|---|---|---|
| Subject Code | 22EC33 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS-03**

**Course Objectives:**

This course will enable students to:

- Illustrate Boolean laws & systematic technique for minimization of Boolean expressions.
- Demonstrate the methods for simplifying Boolean expressions.
- Introduce the basic concepts of Combinational logic & Sequential logic.
- Present real-world examples for making the learner attuned to logic concepts.
- Highlight the formal procedures for the analysis and design of combinational logic & sequential logic.

| **Module1** | **Teaching Hours** |
|---|---|
| **Principles of Combination logic:** Introduction, Generation of switching equations from truth tables, Karnaugh maps-3,4 variables, Incompletely specified functions (Don't care terms) Simplifying Max term equations, General approach to combinational logic design. **(Text 1- Chapter 3)** | **8 Hours** |
| **Module2** | |
| **Applications of Combination logic:** Decoders, Encoders, Digital multiplexers, Design of Boolean function using Multiplexers, Adders and Subtractors, Parallel Adder, Comparators.**(Text 1- Chapter 4)** | **8 Hours** |
| **Module3** | |
| **Principles of Sequential Circuits:** Introduction, Basic Bi-stable elements, Latches, The Master-S-lave flip-flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops, Characteristic equations. **(Text 2- Chapter 6)** | **8 Hours** |
| **Module4** | |
| **Applications of Sequential Circuits:** Registers, Binary ripple counters, Synchronous binary counters, Counters based on shift registers, Design of synchronous counters, Design of asynchronous mod-n counter using clocked T, JK, D and SR flip-flops. **(Text 2- Chapter 6)** | **8 Hours** |
| **Module5** | |
| **Applications of Digital circuits:** Design of Sequence Detector, Guidelines for construction of State graphs, Design Example- Code converter, Design of Iterative Circuits, Design of Sequential Circuits using ROMs and PALs, Serial Adder with Accumulator. **(Text 3 – 14.1,14.3, 16.2-16.4, 18.1)** | **8 Hours** |
| **Course Outcomes:** After studying the course students will be able to:<br>CO-1- Apply the Karnaugh map method to derive minimal forms of Boolean expressions in digital systems. | |

| | |
|---|---|
| CO-2- Design and implement various combinational circuits.<br>CO-3-Analyze the various latches and flip-flops using their characteristic equations.<br>CO-4- Design and develop sequential counters and shift registers using flip-flops.<br>CO-5- Design Mealy and Moore models along with state diagrams to analyze clocked sequential circuit. | |
| **Text Books:**<br>1. Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 2001.ISBN981-240-062-1.<br>2. Donald D.Givone,―Digital Principles and Design‖, McGraw Hill, 2002. ISBN 978-0-07-052906-9.<br>3. Charles H Roth Jr., Larry L.Kinney – Fundamentals of Logic Design, Cengage Learning, 7th Edition. | |
| **ReferenceBooks:**<br>1. D.P.Kothari and J.S Dhillon, Digital Circuits and Design‖, Pearson, 2016, ISBN : 9789332543539<br>2. Morris Mano, ―Digital Design, Prentice Hall of India, Third Edition. | |

| **COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING** | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | Y | N | N | N |
| **CO3** | Y | Y | N | Y | N | N |
| **CO4** | Y | Y | Y | Y | N | N |
| **CO5** | Y | Y | Y | Y | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**
**Note: 1-Low, 2-Medium, 3-High**

| **CO/PO** | **PO.1** | **PO.2** | **PO.3** | **PO.4** | **PO.5** | **PO.6** | **PO.7** | **PO.8** | **PO.9** | **PO.10** | **PO.11** | **PO.12** | **PSO.1** | **PSO.2** | **PSO.3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| **CO2** | 3 | 3 | 2 | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| **CO3** | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **CO4** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **CO5** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |

**NETWORK ANALYSIS**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

| | | | |
|---|---|---|---|
| Subject Code | 22EC34 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS-03**

**Course Objectives:** This course will enable students to:

1. Understand the concepts of transformation techniques, mesh and Nodal analysis of DC circuits.
2. Apply the knowledge of basic circuit law to simplify the networks using network theorems and explain design concept of attenuators and filters
3. Explain importance of series and parallel resonance circuits.
4. Impart the basic knowledge of network analysis using Laplace transforms.
5. Understand the basic knowledge of two port networks.

| **Module-1** | **Teaching Hours** |
|---|---|
| **Network Analysis Techniques:** Sources and its types, Source Transformation and Source Shifting, Network Reduction using Star Delta Transformation, Mesh Analysis, Node Analysis, Concept of Supermesh and Supernode. (only DC circuits with independent and dependent sources) | **08Hours** |
| **Module-2** | |
| **Network theorems**<br>Superposition Theorem, Reciprocity Theorem, Milliam's Theorem, Thevenin's and Norton's Theorem, Maximum Power Transfer Theorem. | **08Hours** |
| **Module-3** | |
| **Attenuators and Conventional Filters:**<br>Nepers, Decibles, lattice attenuator, T-type attenuator, π-type attenuator, L-type attenuator, ladder type attenuator, insertion loss. Filter fundamentals | **08Hours** |
| **Module-4** | |
| **Resonant Circuit:** Introduction to Series and Parallel Resonance, properties, derivation and numericals on Resonant Frequency, Bandwidth and Quality Factor.<br>**Laplace Transform:** Solution of Networks, Step, Ramp and Impulse Responses ,Waveform Synthesis | **08 Hours** |
| **Module-5** | |
| **Two Port Network:** Definition of Z, Y, h and Transmission Parameters, Modeling with these Parameters, Relationship between Parameters sets. | **08Hours** |

**Course Outcomes:** After studying this course, students will be able to:

Co-1-Explain the basic concepts and apply the network analysis techniques and theorems.

Co-2-Analyze the complex electrical circuits using network theorems.

Co-3-Develop simple passive filters and attenuators for the given specification.

Co-4-Analyse series and parallel resonance circuits and synthesize typical waveform using Laplace Transform.

Co-5-Investigate the performance of two port networks.

**Text Books:**

1. M.E.VanValkenberg(2000),—Network analysis, Prentice Hall of India, 3rd edition, 2000.

2. Roy Choudhury, ― Networks and systems, 2nd edition, New Age International Publications, 2006.

**Reference Books:**

1. Hayt, Kemmerly and Durbin―Engineering Circuit Analysis ǁ,TMH 7th Edition, 2010
2. J.David Irwin, R. Mark N elms,―Basic Engineering Circuit Analysisǁ, JohnWiley, 8thed, 2006.
3. Charles K Alexander and Mathew NO Sadiku,― Fundamentals of Electric Circuits, Tata McGraw-Hill,3rdEd, 2009

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N) | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | N | Y | N | N |
| **CO3** | Y | Y | Y | N | N | N |
| **CO4** | Y | Y | N | Y | N | N |
| **CO5** | Y | Y | N | N | Y | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | - | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| **CO2** | 3 | 3 | - | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| **CO3** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **CO4** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **CO5** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |

**SENSORS AND ACTUATORS**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

| | | | |
|---|---|---|---|
| Subject Code | 22EC35 | CIE Marks | 50 |
| Number Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS-03**

**Course Objectives:** Students will be taught to:

1. Understand the fundamental knowledge about sensors and measurement system.
2. Understand the principle, design and working of transducers for the measurement electrical and non electrical quantities.
3. Understand the working of various actuators suitable in industrial process control systems.

| **Module -1** | **Teaching Hours** |
|---|---|
| **Measurements and Measurement Systems**: Measurements, significance of measurements, Methods of Measurements, Instruments and measurement systems, Mechanical, electrical and electronic instruments, Classification of Instruments Elements of generalized measurement system, Input-output configurations of measuring instruments and measurement systems, Methods of correction for interfering and modifying inputs.(Text1: 1.1-1.6, 1.13, 1.14, 1.15) | **8 Hours** |
| **Module -2** | |
| **Transducers:** Introduction, Classification of transducers-Primary and Secondary transducers, Passive and Active transducers, Analog and Digital transducers, Resistive transducers: Potentiometers introduction, Construction of potentiometers, Advantages and disadvantages of resistance potentiometers, Variable inductance transducers, Linear variable differential transformer(LVDT), Capacitive transducers, Digital encoding transducers: Classification of encoders, Construction of encoders. (Text1: 25.6, 25.8, 25.12, 25.15, 25.23, 25.24, 25.28, 25.34-25.36) | **8 Hours** |
| **Module -3** | |
| Resistance thermometers, Thermistors: Construction of thermistors, Resistance-Temperature characteristics of thermistors, Application of thermistor in measurement of temperature, Salient features of thermistors.<br>Thermocouples: Construction of thermocouples, Measurement of thermocouple output, Compensating circuit, Reference junction compensation, Lead compensation, Advantages and disadvantages of thermocouples, Integrated circuit temperature transducers. (Text1: 25.19, 25.20, 25.21, 25.22) | **8 Hours** |
| **Module -4** | |
| Measurement of humidity, sound using microphones and pH value. (Text1: 29.45,29.46, 29.47)<br>**Actuators and process control system:** Introduction, block diagram and description of process control system with an example. Introduction, block diagram of final control operation, Signal conversions analog, digital, pneumatic signal. Actuators,<br>Control elements. (Text2: Chapter1 (1,2,3), Chapter6 (1,2,3)) | **8 Hours** |
| **Module -5** | |

| | |
|---|---|
| **Electrical actuating systems:** Solid-state switches, Solenoids.<br>**Electric Motors- Principle of operation and its application:** D.C motors, AC motors, Synchronous Motor, Stepper motors, Pneumatic Actuators: Principle and working of pneumatic actuators, Hydraulic Actuators: Principle and working of Hydraulic actuators. (Text2: Chapter6 (5.1,5.2,5.3)) (Numerical problems on the topic). | **8 Hours** |

**Course outcomes:** After studying this course, students will be able to:

CO1. Discuss the fundamental concepts related to sensors and measurements and apply them for characterizing measurement systems.

CO2. Explain the transducers and analyze measurement systems using transducers.

CO3. Apply the suitable transducers for measurement of temperature, humidity, sound and pH value.

CO4. Discuss the fundamental concepts of process control system and analyze the process control systems.

CO5. Analyze actuators operation in control systems.

**Reference Books:**


1. Electrical and Electronic Measurements and Instrumentation, A K Sawhney, 19th Edition, Dhanpat Rai & Co. Pvt. Ltd.
2. Process Control Instrumentation Technology, C D Johnson, 7th Edition, Pearson Education Private Limited, New Delhi 2002.


| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N) | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | Y | Y | N | N |
| **CO3** | Y | Y | Y | N | N | N |
| **CO4** | Y | Y | Y | Y | N | N |
| **CO5** | Y | Y | N | Y | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):**

**Note:1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **-** | **-** | **-** | **-** | **-** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO2** | **3** | **2** | **-** | **-** | **-** | **-** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO3** | **3** | **-** | **-** | **-** | **-** | **-** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO4** | **3** | **2** | **-** | **-** | **-** | **-** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO5** | **3** | **2** | **-** | **-** | **-** | **-** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |

**ANALOG CIRCUITS LAB**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

| | | | |
|---|---|---|---|
| Subject Code | 22ECL36 | CIE Marks | 50 |
| Number of Practical Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Practical Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This laboratory course will enable students to:

1. Characterize the JFET and MOSFET.
2. Design and evaluate the BJT amplifier.
3. Design and realize the various Op-Amp applications.
4. Design and realize Monostable and Astable multivibrator using 555 Timer.
5. Design and realize the fixed voltage power supply using IC regulator.

**List of Experiments:**

1. Verify JFET/MOSFET characteristics.
2. Design and test the BJT amplifier circuit and obtain the frequency response characteristics.
3. Design and testing of Inverting and Non inverting amplifier using Op-Amp.
4. Design an instrumentation amplifier of a differential mode gain of 'A' using three amplifiers.
5. Design and testing of RC phase shift oscillator using Op-Amp.
6. Design and testing of Wein bridge oscillator using Op-Amp.
7. Design and verify the operation of Op – Amp as a (a) Adder (b) Integrator and (c) Differentiator.
8. Design and realize Schmitt trigger circuit using an Op – Amp for desired upper trigger point (UTP) and lower trigger point (LTP).
9. Design and verify a Precision full wave rectifier.
10. Design of Monostable and Astable multivibrator using 555 Timer.
11. Design and realization of R – 2R ladder DAC.
12. Design of Fixed voltage power supply (voltage regulator) using IC regulator 78 series.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING**

| COURSE OUTCOME | Remember L1 | Understand L2 | Apply L3 | Analyze L4 | Evaluate L5 | Create L6 |
|---|---|---|---|---|---|---|
| CO1 | Y | Y | Y | N | N | N |
| CO2 | Y | Y | N | N | N | Y |
| CO3 | Y | Y | N | Y | N | N |
| CO4 | Y | Y | N | N | N | N |
| CO5 | Y | Y | N | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

**DIGITAL SYSTEM DESIGN LABORATORY**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

| | | | |
|---|---|---|---|
| Subject Code | 22ECL37 | CIE Marks | 50 |
| Number of Practical Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Practical Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This laboratory course enables students to get practical experience in design, realization and verification of

1. Demorgan's Theorem, SOP, POS forms
2. Full/Parallel Adders, Subtractors and Magnitude Comparator
3. Multiplexer, Demultiplexers, encoder and Decoders applications
4. Flip-Flops, Shift registers and Counters

**Note:** Use discrete components to test and verify the logic gates. The IC numbers given are suggestive. Any equivalent IC can be used.

- For experiment No. 11 any open source or licensed simulation tool may be used.

**List of Experiments:**

1. Verify
   a. Demorgan's Theorem for 2 variables
   b. The sum-of product and product-of-sum expressions using universal gates
2. Design and implement
   a. Half Adder
   b. Full Adder
   c. Full subtractor
3. Design and implement 4-bit Parallel Adder/Subtractor using IC7483
4. Design and implement 3-bit Binary to Gray code converter
5. Realize a 4-variable function using IC 74151 (8:1 MUX)
6. Realize Adder/Subtractor using IC 74139
7. Design and Implementation of 4-bit Magnitude Comparator using IC7485
8. Realize the following shift registers using IC7474/IC7495
   a. SISO (b) SIPO (c) PISO (d) PIPO
9. Realize Ring and Johnson counter
10. Realize Mod-N Asynchronous/Synchronous counter
11. Simulate Full-Adder and Mod-8 Synchronous UP/DOWN Counter using simulation tool

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| CO1 | Y | Y | Y | N | N | N |
| CO2 | Y | Y | N | N | N | Y |
| CO3 | N | N | N | N | N | Y |
| CO4 | Y | Y | N | N | N | N |
| CO5 | Y | Y | N | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**
**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO2** | **2** | **3** | **1** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO3** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO4** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **3** | **3** | **2** | **-** | **-** | **-** | **3** | **-** |
| **CO5** | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **3** | **-** | **3** | **3** | **-** | **-** | **3** | **-** |

**NETWORK ANALYSIS LABORATORY**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

| | | | |
|---|---|---|---|
| Subject Code | 22ECL38 | CIE Marks | 50 |
| Number of practical Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Practical Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This course will enable students to:

1. Realize the basic laws, KVL and KCL.
2. Realize the network theorems.
3. Calculation of frequency response, Quality, bandwidth for both series & parallel resonant circuits.
4. Analysis and understand locus diagram.
5. Calculate the networks parameters for different two port networks.

**NOTE:** The experiments are to be carried out using discrete components, out of which three experiments are to be carried out through simulation

**List of Experiments:**

1. Measurements of DC circuits.
2. Study of Mesh Analysis & Node Analysis.
3. Realization & verification of Superposition theorem
4. Realization & verification of Reciprocity theorem
5. Realization & verification of Thevenin's & Norton's theorem
6. Realization & verification of Maximum power transfer theorem
7. Realization & verification of Milliman's theorem
8. Analysis of series resonance.
9. Analysis of parallel resonance.
10. Locus Diagrams of RL and RC Series Circuits
11. Study of Z &Y parameters of two port network parameters.
12. Transmission and hybrid parameters.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work,

| |
|---|
| data collection, and report writing within specified deadlines. |

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | N | N | N | Y |
| **CO3** | Y | Y | N | Y | N | N |
| **CO4** | Y | Y | N | N | N | N |
| **CO5** | Y | Y | N | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO2** | **2** | **3** | **1** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO3** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO4** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **3** | **3** | **2** | **-** | **-** | **-** | **3** | **-** |
| **CO5** | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **3** | **-** | **3** | **3** | **-** | **-** | **3** | **-** |

| PROJECT-III<br>[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-III | | | |
|---|---|---|---|
| Subject Code | 22PRJ39 | CIE Marks | 50 |
| Number Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Practical Hours | 24 | Exam Hours | 03 |
| **CREDITS-01** | | | |

**Course Objectives:** This course will enable students to:

1. Get exposure about the electronics hardware and various software tools.
2. Design the working model of the open ended problem.
3. Understand concepts of Packaging.
4. Understand the latest technology trends in the PCB design.
5. Prepare technical documentation of the project.

STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM IN A TEAM.

**Course outcomes:** After studying this course, students will be able to:

CO-1-Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO-2-Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO-3-Design and implement the system to solve the real time problem of the society.

CO-4-Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO-5-Use the modern tool available like advanced hardware and software tools.

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | N | Y | N | N |
| **CO3** | Y | Y | N | N | N | Y |
| **CO4** | Y | Y | N | N | Y | N |
| **CO5** | Y | Y | Y | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | 2 | 2 | - | - | 3 | 3 | - | 3 | - | 3 | - |
| **CO2** | 3 | 3 | 1 | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 2 | 2 | - | 3 | 3 | 2 | 3 | - | 3 | - |
| **CO4** | 3 | 3 | 3 | 2 | - | - | - | 3 | 3 | 3 | 3 | 3 | - | 3 | - |
| **CO5** | - | - | - | - | 3 | - | - | 3 | 3 | 3 | 3 | 3 | - | 3 | - |

**SOFT SKILLS**

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

| | | | |
|---|---|---|---|
| Course Code | 22HSM310 | CIE Marks | 50 |
| Number of Lecture Hours/Week | 01 | SEE Marks | 50 |
| Total Number of Lecture Hours | 20 | Exam Hours | 03hrs |

CREDITS– 03

**Course Learning Objectives:**

- To enable the students to obtain the basic knowledge about Communication Skills: Meaning, definition, importance, purpose, process, types, barriers and Essential of communication.
- Develop reading and understanding ability
- Learn effective writing.
- Learn how to write different types of letter.
- Case method of learning.

| **Modules** | **Teaching Hours** | **Revised Bloom's Taxonomy (RBT) Level** |
|---|---|---|
| **Module -1** | | |
| **INTRODUCTION TO COMMUNICATION**: Meaning, Definition, Importance & Purpose of Communication, Process of Communication, Types of Communication, Communication network in an organization, 7c's of communication, Barriers to Communication and Essential of good Communication. | **06 Hours** | **L1,L2,L3** |
| **Module -2** | | |
| **READING AND UNDERSTANDING** – Reading Comprehension – Reading rate and reading comprehension, Paraphrasing, Interpretations of graphical information, Book reading and summarizing it. | **06 Hours** | **L1,L2,L3** |
| **Module -3** | | |
| **EFFECTIVE WRITING:** Purpose of Writing, Clarity in Writing, Principle of Effective Writing. Better writing using personal Experiences – Describing a person, situation, memorable events etc…. | **05 Hours** | **L1,L2,L3** |
| **Module –4** | | |
| **DRAFTING OF LETTERS:** Writing different types of letters – writing for employment, joining letter, complaints & follows up , Enquiries, representation etc. Official Communication – e-mail & Social Media. | **06 Hours** | **L1,L2,L3** |
| **Module -5** | | |

| | | |
|---|---|---|
| CASE METHOD OF LEARNING: Understand Case method of learning, different type of cases, overcoming the difficulties of the case method, analyzing the case. Do's & Don'ts for case preparation. | **05 Hours** | **L1,L2,L3** |

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

CO 1- Describe the process, types and importance of communication in various contexts.

CO 2- Develop the ability to read books or lengthy texts with critical comprehension, effectively identifying and analyzing key themes, arguments, and main ideas.

CO 3- Develop writing skills by effectively describing people, situations, and memorable events and demonstrate responsibility, self-management, self-confidence and ethical behavior.

CO 4- Develop the ability to draft various professional letters such as employment application, Joining letters, complaints, follow ups and representations.

CO 5- Foster teamwork abilities through collaborative case study discussion and problem solving Exercises.

**Text Book:**


1. Scotofer, contemporary business communication, Biztant ra
2. Chaturvedi P D & Mukesh chaturvedi - Business communication:Concepts, cases & applications- 2/e, pearson education.
3. Essential of Business communication – Rajendra Pal and J.S Korlhall – Sultan Chand & Sons, New Delhi


**Reference Books:**


1. Business correspondence & report writing – R.C.Sharma, Krishna Mohan – Tata Megraww Hill Publising Company Ltd, New Delhi.
2. Business Communcation – K.K. Sinha – Galgotio Publishing Company, New Delhi.

**ANALOG ELECTRONICS LAB USING PSPICE/MULTISIM/LTSPICE**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

| | | | |
|---|---|---|---|
| Subject Code | 22AEC311A | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Practical Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This laboratory course will enable students to:

1. To provide practical exposure on designing, setting up, executing and debugging various electronic circuits.
2. Use open source simulation software to analyze the circuits.

**Experiments using Pspice/Multisim/LTspice software**

**List of Experiments:**

1. Realize JFET/MOSFET characteristics.
2. Realize BJT amplifier circuit and obtain the frequency response characteristics.
3. Design and realize Inverting and Non inverting amplifier using Op-Amp.
4. Realize RC phase shift oscillator using Op-Amp.
5. Realize Wein bridge oscillator using Op-Amp.
6. Realize the operation of Op – Amp as a (a) Adder (b) Integrator and (c) Differentiator.
7. Realize Schmitt trigger circuit using an Op – Amp for desired upper trigger point (UTP) and lower trigger point (LTP).
8. Design and verify a Precision full wave rectifier.
9. Design and realize Monostable and Astable multivibrator using 555 Timer.
10. Realize R – 2R ladder DAC.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N)**

| COURSE OUTCOME | Remember L1 | Understand L2 | Apply L3 | Analyze L4 | Evaluate L5 | Create L6 |
|---|---|---|---|---|---|---|
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | Y | N | N | Y |
| **CO3** | Y | Y | N | Y | N | N |
| **CO4** | Y | Y | Y | N | N | N |
| **CO5** | Y | Y | N | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**DIGITAL SYSTEM DESIGN LAB USING PSPICE/MULTISIM/LTSPICE**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

| | | | |
|---|---|---|---|
| Subject Code | 22AEC311B | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Practical Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This laboratory course will enable students to:

1. Provide practical exposure to the students on designing, setting up, executing and debugging various electronic circuits using simulation software.
2. Give the knowledge and practical exposure on simple applications of digital electronic circuits.
3. Analyze and design sequential and combinational logic circuits.
4. Use open source software like Pspice/Multisim/LTspice

**Experiments using Pspice/Multisim/LTspice software**

**List of Experiments:**

**1.** Verify
   (a) DeMorgan's Theorem for two variables.
   (b) The sum-of product and product-of-sum expressions using universal gates.
**2.** Design and implement
   (a) Half Adder.
   (b) Full Adder.
   (c) Full Subtractor.
**3.** Design and implement 4-bit Parallel Adder / Subtractor using IC7483.
**4.** Design and implement 3-bit Binary to Gray code converter.
**5.** Realize a 4-variable function using IC 74151 (8:1 MUX)
**6.** Realize Adder / Subtractor using IC 74139
**7.** Design and Implementation of 4-bit Magnitude Comparator using IC7485.
**8.** Realize the following shift registers using IC7474/IC7495
   (a) SISO (b) SIPO (c) PISO (d) PIPO
**9.** Realize Ring and Johnson counter.
10. Realize Mod-N Asynchronous / Synchronous counter.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N) | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | N | N | N | Y |
| **CO3** | N | N | N | N | N | Y |
| **CO4** | Y | Y | Y | N | N | N |
| **CO5** | Y | Y | N | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO2** | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| **CO3** | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| **CO5** | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**ADDITIONAL MATHEMATICS – I**

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

| | | | |
|---|---|---|---|
| Subject Code | 18MATDIP31 | CIE Marks | 00 |
| Number of Lecture Hour/Week | 3L+1T | SEE Marks | 100 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS-00**

**Course Objectives:**This course will enable students to:

- Acquire basic concepts of complex trigonometry, vector algebra, differential & integral calculus and vector differentiation.
- Evaluation of double and triple integrals.
- Know the basic concepts of partial differential equations.
- To develop the knowledge of matrices and linear algebra in compressive manner.
- To understand the essential concept of linear algebra.

| **Module -1** | **Teaching Hours** |
|---|---|
| **Complex Trigonometry-1:** Complex Numbers: Definition and Properties. Modulus and Amplitude of complex number, Argand's diagram , De-Moivre's theorem ( without proof ) Vector Analysis: Scalar and Vectors. Vector addition and subtraction. Multiplication of vectors ( Dot and Cross products) Scalar and vector triple products- simple problems, Vector Differentiation : Gradient, Divergence and Curl. | 08 Hours |
| **Module -2** | |
| **Differential Calculus**: Review of successive differentiation. Formulae of $N^{th}$ derivatives of standard functions- Leibnitz's theorem ( without proof ).<br>Polar Curves: Expression for Angle between radius vector and tangent, length of perpendicular from pole to the tangent, angle between two polar curves, Pedal Equation of polar curves and problems. Taylor' and Maclaurin'sseires expansions. | 08 Hours |
| **Module -3** | |
| **Partial Differentiation** : Definitions of Partial Differentiation, Direct and Indirect partial derivatives, Symmetric functions, Homogeneous function and Euler's theorem on homogeneous function. Total Derivative of composite and implicit function. Jacobian. | 08 Hours |
| **Module -4** | |
| **Integral Calculus**: Reduction Formulae of $\int_0^{\pi/2} Sin^n x dx$ , $\int_0^{\pi/2} Cos^n x dx$ , $and$ Statement of Reduction formulae $\int_0^{\pi/2} Sin^m x Cos^n x dx$ and Problems.<br>Double and Triple integral- simple problems. | 08 Hours |
| **Module -5** | |
| **Linear Algebra:** Basic concepts of matrices- Rank of matrix by elementary row transformations- Echelon form. Consistency of system of Linear equations. Solution of system linear equations by Gauss Elimination method, Linear Transformation, Cayley- | 08 Hours |

| | |
|---|---|
| Hamilton theorem to compute inverse of matrix. Eigen values and Eigen vector, Largest Eigen value and corresponding Eigen vector by Reyleigh's Power method. | |

**Course Outcomes:** After studying this course, students will be able to:

CO1-Apply derivatives and partial derivatives to calculate rates of change of multivariate functions.

CO2-Apply techniques of integration including double and triple integrals to find area, volume, mass and moment of inertia of plane and solid region.

CO3-Analyze position, velocity and acceleration in two or three dimensions using the calculus of vector valued functions.

CO4-Recognize and solve first-order ordinary differential equations occurring in different branches of engineering.

CO5-Solve systems of linear equations in the different areas of linear algebra.

**Text Books:**

1. *B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015*

**Reference Books:**

**1.** *E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.*

**2.** *N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers, 7th Ed., 2007.*

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** |
| **CO2** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** |
| **CO3** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** |
| **CO4** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** |
| **CO5** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** |

**ANALOG AND DIGITAL COMMUNICATION**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

| | | | |
|---|---|---|---|
| Subject Code | 22EC42 | CIE Marks | 50 |
| Number Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |

CREDITS-03

**Course Objectives:** Students will be taught to:

- Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals.
- Understand the concepts in Angle modulation for the design of communication systems.
- Design simple systems for generating and demodulating frequency modulated signals. ·
- Analyze pulse modulation and sampling techniques.

| Modules | Teaching Hours |
|---|---|
| **Module -1** | |
| **Amplitude Modulation:** Amplitude Modulation, Virtues, Limitations, and Modifications of Amplitude Modulation, Double Sideband-Suppressed Carrier Modulation, Costas Receiver, Quadrature-Carrier Multiplexing, Single-Sideband Modulation, Vestigial Sideband Modulation. (Text 1: 3.1 to 3.7). | **8 Hours** |
| **Module -2** | |
| **Angle Modulation:** Basic Definitions, Narrowband frequency modulation, generation of FM waves, Demodulation of FM signal using frequency discriminator (Text 1: 4.1, 4.4, 4.7, 4.8 ), Detection of Frequency modulation(Text 1: 9.7 ).<br>**Pulse Modulation: Transition from analog to digital communications:** Sampling process, Pulse Amplitude Modulation, pulse position modulation, completing the Transition from analog to digital, (Text 1: 5.1, 5.2, 5.4). | **8 Hours** |
| **Module -3** | |
| **Pulse Modulation: Transition from analog to digital communications:** Quantization process, Pulse code modulation (PCM), Delta modulation, Differential pulse code modulation, line codes (Text 1: 5.5 to 5.9).<br>**Baseband Data Transmission:**<br>Baseband transmission of digital data, The intersymbol interference problem, The Nyquist channel, The eye pattern (Text 1: 6.1 to 6.4 and 6.5). | **8 Hours** |
| **Module -4** | |
| **Digital Band Pass Modulation Techniques:**<br>Binary amplitude shift keying, Phase shift Keying, Frequency shift keying, Summary of three binary signaling schemes, Non coherent digital modulation schemes, M-ary Digital modulation scheme, Mapping of digitally modulated waveform onto constellations of signal point(Text 1: 7.2 to 7.8 ) | **8 Hours** |
| **Module-5** | |
| **Principles of Spread Spectrum:**<br>Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum(Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4). | **8 Hours** |

**Course Outcomes**: At the end of this course students will demonstrate the ability to

CO-1- Comprehend and analyze the basic principles of Amplitude Modulation (AM).

CO-2- Apply the knowledge of sampling and analyze Angle modulation techniques used in communication systems.

CO-3- Examine inter-symbol interference (ISI) and understand the role of the Nyquist channel in baseband transmission.

CO-4- Generation and detection of signals using digital band pass modulation techniques

CO-5- Comprehend the different types of spread spectrum communication systems.

**Text Books**

1. Simon Haykin, Michael Moher " Introduction to Analog And Digital Communications " 2nd Edition 2013.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
4. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.

**Reference Books:**

1. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
2. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
3. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N) | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | N | Y | N | N |
| **CO3** | Y | Y | N | Y | N | N |
| **CO4** | Y | Y | N | N | N | Y |
| **CO5** | Y | Y | N | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO2** | **3** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO3** | **3** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO4** | **3** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO5** | **3** | **3** | **-** | **-** | **-** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |

## MICROCONTROLLER

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]
SEMESTER-IV

| | | | |
|---|---|---|---|
| Subject Code | 22EC43 | CIE Marks | 50 |
| Number of Lecture Hours/Week | 3L | SEE Marks | 50 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS-03**

**Course objectives:** This course will enable students to:

1. Understand the basics of microcontroller, Embedded systems and architecture of 8051 microcontroller.
2. Explain and analyze the instruction sets of 8051 microcontrollers and also to write the Assembly Level Programs using 8051 Instruction set.
3. Understand and write peripheral programming for Timers, Serial Port and Interrupt system of 8051.
4. Analyze the Application and Interfacing of 8051Microcontroller to I/O devices.

| **Module -1** | **Teaching Hours** |
|---|---|
| **8051 Microcontroller: I**ntroduction to 8051, Embedded systems, Microprocessor vs. Microcontrollers., Desirable Features of embedded systems. 8051 Architecture-Oscillator and Clock, Role of PC and DPTR, Flags and PSW, CPU registers, Internal RAM and RAM organization, Internal Memory, Special Function Registers, I/O pins, ports and circuits, External memory, Counter and Timers, Serial Transmission, Interrupts. | **08 Hours** |
| **Module -2** | |
| **8051 Instruction Set:** Addressing Modes, Data Transfer Instructions, Logical Instructions, Arithmetic Instructions, Jump Loop & Call Instruction, 8051 Stack, Stack and Subroutine instructions. | **08 Hours** |
| **Module -3** | |
| **Assembly Language Programming:** Assembly language program involving Jump, Loop, Call, Arithmetical and Logical Instructions, I/O Port Programming, Data conversion programs, Data types and time delays. | **08 Hours** |
| **Module -4** | |
| **Peripheral Programming:** 8051 timer programming, serial port and its programming, interrupt programming**.** | **08 Hours** |
| **Module -5** | |
| **Interfacing and its Applications:** LCD and keyboard interfacing, ADC and DAC interfacing, interfacing to external memory **,** Stepper Motor Interfacing, DC motor interfacing, PWM generation using 8051. | **08 Hours** |

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

CO-1- Demonstrate the basics of microcontrollers and embedded systems, including the architecture of the 8051 microcontrollers.

CO-2-Explore the instruction set of 8051 microcontrollers.

CO-3-Develop the programs using the 8051-microcontroller instruction set.

CO-4- Develop programs for timers, counters, serial communication and interrupts in 8051 microcontrollers.

CO-5- Develop programs for various interfacing applications in the 8051 microcontrollers.

**Text Books:**

1. "The 8051 Microcontroller and Embedded Systems – using Assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson /Cengage Learning.

**Reference Book:**

1. " The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | N | N | N | N |
| **CO2** | Y | Y | Y | N | N | N |
| **CO3** | Y | Y | Y | Y | N | N |
| **CO4** | Y | Y | N | N | N | N |
| **CO5** | Y | Y | N | N | Y | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| **CO/PO** | **PO.1** | **PO.2** | **PO.3** | **PO.4** | **PO.5** | **PO.6** | **PO.7** | **PO.8** | **PO.9** | **PO.10** | **PO.11** | **PO.12** | **PSO.1** | **PSO.2** | **PSO.3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | - | - | - | - | - | - | - | - | - | - | **3** | - | - |
| **CO2** | **3** | - | - | - | - | - | - | - | - | - | - | - | **3** | - | - |
| **CO3** | **3** | **3** | **3** | - | - | - | **2** | - | - | - | - | - | **3** | - | - |
| **CO4** | **2** | **3** | **3** | - | - | - | - | - | - | - | - | - | **3** | - | - |
| **CO5** | **3** | **3** | **3** | - | - | - | **2** | - | - | - | - | - | **3** | - | - |

| SIGNALS AND SYSTEMS<br>[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-IV | | | |
|---|---|---|---|
| Subject Code | 22EC44 | CIE Marks | 50 |
| Number Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |
| **CREDITS-03** | | | |

**Course Objectives:** Students will be taught to:

1. Understand the classification of signals into different categories based on their properties. Explain basic operations on signals and properties of systems.
2. Use convolution in both continuous and discrete domains for the analysis of systems given the impulse response of a system.
3. Evaluate response of a given linear time invariant system and Fourier representation of periodic signals.
4. Apply continuous time Fourier transform representation and discrete time Fourier transform representation to study signals and linear time invariant systems.
5. Use Z-transform and properties of Z transform for the analysis of discrete time systems.

| **Modules** | **Teaching Hours** |
|---|---|
| **Module -1** | |
| **Introduction and Classification of signals:** Definition of signal and systems, communication and control systems as examples. Classification of signals. **Basic Operations on signals:** Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shift and time reversal. **Elementary signals/Functions:** Exponential, sinusoidal, step, impulse and ramp functions. Expression of triangular, rectangular and other waveforms in terms of elementary signals. | **08 Hours** |
| **Module -2** | |
| **System Classification and properties:** Linear-nonlinear, Time variant-invariant, causal-noncausal, static-dynamic, stable-unstable, invertible. **Time domain representation of LTI System:** Impulse response, convolution sum, convolution integral. Computation of convolution sum and convolution integral using graphical method for unit step and unit step, unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular. | **08 Hours** |
| **Module -3** | |
| **Differential & Difference Equation representation of LTI systems:** Solution for Differential & Difference equations. Fourier Representation of Periodic Signals: Orthogonality of complex sinusoids, CTFS properties (No derivation) and basic problems. | **08 Hours** |
| **Module -4** | |
| **Fourier Representation of aperiodic Signals:** Introduction to Fourier Transform & DTFT, Definition and basic problems. Properties of Fourier Transform: Linearity, Symmetry, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parsevals relationships. | **08 Hours** |
| **Module-5** | |
| **The Z-Transforms :** Z transforms, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform. | **08 Hours** |

**Course Outcomes:** After studying this course, students will be able to:

CO1- Analyze the fundamental concepts of signals, including their classifications and perform basic operations on signals.

CO2- Analyze the fundamental concepts of systems and apply the convolution integral and sum to compute the responses of continuous and discrete LTI systems.

CO3- Analyze LTI systems through differential and difference equations, and explore the Fourier representation of periodic signals.

CO-4- Examine the spectral characteristics of continuous and discrete-time signals using Fourier analysis.

CO-5- Analyze the region of convergence (ROC) and apply Z-transform properties to simplify discrete-time signals.

**Text Book:**

Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, WileyIndia. ISBN 9971-51-239-4.

**Reference Book:**


1. Michael Roberts, "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
2. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
3. H. P Hsu, R. Ranjan, "Signals and Systems", Scham's outlines, TMH, 2006.
4. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2005.
5. Ganesh Rao and Satish Tunga, "Signals and Systems", Pearson/Sanguine


| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | N | N | N | N |
| **CO2** | Y | Y | Y | N | N | N |
| **CO3** | Y | Y | N | Y | N | N |
| **CO4** | Y | Y | N | N | Y | N |
| **CO5** | Y | Y | N | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | - | - | - | - | - | - | - | - | - | - | **3** | - | - |
| **CO2** | **3** | **3** | - | - | - | - | - | - | - | - | - | - | **3** | - | - |
| **CO3** | **3** | **3** | - | - | - | - | - | - | - | - | - | - | **3** | - | - |
| **CO4** | **3** | **3** | - | - | - | - | - | - | - | - | - | - | **3** | - | - |
| **CO5** | **3** | **3** | - | - | - | - | - | - | - | - | - | - | **3** | - | - |

**INFORMATION THEORY AND CODING**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

| | | | |
|---|---|---|---|
| Subject Code | 22EC45 | CIE Marks | 50 |
| Number Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS-03**

**Course Objectives:** Students will be taught to :

1. Provide an insight into the concept of information in the context of communication theory and its significance in the design of communication receivers.
2. Study various source encoding algorithms.
3. Model the communication channels.
4. Study various error control coding algorithms.

| **MODULE -1** | **Teaching Hours** |
|---|---|
| **Information Theory:** Introduction, Measure of information: Information content of a message, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences, Markoff statistical model for information sources, Entropy and information rate of Markoff sources.<br>(Section 4.1, 4.2 of Text 1) | **08 Hours** |
| **MODULE -2** | |
| **Source Coding:** Encoding of the source output: Shannon's Encoding Algorithm. (Section 4.3 of Text 1)<br>**Shannon Fano Encoding Algorithm, Arithmetic Coding. (Section 3.6, 3.8 of Text 3)**<br>Source coding theorem: Prefix Codes, Kraft-McMillan inequality property, Huffman codes. (Section 2.2,2.3 of Text 2) | **08 Hours** |
| **MODULE -3** | |
| **Information Channels:** Communication Channels, Discrete Communication channels. (Section 4.4, 4.5: 4.5.1 of Text 1)<br>Mutual Information, Channel capacity of binary symmetric channel. (Section 2.5, 2.6 of Text 2) | **08 Hours** |
| **MODULE -4** | |
| **Error Control Coding:** Introduction, Linear block codes: Matrix description of linear block codes.<br>Binary cyclic codes: Algebraic structure of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation, Error detection and error correction.<br>(Section 9.1, 9.2:9.2.1, 9.3:9.3.1, 9.3.2, 9.3.3 of Text 1) | **08 Hours** |
| **MODULE-5** | |
| **Some Important Cyclic Codes: BHC Codes (Section 8.4 – Article 5 of Text 2).** | **08 Hours** |

| | |
|---|---|
| **Convolution Codes**: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree. (Section 8.5 of Text 2) | |

**Course Outcomes:** After studying this course, students will be able to:

CO1. Explain the fundamental concepts of information theory and apply them to statistical Markov modeling.

CO2.Apply the various types of source coding algorithms and analyze their performance.

CO3. Analyze the discrete communication channels using probability channel matrix.

CO4. Develop the linear block codes and cyclic codes for error detection and correction.

CO5. Develop the convolution codes for channel coding.

**Text Books:**

1. Digital and Analog Communication Systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2. Digital Communications, Simon Haykin, John Wiley India Pvt. Ltd, 2008.
3. **Information Theory and Coding, Muralidhar Kulkarni, K.S. Shivaprakasha, Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1.**

**Reference Books:**

1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007
2. Digital Communications- Fundamentals and Applications, Bernard Sklar, Second Edition, Pearson Education, 2016.
3. Information Theory and Coding, K.N. Haribhat, D. Ganesh Rao, Cengage Learning, 2017.

| **COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING** | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | Y | Y | N | N |
| **CO3** | Y | Y | Y | Y | N | N |
| **CO4** | Y | Y | Y | N | N | N |
| **CO5** | Y | Y | Y | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| **CO/PO** | **PO.1** | **PO.2** | **PO.3** | **PO.4** | **PO.5** | **PO.6** | **PO.7** | **PO.8** | **PO.9** | **PO.10** | **PO.11** | **PO.12** | **PSO.1** | **PSO.2** | **PSO.3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **-** | **-** | **-** | **-** | **-** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO2** | **3** | **3** | **-** | **-** | **-** | **-** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO3** | **3** | **3** | **-** | **-** | **-** | **-** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO4** | **3** | **3** | **2** | **-** | **-** | **-** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO5** | **3** | **3** | **2** | **-** | **-** | **-** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| | | | | | | | | | | | | | | | |

**ANALOG AND DIGITAL COMMUNICATION LAB**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

| | | | |
|---|---|---|---|
| Subject Code | 22ECL46 | CIE Marks | 50 |
| Number Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

CREDITS-01

**Course Objectives :** Students will be taught to:

1. Design, Demonstrate and Analyze filters using op-amp.
2. Design, Demonstrate and Analyze analog systems for AM, FM, PPM, PAM, PWM operations.
3. Design and demonstrate the digital modulation techniques.
4. study phase lock loop and its capture range, lock range and free running VCO.

**Laboratory Experiments**

1. Design active second order Butterworth low pass and high pass filters.
2. Amplitude modulation using transistor/FET (Generation and detection).
3. Frequency modulation using IC 8038/2206 and demodulation.
4. Frequency synthesis using PLL
5. Pulse amplitude modulation and detection.
6. Pulse Width modulation and detection.
7. Pulse Position Modulation and detection.
8. Time Division Multiplexing and De-multiplexing of two band limited signals.
9. ASK generation and detection.
10. FSK generation and detection.
11. PSK generation and detection.
12. PCM generation and detection.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N) | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | N | Y | N | N |
| **CO3** | Y | Y | N | N | N | Y |
| **CO4** | Y | Y | N | N | N | N |
| **CO5** | Y | Y | N | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**
**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO2** | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| **CO3** | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| **CO5** | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**MICROCONTROLLER LAB**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

| | | | |
|---|---|---|---|
| Subject Code | 22ECL47 | CIE Marks | 50 |
| Number of Practical Hour/Week | 2P | SEE Marks | 50 |
| Number of Practical Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** Students will be taught to :

1. Write 8051 application specific programs in Assembly Language and C for 8051.
2. Interface various hardware modules to 8051 Microcontroller board.
3. Use open source software tools like Keil and Flash magic.
4. Develop applications based on Microcontroller 8051.

**List of Experiments:**

**Software program using 8051 Microcontroller**

Simple Assembly Language;

1. Program using 8051 in Block, Move, Exchange.
2. Program on Arithmetic Instructions - Addition/Subtraction, Multiplication and Division, Square, Cube
3. Program in sorting, finding largest and smallest element in an array.
4. Counters ---> For Hex and BCD up/ down count.
5. Boolean and Logical Instructions. (Bit Manipulation).
6. Subroutines using CALL and RETURN Instructions.
7. Code Conversions ---> ASCII to Decimal, Decimal to ASCII, BCD to ASCII

**Hardware Programming (using 8051 With C Program)**

1. Stepper Motor Interface to 8051 Microcontroller.
2. Seven Segment Displays to 8051 Microcontroller.
3. Hex Keyboard Interface to 8051.
4. DAC Interface for to generate Sine wave, Square wave, Triangular wave, Ramp wave through 8051Microcontroller.
5. ADC Interfacing to 8051 Microcontroller
6. LCD Interfacing to 8051 Microcontroller

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | Y | N | N | N |
| **CO3** | Y | Y | N | Y | N | N |
| **CO4** | Y | Y | N | N | N | N |
| **CO5** | Y | Y | N | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO2** | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| **CO3** | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| **CO5** | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**SIGNALS AND SYSTEMS LAB**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

| | | | |
|---|---|---|---|
| Subject Code | 22ECL48 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** Students will be taught to:

1. Simulate basic signals impulse, unit step, unit ramp, sinusoidal, cosine and exponential.
2. Find the even and odd component of the signal and computation of energy and power of the signal.
3. Find solution to the difference equations and computation of convolution.
4. Compute the DFT for a discrete signal.
5. Evaluate the sampling theorem.

**Note:** The experiments are to be carried using Matlab/ Scilab/ Octave or equivalent.

**List of Experiments:**

1. Generate and plot elementary signals like impulse, unit step, unit ramp, sinusoidal, cosine and exponential.
2. To calculate signal energy and signal power.
3. Finding even and odd of the signal.
4. Perform operations on independent variable of a signal.
5. Perform operations on dependent variable of a signal.
6. To compute the linear convolution of the given input sequence & the impulse response of the system.
7. Find the Fourier transform, plot magnitude and phase.
8. Find the inverse Fourier transform, plot magnitude and phase.
9. Solve any given difference equation of an LTI System.
10. Demonstration of sampling theorem.
11. Finding frequency response of LTI system.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | Y | N | N | N |
| **CO3** | Y | Y | N | Y | N | N |
| **CO4** | Y | Y | N | N | N | N |
| **CO5** | Y | Y | N | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO2** | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| **CO3** | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| **CO5** | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

| UNIVERSAL HUMAN VALUES<br>[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-IV | | | |
|---|---|---|---|
| Subject Code | 22UHV410 | CIE Marks | 50 |
| Number Lecture Hour/Week | 2L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |
| **CREDITS-03** | | | |

**Course Objectives:** Students will be taught to:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

| **Module -1** | **Teaching Hours** |
|---|---|
| **Introduction to Value Education: Lecture 1:** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)<br>**Lecture 2:** Understanding Value Education<br>**Tutorial 1**: **Practice Session PS1** Sharing about Oneself<br>**Lecture 3:** Self-exploration as the Process for Value Education<br>**Lecture 4:** Continuous Happiness and Prosperity – the Basic Human Aspirations<br>**Tutorial 2: Practice Session PS2** Exploring Human Consciousness<br>**Lecture 5:** Happiness and Prosperity – Current Scenario<br>**Lecture 6:** Method to Fulfill the Basic Human Aspirations<br>**Tutorial 3: Practice Session PS3** Exploring Natural Acceptance | **08 Hours** |
| **Module -2** | |
| **Module 2 –** Harmony in the Human Being (6 lectures and 3 tutorials for practice session)<br>**Lecture 7:** Understanding Human being as the Co-existence of the Self and the Body<br>**Lecture 8:** Distinguishing between the Needs of the Self and the Body<br>**Tutorial 4:** Practice Session PS4 Exploring the difference of Needs of Self and Body<br>**Lecture 9:** The Body as an Instrument of the Self<br>**Lecture 10:** Understanding Harmony in the Self<br>**Tutorial 5:** Practice Session PS5 Exploring Sources of Imagination in the **Self**<br>**Lecture 11:** Harmony of the Self with the Body<br>**Lecture 12:** Programme to ensure self-regulation and Health<br>**Tutorial 6:** Practice Session PS6 Exploring Harmony of Self with the Body | **08 Hours** |
| **Module -3** | |
| **Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)**<br>**Lecture 13:** Harmony in the Family – the Basic Unit of Human Interaction | **08 Hours** |

| | |
|---|---|
| **Lecture 14:** 'Trust' – the Foundational Value in Relationship<br>**Tutorial 7:** Practice Session PS7 Exploring the Feeling of Trust<br>**Lecture 15:** 'Respect' – as the Right Evaluation<br>**Tutorial 8:** Practice Session PS8 Exploring the Feeling of Respect<br>**Lecture 16:** Other Feelings, Justice in Human-to-Human Relationship<br>**Lecture 17:** Understanding Harmony in the Society<br>**Lecture 18:** Vision for the Universal Human Order | |
| **Module -4** | |
| **Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)**<br>**Lecture 19:** Understanding Harmony in the Nature<br>**Lecture 20:** Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature<br>**Tutorial 10: Practice Session PS10** Exploring the Four Orders of Nature<br>**Lecture 21:** Realizing Existence as Co-existence at All Levels<br>**Lecture 22:** The Holistic Perception of Harmony in Existence<br>**Tutorial 11: Practice Session PS11** Exploring Co-existence in Existence | **08 Hours** |
| **Module-5** | |
| **Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)**<br>**Lecture 23: Natural Acceptance of Human Values**<br>**Lecture 24:** Definitiveness of (Ethical) Human Conduct<br>**Tutorial 12: Practice Session PS12** Exploring Ethical Human Conduct<br>**Lecture 25:** A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order<br>**Lecture 26**: Competence in Professional Ethics<br>**Tutorial 13: Practice Session PS13** Exploring Humanistic Models in Education<br>**Lecture 27:** Holistic Technologies, Production Systems and Management Models-Typical Case Studies<br>**Lecture 28:** Strategies for Transition towards Value-based Life and Profession<br>**Tutorial 14: Practice Session PS14** Exploring Steps of Transition towards Universal Human Order | **08 Hours** |
| **Course Outcomes:** After studying this course, students will be able to:<br>CO-1-Develop and propose sustainable solutions to address societal and environmental challenges.<br>CO-2-Ensure the feasibility of these solutions and create detailed roadmaps to implement them effectively.<br>CO-3-Utilize acquired knowledge in technology, engineering, management, or other fields to promote mutual benefits, such as creating systems that positively impact both society and nature.<br>CO-4- Critically assess the course content and share insights with peers, while suggesting improvements to enhance its effectiveness and relevance.<br>CO-5- Apply the knowledge gained from the course to foster a prosperous and harmonious family and societal life. | |
| **Text Books:** | |

1. The Textbook - A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. The Teacher's Manual- Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53

**Reference Books:**


1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English).


**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | 3 | 3 | 2 | - | - | - | 2 | - | - | - |
| CO2 | - | - | - | - | - | 3 | 2 | 2 | - | - | - | 2 | - | - | - |
| CO3 | - | - | - | - | - | - | 3 | 2 | - | - | - | 2 | - | - | - |
| CO4 | - | - | - | - | - | - | - | 2 | 3 | - | - | 2 | 3 | - | - |
| CO5 | - | - | - | - | - | 3 | - | 2 | - | - | - | 2 | 3 | - | - |

| PROJECT-IV<br>[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-IV | | | |
|---|---|---|---|
| Subject Code | 22PRJ49 | CIE Marks | 50 |
| Number Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** Students will be taught to:

1. Get exposure about the electronics hardware and various software tools.
2. Design the working model of the open ended problem.
3. Understand concepts of Packaging.
4. Understand the latest technology trends in the PCB design.
5. Prepare technical documentation of the project.

STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM IN TEAM.

**Course outcomes:** After studying this course, students will be able to:

CO1. Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO2. Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO3. Design and implement the system to solve the real time problem of the society.

CO4. Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO5. Use the modern tool available like advanced hardware and software tools.

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | **Y** | **Y** | **Y** | N | N | N |
| **CO2** | **Y** | **Y** | N | Y | N | **N** |
| **CO3** | **Y** | **Y** | N | **N** | N | Y |
| **CO4** | **Y** | **Y** | N | N | N | N |
| **CO5** | **Y** | **Y** | N | **N** | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | 2 | 2 | - | - | 3 | 3 | - | 3 | - | 3 | - |
| CO2 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| CO3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | - | 3 | 3 | 2 | 3 | - | 3 | - |
| CO4 | 3 | 3 | 3 | 2 | - | - | - | 3 | 3 | 3 | 3 | 3 | - | 3 | - |
| CO5 | - | - | - | - | 3 | - | - | 3 | 3 | 3 | 3 | 3 | - | 3 | - |

**EMBEDDED C BASICS**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

| | | | |
|---|---|---|---|
| Laboratory Code | 22AEC411A | CIE Marks | 50 |
| Number of Practical Sessions/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

**CREDITS – 01**

**Course Learning Objectives:** Students will be taught to:

1. Develop the microcontroller-based programs for various applications using embedded C.

**Laboratory Experiments**

Conduct the following experiments by writing C Program using Keil microvision simulator (any 8051 microcontrollers can be chosen as the target).

1. Write a 8051 C program to multiply two 8 bit binary numbers.
2. Write a 8051 C program to find the sum of first 10 integer numbers.
3. Write a 8051 C program to find factorial of a given number.
4. Write a 8051 C program to add an array of 16 bit numbers and store the 32 bit result in internal RAM
5. Write a 8051 C program to find the square of a number (1 to 10) using look-up table.
6. Write a 8051 C program to find the largest/smallest number in an array of 32 numbers
7. Write a 8051 C program to arrange a series of 32 bit numbers in ascending/descending order
8. Write a 8051 C program to count the number of ones and zeros in two consecutive memory locations.
9. Write a 8051 C program to scan a series of 32 bit numbers to find how many are negative.
10. Write a 8051 C program to display "Hello World" message (either in simulation mode or interface an LCD display).

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

Learning Resources: "The 8051 Microcontroller: Hardware, Software and Applications", V Udayashankara and M S Mallikarjuna Swamy, McGraw Hill Education, 1st edition, 2017

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N)

| COURSE OUTCOME | Remember L1 | Understand L2 | Apply L3 | Analyze L4 | Evaluate L5 | Create L6 |
|---|---|---|---|---|---|---|
| **CO1** | **Y** | **Y** | **Y** | N | N | N |
| **CO2** | **Y** | **Y** | Y | N | N | **N** |
| **CO3** | **Y** | **Y** | N | **Y** | N | N |
| **CO4** | **Y** | **Y** | N | N | N | N |
| **CO5** | **Y** | **Y** | N | **N** | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO2** | **2** | **3** | **1** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO3** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO4** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **3** | **3** | **2** | **-** | **-** | **-** | **3** | **-** |
| **CO5** | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **3** | **-** | **3** | **3** | **-** | **-** | **3** | **-** |

**PCB DESIGN AND FABRICATION**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

| | | | |
|---|---|---|---|
| Subject Code | 22EC411B | CIE Marks | 50 |
| Number of practical Hours/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

CREDITS-01

**Course Objectives:** Students will be taught to:

1. Acquire the knowledge of fabrication process in current trending technological electronic world.
2. Learn the designing of circuits for PCB.
3. Learn the Fabrication and Itching of PCB.
4. Learn the trouble shooting of any kind of faults in PCB.
5. Acquire the necessary employable skills.

**Laboratory Experiments**

1. Study of basic electronics components.
2. Study the basic functionality of PCB designing CAD software (PCB EXPRESS)
3. Study the basic fabrication process
4. Study the basic Etching process
5. Applications of PCB designing, Etching & fabrication.
6. Design, Etch and fabricate the LED switch circuit.
7. Design, Etch and fabricate the circuit for regulate the speed of fan.
8. Design, etch and fabricate the circuit for touch switch circuit.
9. Design, etch and fabricate the circuit for non-contact AC Voltage Detector.
10. Design, etch and fabricate the circuit for Simple Water Level Indicator.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**Reference material information**

1. R.S Khandpur, "Printed Circuit Boards - Design, Fabrication, Assembly and Testing," 1st Edition, TMH, 2017.

2. Walter C. Bosshart, "Printed Circuit Boards- Design and Technology," McGraw Hill Education,1983.

3. Clyde F. Coombs, “Printed Circuits Handbook,” 6th Edition, McGraw Hill Education, 2007.
4. Kraig Mitzner, “Complete PCB Design Using Or CAD Capture and PCB Editor,” 2nd Edition, Academic Press, 2019.
5. Rao R. Tummala, “Introduction to System-on-Package (SOP): Miniaturization of the Entire System,” McGraw Hill, 2008.
6. Mark I. Montrose, “EMC and the Printed Circuit Board-Design, Theory and Layout Made simple,” 1st Edition, Wiley-IEEE Press, 1998. 2013.
3. G. C. Loveday, “Electronic fault diagnosis,” Pearson Education, 1994

| COURSE OUTCOME AND REVISED BLOOM’S TAXONOMY LEVEL MAPPING | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | N | N | N | N |
| **CO2** | Y | Y | Y | N | N | N |
| **CO3** | Y | Y | N | N | N | Y |
| **CO4** | Y | Y | N | N | N | N |
| **CO5** | Y | Y | N | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**
**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO2** | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| **CO3** | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| **CO5** | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

## MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

[As per NEP, Outcome Based Education, and Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

| | | | |
|---|---|---|---|
| Subject Code | 22HSM51 | CIE Marks | 50 |
| Number Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS-03**

**Course Objectives** The objectives of the course is to enable students to:

1. Understand basic skills of Management.
2. Understand the need for Entrepreneurs and their skills.
3. Identify the Management functions and Social responsibilities.
4. Distinguish between management and administration.
5. Understand Project identification and Selection.

| **Module -1** | **Teaching Hours** |
|---|---|
| **Management:** Introduction-Meaning-Nature and characteristics of management, Scope and Functional areas of management- Management as art of science, art or profession-Management & Administration-Roles of Management, Levels of Management, Development of Management Thought-Early management approaches-Modern management approaches.<br><br>**Planning**: Nature, Importance and purpose of planning process objectives-types of plans (meaning only)-decision making, Importance of planning-steps in planning & planning premise- Hierarchy of plans. | 08 Hours |
| **Module -2** | |
| **Organizing and Staffing:** Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalization, Committees–Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility;<br>**Staffing**-Need and Importance, Recruitment and Selection Process.<br><br>**Directing:** Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow's Need-Hierarchy Theory and Herzberg's Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioral Approach of Leadership; | 08 Hours |
| **Module -3** | |
| **Coordination:** Coordination-Meaning, Types, Techniques of Coordination;<br>**Controlling** – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process.<br>**Authority delegation:** Meaning, advantage of effective delegation, barriers to effective delegation, guidelines for effective delegation.<br>Decentralization: Decentralization of authority meaning, distinction between delegation and decentralization, the trade-off of centralization and decentralization. | 08 Hours |
| **Module -4** | |

| | |
|---|---|
| **Entrepreneurship:** Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle.<br><br>**Modern Small Business Enterprises:** Role of Small Scale Industries, Impact of Globalization and WTO on SSIs, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Ancillary Industry and Tiny Industry (Definition only) . | 08 Hours |
| **Module -5** | |
| **Projects Management:** A Project. Search for a Business idea: Introduction, Choosing an Idea, Selection of product, The Adoption process, Product Innovation, Product Planning and Development Strategy, Product Planning and Development Process. Concepts of Projects and Classification: Introduction, Meaning of Projects, Characteristics of a Project, Project Levels, Project Classification, Aspects of a Project, The project Cycle, Features and Phases of Project management, Project Management Processes. Project Identification: Feasibility Report, Project Feasibility Analysis. Project Formulation: Meaning, Steps in Project formulation, Sequential Stages of Project Formulation, Project Evaluation.<br>**Project Design and Network Analysis:** Introduction, Importance of Network Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences. | 08 Hours |

**Course Outcomes**: After studying this course, students will be able to:

CO-1- Understand core principles of management and planning to effectively apply these concepts in real-world scenarios.

CO-2- Understand essential elements of Organizing, Staffing, and Directing and controlling, which are vital for effective management.

CO-3- Comprehend the key aspects of Social Responsibilities of Business and Entrepreneurship, with a focus on corporate governance and the entrepreneurial journey.

CO-4- Understand concepts, government policies, challenges, and entrepreneurial development.

CO-5- Explain Project management concepts, network analysis techniques, and the formulation and identification process for effective planning and execution.

**Text Books:**


1. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017. ISBN-13:978-93-5260-535-4.
2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education 2008, ISBN 978-81-7758-260-4.
3. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN: 978- 81-8488-801-2.
4. Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, "Entrepreneurship", 8th Edition, Tata Mc-graw Hill Publishing Co.ltd.-new Delhi, 2012


**Reference Books:**


1. Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | 3 | 2 | 2 | 2 | 3 | 2 | 3 | - | - | 3 |
| CO2 | - | - | - | - | - | 3 | 2 | 3 | 3 | 3 | 2 | 3 | - | - | 3 |
| CO3 | - | - | - | - | - | 2 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | 3 |
| CO4 | - | - | - | - | - | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | 3 |
| CO5 | - | - | - | - | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | 3 |

## DIGITAL SIGNAL PROCESING

[As per NEP, Outcome Based Education, and Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

| | | | |
|---|---|---|---|
| Subject Code | 22EC52 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 3L+1T | SEE Marks | 50 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |

**CREDITS-04**

**Course Objectives:** This course will enable students to:

1. Understand the frequency domain sampling and reconstruction of discrete time signals.
2. Study the properties and the development of efficient algorithms for the computation of DFT.
3. Learn the procedures to design of IIR filters from the analog filters using impulse invariance and bilinear transformation.
4. Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.
5. Realization of FIR and IIR filters in different structural forms.

| **Module -1** | **Teaching Hours** |
|---|---|
| **Discrete Fourier Transforms (DFT**): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms. Properties of DFT, multiplication of two DFTs- the circular convolution. **(Text 1 & Ref 1)** | 10 Hours |
| **Module -2** | |
| Additional DFT properties, Application of DFT: use of DFT in linear filtering, overlap-save and overlap-add method. Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms). **(Text 1 & Ref 1)** | 10 Hours |
| **Module -3** | |
| Radix-2 FFT algorithm for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm and chirp-z transform. **(Text 2 & Ref 2)** | 10 Hours |
| **Module -4** | |
| Structure for IIR Systems: Direct form, Cascade form, Parallel form structures. IIR filter design: Characteristics of commonly used analog filter – Butterworth and Chebyshev filters, analog to analog frequency transformations. Design of IIR Filters from analog filter using Butterworth filter: Impulse invariance, Bilinear transformation. **(Text3& Ref 3)** | 10 Hours |
| **Module -5** | |
| FIR filter design: Magnitude and frequency response of Rectangular, Hamming, Hanning, Bartlett windows. Introduction to FIR filters, design of FIR filters using window method, Structure for FIR Systems: Direct form, Linear Phase, Frequency sampling structure, Lattice structure. **(Text3& Ref 3)** | 10 Hours |

**Course Outcomes:** After studying this course, students will be able to:

CO-1- Apply the discrete time Fourier transform algorithm and its properties on discrete time signals.

CO-2- Perform linear filtering on discrete time signals using discrete time Fourier transform.

CO-3- Apply the discrete in time and discrete in frequency fast Fourier transform, Chirp-Z transform, and Goertzel algorithms on discrete time signals to perform the discrete Fourier transform efficiently.
CO-4- Design of infinite impulse response (IIR) filters and develop IIR structures.
CO-5- Design of finite impulse response filters and develop FIR structures.

**Text Books:**

1. Digital signal processing – Principles Algorithms & Applications, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.
2. Digital signal processing-Theory and Lab practice, D.Ganesh Rao, Vineeta P.Gejji, Second addition, PEARSON, 2010.

**Reference Books:**

1. Discrete Time Signal Processing, Oppenheim & Schaffer, PHI, 2003.
2. Digital Signal2. Processing, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010.
3. Digital Signal Processing, Lee Tan: Elsevier publications, 2007.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 2 | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| CO4 | 2 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

| ELECTROMAGNETIC WAVES AND ANTENNAS<br>[As per Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-V | | | |
|---|---|---|---|
| Subject Code | 22EC53 | CIE Marks | 50 |
| Number Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |
| **CREDITS-03** | | | |

**Course Objectives:** The objectives of the course is to enable students to:

1. Physical significance of Divergence, Curl and Gradient.
2. Understand the applications of Coulomb‘s law and Gauss law to different charge distributions and the Laplace‘s and Poisson‘s Equations
3. Know the physical interpretation of Maxwell’s equations and applications for Plane waves for their behavior in free space, Dielectrics.
4. Introduce and discuss different types of Antennas, various terminologies, excitations.
5. Study different types of Arrays, Pattern-multiplication, design antennas like Yagi-Uda, Helical antennas and other broad band antennas.

| **Module -1** | **Teaching Hours** |
|---|---|
| Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Electric flux density. Gauss law, Divergence. Maxwell‘s First equation (Electrostatics), Vector Operator and divergence theorem. (2.1,2.2,2.4,3.1,3.2,3.5,3.6,3.7 of Text 1) | 08 Hours |
| **Module -2** | |
| The line integral, Definition of potential difference & potential, The potential field of point charge, Potential Gradient, Current and Current density, Continuity of current, Derivation of Poisson’s and Laplace’s Equations, Uniqueness theorem, Biot-Savart Law, Ampere’s circuital law, Curl, Stokes’ theorem (4.2,4.3,4.4,4.6,5.1,5.2,7.1,7.2,8.1,8.2,8.3,8.4 of Text 1) | 08 Hours |
| **Module -3** | |
| Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials. Farday’s law, displacement current, Maxwell’s equations in point form, Maxwell’s equations in integral form. Wave propagation in free space, Dielectrics, Poynting’s Theorem and wave power(8.5,8.6,10.1,10.2,10.3,10.4,12.1,12.2,12.3of Text1) | 08 Hours |
| **Module -4** | |
| Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Bandwidth, Radio Communication Link, Antenna Field Zones & Polarization. Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Field Patterns, Phase Patterns, Arrays of Two Isotropic Point Sources, Pattern Multiplication, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing. (2.1-2.11,2.13,2.15,5.1-5.10,5.13 of Text 2) | 08 Hours |
| **Module -5** | |
| Antenna Types: Helical Antenna, Yagi-Uda antenna, corner reflectors, parabolic reflectors, log periodic antenna, lens antenna, antenna for special applications – sleeve antenna, turnstile antenna, omni directional antennas, antennas for satellite, antennas | 08 Hours |

| | |
|---|---|
| for ground penetrating radars, embedded antennas, ultra wide band antennas, plasma antenna. Patch or Microstrip Antennas (8.1-8.3,9.3,9.9,10.115.6,15.7,15.9,15.26-15.29 ,16-12 of Text 2) | |

**Course Outcomes**: After studying this course, students will be able to:

CO-1- Explain and analyze electric field due to point, linear, and volume charges by applying Conventional method or Gauss law.

CO-2- Analyze the potential energy of a point charge through Laplace's equation and examine laws linking magnetic fields to electric current.

CO-3- Apply Maxwell's equations for time-varying electromagnetic fields and EM wave propagation in free space, then use Poynting's theorem to calculate wave power and energy.

CO-4- Analyze the fundamentals of antenna theory.

CO-5- Understand and analyze the functionality and applications of different antennas.

**Text Books:**


1. W.H. Hayt and J.A. Buck, "Engineering Electromagnetics", 7th Edition, TataMcGraw-Hill, 2009, ISBN-978-0-07-061223-5.
2. D. Krauss, "Antennas and Wave Propagation", McGraw Hill TMH, 4th Edition, 2010.


**Reference Books:**


1. C. A. Balanis, "Antenna Theory Analysis and Design", John Wiley, 2nd Edition 2007.
2. A.R.Harish, M.Sachidanada, "Antennas and propagation", Pearson Education, 2015.


**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |

**VERILOG HDL**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

**SEMESTER-V**

| | | | |
|---|---|---|---|
| Course Code | 22EC541 | CIE Marks | 50 |
| Number of Lecture Hours/Week | 3L | SEE Marks | 50 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03hrs |

**CREDITS– 03**

**Course Learning Objectives:**

1. Learn different Verilog HDL constructs.
2. Understand the basic concepts and internals of module.
3. Understand different aspects of gate level design and constructs.
4. Understand behavioral statements, Verilog Tasks, Functions and Directives.
5. Understand the concept of logic synthesis and its impact in verification

| **Module 1** | **Teaching Hours** |
|---|---|
| **Overview of Digital Design with Verilog HDL:** Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs.<br>**Hierarchical Modeling Concepts:** Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. (Text1: CH. 1, 2) | **08 Hours** |
| **Module 2** | |
| **Basic Concepts:** Lexical conventions, data types, system tasks, compiler directives.<br>**Modules and Ports:** Module definition, port declaration, connecting ports, hierarchical name referencing. (Text1: CH. 3, 4) | **08 Hours** |
| **Module 3** | |
| **Gate-Level Modeling:** Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays, Examples.<br>**Dataflow Modeling:** Continuous assignments, delay specification, expressions, operators, operands, operator types. (Text1: CH. 5, 6.1, 6.2, 6.3, 6.4, 6.5) | **08 Hours** |
| **Module 4** | |
| **Behavioral Modeling:** Structured procedures, initial and always, blocking and non-blocking statements, regular delay control, event based timing control, conditional statements, Multiway branching-case statement, loops, Examples.<br>**Tasks and functions:** differences between tasks and functions, tasks and functions with examples. (Text1: CH. 7.1-7.6, 7.9.1, 7.9.2, 8.1, 8.2, 8.3.1, 8.3.2) | **08 Hours** |
| **Module 5** | |
| **Switch level modeling**: switch modeling elements: MOS switches, CMOS switches, bidirectional switches, power & ground, delay specification on switches, examples.<br>**Logic Synthesis with Verilog:** Logic synthesis, impact of logic synthesis, Verilog HDL synthesis, Synthesis design flow, verification of gate-level | **08 Hours** |

| | |
|---|---|
| netlist. (Text1: CH. 11, 14.1, 14.2, 14.3, 14.4, 14.6) | |

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

CO-1- Emphasize the importance of Verilog HDL, design methodology, and abstraction levels in relation to a particular digital design.

CO-2- Grasp the fundamental concepts, components, and internal structure of Verilog HDL.

CO-3- Analyze and design circuits at gate level and data flow level by applying the basic knowledge of delay and operators.

CO-4- Design and explain a behavioral circuit using structured procedures and conditional statements.

CO-5- Develop fundamental switch-level circuits and analyze the various constructs used in logic synthesis.

**Text Book:**

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, Second Edition.

**Reference Books:**

1. Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", Springer Science+Business Media, LLC, Fifth edition.
2. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition.
3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016 or earlier.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **3** | - | - | - | - | - | - | - | - | - | **3** | - | - |
| **CO2** | **3** | **2** | - | - | - | - | - | - | - | - | - | - | **3** | - | - |
| **CO3** | **2** | **3** | **3** | - | - | - | - | - | - | - | - | - | **3** | - | - |
| **CO4** | **2** | **3** | **3** | - | - | - | - | - | - | - | - | - | **3** | - | - |
| **CO5** | **3** | **3** | **3** | - | - | - | - | - | - | - | - | - | **3** | - | - |

## OPTICAL FIBER COMMUNICATION

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System CBCS) Scheme]

SEMESTER-V

| | | | |
|---|---|---|---|
| Subject Code | 22EC542 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 3L | SEE Marks | 50 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |

CREDITS-03

**Course Objectives :** This course will enable students to:

1. Learn the basic principle of optical fiber communication with different modes of light propagation.
2. Understand the transmission characteristics and losses in optical fiber.
3. Study of optical components and its applications in optical communication networks.
4. Learn the network standards in optical fiber and understand the network architectures along with its functionalities.

| Modules | Teaching Hours |
|---|---|
| **Module-1** | |
| Optical fiber Communications: Historical development, The general system, Advantages of optical fiber communication, Optical fiber wave guides :Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength ,Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers. Text book 2: Chapter 1 and 2 | **08Hours** |
| **Module-2** | |
| Transmission characteristics of optical fiber: Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss,<br>Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber.<br>Optical Fiber Connectors: Fiber alignment and joint loss, Fiber splices: Fusion Splices, Mechanical splices, Fiber connector, Cylindrical ferrule connectors, Duplex and Multiple fiber connectors.<br>Fiber couplers: three and four port couplers, star couplers, Optical Isolators and Circulators. Text book 2: Chapter 3 and 5 | **08Hours** |
| **Module-3** | |
| **Optical sources:** Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power,<br>Modulation.<br>**Laser Diodes:** Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant Frequencies.<br>**Photo-detectors**: Physical principles of Photodiodes, Photo detector noise, Detector response time.<br>**Optical Receiver:** Optical Receiver Operation: Error Sources, Front End Amplifiers. Text book 1: Chapter 4:4.2,4.3, Chapter 6:6.1,6.2,6.3,Chapter 7:7.1 | **08Hours** |
| **Module-4** | |

| | |
|---|---|
| **WDM Concepts and Components**: Overview of WDM: Operational Principles of WDM,WDM standards.<br>**Optical amplifiers:** Basic application and Types, Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, Wideband Optical Amplifiers. Text book 1: Chapter 10:10.1,10.8,Chapter 11:11.1,11.2,11.3 | **08 Hours** |
| **Module-5** | |
| **OPTICAL AMPLIFIERS AND NETWORKS**: optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA.<br>Optical Networks: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides. Text book 1: Chapter 13:13.1,13.2,13.3. | **08 Hours** |

**Course outcomes:** After studying this course, students will be able to:

CO-1-Comprahend the construction and working principle of optical connectors, multiplexers, amplifiers, Optical sources, and detectors.

CO-2-Analyze the Applications of Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, and Wide band Optical Amplifiers.

CO-3-Analyze the various transmission losses in the optical fiber.

CO-4-Analyzethenetworkingaspectsofopticalfiberanddescribevariousstandardsassociatedwithit.

CO-5-Design and interface issues of SONET/SDH optical networks.

**Text Books:**


1. Gerd Keiser, Optical Fiber Communication, 4th Edition, Mc Graw Hill Education (India) Private Limited, 2015. ISBN:1-25-900687-5.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3.


**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **CO2** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **CO3** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **CO4** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **CO5** | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

**INTERNET OF THINGS**
**[As per Choice Based Credit System (CBCS) Scheme]**
**SEMESTER-V**

| | | | |
|---|---|---|---|
| Subject Code | 22EC551 | CIE Marks | 50 |
| Number Lecture Hour/Week | 4L | SEE Marks | 50 |
| Number of Lecture Hours | 50 | Exam Hours | 03 |

**CREDITS-04**

**Course Objectives:** This course will enable students to:

1. Understand the overview of IoT, Physical and Logical Design of IoT.
2. Studying the similarity between M2M & IoT and its system management.
3. Understand IoT platform design methodology.
4. Know the IoT physical devices and Python programming concept.
5. Understand the role of IoT in various domains of applications.

| **Module -1** | **Teaching Hours** |
|---|---|
| **Introduction to Internet of Things**<br>**Introduction:** Definition, and Characteristics of IoT,<br>**Physical Design of IoT**: Things in IoT, IoT Protocols<br>**Logical Design of IoT**: IoT Functional Blocks, IoT Communication Models, IoT communication APIs<br>**IoT Enabling Technologies:** Wireless sensor networks, Cloud computing, Big data analytics, communication protocol, Embedded systems<br>**IoT levels and Deployment Templates:** IoT level1 to Level 6 (Chapter 1) | 10 Hours |
| **Module -2** | |
| **IoT and M2M:** M2M, Difference between IoT and M2M, Software defined networking and network function virtualization<br>**IoT System Management with NETCONF-YANG:** Need for IoT System Management, SNMP, Network operator requirements, NETCONF, YANG,IoT System Management with NETCONF-YANG. (Chapter 3 & 4) | 10 Hours |
| **Module -3** | |
| **IoT Platforms Design Methodology:** Introduction, IoT Design Methodology, Purpose and Requirements Specification, Process Specification, Domain model Specification, Information Model specification, service specifications, IoT level Specifications, Functional view specifications, operational view specifications, Device and component Integration, Application Development, Motivation for Using Python(chapter-5) | 10 Hours |
| **Module -4** | |
| **IoT Systems- Logical Design using Python:** Introduction, Installing Python, Python Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File handling, Python Packages.<br>**IoT Physical Devices & Endpoints:**<br>Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces. Programming Raspberry Pi with Python, Arduino, About the board.(Chapter 6&7) | 10 Hours |
| **Module -5** | |
| **Domain Specific IoTs and its Applications:** Home automation, Cities, Environment Energy, Retail, logistics, Agriculture, Industry, Health and life style | 10 Hours |

**IoT applications:** Smart lighting, smart parking, whether monitoring system, air pollution monitoring, forest fire detection, smart irrigation. (Chapter-2 & 9)

**Course Outcomes**: After studying this course, students will be able to:

CO-1-Define and illustrate architectural view of IoT and analyze all the six levels of IoT deployment templets.

CO-2-Compare M2M & IOT and applications of NETCONF-YANG in IoT system management.

CO-3-Analyse various IoT design methodology specifications.

CO-4-Logical and physical design of IoT system using Python and Respberry Pi.

CO-5-Design IoT system for Home automation, cities, energy, environment, retail, logistic, agriculture, industry, health and life style.

**Text Books:**

1. Arshdeep Bhaga and Vijay Madisetti, "Internet of Things – A Hands-on Approach 2014

**Reference Book:**

3. Raj Kamal, "Internet of Things- Architecture and Design Principles", McGraw Hill Education.
4. Qusay F. Hassan, Internet of Things A to Z Technologies and Applications, IEEE press, WILEY, ISBN:978-1-111-945674-2.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

## MICROCONTROLLER AND MICROPROCESSOR

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

| | | | |
|---|---|---|---|
| Subject Code | 22EC552 | CIE Marks | 50 |
| Number of Lecture Hours/Week | 4L | SEE Marks | 50 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS-04**

**Course objectives:** Students will be taught to:

1. Understand the basics of microcontroller, Embedded systems and architecture of 8051microcontrollers.
2. Explain and analyze the instruction sets of 8051microcontrollers and also to write the Assembly Level Programs using8051 Instruction set.
3. Understand and write peripheral programming for timers, serial port and Interrupt system of 8051. Analyze the Application and Interfacing of 8051MicrocontrollertoI/O devices.
4. To develop an Understand the basics of microprocessors. architecture of 8086 microprocessors.
5. Analyze and write the Assembly language programs of 8086

| Module -1 | Teaching Hours |
|---|---|
| 8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing. | **08 Hours** |
| **Module -2** | |
| 8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions. | **08 Hours** |
| **Module -3** | |
| 8051 Interrupts and Interfacing Applications: 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly language interfacing programming | **08 Hours** |
| **Module -4** | |
| **8086 Architecture:** 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086. | **08 Hours** |
| **Module -5** | |
| **Instruction Set and Assembly Language Programming of 8086**: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations. | **08 Hours** |

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

CO1. Understand and analyze basics of microcontroller and microprocessor.

CO2. Develop 8051 application specific programs using 8051 instructions set.

CO3. Analyze the interfacing of 8051microcontroller to various I/O devices.

CO4. Apply the 8086 instruction set to write the programs.

CO5. Investigate the performance of all the microprocessors starting from Pentium-IV to i7 and submit a report.

**Text Books:**

1. "The 8051 Microcontroller and Embedded Systems – using Assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth. J Ayala,3rd Edition, Thomson /Cengage Learning.
3. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, MHE, 2nd Edition 2006.

**Reference Book:**

1. "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN:978-93-329-0125-4.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education,2005.
3. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):**

**Note:1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |

**DIGITAL SIGNAL PROCESING LABORATORY**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

**SEMESTER-V**

| | | | |
|---|---|---|---|
| Subject Code | 22ECL56 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This course will enable students to:

1. Simulate discrete time signals and verification of sampling theorem.
2. Compute the DFT for a discrete signal and verification of its properties using SCILAB.
3. Find solution to the difference equations and computation of convolution and correlation along with the verification of properties.
4. Compute and display the filtering operations and compare with the theoretical values.
5. Implement the DSP computations on DSP hardware and verify the result.

**List of Experiments:**

**Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:**

1. Specifications (using different window techniques). Verification of sampling theorem.
2. Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.
3. Auto and cross correlation of two sequences and verification of their properties.
4. Solving a given difference equation.
5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine, Study the frequency resolution with different values of N).
6. 
   (i) Verification of DFT properties (like Linearity and Parseval's theorem, etc.)
   (ii) DFT computations of square pulse and sinc function etc.
7. Design and implementation of FIR filter to meet given.
8. Design and implementation of IIR filter to meet given specifications.

**Following Experiments to be done using DSP kit**

1.Linear convolution of two sequences
2.Circular convolution of two sequences
3.N-point DFT of a given sequence
4.Impulse response of first order and second order system
5.Implementation of FIR filter

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.
CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.
CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):**
**Note:1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**ELECTROMAGNETIC WAVES AND ANTENNAS LABORATORY**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

| | | | |
|---|---|---|---|
| Subject Code | 22ECL57 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This course will enable students to:

1. Radiation pattern of antennas.
2. Determining gain and directivity of a given antenna.
3. Working of Klystron source.
4. Study of directional coupler, Microstrip ring resonator.

**List of Experiments:**

1. Measurement of frequency, guide wavelength, power, VSWR and attenuation in microwave test bench
2. Measurement of directivity of microstrip dipole
3. Measurement of gain of microstrip dipole
4. Measurement of directivity of Yagi antennas.
5. Measurement of gain of Yagi antennas.
6. Measurement of directivity of horn antennas
7. Measurement of gain of horn antennas.
8. Impedance measurements of Horn/Yagi/dipole/Parabolic antennas
9. Determination of Coupling and isolation characteristics of microstrip directional coupler.
10. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
11. Power division and isolation of microstrip power divider.
12. Measurement of cross and co-polarisation of an antenna.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):**

**Note:1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO2** | **2** | **3** | **1** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO3** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO4** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **3** | **3** | **2** | **-** | **-** | **-** | **3** | **-** |
| **CO5** | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **3** | **-** | **3** | **3** | **-** | **-** | **3** | **-** |

## VERILOG HDL LABORATORY

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

**SEMESTER-V**

| | | | |
|---|---|---|---|
| Laboratory Code | 22ECL581 | CIE Marks | 50 |
| Number of Lecture Hours/Week | 2P | SEE Marks | 50 |
| Total Number of Lecture Hours | 24 | Exam Hours | 03 |

**CREDITS – 01**

**Course Learning Objectives:** This course will enable students to:

1. Familiarize with the CAD tool to write HDL programs.
2. Understand simulation and synthesis of digital design.
3. Program FPGAs/CPLDs to synthesize the digital designs.
4. Interface hardware to programmable ICs through I/O ports.
5. Use Verilog for a given Abstraction level.

**Note:** Programming can be done using any compiler. Download the programs on a FPGA/CPLD board and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/ Modelsim or equivalent.

### Laboratory Experiments

**Part–A: PROGRAMMING**

1. Write Verilog code to realize all the logic gates.
2. Write a Verilog program for the following combinational designs
    a. 2 to 4 decoder
    b. 8 to 3 (encoder without priority & with priority)
    c. Multiplexer, de-multiplexer.
3. Write a Verilog code to describe the functions of a Full Adder using three modeling styles.
4. Develop the Verilog code for 4 bit ripple carry adder.
5. Develop the Verilog code for 4 bit parallel multiplier.
6. Develop the Verilog code for the following flip-flops, SR, D, JK and T.
7. Design a 4 bit binary counters (Synchronous reset and Asynchronous reset).
8. Design 4 bit ALU and write a Verilog Code.
9. Write Verilog HDL code to control speed, direction of DC and Stepper motor.
10. Write Verilog HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC - change the frequency.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful

conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):**
**Note:1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

## OPTICAL FIBER COMMUNICATION LABORATORY

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

| | | | |
|---|---|---|---|
| Subject Code | 22ECL582 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Lecture Hours | 24 | Exam Hours | 03 |

CREDITS-01

**Course Objectives:** This course will enable students to:

1. Performance comparison of optical link using LED and LASER for specific distance.
2. Performance Evaluation of Point to point optical link at different distances and for different transmitter powers.
3. Performance comparison of optical link receivers and for different fibers.
4. Impact of optical amplifiers on link performance.

## Experiments

**1.** To study the VI & PI characteristics of the FO-LED.

**2.** To study the VI & PI characteristics of the Laser Diode.

**3.** Real time Temperature sensor data transfer using fiber optic

**4.** To study the transfer Characteristics between the DETECTOR and SOURCE with simplex cable.

**5.** To study the VOICE communication over the fiber optic cable.

**6.** To study Voice communication using CODEC.

**7.** To study PWM signal communication using fiber optic.

**8.** To study digital data transmission with LED and switch.

**9.** To set up Fiber Optic Analog and fiber Optic Digital link.

**10.** Measurement of Propagation loss and numerical aperture.

**11.** Measurement of optical power bending loss in a plastic optical fiber.

**12.** Study and measure characteristics of fiber optic LED's, LDR and Laser diode.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**Reference Books:**

1.GerdKeiser,"OpticalFiberCommunication"McGraw–HillInternational,4th Edition 2010.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

| PROJECT-V<br>[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-V | | | |
|---|---|---|---|
| Subject Code | 22PRJ59 | CIE Marks | 50 |
| Number Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Lecture Hours | 24 | Exam Hours | 03 |
| **CREDITS-01** | | | |

**Course Objectives:**Students will be taught to:

1. Get exposure about the electronics hardware and various software tools.
2. Design the working model of the open ended problem.
3. Understand concepts of Packaging.
4. Understand the latest technology trends in the PCB design.
5. Prepare technical documentation of the project.

STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM IN TEAM.

**Course outcomes:** After studying this course, students will be able to:

CO1. Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO2. Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO3. Design and implement the system to solve the real time problem of the society.

CO4. Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO5. Use the modern tool available like advanced hardware and software tools.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | 2 | 2 | - | - | 3 | 3 | - | 3 | - | 3 | - |
| **CO2** | 3 | 3 | 1 | - | - | - | - | - | - | - | - | 3 | - | 3 | - |
| **CO3** | 3 | 3 | 3 | 2 | 3 | 2 | 2 | - | 3 | 3 | 2 | 3 | - | 3 | - |
| **CO4** | 3 | 3 | 3 | 2 | - | - | - | 3 | 3 | 3 | 3 | 3 | - | 3 | - |
| **CO5** | - | - | - | - | 3 | - | - | 3 | 3 | 3 | 3 | 3 | - | 3 | - |

| RESEARCH ARTICLE/REPORT READING AND WRITING<br>[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-V | | | |
|---|---|---|---|
| Subject Code | 22EC510A | CIE Marks | 50 |
| Number Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Lecture Hours | 24 | Exam Hours | 03 |
| **CREDITS-01** | | | |

**Course Objectives:**Students will be taught to:

1. Download the research articles from the digital platforms and read it.
2. Understand the various sections of the research article.
3. How to review the literature?
4. How to formulate the research problem statement?
5. How to design the methodology, represent the result, write the research article and publish it.

EVERY WEEK STUDENTS WILL BE GIVEN ONE RESEARCH ARTICLE AND MAKE THEM TO READ UNDERSTAND AND ANALYZE IT.

**Course outcomes:** After studying this course, students will be able to:

CO-1-Independently down load the research articles of their interested domain and read it.
CO-2-Analize the various sections of the research paper and present it using power point/chart.
CO3. Do the proper literature survey and submit the report individual/ group.
CO4. Design various sections of the research paper like introduction, literature review, methodology, result and conclusions.
CO5. Write the research article and publish in indexed journals/ submit report.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO2** | **2** | **3** | **1** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO3** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO4** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **3** | **3** | **2** | **-** | **-** | **-** | **3** | **-** |
| **CO5** | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **3** | **-** | **3** | **3** | **-** | **-** | **3** | **-** |

**C++ BASICS**

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

| | | | |
|---|---|---|---|
| Course Code | 22ECL510B | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Number of Lecture Hours | 24 | Exam hours | 03 |

**CREDITS-01**

**Course Objectives:** Students will be taught to:

1. Introduces object-oriented programming concepts using the C++ language.
2. Introduces the principles of data abstraction, inheritance and polymorphism;
3. Introduces the principles of virtual functions and polymorphism
4. Introduces handling formatted I/O and unformatted I/O
5. Introduces exception handling

**Module -1**

1. Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.
2. Write a C++ program to declare Struct. Initialize and display contents of member variables.
3. Write a C++ program to declare a class. Declare pointer to class. Initialize and display the contents of the class member.
4. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.
5. Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).
6. Write a C++ to illustrate the concepts of console I/O operations.
7. Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.
8. Write a C++ program to allocate memory using new operator.
9. Write a C++ program to create multilevel inheritance. (Hint: Classes A1, A2, A3)
10. Write a C++ program to create an array of pointers. Invoke functions using array objects.
11. Write a C++ program to use pointer for both base and derived classes and call the member function. Use Virtual keyword.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**VLSI CIRCUITS**

[As per NEP, Outcome Based Education, and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

| | | | |
|---|---|---|---|
| Subject Code | 22EC61 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 3L | SEE Marks | 50 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS-03**

**Course Objectives:** The objectives of the course is to enable students to:

1. Impart knowledge of MOS transistor theory and CMOS technologies
2. Impart knowledge on architectural choices and performance trade-offs involved indesigning and realizing the circuits in CMOS technology
3. Cultivate the concepts of Memory and subsystem design processes.
4. Exemplify single-stage amplifiers
5. Describe Differential amplifier and Current Mirrors.

| **Module -1** | **Teaching Hours** |
|---|---|
| **Introduction:** MOS transistors, MOS Transistor Theory, Ideal I-V Characteristics, Non-Ideal I-V Effects, DC Transfer Characteristics, Fabrication Process. **(Text 1)** | 08 Hours |
| **Module -2** | |
| **MOS and BiCMOS Circuit Design Process:** MOS Layers, Stick Diagrams, Design Rules and Layout, VLSI Design Flow. **(Text 3)**<br>Sheet Resistance, Area Capacitance of Layers, Standard Unit of Capacitance, Scaling Models and Scaling factors, Scaling Factors for Device Parameters. **(Text 3)** | 08 Hours |
| **Module -3** | |
| **Memory:** SRAM, DRAM, read only memory, Serial Access Memory, programmable Logic array. **(Text 1)**<br>**Subsystem Design:** Some architectural issues, Pseudo nMOS logic, Dynamic CMOS Logic, $C^2$MOS logic, CMOS Domino logic**(Text 3)** | 08 Hours |
| **Module -4** | |
| **Single Stage Amplifier:** Common Source Stage, Source Follower,Common gate Stage, Cascode Stage. **(Text 2)** | 08 Hours |
| **Module -5** | |
| **Differential amplifiers:** Single Ended and Differential Amplifiers, Basic differential pair, Common Mode Response, Differential Pair with MOS Loads.<br>**Passive and Active Current Mirrors:** Basic Current Mirror, Cascode Current Mirror, Active Current Mirror. **(Text 2)** | 08 Hours |

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

CO-1-Analyze the ideal and non-ideal I-V characteristics of MOS transistor.

CO-2- Develop the ability to create and interpret gate layouts and stick diagrams for basic circuits while adhering to design rules, and analyze and apply scaling models to predict the impact of device miniaturization.

CO-3- Design memory and sub systems for various applications based on system requirements.

CO-4- Design and analyze the performance parameters of a single-stage and cascode amplifier.

CO-5-Design and analyze a differential amplifier and explore current mirrors.

**Text Books:**


1. "CMOS VLSI Design- A Circuits and Systems Perspective"- Neil H.E. Weste, David Harris, Ayan Banerjee, 3rd Edition, Pearson Education.
2. "Design Of Analog CMOS Integrated Circuits"-Behzad Razavi, McGraw Hill Education (India) Edition 2002
3. " Basic VLSI Design ", Douglass A. Pucknell & Kamran Eshraghian,PHI 3rd Edition(orginal edition 1994)2005.


**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | - | - | 1 | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 2 | - | - | - | 1 | - | - | - | - | - | 3 | - | - |
| CO3 | 2 | 3 | 3 | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| CO4 | 2 | 3 | 3 | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | 2 | - | - | - | - | - | 3 | - | - |

## CONTROL SYSTEM

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]
SEMESTER-VI

| | | | |
|---|---|---|---|
| Subject Code | 22EC62 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2L+1T | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS-03**

Course Objectives: This course will enable students to:

1. To introduce the components and their representation of control systems
2. Learn how to find a mathematical model of electrical, mechanical and electromechanical systems.
3. Find the transfer function via Masons' rule .
4. Know how to find time response and analyze the stability of a system from the transfer function.
5. To learn various methods for analyzing the time response, frequency response and stability of the systems

| **Module -1** | **Teaching Hours** |
|---|---|
| **INTRODUCTION TO CONTROL SYSTEMS:** Basic control system and its classifications, Servomechanics, Differential Equation Of Physical Systems: Mechanical Systems, Electrical Systems, Analogous Systems (mentioned system numerical's) (Text1& Ref 1) | **08 Hours** |
| **Module -2** | |
| **MODELING A CONTROL SYSTEM:** Transfer functions, Block diagram algebra and Signal Flow graphs. | **08 Hours** |
| **Module -3** | |
| **TIME RESPONSE ANALYSIS OF CONTROL SYSTEMS**: Standard test signals, Unit step & ramp step response of First order Systems , Unit step response of second order System, Time response specifications of second order systems, steady state errors and error constants. (Text1& Ref 1) | **08 Hours** |
| **Module -4** | |
| **STABILITY ANALYSIS AND ROOT LOCUS**: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Introduction to Root Locus Techniques ,The root locus concepts, Construction of root loci.(Text1& Ref 1) | **08 Hours** |
| **Module -5** | |
| **FREQUENCY DOMAIN ANALYSIS AND STABILITY:** Correlation between time and frequency response, Bode Plots, Nyquist Stability criterion.(Text1 & Ref 1) | **08 Hours** |

**Course Outcomes:** After studying this course, students will be able to:

CO-1- Derive and analyze Mechanical and Electrical Systems using analogous system.

CO-2- Analyze the transfer functions of block diagram algebra, and signal flow graphs for system analysis.

CO-3- Analyze the time response specification and evaluate steady state errors and error constants for different types of input signals.

CO-4- Develop root locus diagrams and analyze the system dynamics for stability assessment.

CO-5- Assess the stability of control systems in frequency domain using the Nyquist and Bode plots.

Text Books:

1. J.Nagarath and M.Gopal, ― Control Systems Engineering‖, New Age International (P) Limited,

| |
|---|
| Publishers, Fifth edition-2005, ISBN: 81-224-2008-7. |
| Reference Books:<br>1. Control Systems,‖ A Anand Kumar ,Second Edition. 2. Modern Control Engineering,‖ K.Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7. |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):**

**Note:1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 2 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 2 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

**ARM CORTEX-M3 & EMBEDDED SYSTEMS**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

| | | | |
|---|---|---|---|
| Subject Code | 22EC631 | CIE Marks | 50 |
| Number Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 Hours | Exam Hours | 03 |

**CREDITS-03**

**Course Learning Objectives:** This course will enable students to**:**

1. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
2. Develop the hardware software co-design and firmware design approaches.
3. Explain the need of real time operating system for embedded system applications
4. Understand the architectural features and instruction set of 32-bit Microcontroller ARM Cortex M3.
5. Program ARM Cortex M3 using the various instructions and C language for different applications.

| Modules | Teaching Hours |
|---|---|
| **Module -1** | |
| **Embedded System Components:** Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation), Differences between RISC and CISC, Harvard and Von-neumann, Big and Little Endian formats, Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only) **(Text 1: All the Topics from Ch-1 and Ch-2 (Fig and explanation before 2.1) 2.1.1.6 to 2.1.1.8, 2.2 to 2.2.2.3, 2.3 to 2.3.2, 2.3.3.3, selected topics of 2.4.1 and 2.4.2 only).** | **08 Hours** |
| **Module -2** | |
| **Embedded System Design Concepts:** Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modeling (excluding UML), Embedded firmware design and development (excluding C language). **(Text 1: Ch-3, Ch-4 (4.1, 4.2.1 and 4.2.2 only), Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only))** | **08 Hours** |
| **Module -3** | |
| **RTOS and The Embedded product development life cycle(EDLC):** Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive scheduling techniques, How to choose an RTOS, The Embedded product development life cycle (EDLC): What is EDLC?,Why EDLC?, objectives of EDLC, Different phases of EDLC,EDLC approaches(Modeling the EDLC) **(Text 1: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.10 only), ch-15** | **08 Hours** |

| Module -4 | |
|---|---|
| **ARM-32 bit Microcontroller:** Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence **(Text 2: Ch 1, 2, 3)** | **08 Hours** |
| **Module-5** | |
| **ARM Cortex M3 Instruction Sets and Programming:** Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly and C language Programming **(Text 2: Ch-4(4.1,4,2,4.3.1 to 4.3.5,4,3.8,4.4only),Ch-5(5.1,5.2,5.3,5.5only), Ch-10 (10.1,10.2, 10.3, 10.4 only) )** | **08 Hours** |

**Course outcomes: After studying this course, students will be able to:**

CO-1-Indentify the purpose, core of embedded systems and area of applications.

CO-2- Analyze the hardware /software co-design and firmware design approaches.

CO-3- Investigate the need of real time operating system for embedded system applications.

CO-4- Analyze the architectural features of ARM Cortex M3 and apply for embedded system applications.

CO-5- Apply the knowledge gained for programming ARM Cortex M3 for applications, interface external devices and I/O with ARM microcontroller.

**Text Book:**


1. Shibu K V, ―Introduction to Embedded Systems‖, Tata McGraw Hill Education Private Limited, 2nd Edition.
2. Joseph Yiu, ―The Definitive Guide to the ARM Cortex-M3‖, 2nd Edition, Newnes, (Elsevier), 2010.


**Reference Book:**


1. James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008, ISBN: 978-0- 471-72180-2.
2. Yifeng Zhu, "Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C", 2nd E -Man Press LLC ©2015 ISBN:0982692633 9780982692639.
3. Embedded real time systems by K.V. K. K Prasad, Dreamtech publications, 2003.
4. Embedded Systems by Rajkamal, 2nd Edition, McGraw hill Publications, 2010.


**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):**

**Note:1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | - | - | - | - | 1 | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 2 | - | - | - | 1 | - | - | - | - | - | 3 | - | - |
| CO3 | 2 | 3 | 3 | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| CO4 | 2 | 3 | 3 | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | 2 | - | - | - | - | - | 3 | - | - |

**TINY MACHINE LEARNING**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

| | | | |
|---|---|---|---|
| Subject Code | 22EC632 | CIE Marks | 50 |
| Number Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS-03**

Course Objectives: The objectives of the course is to enable students to:

1. Work with Arduino and ultra-low-power microcontrollers
2. Learn the essentials of ML and how to train models
3. Train models to understand audio, image, and accelerometer data
4. Explore Tensor Flow Lite for Microcontrollers, Google's toolkit for TinyML
5. Debug applications and provide safeguards for privacy and security

| **Module -1** | **Teaching Hours** |
|---|---|
| **Getting up to speed on ML**: What machine learning actually is, Deep learning workflow, decide on a goal, collect dataset, design model architecture, train the model, convert model, run interface, Evaluate and troubleshoot, wrapping up, Machine learning tool chain, Python and Jupyter notebooks, Google co laboratory, tensor flow and keras building model, importing dependencies, generating data, splitting data, defining basic model, Training model, training metrics, graphing the history, improving model, testing, converting model to tensor flowlite, converting to C file.<br>**Hello world of TinyML: Building an application**, walking through tests, including the dependencies, setting up test, getting ready to log data, mapping model, creating allopsresolver, defining tensor arena, creating interpreter, inspecting input, running interface, reading output, running tests, project file structure, walking through source.<br>**Hello world of TinyML: Deploying to Microcontrollers,** Arduino, sparkfun edge, ST Microelectronics, handling output, running example, making own changes.<br>(Chapter 3, 4, 5 & 6 of Text1) | 08 Hours |
| **Module -2** | |
| **Wake-word detection: Building an application**, application architecture, introducing model , all moving parts, walking through the tests, basicflow, audio provider, feature provider, command recognizer, command responder, listening for wake words, running application, deploying to microcontrollers.<br>**Wake-word detection: Training a Model**, Training in co lab, using model, replacing model, updating labels, updating command responder, other ways to run scripts, model working, visualizing inputs, understanding model architecture, model output, training data, speech commands dataset, training dataset, data augmentation, model architectures.<br>**Person detection: Building an application**, application architecture, introducing model, all moving parts, walking through the tests, basic flow, image provider, detection responder, detecting people, deploying to microcontrollers, wrapping up**. Person detection: Training model,** picking a machine, setting google cloud platform instance, training framework choice, building dataset, training model, tensorboard, evaluating model, exporting to tensorflow lite, training other categories, understanding architecture.<br>(Chapter, 7, 8 9 & 10, of Text1) | 08 Hours |
| **Module -3** | |

| | |
|---|---|
| **Magic Wand: Building an application**, application architecture, introducing model, all moving parts, walking through the tests, basic flow, accelerometer handler, gesture predictor, output handler, detecting gestures, deploying to microcontrollers.<br>**Magic Wand: Training model**, training in Colab, other ways to run the scripts, model working, visualizing input, understanding model architecture, training data, capturing data, modifying training scripts, using new model.<br>**TensorFlow lite for Microcontrollers**, tensorflow, tensorflow lite, tensorflow lite for microcontrollers, requirements, model interpretation, project generation, building systems, specializing code, makefiles, writing tests, supporting a new hardware platform, supporting a new IDE, integrating code changes, contributing back to open source, supporting new hardware accelerators, understanding file format, porting tensorflow lite mobile Ops to micro.<br>**Designing own TinyML applications**, design process, need a microcontroller or larger device, understanding possibilities, find similar models to train, look data, wizard of Oz-ing, get it working on desktop.<br>(Chapter 11, 12, 13 & 14 of Text1) | 10 Hours |
| **Module -4** | |
| **Optimizing Latency,** first make sure it matters, hardware changes, model improvements.quantization, product design, code optimizations, optimizing operations, contributing back to opensource. **Optimizing energy usage,** developing intuition, typical component power usage, hardware choice, measuring real power usage, estimating power usage for model, improving power usage for model, duty cycling, cascading design. **Optimizing model and binary size,** understanding system's limits, estimating memory usage, flash usage, RAM usage, ballpark figures for model accuracy and size on different problems, model choice, reducing size of executables, truly tiny models.<br>(Chapter 15, 16 & 17 of Text1 | 10 Hours |
| **Module -5** | |
| **Debugging,** accuracy loss between training and deployment, preprocessing differences, debugging preprocessing, On-device evaluation, Numerical differences, are the differences problem, establish a metric, compare against baseline, swap out implementation, mysterious crashes and hangs, desktop debugging, log tracing, shotgun debugging, memory corruption, **Porting models from tensor flow to tensor flow lite,** understand Ops need, look existing Op coverage in tensor flow lite, move preprocessing and post processing into application code, implement and optimize Ops, **Privacy, security and deployment,** privacy design document, using a PDD, protecting models, moving from a development board to a product<br>(Chapter 18, 19 & 20 of Text1) | 10 Hours |
| **Course Outcomes**: After studying this course, students will be able to:<br>CO-1-Make use concepts in Tiny ML.<br>CO-2-Build an application and deploy to the microcontroller<br>CO-3-Analyze a Tensor flow lite for microcontroller and Design a Tiny ML application.<br>CO-4- Experiment with Latency, Energy usage, model and binary size parameter.<br>CO-5- Analyze accuracy loss between training and deployment, Privacy, security and deployment | |
| **Text Books:** | |

1. Pete warden and Daniel Situnayake, TinyML: Machine Learning with TensorFlow Lite on Arduino and UltraLow-Power Microcontrollers, O'Reilly Media, 1st edition, 2020. ISBN-10: 1492052043.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note:1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | - | - | - | - | | - | - | - | 1 | - | 2 | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | - | 2 | - |
| CO3 | 1 | 1 | 3 | - | - | - | - | - | - | - | - | 2 | - | 3 | - |
| CO4 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | - | 3 | - |
| CO5 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | - | 3 | - |

## PROGRAMMING USING PYTHON

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

**SEMESTER – VI**

| | | | |
|---|---|---|---|
| Subject Code | 22EC641 | IA Marks | 50 |
| Number of Lecture Hours/Week | 3L | Exam Marks | 50 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS – 03**

**Course objectives:** This course will enable students to

1. Learn Syntax and Semantics and create Functions in Python.
2. Handle Strings and Files in Python.
3. Understand Lists, Dictionaries and Regular expressions in Python.
4. Implement Object Oriented Programming concepts in Python
5. Build Web Services and introduction to Network and Database Programming inPython.

| Module – 1 | TeachingHours |
|---|---|
| The way of the program, Variables, expressions and statements, Functions, conditionals and recursions | 8 Hours |
| Module – 2 | |
| Iteration, Strings, lists | 8 Hours |
| Module – 3 | |
| Dictionaries, Tuples, Files, Regular Expressions | 8 Hours |
| Module – 4 | |
| Classes and objects, Classes and functions, Classes and methods | 8 Hours |
| Module – 5 | |
| Networked programs, Using Web Services, Using databases and SQL | 8 Hours |

**Course outcomes:** The students should be able to:

CO1- Understand Python syntax and semantics, and be fluent in the use of Python flow control and Functions.
CO2- Develop, run, and manipulate Python programs using Core data structures like Lists, Dictionaries, and string handling methods.
CO3- Develop, run, and manipulate Python programs using File Operations and searching patterns using regular expressions.
CO4- Interpret the concepts of object-oriented programming using Python.
CO5- Implement exemplary applications related to Network Programming, Web Services, and Databases in Python.

**Text Books:**

1.Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition,GreenTeaPress,2015.(http://greenteapress.com/thinkpython2/thinkpython2.pdf)(Chapters 1-3,5,7,8,10-12,14-17) (Download pdf files from the above links)
2.Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf ) (Chapters 11 –13, 15)

**Reference Books:**


1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014
2. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition,Pearson Education India, 2015. ISBN-13: 978-9332555365


**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | 3 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | 3 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | 3 | - | - | - | - | - | - | - | 3 | - | - |

**IOT & ITS APPLICATIONS**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

**SEMESTER-VI**

| | | | |
|---|---|---|---|
| Subject Code | 22EC642 | CIE Marks | 50 |
| Number Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |

**CREDITS-03**

**Course Objectives:** This course will enable students to:

1. Understand the overview of IoT, Physical and Logical Design of IoT.
2. Studying the similarity between M2M & IoT and its system management.
3. Understand IoT platform design methodology.
4. Know the IoT physical devices and Python programming concept.
5. Understand the role of IoT in various domains of applications.

| **Module -1** | **Teaching Hours** |
|---|---|
| **Introduction to Internet of Things**<br>**Introduction:** Definition, and Characteristics of IoT,<br>**Physical Design of IoT**: Things in IoT, IoT Protocols<br>**Logical Design of IoT**: IoT Functional Blocks, IoT Communication Models, IoT communication APIs<br>**IoT Enabling Technologies:** Wireless sensor networks, Cloud computing, Big data analytics, communication protocol, Embedded systems<br>**IoT levels and Deployment Templates:** IoT level1 to Level 6 (Chapter 1) | 8 Hours |
| **Module -2** | |
| **IoT and M2M:**M2M, Difference between IoT and M2M, Software defined networking and network function virtualization<br>**IoT System Management with NETCONF-YANG:** Need for IoT System Management, SNMP, Network operator requirements, NETCONF, YANG, IoT System Management with NETCONF-YANG. (Chapter 3 & 4) | 8 Hours |
| **Module -3** | |
| **IoT Platforms Design Methodology:** Introduction, IoT Design Methodology, Purpose and Requirements Specification, Process Specification, Domain model Specification, Information Model specification, service specifications, IoT level Specifications, Functional view specifications, operational view specifications, Device and component Integration, Application Development, Motivation for Using Python(chapter-5) | 8 Hours |
| **Module -4** | |
| **IoT Systems- Logical Design using Python:** Introduction, Installing Python, Python Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File handling, Python Packages.<br>**IoT Physical Devices & Endpoints:**<br>Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces. Programming Raspberry Pi with Python, Arduino, About the board. (Chapter 6&7) | 8 Hours |
| **Module -5** | |

| | |
|---|---|
| **Domain Specific IoTs and its Applications:** Home automation, Cities, Environment Energy, Retail, logistics, Agriculture, Industry, Health and life style<br>**IoT applications:** Smart lighting, smart parking, whether monitoring system, air pollution monitoring, forest fire detection, smart irrigation. (Chapter-2 & 9) | 8 Hours |
| **Course outcomes:** After studying this course, students will be able to:<br>CO-1- Gain a foundational understanding of IoT concepts, architecture, and analyze the data collection and processing mechanisms.<br>CO-2- Analyze IoT communication protocols and application layer protocols, focusing on data collection, storage, and computing using cloud platforms.<br>CO-3- Identify security concerns and analyze the vulnerabilities encountered in IoT applications.<br>CO-4 Analyze the real-time applications of IoT in various scenarios.<br>CO-5- Apply Python programming skills to develop IoT applications. | |
| **Text Books:**<br>1. Arshdeep Bhaga and Vijay Madisetti, "Internet of Things – A Hands-on Approach 2014 | |
| **Reference Book:**<br>1. Raj Kamal, "Internet of Things- Architecture and Design Principles", McGraw Hill Education.<br>2. Qusay F. Hassan, Internet of Things A to Z Technologies and Applications, IEEE press, WILEY, ISBN:978-1-111-945674-2. | |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

**EMBEDDED SYSTEMS**

[ As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS Scheme]
SEMESTER-VI

| | | | |
|---|---|---|---|
| Course Code | 22EC651 | CIE Marks | 50 |
| Number of Lecture Hours/Week | 4L | SEE Marks | 50 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03hrs |

**CREDITS– 04**

**Course Learning Objectives:** This course will enable students to**:**

1. Understand the basic hardware components and their selection method based of the characteristics and attributes of an embedded system.
2. Understand typical Embedded system with its components.
3. Develop the hardware software co-design and firmware design approaches.
4. Explain the need of real time operating system for embedded system applications
5. Understand the integration, testing of Embedded hardware and firmware and Embedded development Life cycle.

| **Module 1** | **Teaching Hours** |
|---|---|
| **Introduction To Embedded Systems:** History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded system, characteristics of embedded systems and quality attributes of an embedded system, Embedded system-Application specific and Domain specific.<br>**(Text 1:Chapter-1,chapter-3 and chapter-4)** | **10Hrs** |
| **Module 2** | |
| **Typical Embedded System:** Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, Onboard communication interfaces, External communication interfaces, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer.<br>**(Text 1:Chapter-2)** | **10 Hrs** |
| **Module 3** | |
| **Hardware Software Co-Design and Program Modeling:** Fundamental issues in hardware software co-design and Computational models in Embedded design.<br>**Embedded Firmware Design And Development:** Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.<br>**(Text1:Chapter 7.1,7.2,chapter 9.1 and 9.2)** | **10 Hrs** |
| **Module 4** | |

| | |
|---|---|
| **RTOS Based Embedded System Design:** Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling; task communication-shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques and How to choose an RTOS.(**Text1:Chapter 10)** | **10 Hrs** |
| **Module 5** | |
| **Integration and testing of Embedded hardware and firmware.**<br>**Embedded system Development Environment** – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques.<br>**The Embedded product development life cycle (EDLC):** What is EDLC?,Why EDLC?, objectives of EDLC, Different phases of EDLC,EDLC approaches(Modeling the EDLC) **(Chapter 12,13,15)** | **10 Hrs** |

**Course outcomes: After studying this course, students will be able to:**

CO-1-Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems and its applications

CO-2-Apply the knowledge of Microcontrollers to understand the basics of typical embedded system and its design components.

CO-3-Analyze the typical embedded system components.

CO-4-Develop the hardware /software co-design and firmware design approaches.

CO-5-Investigate the process of embedded product development life cycle.

**Text Book:**

1. Shibu K V, ―Introduction to Embedded Systems‖, Tata McGraw Hill Education Private Limited, 2nd Edition.

**Reference Books:**

1. James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008, ISBN: 978-0-471-72180-2.
2. Yifeng Zhu, “Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C”, 2nd E -Man Press LLC ©2015 ISBN:0982692633 9780982692639.
3. Embedded real time systems by K.V. K. K Prasad, Dreamtech publications, 2003.
4. Embedded Systems by Rajkamal, 2nd Edition, McGraw hill Publications, 2010

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):**

**Note:1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | - | - | - | | - | - | - | - | 3 | - | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |

**INTRODUCTION TO UAV ELECTRONICS**

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

| | | | |
|---|---|---|---|
| Course Code | 22EC652 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 4L | SEE Marks | 50 |
| Number of Lecture Hours | 50 | Exam Hours | 03 |

**CREDITS-04**

**Course Objectives:** Students will be taught to:

1. To introduce the basic concepts of comparator, converter and interfacing circuits.
2. To give exposure on the construction and working of digital circuits.
3. To get introduce about the basics of signal generators.
4. To make familiarize with the microprocessor and its applications.
5. To make familiarize with the microprocessor and its applications.

| **Module -1** | **Teaching Hours** |
|---|---|
| Linear IC's: OP-AMP specifications, applications, voltage comparator, A/D and D/A converter, sample and hold circuit, timer, VCO, PLL, interfacing circuits. | 10 Hours |
| **Module -2** | |
| Digital Systems**:** Review of TTL, ECL, CMOS- Logic gates, Flip Flops, Shift Register, Counter, Multiplexer, Demultiplexer / Decoder, Encoder, Adder, Arithmetic functions, analysis and design of clocked sequential circuits, Asynchronous sequential circuits. | 10 Hours |
| **Module -3** | |
| Signal Generators: Monostable, Astable and Bistable muti-vibrators. Schmitt Trigger. Conditions for oscillation, RC phase shift oscillator, Wien bridge oscillator, Crystal oscillator. LC oscillators. Relaxation oscillators. | 10 Hours |
| **Module -4** | |
| Microprocessor Based Systems:The 8085 microprocessor, interfacing with Alpha numeric displays, LCD panels, Stepper motor controller, Analog interfacing and industrial control. | 10 Hours |
| **Module -5** | |
| Microcontroller Based Systems: 8031/8051 Micro controllers:– Architecture- Assembly language Programming-Timer and Counter Programming- External Memory interfacing – D/A and A/D conversions – Multiple Interrupts . Introduction to 16 bit Microcontrollers. | 10 Hours |

**Course Outcomes:** After studying this course, students will be able to

**CO1**: The Students will be able to understand and apply the basic concepts of Electronic Systems for UAV.

**CO2:** The students will be able to get exposure in the construction and analyze the working of digital circuits.

**CO3:** The students will be able to understand/ analyze/design various signal generators used in the avionics.

**CO4:** The students will get familiarize with microprocessors/ microcontrollers and will be able to deploy these skills effectively in designing avionics subsystems.

**CO5:** The students will develop ability to conduct independent study and investigations on microprocessors/ microcontrollers based designs.

**Text Books:**


1. Jacob Millman, Christos C Halkias, SatyabrataJit, Millman's, "Electronic Devices and Circuits", Second Edition, Tata McGraw Hill,New Delhi, 2007.
2. Donald P Leach, Albert Paul Malvino, GoutamSaha, "Digital Principles and Applications", 6th Edition Tata McGraw Hill, New Delhi, 2006.
3. Gayakwad, Ramakant A., "Op-Amps And Linear Integrated Circuits", Prentice Hall/ Pearson Higher Education, New Delhi, 1999.


**Reference Books / Web links:**


1. John Crisp, "Inroduction to Microprocessor and Microcontroller", Newnes Publication, London. 2004.
2. William Kleitz, "Microprocessor and Microcontroller Fundamentals: The 8085 and 8051 Hardware and Software", Prentice Hall Inc, New York, 1997.


**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):**

**Note:1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | - | - | - | - | | - | - | - | 2 | 2 | 2 |
| CO2 | | 3 | - | - | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO3 | - | | 3 | - | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO4 | - | - | 3 | - | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO5 | - | - | | 3 | - | - | - | - | - | - | - | 2 | 3 | 3 |

**VLSI CIRCUITS LABORATORY**

[As per NEP, Outcome Based Education (OBE), and Choice Based Credit System (CBCS)]

**SEMESTER-VI**

| | | | |
|---|---|---|---|
| Subject Code | 22ECL66 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This course will enable students to:

- Explore the CAD tool and understand the flow of the Full Custom IC design cycle.
- Learn DRC, LVS and Parasitic Extraction of the various designs.
- Design and simulate the various basic CMOS analog circuits and use them in higher circuits like data converters using design abstraction concepts.
- Design and simulate the various basic CMOS digital circuits and use them in higher circuits like adders and shift registers using design abstraction concepts.

**List of Experiments:**

**Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:**

**PART A**

**ASIC DIGITAL DESIGN**

1. Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given constraints*. Do the initial timing verification with gate level simulation.
   i. CMOS flip flop
   ii. Transmission Gate
   iii. Edge triggered D Flip flop
   iv. 4 bit Ripple Carry Adder, Carry Look Ahead Adder
   v. Serial Adder
   vi. 32 bit ALU
   vii. Ripple Counter using T- Flop Flop
   viii. 4-bit counter [Synchronous and Asynchronous counter]

**PART B**

**ANALOG DESIGN**

1. Design an Inverter with given specifications**, completing the design flow mentioned below:
   a. Draw the schematic and verify the following
   i) DC Analysis
   ii) Transient Analysis
   b. Draw the Layout and verify the DRC, ERC
   c. Check for LVS
   d. Extract RC and back annotate the same and verify the Design
   e. Verify & Optimize for Time, Power and Area to the given constraint*
2. Design the (i) Common source and Common Drain amplifier and
   (ii) A Single Stage differential amplifier, with give specifications**, completing the design flow mentioned below:
   a. Draw the schematic and verify the following
   i) DC Analysis
   ii) AC Analysis
   iii) Transient Analysis

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**EMBEDDED SYSTEM LABORATORY**

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

**SEMESTER-VI**

| | | | |
|---|---|---|---|
| Subject Code | 22ECL671 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This course will enable students to:

1. Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
2. Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
3. Interface external devices and I/O with ARM Cortex M3.
4. Develop C language programs and library functions for embedded system applications.

**List of Experiments:**

PART-A: Conduct the following Study experiments to learn ALP using ARM Cortex M3 Registers using an Evaluation board and the required software tool.

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.

PART-B: Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

1. Display ―Hello World‖ message using Internal UART.
2. Interface and Control a DC Motor.
3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
4. Interface a DAC and generate Triangular and Square waveforms.
5. Interface a 4x4 keyboard and display the key code on an LCD.
6. Using the Internal PWM module of ARM controller generate PWM and vary its duty cycle.
7. Demonstrate the use of an external interrupt to toggle an LED On/Off.
8. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
9. Interface a simple Switch and display its status through Relay, Buzzer and LED.
10. Measure Ambient temperature using a sensor and SPI ADC IC.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.
CO2: Utilize laboratory instruments/simulation tools to build and test experiments.
CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.
CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.
CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**MACHINE LEARNING LABORATORY**

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

**SEMESTER-VI**

| | | | |
|---|---|---|---|
| Subject Code | 22ECL672 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This course will enable students to:

1. Understand the Integrated development environments and deploying the code to specific microcontrollers
2. Analyse the code written in platforms like C, C++, Python, Tensor flow, Google's Colab
3. Understand microcontrollers like Arduino Nano, Sparkfun Edge and ST Microelectronics STM32F746G discovery kit for various applications
4. Design Tiny ML applications
5. Design model architecture, train, convert, run interface evaluate and troubleshoot

**List of Experiments:**

1. Build an application and deploy it to a microcontroller for turning LEDs on and off
2. Build an application for wake word detection and deploy it to a microcontroller
3. Build an application for person detection and deploy it to a microcontroller
4. Build an application for Magic Wand and deploy it to a microcontroller
5. For a given model optimize latency
6. Estimate, measure and improve the power usage for a model
7. Optimize the given model in terms of its binary size
8. Port a model from tensorflow to tensorflow lite

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.
CO2: Utilize laboratory instruments/simulation tools to build and test experiments.
CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.
CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.
CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**PROGRAMMING USING PYTHON LABORATORY**

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

**SEMESTER-VI**

| | | | |
|---|---|---|---|
| Subject Code | 22ECL681 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This course will enable students to:

1. Learn Syntax and Semantics and create Functions in Python.
2. Handle Strings and Files in Python.
3. Understand Lists, Dictionaries and Regular expressions in Python.
4. Implement Object Oriented Programming concepts in Python
5. Build Web Services and introduction to Network and Database Programming inPython.

**List of Experiments:**

1.write a program to demonstrate different number data types in python(script.py)

2. Create a list and perform the following methods
   1) insert() 2) remove() 3) append() 4) len() 5) pop() 6)clear()

3.write a program to perform different arithmetic operations on numbers in Python.

4.write a program to demonstrate working with tuples in python.

5.write a program to create, concatenate and print a string and accessing sub-string from given string

6. Create a dictionary and apply the following methods
   1) Print the dictionary items 2) access items 3) useget() 4)change values 5) use len()

7. Write a python program to find largest number among three numbers.

8. Write a python program to check whether the given string is palindrome or not.

9. Program to convert temperature in Celsius to Fahrenheit

10.write a python program to construct the following pattern, using a nested for loop

11.write a python script that prints prime numbers less than 20

12.write a python program to find the factorial of a number using recursion

13.Write a program to do the following operations:
   i. Create a empty dictionary with dict() method
   ii. Add elements one at a time
   iii. Update existing key‟s value
   iv. Access an element using a key and also get() method
   v. Deleting a key value using del() method

14. Write a program to create a dictionary and apply the following methods:
   i. pop() method
   ii. popitem() method
   iii. clear() method

15. Given a dictionary, write a program to find the sum of all items in the dictionary.

16. Write a program to merge two dictionaries using update() method.

17.write a program that input a text file .the program should print all of the unique words in the file in alphabetical order.

18.write a python class to convert an integer to Roman numeral.

19.write a python class to implement pow(x, n).

20.write a python class to reverse a string word by word.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.
CO2: Utilize laboratory instruments/simulation tools to build and test experiments.
CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.
CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.
CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**IOT & ITS APPLICATION LABORATORY**

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

**SEMESTER-VI**

| | | | |
|---|---|---|---|
| Subject Code | 22ECL682 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This course will enable students to:

1. Understand the use of Respberry Pi.
2. Study the Interfacing of Gas, Soil Moisture, Ultrasonic sensor, Temperature sensor, and Humidity sensor to the Respiberry Pi.
3. Understand the use of Things speaks or xtrans cloud storage.
4. Study the design of IoT application.

**List of Experiments:**

**Following Experiments to be done using Python Application software**

**PART-A**

1) Getting started with raspberry Pi 3B+- down loading OS, connecting to PC monitor and initial setup.
2) Study of various sensors- i) GAS Sensor ii) Soil Moisture Sensor iii) Light Sensor iv) Ultrasonic Distance Sensor v) Temperature and Humidity Sensor.
3) Interfacing GAS sensor to the Respberry pi and test the working of GAS sensor and make the buzzer on.
4) Interfacing Soil moisture sensor to the Respberry pi and test the working of soil moisture sensor and send the data to cloud.
5) Interfacing light sensor to the Respberry pi and test the working of light sensor and send the data to cloud.
6) Interfacing Ultrasonic distance to the Respberry pi and test the working of ultrasonic distance senor.
7) Interfacing Temperature & Humidity sensor to the Respberry pi and test the working of Temperature & Humidity sensor.

**PART-B**

1) Live weather broadcasting using DHT11 and Things speak cloud/xtrans cloud.
2) Smart gas leakage email alerts using Things speak or xtrans alerts.
3) Weather display system using DHT11 and LCD display.
4) Object distance display using 7-segment display and Ultrasonic sensor.
5) Read the sensor data when specified key is pressed.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.
CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

| PROJECT-VI<br>[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-VI | | | |
|---|---|---|---|
| Subject Code | 22PRJ69 | CIE Marks | 50 |
| Number Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Lecture Hours | 24 | Exam Hours | 03 |
| **CREDITS-01** | | | |

**Course Objectives:** Students will be taught to:

1. Get exposure about the electronics hardware and various software tools.
2. Design the working model of the open ended problem.
3. Understand concepts of Packaging.
4. Understand the latest technology trends in the PCB design.
5. Prepare technical documentation of the project.

STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM IN TEAM.

**Course outcomes:** After studying this course, students will be able to:

CO1. Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO2. Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO3. Design and implement the system to solve the real time problem of the society.

CO4. Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO5. Use the modern tool available like advanced hardware and software tools.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **-** | **-** | **2** | **2** | **-** | **-** | **3** | 3 | **-** | **3** | **-** | **3** | **-** |
| **CO2** | **3** | **3** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **3** | **-** |
| **CO3** | **3** | **3** | **3** | **2** | **3** | **2** | **2** | **-** | **3** | **3** | **2** | **3** | **-** | **3** | **-** |
| **CO4** | **3** | **3** | **3** | **2** | **-** | **-** | **-** | **3** | **3** | **3** | **3** | **3** | **-** | **3** | **-** |
| **CO5** | **-** | **-** | **-** | **-** | **3** | **-** | **-** | **3** | **3** | **3** | **3** | **3** | **-** | **3** | **-** |

**PROFESSIONAL ETHICS**

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VI

| | | | |
|---|---|---|---|
| Subject Code | 22HSM610 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2L | SEE Marks | 50 |
| Total Number of Lecture Hours | 20 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:**

1. To enable the students to create an awareness on Engineering Ethics and Human Values,
2. To instill Moral and Social Values and Loyalty and to appreciate the rights of others.

| **Module -1** | **Teaching Hours** |
|---|---|
| **HUMAN VALUES**<br>Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management | 04 Hours |
| **Module -2** | |
| **ENGINEERING ETHICS**<br>Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories | 04 Hours |
| **Module -3** | |
| **ENGINEERING AS SOCIAL EXPERIMENTATION**<br>Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law. | 04 Hours |
| **Module -4** | |
| **SAFETY, RESPONSIBILITIES AND RIGHTS**<br>Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination | 04 Hours |
| **Module -5** | |
| **GLOBAL ISSUES**<br>Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility | 04 Hours |

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

CO-1-Understand the human values required to live peaceful in the society.

CO-2-Apply ethics in society, discuss the ethical issues related to engineering

CO-3-Realize the responsibilities and rights of an engineer in the society
CO-4-Understand the role and responsibility of an engineer in maintaining the safety of society.
CO-5-Understand the global issues related to product development.

**Text Books:**


1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.


**Reference Books:**


1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
6. World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2011


**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | 3 | 2 | 2 | 2 | 3 | 2 | 3 | - | - | 3 |
| CO2 | - | - | - | - | - | 3 | 2 | 3 | 3 | 3 | 2 | 3 | - | - | 3 |
| CO3 | - | - | - | - | - | 2 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | 3 |
| CO4 | - | - | - | - | - | 3 | 2 | 3 | 3 | 3 | 3 | 3 | - | - | 3 |
| CO5 | - | - | - | - | - | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | 3 |

| ANTENNAS DESIGN SIMULATION<br>[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-VI | | | |
|---|---|---|---|
| Subject Code | 22EC611A | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

Course Objectives: This course will enable students to:

1. Students will be able to understand the working principle of different antennas
2. Students will be able to microstrip antennas using 3DEM of Mentorgraphics.
3. Students will be able to understand the different feeding techniques
4. Students will be able to design, Microstrip antennas for various wireless applications

**List of Experiments:**

1. Design and simulation of rectangular microstrip patch antenna with a particular operating frequency, dielectric constant and substrate thickness
2. Design of microstrip patch antenna using microstrip line feeding technique
3. Design of microstrip patch antenna using a coaxial feeding technique
4. Design and simulation of dual-band patch antenna
5. Design and simulation of compact patch antenna
6. Design and simulation of wide band patch antenna
7. Design and simulation of compact and wide band patch antenna
8. Design and simulation of circular polarized patch antenna

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

Text book:

1. C A Balanis, Antenna Theory: Analysis and Design, John Wiley & Sons, 2nd. Edn.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO4** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **3** | **3** | **2** | **-** | **-** | **-** | **3** | **-** |
| **CO5** | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **3** | **-** | **3** | **3** | **-** | **-** | **3** | **-** |

## DESIGN OF VLSI CIRCUIT USING LT SPICE LABORATORY

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

**SEMESTER-IV**

| | | | |
|---|---|---|---|
| Subject Code | 21EC610B | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

**CREDITS-01**

**Course Objectives:** This course will enable students to:

1. To provide practical exposure on designing, setting up, executing and debugging various electronic circuits.
2. Draw the schematic diagram some digital circuits like few combinational and sequential circuits and verify their functionality.
3. Draw the schematic diagram some analog circuits and verify their functionality.
4. Use open source simulation software to analyze the circuits.

**List of Experiments:**

Design Analyze and simulate using LT-SPICE

1. Inverter
2. NAND Gate
3. NOR Gate
4. 2:1 MUX
5. RS-Flip flop
6. D-Flip flop
7. T- Flip flop
8. Half adder
9. Common source with resistive load
10. Ring oscillator

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | Y | N | N | N |
| **CO2** | Y | Y | Y | N | N | Y |
| **CO3** | Y | Y | N | Y | N | N |
| **CO4** | Y | Y | N | N | N | N |
| **CO5** | Y | Y | N | N | N | N |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| **CO/PO** | **PO.1** | **PO.2** | **PO.3** | **PO.4** | **PO.5** | **PO.6** | **PO.7** | **PO.8** | **PO.9** | **PO.10** | **PO.11** | **PO.12** | **PSO.1** | **PSO.2** | **PSO.3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO2** | **2** | **3** | **1** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO3** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** |
| **CO4** | **2** | **3** | **2** | **-** | **-** | **-** | **-** | **3** | **3** | **2** | **-** | **-** | **-** | **3** | **-** |
| **CO5** | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **3** | **-** | **3** | **3** | **-** | **-** | **3** | **-** |

## COMPUTER NETWORKS

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]
SEMESTER-VII

| | | | |
|---|---|---|---|
| Subject Code | 22EC71 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 3L | SEE Marks | 50 |
| Total Number of Lecture Hours | 40 Hours | Exam Hours | 03 |

CREDITS-03

**Course Objectives:** This course will enable students to:

1. Understand the layering architecture of OSI reference model and TCP/IP protocol suite.
2. Understand the protocols associated with each layer.
3. Learn the different networking architectures and their representations.
4. Learn the various routing techniques and the transport layer services.

| **Modules** | **Teaching Hours** |
|---|---|
| **Module -1** | |
| **Introduction:** Data Communications: Components, Representations, Data Flow.<br>**Networks**: Physical Structures, Network Types: LAN, WAN, Switching, The Internet.<br>**Network Models:** Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP.<br>Text 1: 1.1,1.2,1.3,2.1,2.2,2.3. | **08 Hours** |
| **Module -2** | |
| **Data-Link Layer:** Introduction: Nodes and Links, Services, Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP.<br>**Data Link Control (DLC)**: services, Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Piggybacking.<br>**Media Access Control:** Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Controlled Access: Reservation, Polling, Token Passing, Channelization.<br>Text 1: 9.1,9.2,11.1,11.2,12.1,12.2,12.3. | **08 Hours** |
| **Module -3** | |
| **Connecting Devices:** Hubs, Switches, Routers. **Virtual LANs:** Membership, Configuration, Communication between Switches and Routers, Advantages.<br>**Network Layer:** Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution, Forwarding of IP Packets: Based on destination Address and Label.<br>Text 1: 17.1, 17.2,18.1,18.2,18.4,18.5 | **08 Hours** |
| **Module -4** | |
| **Network Layer Protocols:** Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams, ICMPv4: Messages, Debugging tools, ICMP checksum.<br>Mobile IP: Addressing, Agents, Three Phases, | **08 Hours** |

| | |
|---|---|
| **Unicast Routing:** Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing, Unicast Routing Protocol: Internet Structure, Routing Information Protocol, Open Shortest Path First, Border Gateway Protocol Version 4.<br>Text 1: 19.1,19.2,19.3, 20.1,20.2,20.3 | |
| **Module-5** | |
| **Transport Layer:** Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols,<br>**Transport Layer Protocols:** Simple protocol, Stop and wait protocol, Go-Back-N Protocol, Selective repeat protocol,<br>**User Datagram Protocol**: User Datagram, UDP Services, UDP Applications,<br>**Transmission Control Protocol:** TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control.<br>Text 1: 23.1, 23.2,24.1, 24.2, 24.3 | **08 Hours** |
| **Course Outcomes:** At the end of the course, the students will be able to:<br>CO-1- Demonstrate the fundamental principles of computer networking and the significance of layered network architecture in facilitating communication.<br>CO-2- Identify and analyze the protocols and services associated with the Data Link layer in networking.<br>CO-3- Describe the protocols and functions of the Network layer and their impact on data transmission and routing.<br>CO-4- Analyze and design routing protocols, and evaluate the packet routing process using various routing algorithms.<br>CO-5- Recognize the protocols and services of the Transport layer, and explain their role in supporting communication processes across the network. | |
| **Text Books:**<br>1. Data Communications and Networking , Forouzan, 5th Edition, McGraw Hill, 2016<br>ISBN: 1-25-906475-3 | |
| **Reference Books:**<br>1. Computer Networks, James J Kurose, Keith W Ross, Pearson Education, 2013, ISBN: 0-273-76896-4<br>2. Introduction to Data Communication and Networking, Wayarles Tomasi, Pearson Education, 2007, ISBN:0130138282 | |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |

## MOBILE COMMUNICATION AND NETWORKS

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

| | | | |
|---|---|---|---|
| Subject Code | 22EC72 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 3L | SEE Marks | 50 |
| Total Number of Lecture Hours | 40 Hours | Exam Hours | 03 |

CREDITS-03

**Course Objectives:** This course will enable students to:

1. Understand the issues involved in mobile communication system design and analysis.
2. Understand the concept of frequency reuse.
3. Understand the characteristics of wireless channels.
4. Know the fundamental limits on the capacity of wireless channel.

| **Modules** | **Teaching Hours** |
|---|---|
| **Module -1** | |
| **Cellular concepts**- Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G 3G, 4G and 5G cellular mobile standards. | **08 Hours** |
| **Module -2** | |
| **Signal propagation**- Propagation mechanism, reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels- Multipath and small-scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate. Capacity of flat and frequency selective channels.. | **08 Hours** |
| **Module -3** | |
| **Multiple access schemes**-FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM. | **08 Hours** |
| **Module -4** | |
| Antennas: antennas for mobile terminal, monopole antennas, PIFA, base station antennas and arrays. Receiver structure- Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity Altamonte scheme. MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. | **08 Hours** |
| **Module-5** | |
| Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA, 3G, 4G and 5G mobile communications. | **08 Hours** |

**Course Outcomes:** After studying this course, students will be able to:

CO-1-Understand cellular concepts and signal propagation in mobile communication

CO-2- Explain the evolution of cellular technologies.

CO-3-Analyze the modulation and multiple access schemes.

CO-4-Apply the multicarrier modulation techniques for advanced wireless communication systems design.

CO-5-Analyze the multiple antenna transmission and reception techniques.

**Text/Reference Books**

1. Erik Dahlman , 4G, LTE-Advanced Pro and The Road to 5G
2. Sassan Ahmadi, 5G NR: Architecture, Technology, Implementation, and Operation of 3GPP New Radio Standards Hardcover – 1 June 2019
3. Vijay K. Garg, "Wireless Communication and Networking", Elsevier, Morgan Kaufmann, Reprinted 2012.
4. Vijay K. Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, Fifth Impression 2008
5. T.S.Rappaport, "Wireless Communications Principles and Practice", PHI, II Edition, 2006.
6. William Lee ,"Mobile Cellular Telecommunications: Analog and Digital Systems", McGraw Hill Education

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - |

## DIGITAL IMAGE PROCESSING

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

SEMESTER- VII

| | | | |
|---|---|---|---|
| Course Code | 22EC73 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam hours | 03 |

**CREDITS-03**

**Course Objectives:** Students will be taught to:

1. Understand the fundamentals of digital image processing.
2. Understand the image transforms used in digital image processing.
3. Understand the image enhancement techniques used in digital image processing.
4. Understand the image restoration techniques and methods used in digital image processing.
5. Understand the Morphological Operations used in digital image processing.

| **Module -1** | **Teaching Hours** |
|---|---|
| Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition. **(Text: Chapter 1and Chapter 2: Sections 2.1to 2.2, 2.6.2)** | 08 Hours |
| **Module -2** | |
| Image Enhancement in the Spatial Domain: Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters<br>(Text:Chapter2: Sections 2.3 to 2.62, Chapter3: Sections3.2 to3.6) | 08 Hours |
| **Module -3** | |
| Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of TwoVariables, Properties of the 2-DDFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.<br>(Text: Cbapter4: Sections 4.2, 4.5 to 4.10) | 08 Hours |
| **Module -4** | |
| Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant degradations Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error(Wiener) Filtering, Constrained Least Squares Filtering. (Text: Chapter 5: Sections 5.2, to 5.9) | 08 Hours |
| **Module -5** | |
| Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing.<br>Color Image Processing**:** Color Fundamentals, Color Models, Pseudo color Image Processing.<br>(Text: Chapter 6: Sections 6.1 to 6.3 Chapter 9: Sedions9.1 to 9.3) | 08 Hours |

CO1. Ability to define the fundamental concepts of digital image processing and to recognize different image processing applications.
CO2. Ability to apply image processing techniques in both the spatial domain.
CO3. Study and analysis of image enhancement in frequency domain.
CO4. Investigate the various noise models and image restoration techniques.
CO5. Ability to learn color image processing and morphological image processing.

**Text Books:**

1. Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.

**Refrence Books:**

1. Digital Image Processing- S.Jayaraman, S. Esakkirajan,T. Veerakumar, TataMcGrawHill2014.
2. Fundamentals of Digital Image Processing- A K. Jain, Pearson 2004.
3. Image Processing analysis and Machine vision with Mind Tap by Milan Sonka and Roger Boile, Cengage Publications, 2018.

| COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N) | | | | | | |
|---|---|---|---|---|---|---|
| **COURSE OUTCOME** | **Remember L1** | **Understand L2** | **Apply L3** | **Analyze L4** | **Evaluate L5** | **Create L6** |
| **CO1** | Y | Y | N | N | N | N |
| **CO2** | Y | Y | N | N | N | N |
| **CO3** | Y | Y | Y | N | N | N |
| **CO4** | Y | Y | Y | Y | N | N |
| **CO5** | Y | Y | Y | Y | Y | Y |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note:1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO2** | **3** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO3** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO4** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO5** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |

## POWER ELECTRONICS

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

| | | | |
|---|---|---|---|
| Subject Code | 22EC741 | CIE Marks | 50 |
| Number Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |

CREDITS-03

**Course Objectives** The objectives of the course is to enable students to:

1. Understand the working of various power devices.
2. Study and analysis of thyristor circuits with different triggering techniques.
3. Learn the applications of power devices in controlled rectifiers, converters and inverters.
4. Study of power electronics circuits under different load conditions.

| **Modules** | **Teaching Hours** |
|---|---|
| **Module -1 :** Introduction & Power Transistors | |
| Introduction - Applications of Powe,r Electronics, Power Semiconductor Devices, Control Characteristics of Power Devices, types of Power Electronic Circuits.<br>Power Transistors: Power BJTs: Steady state characteristics. Power<br>MOSFETs: device operation, switching characteristics, IGBTs: device operation, output and transfer characteristics. (Text 1) | **08 Hours** |
| **Module -2 :** Thyristors | |
| Thyristors - Introduction, Principle of Operation of SCR, Static Anode-Cathode Characteristics of SCR, Two transistor model of SCR, Gate Characteristics of SCR, Turn-ON Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural and Forced Commutation . Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firing circuit. (Text 2) | **08 Hours** |
| **Module -3 :** Controlled Rectifiers & AC Voltage Controllers | |
| Controlled Rectifiers - Introduction, principle of phase controlled converter operation, Single phase full converters, Single phase dual converters.<br>AC Voltage Controllers - Introduction, Principles of ON-OFF Control, Principle of Phase Control, Single phase control with resistive and inductive loads. (Text 1) | **08 Hours** |
| **Module -4 :** DC-DC Converters | |
| DC-DC Converters - Introduction, principle of step-down operation and it's analysis with RL load, principle of step-up operation, Step-up converter with a resistive load, Performance parameters, Converter classifications. (Text 1) | **08 Hours** |
| **Module-5 :** Pulse Width Modulated Inverters | |
| Pulse Width Modulated Inverters- Introduction, principle of operation, performance parameters, Single phase bridge inverters, voltage control of single phase inverters, current source inverters, Variable DC-link inverter. (Text 1) | **08 Hours** |

**Course Outcomes**: After studying this course, students will be able to:

CO-1- Analyze the I-V characteristics of SCR, DIAC and TRIAC.

CO-2- Analyze the characteristics of MOSFET, IGBT and UJT.

CO-3- Construct and demonstrate the operation of AC voltage controller and differentiate its various configurations.

CO-4- Design controllers for dc-dc converters in voltage and peak-current mode

| |
|---|
| CO-5- Apply the different modulation techniques to pulse width modulated inverters and identify the harmonic reduction methods. |
| **Text Books :**<br>1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.<br>2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc- Graw Hill, 2009, ISBN: 0070583897. |
| **Reference Books :**<br>1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.<br>2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012. |

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**
**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO2** | **3** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO3** | **3** | **3** | **-** | **-** | **-** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO4** | **3** | **3** | **3** | **-** | **-** | **-** | 2 | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| **CO5** | **3** | **3** | **3** | **-** | **-** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |

**LOW POWER VLSI DESIGN**

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

| | | | |
|---|---|---|---|
| Subject Code | 22EC732 | CIE Marks | 50 |
| Number Lecture Hour/Week | 3L | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |

CREDITS-03

**Course Objectives:** This course will enable students to:

1. Know the basics and advanced techniques in low power design which is a hot topic in today's market where the power plays a major role.
2. Describe the various power reduction and the power estimation methods.
3. Explain power dissipation at all layers of design hierarchy from technology, circuit, logic, architecture and system.
4. Apply State-of-the art approaches to power estimation and reduction.
5. Practice the low power techniques using current generation design style and process technology

| **Modules** | **Teaching Hours** |
|---|---|
| **Module -1** | |
| **Introduction**: Need for low power VLSI chips, charging and discharging capacitance, short circuit current in CMOS leakage current, static current, basic principles of low power design, low power figure of merits. | 08 Hours |
| **Module -2** | |
| **Simulation Power Analysis:** SPICE circuit simulation, discrete transistor modeling and analysis, gate level logic simulation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation. | 08Hours |
| **Module -3** | |
| **Probabilistic Power Analysis:** Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy. | 08 Hours |
| **Module -4** | |
| **Circuit:** Transistor and gate sizing, equivalent pin ordering, network restructuring and reorganization, special latches and flip flops, low power digital cell library, adjustable device threshold voltage. | 08 Hours |
| **Module -5** | |
| **Logic:** Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic (Text 1).<br>**Architecture and System:** Power and Performance Management, Switching Activity Reduction, Parallel Architecture with Voltage Reduction, Flow Graph Transformation. | 08 Hours |

**Course outcomes** After studying this course, students will be able to

CO-1-Identify and analyze the various sources of power dissipation in CMOS circuits.

CO-2- Analysis of power for discrete, gate level and architecture level using SPICE simulation.

CO-3- Analysis of probabilistic power techniques and power estimation using signal entropy.

CO-4-Design and optimize circuit networks by applying restructuring and reorganization techniques to meet low-power objectives.

CO-5-Apply strategies to minimize switching activity for improved energy efficiency and design gate reorganization techniques to boost circuit efficiency and lower power consumption.

**Text Book:**

1. Gary K. Yeap, “Practical Low Power Digital VLSI Design”, Kluwer Academic, 1998.

**Reference Books:**

1. Kaushik Roy, Sharat Prasad, “Low-Power CMOS VLSI Circuit Design” Wiley, 2000
2. A.P.Chandrasekaran and R.W.Broadersen, “Low power digital CMOS design”, Kluwer Academic,1995. 3. A Bellamour and M I Elmasri, “ Low power VLSI CMOS circuit design”, Kluwer Academic,1995.
3. Jan M.Rabaey, MassoudPedram, “Low Power Design Methodologies” Kluwer Academic, 2010.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| CO2 | 2 | 3 | - | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| CO3 | 2 | 3 | 2 | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| CO4 | 2 | 3 | 3 | - | - | - | 2 | - | - | - | - | - | 3 | - | - |
| CO5 | 2 | 3 | 3 | - | - | - | 2 | - | - | - | - | - | 3 | - | - |

**E-WASTE MANAGEMENT**

[NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

| | | | |
|---|---|---|---|
| Subject Code | 22EC751 | CIE Marks | 50 |
| Number Lecture Hour/Week | 4L | SEE Marks | 50 |
| Number of Lecture Hours | 50 | Exam Hours | 03 |

**CREDITS-04**

**Course Objectives:** This course will enable students to:

1. This course covers an extensive review of e-waste management in India.
2. Focus on the evolution of legal frameworks in India and the world, it presents impacts and outcomes; challenges and opportunities; and management strategies and practices to deal with e-waste.
3. Pan-India initiatives and trajectories of law-driven initiatives for effective ewaste management along with responses from industries and producers.
4. Mitigate e-waste management issues, and helps to generate employment.
5. Start E-waste recycling plants, with this the demand for employees with all levels of qualification and skills also increases.

| **Module -1** | **Teaching Hours** |
|---|---|
| Sustainable development and e-waste management: Importance of electrical and electronic equipment in a nation's development, and e-waste as toxic companion of digital era, I: Let's understand e-waste, II: E-waste statistics: quantities, collection and recycling, E-waste categories and harmonising statistics, III: An overview on status of e-waste related legislation across the globe; IV: UN initiatives for e-waste management: creating partnerships and achieving Agenda 2030; V: Indian scenario: e-waste generation, collection and recycling. | 10 Hours |
| **Module -2** | |
| Extended producer responsibility: a mainstay for e-waste management: Evolution of concept of 'extended producer responsibility', EPR applied for waste management and extended for e-waste, management, EPR: goals, implementation, and challenges for e-waste management, EPR implemented for e-waste management under the existing regulatory frameworks in different countries, Role of a PRO prescribed in regulatory framework, Considerations for successful implementation of EPR, Challenges in implementation of EPR for e-waste management, Impact of EPR, EPR and e-waste management in India. Toxicity and impacts on environment and human health: Toxicity, recycling, and regulations, I: Environmental concerns, II: Human health concerns. | 10 Hours |
| **Module -3** | |
| Treating e-waste, resource efficiency, and circular economy: Safe environment, resource use, and circular economy, Circular economy: recycling, resource recovery, and resource efficiency, Potentials of urban mining in circular economy, Recycling and resource efficiency related challenges to the circular economy, Urban mining, recycling, resource use, resource efficiency, and circular economy in India. E-waste management through legislations in India: I: Historical backdrop of regulatory regime for e-waste in India, II: E-waste (management) Rules, 2016 and E-waste (management) Amendment Rules, 2018, III: Analysing performance of EPR and CPCB as regulatory mechanisms, IV: Legal cases and judicial directives. | 10 Hours |
| **Module -4** | |

| | |
|---|---|
| Strategies and initiatives for dealing with e-waste in India: I: Overview of pan-India initiatives for dealing with e-waste during 2000 and 2012, II: Law-driven e-waste management – initiatives by the government, non-government agencies, and judiciary. | 10 Hours |
| **Module -5** | |
| Moving towards horizons: I: Legal and judicial domain, II: Economic concerns, III: Environment concerns, IV: Recycling culture/recycling society | 10 Hours |

**Course outcomes:** After studying this course, students will be able to:

CO-1-Understand the existing discourse on e-waste and its management, statistics across the world, opportunities, and challenges w.r.t. regulatory framework, SDGs, CE, and LCIA (Life Cycle Impact Assessment) and MFA (Material Flow Analysis), Indian scenario.

CO-2-Describe EPR, a regulatory framework for achieving specified goals across different countries and impacts on environment and human health.

CO-3-Explain themes in the context of resource use and sustainable development. Urban mining, informal sector operations and need for resource use policy, financial support for recycling infrastructure building, etc. in Indian context and also explain to what extent – different aspects of e-waste management have been incorporated in the existing regulatory framework in comparison with international legislatures.

CO-4-Identify and infer pan-Indian initiatives dealing with e-waste management, ranging from building knowledge base through research and social action by different stakeholders to technological and legal advancements, and industrial initiatives. Analyse roadmap for the Agenda 2030.

CO-5-Use opportunities and challenges around four domains: legal and judicial domain; economic concerns; recycling culture/society; and environment concerns.

**Reference Books:**

1. Varsha Bhagat Gangulay, 'E-Waste Management', Taylor and Francis, 2022.
2. https://link.springer.com/book/10.1007/978-3-030-14184-4 3.
3. https://rajyasabha.nic.in/rsnew/publication_electronic/E-Waste_in_india.pdf
4. https://greene.gov.in/wp-content/uploads/2018/01/E-waste-Vol-II-E-waste-Management-
5. Manual.pdf •https://nptel.ac.in/courses/105105169

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | 3 | 3 | 2 | - | - | - | 2 | - | - | 3 |
| CO2 | - | - | - | - | - | 3 | 3 | 2 | - | - | - | 2 | - | - | 3 |
| CO3 | - | - | - | - | - | 3 | 3 | 2 | - | - | - | 2 | - | - | 3 |
| CO4 | - | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - | - | 3 |
| CO5 | - | - | - | - | - | 3 | 3 | 3 | - | - | - | 3 | - | - | 3 |

**DOMESTIC ELECTRONICS EQUIPMENT MAINTENANCE**

[NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

| | | | |
|---|---|---|---|
| Subject Code | 22EC752 | CIE Marks | 50 |
| Number Lecture Hour/Week | 4L | SEE Marks | 50 |
| Number of Lecture Hours | 50 | Exam Hours | 03 |

**CREDITS-04**

**Course Objectives:** This course will enable students to:

1. Understand the working principle of domestic equipments.
2. Identify the common faults that occurs in the domestic equipment.
3. Understand the electronics peripheral components of the equipment
4. Able to carry out minor repairs in the equipments.
5. Understand the technical specifications of the equipments.

| **Module -1** | **Teaching Hours** |
|---|---|
| **Microwave Oven:** Working, parts, Common faults and their troubleshooting: Microwave does not heat, runs then stops, buttons do not work, plate do not spin, bulb does not turn ON during operation, sparking inside, shuts OFF after few seconds. Demonstrate the working of microwave oven. | 10 Hours |
| **Module -2** | |
| **Geyser:** Construction and working, parts and types. Common faults and their troubleshooting: Dripping geyser overflow, overheating, steam or hot water escaping from overflow, water leaking through the ceiling, no hot water, water not hot enough, poor hot water pressure. Demonstrate the working of Geyer. | 10 Hours |
| **Module -3** | |
| **Induction Cooker:** Construction and working, parts and types. Common faults and their troubleshooting: Cooker fuse blown, cooker buttons not working, cook top shuts off while cooking, food not get cooked or heated properly, overheating and uneven heating, display keep flashing, weird noises, crackling, fan noise, humming sound, clicking. Demonstrate the working of induction cooker. | 10 Hours |
| **Module -4** | |
| **Refrigerator:** Working, electrical wiring diagram, types of refrigerator. Common faults and their troubleshooting: Fridge not cooling, fridge not defrosting, leaking water, freezing food light not working, freezer is cooled but fridge stays warm, dead refrigerator, not enough cooling, keeps running, leakage, makes noise. Replacement procedure for: seal (gasket), evaporator fan motor, PTC relay, thermostat, compressor, bulb. Demonstrate the working of refrigerator. | 10 Hours |
| **Module -5** | |
| **Air Conditioner:** Working, electrical wiring diagram, types. Common Faults and their Trouble shooting: Faults in following parts of AC: Filter, thermostat, refrigerant leaks, breakers, capacitors, compressor, evaporator coils, condenser coils, and warm contactor. General faults : AC unit has an odour, shuts ON and OFF repeatedly, does not blow cold air, repeatedly tripping a circuit breaker, indoor unit is leaking water inside the room, outdoor unit is making an unusually loud sound, room is not getting cold enough, AC not turning ON. Demonstrate the working of air conditioner. | 10 Hours |
| | |

**Course outcomes:** After studying this course, students will be able to:

CO-1-Comprahend the working principle of domestic electronics equipments.

CO-2-Apply the concept common faults to identify the faults and carryout the minor repairs in the domestic equipments.

CO-3-Analyze a given scenario and use appropriate techniques to repair the domestic electronics equipments.

CO-4-Demonstrate the working of various domestic electronics equipments.

CO-5-Investigate the working principle of various other domestic electronics equipments available in the literature and submit the report in a team.

**Reference Books:**

1. R. G. Gupta, "Electronic instruments and systems: Principles, maintenance and troubleshooting," TMH, 2001.

2. R. S. Khandpur, "Troubleshooting Electronic Equipment: Includes Repair & Maintenance," TMH, 2013.

3. G. C. Loveday, "Electronic fault diagnosis," Pearson Education, 1994

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | - | 2 | 2 | - | - | - | - | - | 3 | - | - |
| CO2 | 3 | 3 | - | - | - | 2 | 2 | - | - | - | - | - | 3 | - | - |
| CO3 | 3 | 3 | - | - | - | 2 | 2 | - | - | - | - | - | 3 | - | - |
| CO4 | 3 | 3 | - | - | - | 2 | 2 | - | - | - | - | - | 3 | - | - |
| CO5 | 3 | 3 | - | - | - | 2 | 2 | - | 3 | 3 | - | - | 3 | - | - |

| RESEARCH METHODOLOGY<br>[As per Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-I | | | |
|---|---|---|---|
| Subject Code | 21RM15 | CIE Marks | 50 |
| Number Lecture Hour/Week | 03 | SEE Marks | 50 |
| Number of Lecture Hours | 40 | Exam Hours | 03 |
| **CREDITS-02** | | | |

**Course objectives:**

- To give an overview of the research methodology and explain the technique of defining a research problem.
- To explain the functions of the literature review in research.
- To explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review.
- To explain various research designs and their characteristics.
- To explain the details of sampling designs, and also different methods of data collections.
- To explain the art of interpretation and the art of writing research reports.

| **Modules** | **Teaching Hours** | **Revised Bloom's Taxonomy (RBT) Level** |
|---|---|---|
| **Module -1** | | |
| **Research Methodology:** Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. | **08 Hours** | **L1,L2** |
| **Module -2** | | |
| **Defining the Research Problem:** Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.<br>**Reviewing the literature:** Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. | **08 Hours** | **L1,L2** |
| **Module -3** | | |
| **Research Design:** Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.<br>**Design of Sample Surveys:** Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. | **08 Hours** | **L1,L2, L3** |
| **Module-4** | | |
| **Data Collection**: Collection of Primary Data, Collection of data through questionnaires, Collection of data through schedules, Difference between questionnaires and schedules, Some other methods of data collection, | **08 Hours** | **L1, L2, L3** |

| | | |
|---|---|---|
| Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. | | |
| **Module-5** | | |
| **Interpretation and Report Writing:** Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. | **08 Hours** | **L1, L2, L3** |

**Course outcomes:**

At the end of the course the student will be able to:

- Discuss research methodology and the technique of defining a research problem
- Understand the functions of the literature review in research, carrying out a literature search.
- Awareness about various research designs and their characteristics.
- Understand the significance of data collection in research.
- Describe art of interpretation and art of writing research reports.

**Textbooks:**


1. Research Methodology: Methods and Techniques C.R. Kothari, Gaurav Garg New Age International 4th Edition, 2018.
2. Research Methodology step-by- Research Methodology step-by- Ranjit Kumar, SAGE Publications Ltd, 3rd Edition, 2011.
3. Study Material (For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body under an Act of Parliament, September 2013.


**Reference Books:**


1. Research Methods: the concise knowledgebase Trochim, Atomic Dog Publishing 2005.
2. Conducting Research Literature Reviews: From the Internet to Paper, Fink A Sage Publications 2009.


**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | - | 1 | 3 | 3 | 3 | - | - | - | - | **3** |
| **CO2** | - | - | - | - | - | - | 1 | 3 | 3 | 3 | - | - | - | - | **3** |
| **CO3** | - | - | - | - | - | - | 1 | 3 | 3 | 3 | - | - | - | - | **3** |
| **CO4** | - | - | - | - | - | - | 1 | 3 | 3 | 3 | - | - | - | - | **3** |
| **CO5** | - | - | - | - | - | - | 2 | 3 | 3 | 3 | - | - | - | - | **3** |

**COMPUTER NETWORKS LAB**

[NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

| | | | |
|---|---|---|---|
| Subject Code | 22ECL76 | CIE Marks | 50 |
| Number Lab practice Hour/Week | 02 | SEE Marks | 50 |
| Total Number of Hours | 24 | Exam Hours | 03 |

CREDITS-01

**Course Objectives:** This course will enable students to:

1. Choose suitable tools to model a network and understand the protocols at various OSI reference levels.
2. Design a suitable network and simulate using a Network simulator tool.
3. Simulate the networking concepts and protocols using C/C++ programming.
4. Model the networks for different configurations and analyze the results.

**Laboratory Experiments**

**PART-A:**

**Implement the following in C/C++**

1. Write a program for a HLDC frame to perform the Bit stuffing.
2. Write a program for a HLDC frame to perform the Character stuffing.
3. Write a program for Distance vector algorithm to find suitable path for transmission.
4. Implement Dijkstra's algorithm to compute the shortest routing path.
5. For the given data, use CRC-CCITT polynomial to obtain CRC code. Verify the program for the cases
   a. Without error
   b. With error
6. Implementation of Stop and Wait Protocol.
7. Implementation of Sliding Window Protocol.
8. Write a program for congestion control using leaky bucket algorithm.

**PART-B:**

**Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/QualNet or any other equivalent tool**

1. Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth.
2. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3.
Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
3. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.
4. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.
5. Implementation of Link state routing algorithm.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.
CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.
CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**Reference Book**

1. Data Communications and Networking , Forouzan, 5th Edition, McGraw Hill, 2016 ISBN: 1-25-906475-3.
2. Computer Networks, James J Kurose, Keith W Ross, Pearson Education, 2013, ISBN: 0-273-76896

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**POWER ELECTRONICS LAB**

[NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

| | | | |
|---|---|---|---|
| Subject Code | 22ECL771 | CIE Marks | 50 |
| Number Lecture Hour/Week | 02 | SEE Marks | 50 |
| Number of Practical Hours | 24 | Exam Hours | 03 |

CREDITS-01

Any five experiments from the below list **must be** simulated using the **spice-simulator**.

Course objectives: This laboratory course enables students to get practical experience in design, assembly, testing and evaluation of:

1. SCR, DIAC Static characteristics
2. Static characteristics of MOSFET and IGBT
3. Controlled Rectifiers
4. SCR Turn off & UJT firing circuit circuits.
5. Voltage (Impulse) commutated choppers.
6. AC voltage controllers & controlled rectifiers.
7. Speed control of universal & stepper motor.

## Experiments

1. Static characteristics of SCR and DIAC.
2. Static characteristics of MOSFET and IGBT
3. Controlled HWR and FWR using RC triggering circuit
4. SCR turn off using
    a. LC circuit
    b. ii) Auxiliary Commutation
5. UJT firing circuit for HWR and FWR circuits.
6. Generation of firing signals for thyristors/ trials using digital circuits/ microprocessor.
7. AC voltage controller using triac – diac combination.
8. Single phase Fully Controlled Bridge Converter with R and R-L loads.
9. Voltage (Impulse) commutated chopper both constant frequency and variable frequency operations.
10. Speed control of universal motor.
11. Speed control of stepper motor.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**Text Books :**

1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc- Graw Hill, 2009, ISBN: 0070583897.

**Reference Books :**

1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

## LOW POWER VLSI DESIGN LAB

[NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

| | | | |
|---|---|---|---|
| Subject Code | 22ECL772 | CIE Marks | 50 |
| Number Lab practice Hour/Week | 02 | SEE Marks | 50 |
| Total Number of Hours | 20 | Exam Hours | 03 |

CREDITS-01

**Course Objectives:** This course will enable students to:

1. Understand the different parameters which are going to effect on power.
2. Understand the different types of power dissipations.
3. Learn different types of low power VLSI designs techniques.
4. Learn the use of different EDA tools.
5. Understand the design and realization of CMOS Digital circuits.

**Laboratory Experiments**

**Following Experiments to be done using Mentor Graphics/Cadence Tool/ Spice Tool**

Design, simulate and estimate the power dissipation for following circuits using

a) Conventional CMOS techniques.

1. Inverter
2. NAND and NOR
3. XOR/ XNOR

b) MTCMOS techniques.

4. D-Latch
5. NAND and NOR
6. XOR/ XNOR

c) DTCMOS techniques.

7. Inverter

d) compare static NOR and dynamic NOR

e) Glitch free AND circuit.

f) D-latch using clock gating.

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**Reference Book**


1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic, 1998.
2. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley, 2000
3. A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer Academic,1995. 3. A Bellamour and M I Elmasri, " Low power VLSI CMOS circuit design", Kluwer Academic,1995.
4. Jan M.Rabaey, MassoudPedram, "Low Power Design Methodologies" Kluwer Academic, 2010.
5. Sung-Mo Kang and Yusuf Leblebici "CMOS Digital Integrated Circuits"


**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**
**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

**DIGITAL IMAGE PROCESSING LAB**

[As per NEP, Outcome based Education (OBE), and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

| | | | |
|---|---|---|---|
| Course Code | 22ECL78 | CIE Marks | 50 |
| Number of Lecture Hour/Week | 2P | SEE Marks | 50 |
| Number of Lecture Hours | 24 | Credits | 03 |

**CREDITS-03**

**Course Objectives:** Students will be taught to:

1. To introduce the concepts of image processing.
2. To expose students to basic concepts such as distance and connectivity, image transformation, point operation, analysis of colour image processing.
3. To introduce the concepts of Image Compression techniques.
4. To expose students to basic edge detection techniques.

**LIST OF EXPERIMENTS**

1. Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2. Implementation of Relationships between Pixels
3. Implementation of Transformations of an Image
4. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
5. Display of bit planes of an Image
6. Display of FFT(1-D & 2-D) of an image
7. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
8. Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)
9. Implementation of image sharpening filters and Edge Detection using Gradient Filters
10. Image Compression by DCT,DPCM, HUFFMAN coding
11. Implementation of image restoring techniques
12. Implementation of Image Intensity slicing technique for image enhancement
13. Canny edge detection Algorithm

**Course Outcomes:** After studying this course, the students will be able to:

CO1: Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2: Utilize laboratory instruments/simulation tools to build and test experiments.

CO3: Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4: Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):**
**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 1 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| CO3 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| CO4 | 2 | 3 | 2 | - | - | - | - | 3 | 3 | 2 | - | - | - | 3 | - |
| CO5 | 2 | 2 | 2 | - | - | - | - | 3 | - | 3 | 3 | - | - | 3 | - |

| PROJECT-VII<br>[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-VII | | | |
|---|---|---|---|
| Subject Code | 22PRJ79 | CIE Marks | 50 |
| Number Lecture Hour/Week | 2P | SEE Marks | 50 |
| Total Number of Lecture Hours | 24 | Exam Hours | 03 |
| **CREDITS-01** | | | |

**Course Objectives:** Students will be taught to:

1. Get exposure about the electronics hardware and various software tools.
2. Design the working model of the open ended problem.
3. Understand concepts of Packaging.
1. Understand the latest technology trends in the PCB design.
2. Prepare technical documentation of the project.

STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM IN TEAM.

**Course outcomes:** After studying this course, students will be able to:

CO1. Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO2. Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO3. Design and implement the system to solve the real time problem of the society.

CO4. Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO5. Use the modern tool available like advanced hardware and software tools.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **2** | **-** | **-** | **2** | **2** | **-** | **-** | **3** | 3 | **-** | **3** | **-** | **3** | **-** |
| **CO2** | **3** | **3** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **3** | **-** |
| **CO3** | **3** | **3** | **3** | **2** | **3** | **2** | **2** | **-** | **3** | **3** | **2** | **3** | **-** | **3** | **-** |
| **CO4** | **3** | **3** | **3** | **2** | **-** | **-** | **-** | **3** | **3** | **3** | **3** | **3** | **-** | **3** | **-** |
| **CO5** | **-** | **-** | **-** | **-** | **3** | **-** | **-** | **3** | **3** | **3** | **3** | **3** | **-** | **3** | **-** |

## INDUSTRIAL PSYCHOLOGY AND ORGANISATIONAL BEHAVIOUR

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-VII

| Subject Code | 18HSM79 | CIE Marks | 50 |
|---|---|---|---|
| Number of Lecture Hour/Week | 01 | SEE Marks | 50 |
| Total Number of Lecture Hours | 20 | Exam Hours | 03 |

CREDITS-01

**Course Objectives:** This course will enable students to:

1. Relating human psychology to science
2. Understand the human psychology
3. Understand the nature of organization and organization models
4. Understand the human social communication
5. Understand the leadership qualities

| **Modules** | **Teaching Hours** |
|---|---|
| **Module -1** | |
| Introduction to I/O psychology:<br>Major fields of I/O psychology, brief history of I/O psychology, employment of I/O psychology, ethics in I/O psychology. (Chapter-1) | **3 Hours** |
| **Module -2** | |
| Organisational communication:<br>Types of organizational communication, interpersonal communication, improving employee communication skills. (Chapter-11) | **3 Hours** |
| **Module -3** | |
| Leadership :<br>Introduction, personal characteristics associated with leadership, interaction between the leadership and the situation specific leader skills, leadership where we are today. (Chapter-12) | **5 Hours** |
| **Module -4** | |
| Group behaviour- teams and conflicts<br>Group dynamics, factors affecting group performance, individual versus group performance, group conflicts. (Chapter-13) | **5 Hours** |
| **Module-5** | |
| Stress management:<br>Dealing with the demands of life and work, stress defined, predisposition to stress, sources of stress, consequences of stress, stress reduction intervention related to life /work issues.<br>(Chapter-15) | **4 Hours** |

**Course Outcomes:** At the end of this course, students would be able to

CO-1-Comprehend the knowledge and concepts of human psychology

CO-2-know the importance of psychology

CO-3-have insight into individual and group behavior

CO-3-deal with people in better way

CO-4-motivate groups and build groups

**Text Book:** Michael G.Aamodt, Industrial/Organizational Psychology: An Applied Approach, 6th Edition, Wadsworth Cengage Learning, ISBN: 978-0-495-60106-7.

**Reference Books:**

1. Blum M.L. Naylor J.C., Horper & Row, Industrial Psychology, CBS Publisher, 1968
2. Luthans, Organizational Behaviour, McGraw Hill, International, 1997
3. Morgan C.t.,King R.A.,John Rweisz &John Schoples, Introduction to Psychology, McHraw Hill, 1966
4. Schermerhorn J.R.Jr., Hunt J.G &Osborn R.N., Managing, Organizational Behaviour, John Willy

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | **3** | **2** | **2** | **2** | **3** | **2** | **3** | - | - | **3** |
| **CO2** | - | - | - | - | - | **3** | **2** | **3** | **3** | **3** | **2** | **3** | - | - | **3** |
| **CO3** | - | - | - | - | - | **2** | **2** | **3** | **3** | **3** | **3** | **3** | - | - | **3** |
| **CO4** | - | - | - | - | - | **3** | **2** | **3** | **3** | **3** | **3** | **3** | - | - | **3** |
| **CO5** | - | - | - | - | - | **3** | **3** | **3** | **3** | **3** | **3** | **3** | - | - | **3** |

| **RESEARCH PROJECT/FIELD PROJECT-8**<br>[As per Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-VIII | | | |
|---|---|---|---|
| Subject Code | 22PRJ81 | CIE Marks | 50 |
| Total No. of implementation weeks | 16P | SEE Marks | 50 |
| | | Exam Hours | 03 |
| **CREDITS-8** | | | |

**Course Objectives:** Students will be Guided to:

1. Understanding about the Project and its components.
2. Introduction of the project selected.
3. Detailed literature survey of the project and understand concepts of problem identification.
4. Design and development of Proposed Methodology.
5. Implementation of the proposed methodology and thesis document preparation.

STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM INDIVIDUALLY

**Course outcomes:** After studying this course, students will be able to:

CO-1- Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO2. Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO-3-Design and development of proposed methodology based on the societal needs, environmental friendly.

CO-4-Use the modern tool available like advanced hardware and software tools to implement the proposed methodology and make it use for society and prepare a document and submit.

CO-5-Publish the proposed work in the peer reviewed Journal

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| **CO/PO** | **PO.1** | **PO.2** | **PO.3** | **PO.4** | **PO.5** | **PO.6** | **PO.7** | **PO.8** | **PO.9** | **PO.10** | **PO.11** | **PO.12** | **PSO.1** | **PSO.2** | **PSO.3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **3** | 3 | **-** | **3** | **-** | **3** | **-** |
| **CO2** | **3** | **3** | **3** | **3** | **3** | **1** | **2** | **3** | **3** | **3** | **2** | **3** | **-** | **3** | **-** |
| **CO3** | **3** | **3** | **3** | **-** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **3** | **-** | **3** | **-** |
| **CO4** | **3** | **3** | **3** | **-** | **-** | **-** | **-** | **3** | **3** | **3** | **3** | **3** | **-** | **3** | **-** |
| **CO5** | **3** | **3** | **-** | **3** | **-** | **-** | **-** | **3** | **3** | **3** | **3** | **3** | **-** | **3** | **-** |

| INTERNSHIP<br>[As per Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]<br>SEMESTER-IV | | | |
|---|---|---|---|
| Subject Code | 22ECI82 | CIE Marks | 50 |
| Total No. of implementation/training weeks | 12P | SEE Marks | 50 |
| | | Exam Hours | 03 |

**CREDITS-06**

**Course Objectives:** Students will be taught to:

1. Learn to appreciate work and its function in the economy.
2. Develop work habits and attitudes necessary for job success.
3. Develop communication, interpersonal and other critical skills in the job interview process.
4. Build a record of work experience.
5. Acquire employment contacts leading directly to a full-time job following graduation from college.

Students has to carry out the internship OF 12 weeks in the industry.

**Course outcomes:** After studying this course, students will be able to:

CO1. Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO2. Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO3. Design and implement the system to solve the real time problem of the society.

CO4.Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO5.Use the modern tool available like advanced hardware and software tools.

**COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):**

**Note: 1-Low, 2-Medium, 3-High**

| CO/PO | PO.1 | PO.2 | PO.3 | PO.4 | PO.5 | PO.6 | PO.7 | PO.8 | PO.9 | PO.10 | PO.11 | PO.12 | PSO.1 | PSO.2 | PSO.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | - | 3 | 3 | 2 | - | - | - | - | 3 | - | 3 | - |
| CO2 | 2 | 3 | 2 | 2 | - | 2 | 2 | - | - | - | - | 3 | - | 3 | - |
| CO3 | 2 | 2 | 3 | 2 | - | 2 | 2 | - | - | - | - | 3 | - | 3 | - |
| CO4 | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 3 | - | 3 | - |
| CO5 | - | - | - | - | 3 | - | - | 2 | - | - | - | 3 | - | 3 | - |