# Karmaveer Bhaurao Patil University, Satara

## Syllabus for

## M. Sc. I Electronics

## Under

## Faculty of Science and Technology

## (As per NEP 2020)

## With effect from Academic Year 2024-2025

## Department of Electronics

1. **SUBJECT:** Electronics
2. **YEAR OF IMPLEMENTATION:** New Syllabi for the M.Sc. I Electronics will be implemented from June 2024 onwards.
3. **PREAMBLE:**

   Master of Science is an integrated academic degree in faculty of science. The faculty is not ignoring the developments in the field of Electronics. The revision of existing syllabus of Electronics subject in science faculty is essential. This is a humble endeavour to initiate the process towards an era of knowledge. The students from science faculty should also be competent for this change in the technology.

   In this year, a student will be able to understand handling of laboratory equipment, build Electronics circuits with confidence. In the subject, the student will also get a basic and proper knowledge in the field of Embedded System design

4. **GENERAL OBJECTIVES OF THE COURSE:**
   a) To create post-graduates with sound knowledge of fundamentals of Electronics, who can contribute towards advancing science and technology.
   b) To create post-graduates with sufficient capabilities in Electronics who can become researchers and developers to satisfy the needs of the core Electronics industry.
   c) To develop ability among students to formulate, analyse and solve real life problems faced in Electronics industry.
   d) To provide opportunity to students to learn the latest trends in Electronics and make them ready for life-long learning process.
   e) To make the students aware of professional ethics of the industry and prepare them with basic soft skills essential for working in community and professional teams.
   f) To prepare the students for post graduate studies through competitive examinations, enabling them to reach higher echelons of excellence.
   g) To produce electronic professionals who can be directly employed or start his/her own work as electronic circuit Designer, Electronics consultant, testing professional, Service engineer and even an entrepreneur in electronic industry.
5. Pos
6. PSOs
7. 
8. **DURATION:**

   **Two Years** (Full Time)
9. **PATTERN:** SEMESTER EXAM (NEP 2020)
10. **MEDIUM OF INSTRUCTIONS:** ENGLISH

## 11. STRUCTURE OF COURSE:

<table>
<tr><th rowspan="3">Level</th><th rowspan="3">Sem</th><th colspan="4">Major</th><th rowspan="3">RM</th><th rowspan="3">OJT</th><th rowspan="3">RP</th><th rowspan="3">Total</th></tr>
<tr><th colspan="2">Discipline Specific Core Mandatory</th><th colspan="2">Discipline Specific Elective</th></tr>
<tr><th>T</th><th>P</th><th>T</th><th>P</th></tr>
<tr><td rowspan="2">6</td><td>I</td><td>12<br>(3 Courses)</td><td>2</td><td>2<br>(1 Course out of Two)</td><td>2</td><td>4</td><td>-</td><td>-</td><td>22</td></tr>
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<tr><td colspan="2" rowspan="2">Total</td><td>48</td><td>8</td><td>16</td><td>8</td><td>4</td><td>4</td><td>10</td><td rowspan="2">88</td></tr>
<tr><td colspan="3">70</td><td></td><td colspan="2">8</td><td>10</td></tr>
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**M. Sc. I Semester I**

| Level | Course Code | Title of the Course | Course Category | No. of Lectures Per Week | Credits |
|---|---|---|---|---|---|
| 6 | **DSC (Discipline Specific Core)** | | | | |
| | MET411 | Foundation of Semiconductor Devices | Theory | 4 | 4 |
| | MET412 | Measurement Techniques | Theory | 4 | 4 |
| | MET413 | Computer Organization | Theory | 4 | 4 |
| | **DSE (Discipline Specific Elective) (any one out of two)** | | | | |
| | MET414 E-I | Advanced Digital System Design | Theory | 2 | 2 |
| | MET414 E-II | Advances in Digital Communication | | | |
| | MET415 | Research Methodology | RM | 4 | 4 |
| | MEP416 | Practical Course: Lab I (Based on MET411, 412, 413) | Practical | 4 | 2 |
| | MEP417 | Practical Course: Lab II (Based on MET414) | Practical | 4 | 2 |
| **Total** | | | | | **22** |

**M. Sc. I Semester II**

| Level | Course Code | Title of the Course | Course Category | No. of Lectures Per Week | Credits |
|---|---|---|---|---|---|
| 6 | **DSC (Discipline Specific Core)** | | | | |
| | MET421 | Power Electronics | Theory | 4 | 4 |
| | MET422 | Applied Electromagnetics and Microwaves | Theory | 4 | 4 |
| | MET423 | 8-bit Microcontrollers and Applications | Theory | 4 | 4 |
| | **DSE (Discipline Specific Elective) (any one out of two)** | | | | |
| | MET424 E-I | HDL and MOS Technology | Theory | 2 | 2 |
| | MET424 E-II | Computer Networks | | | |
| | MET425 | Research Project | RP | 8 | 4 |
| | MEP426 | Practical Course: Lab III (Based on MET 421, 422, 423) | Practical | 4 | 2 |
| | MEP427 | Practical Course: Lab IV (Based on MET 424) | Practical | 4 | 2 |
| **Total** | | | | | **22** |

**Notations (MET xyz):**

**M:** M.Sc., **E:** Electronics, **T:** Theory, **P:** Practical, **x (1 to 4):** Semester number, **yz (1 to 5):** course number, **DSC:** Discipline Specific Core, **DSE:** Discipline Specific Elective

**SEMESTER I**

**DSC: I MET411: Foundation of Semiconductor Devices**

- **Course Objectives:** Students will be able to:
  1. Introduce crystal structure with reference to semiconductors.
  2. Introduce quantum and statistical mechanics.
  3. Understand the characteristics of semiconductor devices.
  4. Introduce theory of diode, transistor, and FETs

| **Credits=4** | **SEMESTER – I**<br>**MET411: Foundation of Semiconductor Devices** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **Theory of Solids** | **(15)** |
| | **Crystal structure of solids:** Semiconductor materials, types of solids, basics of crystallography, space lattice atomic bonding, unit cell, Miller indices imperfections and impurities in solids, methods for semiconductor crystal growth. | |
| **Credit –1**<br>**UNIT II** | **Introduction to Quantum and statistical Mechanics** | **(15)** |
| | Principles of quantum mechanics, Schrodinger wave equation, and Applications of Schrodinger's wave equation for bound state potential problems.<br>**Introduction to quantum theory of solids:** Allowed & forbidden energy bands, electrical conduction in solids, extensions to three dimensions, density of states<br>**Statistical mechanics:** Statistical laws, Fermi-Dirac probability function, the distribution function, and the Fermi energy. | |
| **Credit –1**<br>**UNIT III** | **Physics of semiconductors** | **(15)** |
| | **Semiconductor in equilibrium:** Charge carriers in semiconductors, dopant atoms and energy levels, extrinsic semiconductors, Statistics of donors and acceptors, charge neutrality, position of Fermi energy level.<br>**Carrier transport phenomena:** charge, effective mass, state & carrier distributions, Carrier drift, carrier diffusion, graded impurity distribution, resistivity, Hall Effect.<br>**Non-equilibrium excess carriers in semiconductors:** Carrier generation and recombination, characteristics of excess carriers, bipolar transport, quasi-Fermi energy levels, excess carrier lifetime, surface effects | |
| **Credit –1**<br>**UNIT IV** | **Basics of Semiconductor Devices** | **(15)** |
| | **Diode:** Junction terminologies, Poisson's equation, built-in potential, depletion approximation, diode equation, Qualitative and Quantitative | |

| | | |
|---|---|---|
| | analysis, Reverse-bias breakdown, avalanching, zener process, C-V characteristics, Transient response.<br>**BJT:** Terminology, electrostatics and performance parameters, Eber-Moll model, two port model, hybrid – pi model, device models in spice, Modern BJT structures –polysilicon emitter BJT, Heterojunction bipolar transistor (HBT)<br>**FETs:** JFET and MESFET - Junction terminologies, characteristics, ac response, spice models<br>**MOSFET:** Fundamentals, Capacitance- voltage characteristics, I-V characteristics, Qualitative Theory of Operation, ID - VD Relationship, ac response, spice models. | |

- **Course Outcomes:** Student should be able to:
  1. Apply theory of solids
  2. Present quantum and statistical mechanics.
  3. Demonstrate Physics of semiconductors.
  4. Implement various blocks in computers.
- **Reference Books:**

  1. Donald A. Neamen, Semiconductor Physics and Devices Basic Principles, TMH, 3rd Edition (2003)
  2. Robert F. Pierret, Semiconductor Device fundamentals, Pearson Education
  3. Streetman, Solid State Electronics Devices, PHI, 5th Edition, (2006)
  4. S.M. Sze, Kwok K. N, Physics of Semiconductor Devices, 3ed, Wiley edn.

**SEMESTER I**

**DSC: II MET412: Measurement Techniques**

- **Course Objectives:** Students will be able to:
    1. Understand the configurations and functional descriptions of measuring instruments.
    2. Understand the basic performance characteristics of instruments.
    3. Understand the working principles of various types of sensors and transducer and their use in measuring systems.
    4. Study the techniques involved in various types of instruments.
    5. Understand the relevance of electronics with other disciplines.

| **Credits=4** | **SEMESTER – I**<br>**MET412: Measurement Techniques** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **Introduction to Measurement and Measurement Systems** | **(15)** |
| | Definition and significance of measurement, classification of instruments and types of measurement applications, elements of an instrument / measurement system, active and passive transducers, analog and digital modes of operation, null and deflection methods, input output configuration of instruments and measurement systems, methods of correction of instruments and measurement systems Generalized performance characteristics of instruments: static characteristics and static calibration, meaning of static calibration, true value, basic statistics, least–squares calibration curves, calibration accuracy versus installed accuracy, combination of components errors in overall system accuracy calculations, theory validation by experimental testing | |
| **Credit –1**<br>**UNIT II** | **Static Dynamic Characteristic of Measurement System** | **(15)** |
| | Static sensitivity, linearity, threshold, noise floor, resolution, hysteresis and dead space, scale readability, span, generalized static stiffness and input impedance, loading effect Dynamic characteristics: generalized mathematical model of measurement system, operational transfer function, sinusoidal transfer function, zero-order instrument, first order instrument, second order instruments, step response, ramp response, frequency response of first -order instruments and second order instruments Errors in measurement: Types of Errors - gross, systematic, environmental errors, systemic errors, computational error, personal error etc. | |
| **Credit –1**<br>**UNIT III** | **Motion Measurement** | **(15)** |
| | Methods of transduction, primary sensing elements and transducers, | |

| | | |
|---|---|---|
| | electrical transducers, classification of transducers Motion and dimensional measurement: fundamental standards, relative displacement translational and rotational, calibration, resistive potentiometers, resistance strain gauge, differential transformers, variable–inductance and variable– reluctance pickups, eddy current, non-contacting transducers, capacitance pickups, piezoelectric transducers, digital displacement transducers (translational and rotary encoders), ultrasonic transducers, detailed discussion of strain gauges, LVDT and synchros Relative velocity: translational and rotational, calibration, average velocity from measured x and t, tachometer encoder methods, laser based methods, stroboscopic methods, translational– velocity transducers (moving coil and moving magnet pickups) Relative acceleration measurements: seismic (absolute) displacement pickups, seismic (absolute) velocity pickups, seismic (absolute) acceleration pickups (accelerometers) | |
| **Credit –1 UNIT IV** | **Process Parameter Measurements** | **(15)** |
| | Force, Torque and Shaft power: standards and calibration, basic methods of, bonded strain gauge, differential transformer, piezoelectric, variable reluctance/ FM oscillator digital system, torque measurement on rotating shafts Pressure and Sound Measurement: standards and calibration, dead weight gauges and manometers, low pressure measurement – Mcleod gauge, Knudsen gauge, viscosity, thermal conductivity, ionization, sound level meter, microphone, capacitor microphone Flow measurement: Pitot-static tube, Yaw tube, hot wire and hot film anemometers, Laser Doppler anemometer, Gross Volume Flow Rate- rotameter, turbine, ultrasonic flow meter, electromagnetic flow meters Temperature and Heat Measurement Transducers: standards and calibration, bimetallic thermometers, liquid in glass thermometers, pressure thermometers, RTD, thermocouples, thermistors, semiconductor based temperature sensors, detailed discussion on basics of thermocouples, laws of thermocouples, cold junction compensation; thermistor types, materials used, application circuits, LM35 Radiation Fundamentals: detectors, optical pyrometers, IR imaging systems, heat flux sensing slug type sensors, Gorden gauge. | |

- **Course Outcomes:** Student should be able to:
  1. Explore measurement and measurement systems.
  2. Present static and dynamic systems.
  3. Present various motion measurement methods.
  4. Utilise Process parameter measurements.
- **Reference Books:**

  1. Ernest O. Doeblin and Dhanesh N. Manik, Measurement Systems, Applications and Design, 5th Edition, Tata McGraw Hill.

2. A. K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation by Dhanpat Rai & Co.
3. Kalsi, Electronic Instrumentation, TMH.
4. Cooper and Helfrick, Modern Electronic Instrumentation and Measurements Techniques, PHI.

**SEMESTER I**

**DSC: III MET413: Computer Organization**

- **Course Objectives:** Students will be able to:
  1. Learn basics of the computer organization
  2. Study fundamental architectures of computer organizations
  3. Learn Parallel Processors concept in Computer Organizations
  4. Learn implementation of functional blocks for computer organizations.

| **Credits=4** | **SEMESTER – I**<br>**MET413: Computer Organization** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **Introduction** | **(15)** |
| | Computer system organization – hardware and software components, overview of Operating System, Computer booting process, Instruction set architectures, Chronology of Microprocessor Development w.r.t. CISC/RISC families, Timeline of POWER PC, Alpha SPARC families. Operating system case study: DOS, UNIX. | |
| **Credit –1**<br>**UNIT II** | **Fundamental Architectures** | **(15)** |
| | Defining a Computer Architecture, Von Neumann and Harvard Architectures, bus topologies, pipelining, Super pipelining, Superscalar processors, Very Long Instruction Word (VLIW) architectures, multithreaded processors – super threading, hyperthreading | |
| **Credit –1**<br>**UNIT III** | **Parallel Processors** | **(15)** |
| | Flynn's taxonomy, SIMD, MIMD and multi-computer approaches. Implementation Considerations: memory technologies, Hierarchical Memory Systems, caches, prefetching techniques, virtual memory, pipelining, ternary logic, packaging considerations, wafer scale integration. | |
| **Credit –1**<br>**UNIT IV** | **Implementation of Functional Units** | **(15)** |
| | Memory Management, Arithmetic Logic Unit, Floating Point Unit, Branch Unit, Vector Unit, Load/Store Unit. Development Tools: Microcomputer Development Systems (MDS), In Circuit Emulator (ICE), Assembler, Editors, Logic Analyses. | |

- **Course Outcomes:** Student should be able to:
  1. Present Computer system organization – hardware and software
  2. Define Computer Architecture.
  3. Use computer architecture classifications tools in designing of modern processors.

4. Implement various blocks in computers.

- **Reference Books:**


1. Computer Organization and design, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, fifth Edition, Tata McGraw-Hill Edition
2. David A. Patterson, John L. Hennessy, Computer Organization and Design, the Hardware/Software Interface, Third Edition, Publisher: Morgan Kaufman, ISBN-10: 58606041.
3. William Stalling, Computer Organization and Architecture, designing for performance, Eighth Edition,
4. Linda Null and Julia Labur, The Essentials of Computer Organization and Architecture, ISBN:076370444x, Jones and Bartlett Publishers 2003
5. Computer Organization and design, P. PAL CHAUDHURI, third Edition, PHI Learning PVT LTD
6. Brian Kernighan and Dennis Ritchie, The C Programming Language. 2nd Edition, Pearson, 2015
7. Brian W. Kernighan, Rob Pike, The UNIX Programming Environment, PHI Learning PVT LTD

**SEMESTER I**

**DSE: I MET414 E-I: Advanced Digital System Design**

- **Course Objectives:** Students will be able to:
  1. Make the students able to understand key ideas behind digital system design.
  2. Introduce the students able to design CMOS based circuit design necessary as a foundation of VLSI technology.
  3. Make students able to solve problems on Digital Systems and CMOS Design techniques
  4. To make students able to qualify aptitude test being conducted by Industries working on VLSI and Embedded system design.

| **Credits=2** | **SEMESTER – I**<br>**MET414 E-I: Advanced Digital System Design** | **No. of hours per unit/ credits** |
|---|---|---|
| **UNIT I** | **Combinational Logic Design** | **(8)** |
| | **Decoder Design using Universal Gates:** BCD to Binary, BCD to 7 Segment, 3:8 Decoder, Concept of Redundant Logic, One-hot encoder, One-Cold Encoder, and its importance, Four, Five Variable K-Map, Variable Reduction in K-Map, Folded K-Map, and Implementation of Logic Functions: using K-Map, using Multiplexor (MUX) ICs. Comparison between Decoder and DMUX, Full Adder using DMUX. Designing Logic Gates using MUXs. BCD Adder using ICs, Single bit comparator. | |
| **UNIT II** | **Sequential Logic Design** | **(8)** |
| | Difference between Flip-Flop (F/F) and Latch, F/F Characteristics, F/F Conversions, Race Condition in JK F/F, Excitation table of F/Fs. Finite State Machines (FSMs): Moore and Mealy Machine, Asynchronous Counter Design: 2-bit, 3-bit and 4-bit, Glitches, Synchronous Counters Design: 2-bit, 3-bit and 4-bit using FSM. Decade Counter Design using FSM. Synchronous Counter design for given state diagram. | |
| **UNIT III** | **Programmable Logic Devices** | **(7)** |
| | Need of PLD, antifuse, architecture of simple PLD (SPLD)- PAL, PLA, typical combinational and sequential system implementation.<br>Complex Programmable Logic Device (CPLD), Types, Difference between SPLDs and CPLDs.<br>**FPGAs:** Architecture study of some popular FPGA families (Ultra Scale architecture), Detailed study of an AMD-Xilinx high end FPGA family, Architecture of Microcontrollers in FPGA (ARM), The backend tools, Integrating non-HDL modules: Building macros<br>Introduction to System on Chip (SOC), Multicore Architecture. | |
| **UNIT IV** | **Memory Architecture** | **(7)** |
| | Memory types, data storage principle, control inputs, and timings, | |

| | | |
|---|---|---|
| | applications, Random Access Memories (RAM), Static Ram (SRAM), standard architecture, 6 transistor cell diagram, address decoders, timings, Dynamic RAM (DRAM), different DRAM cells, refresh circuits, timings, role of memories in PLD | |

- **Course Outcomes:** Student should be able to:
  1. Explore measurement and measurement systems
  2. Design and constructs logic as well as arithmetical circuits
  3. Calculate various important parameters of Digital logic families
  4. Design & analyze combinational logic and sequential logic circuits
- **Reference Books:**


  1. R. J. Tocci, Digital Systems Principles and Applications, PHI Pvt. Ltd.
  2. N. G. Palan, Digital Electronics, Technova Publications.
  3. John F. Wakerly, Digital Design Principles and Practices Prentice Hall International Edition.
  4. R. Jacob Baker, Layout, and Simulation, Wiley India, 2008
  5. Anantha P. Chandrakasan and Jan M. Rabaey, Digital Integrated Circuits: A design perspective, Prentice Hall publication
  6. Douglas A. Pucknell and Kamran Eshraghian, Basic VLSI Design, Prentice Hall Publication

**SEMESTER I**

**DSE: II MET414 E-II: Advances in Digital Communication**

- **Course Objectives:** Students will be able to
  1. Understand the coding techniques for digital communication
  2. Study the communication through channels
  3. Understand spread spectrum signals for digital communication
  4. Study Digital communication through fading multi-path channels

| **Credits=2** | **SEMESTER - I**<br>**MET414 E-II: Advances in Digital Communication** | **No. of hours per unit/ credits** |
|---|---|---|
| **UNIT I** | **Overview of Digital Communication** | **(7)** |
| | Principles, baseband and band-pass digital modulation demodulation schemes.<br>**Coding techniques:**<br>Information measures, Coding techniques for discrete and analog sources. Channel capacity, error detection and correction codes - Linear block codes, cyclic convolutional codes. | |
| **UNIT II** | **Communication through band limited linear filter channels** | **(7)** |
| | Optimum receiver for channels with ISI and AWGN, Linear equalization, Decision feedback equalization, Iterative equalization and decoding, Adaptive equalization. | |
| **UNIT III** | **Spread Spectrum signals for digital communication** | **(8)** |
| | Model of spread spectrum digital communication system, Direct sequence spread spectrum (DSSS), Frequency hopped spread spectrum (FHSS), CDMA,<br>Time hopping Spread Spectrum (THSS), Synchronization of spread spectrum systems. | |
| **UNIT IV** | **Digital communication through fading multi-path channels** | **(8)** |
| | Characterization of fading multipath channels, The effect of signal characteristics on the choice of a channel model, Frequency nonselective, Slowly fading channel, Diversity techniques for fading multipath channels, Digital signals over a frequency selective, Slowly fading channel. | |

- **Course Outcomes:** students should be able to:
  1. Explore various coding techniques for digital communications
  2. Visualize the different Digital modulation and spread spectrum techniques.
  3. Apply different types of coding techniques to design the optimum receiver for different channels.
  4. Design and develop the different types of modulation techniques, equalizer to improve the performance under fading channels for various applications.

- **Reference Books:**


1. John G. Proakis and Masoud Salehi, “Digital Communications”, Tata McGraw Hill, 5th Edition.
2. Bernard Sklar and Pabitra Kumar Ray, “Digital Communications: Fundamentals and Applications”, Pearson Education Asia, 2nd Edition.
3. John R. Barry, Edward A. Lee and David G. Messerschmitt, “Digital Communication”, Springer 2003, 3rd edition.
4. Andrew J. Viterbi, “CDMA: Principles of Spread Spectrum Communications”, Prentice Hall

**SEMESTER I**

**RM: MET415: Research Methodology**

- **Course Objectives:** Student will be able to…
  1. Study the basic knowledge on the fundamentals of research methodology.
  2. Understand to present research in scientific manner.
  3. Get acquainted with different statistical tools in modern research.
  4. Understand the relationship between computational researches.

| **Credits 4** | **SEMESTER I**<br>**MET415: Research Methodology** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –1**<br>**UNIT I** | **Fundamentals of Research** | **(15)** |
| | **Introduction:** Meaning, Objectives, Types and Significance of Research, Motivation in Research, Research Approaches, Research Methods vs Methodology, Research and Scientific Method, Research Process, Criteria of Good Research<br>**Research Problem**: Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem<br>**Research Design:** Need for Research Design, Features and Important Concepts Relating to Research Design, Basic Principles of Experimental Designs, Developing Research Plan, Quantitative vs Qualitative study designs, Sampling Design | |
| **Credit –1**<br>**UNIT I** | **Measurement, Scaling Techniques and Methods of Data Collection** | **(15)** |
| | **Measurement and Scaling:** Measurement in Research, Measurement Scales, Sources of Error in Measurement, Tests for Electronics Measurement, Technique of Developing Measurement Tools, Meaning of Scaling, Scale Classification Bases, Scaling Techniques<br>**Methods of Data Collection:** Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Schedules, Difference between Questionnaires and Schedules, Other Methods of Data Collection, Collection of Secondary Data | |
| **Credit –1**<br>**UNIT I** | **Processing and Analysis of Data** | **(15)** |
| | Processing Operations, Problems in Processing, Elements/Types of Analysis, Statistics in Research, Measures of Central Tendency, Measures of Dispersion, Measures of Asymmetry (Skewness), Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, Association in Case of Attributes, Other Measures | |
| **Credit –1**<br>**UNIT I** | **Interpretation and Report Writing** | **(15)** |
| | 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<br>**Ethics and Plagiarism:** Seeking consent, Maintaining confidentiality, Ethical issues to consider relating to the researcher Avoiding bias<br>**Research Application Tools:** Latex (Writing Paper, Thesis, Report, Bibliography), BEAMER for presentation | |

- **Course Outcomes:** Students should be able to
  1. Apply Measurement, Scaling Techniques and Methods of Data Collection knowledge
  2. Design a research plan.
  3. Present research in scientific language.
  4. Analyse research data employing computational tools.
- **Reference Books:**


1. C. R. Kothari, Research Methodology methods and Techniques, 2nd Edition, New Age International Publishers, 2004
2. N. Gurumani, Scientific thesis writing and Paper presentation, (MJP Publishers, Chennai, 2010)
3. C. R. Kothari, Research Methodology; Methods and Techniques, 2nd Ed, (New Age International Publishers, New Delhi, 2004)
4. Irfan Ali Khan and Atiya Khanum, Fundamentals of Biostatistics. 3rd (Ukaaz, Publications, Hyderabad, 2004)
5. Robert R. Sokal and F. James Rohlf, Introduction to Biostatistics, 2nd Ed, (Dover Publications, INC. Mineola, New York,1969)
6. P.N. Arora, P. K. Malhan, Biostatistics, (Himalaya Publishing House, Mumbai, 2006)

**SEMESTER – I**

**MEP416: Lab I: General Electronics Lab (Hardware and Simulation)**

**(Based on MEP411, 412, 413 courses)**

- **Course Objectives:** Students will be able to
  1. Review various types of Instruments and measurement systems.
  2. Study transducer and their response.
  3. Learn designing of digital systems
  4. Design digital systems for an application

| **Credits= 2** | **SEMESTER – I**<br>**MEP416**<br>**Lab I: General Electronics Lab (Hardware and Simulation) Based on MEP411, 412, 413 courses)** | **No. of hours per unit (60)/ Credits** |
|---|---|---|
| | 1. Design build and test rms to dc converter for voltage measurement of ac signal<br>2. Displacement measurement using LVDT, signal conditioning and DPM<br>3. Temperature measurement using PT100, signal conditioning and DPM<br>4. Temperature measurement using thermocouple with cold junction compensation<br>5. To build and test current telemetry (4 to 20 mA)<br>6. Ultrasonic transmitter and receiver, distance measurement<br>7. RPM measurement using various methods<br>8. Design and calibrate light intensity meter using photodiode or LDR and the necessary signal conditioning and display.<br>9. Study of Strain Measurement using Strain Gauges and Cantilever Assembly<br>10. Determination of Linear Range of operation of Strain Measurement<br>11. Two-digit combinational lock<br>12. Keyboard encoder with latches<br>13. Traffic light controller<br>14. Multiplexed display (Bank token / two-digit counter)<br>15. Bidirectional stepper motor control (Sequence Generator)<br>16. One digit BCD adder and 8-bit adder / subtractor<br>17. Object counter (use of MMV, counter)<br>18. Binary-Gray and Gray-Binary code converter | |

| | | |
|---|---|---|
| | 19. Design build and test IR transmitter and receiver (TSOP1738 or similar) for object detection<br>20. Hot wire anemometer | |

- **Course Outcomes:** Students should be able to
  1. Design and constructs logic as well as arithmetical circuits
  2. Calculate various important parameters of Digital logic families
  3. Design & analyze combinational logic and sequential logic circuits
  4. Process programs and execution of program.

- **Reference Books:**

  1. Ernest O. Doeblin and Dhanesh N Manik, Measurement Systems, Applications and Design,.5th Edition, Tata McGrawHill.
  2. A.K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation Dhanpat Rai & Co.
  3. Kalsi, Electronic Instrumentation, TMH.
  4. Modern Electronic Instrumentation and Measurements Techniques, Cooper and Helfrick, PHI.
  5. R. J. Tocci, Digital Systems Principles and Applications, PHI Pvt. Ltd.
  6. N.G. Palan, Digital Electronics, Technova Publications.
  7. John F. Wakerly, Digital Design Principles and Practices Prentice Hall International Edition

**SEMESTER – I**

**MEP417: Lab II: C Programming Lab**

**(Based on MEP414 course)**

- **Course Objectives:** Students will be able to
  1. Study programming logic and algorithm writing.
  2. Develop skills for writing programs using C.

| **Credits= 2** | **SEMESTER – I**<br>**MEP417 Lab II: C Programming Lab**<br>**(Based on MEP414 course)** | **No. of hours per unit (60)/ Credits** |
|---|---|---|
| | • Basic C Programs.<br>1. The printf and Scanf functions<br>2. Use of data types, variables.<br>3. Expression in C.<br>• Floating Point Operations.<br>4. Conditional Statements.<br>5. Program to check whether input alphabet is vowel or not.<br>6. Program to input no and check even and odd no.<br>7. Program to display sum of digit.<br>• Looping Structure<br>8. Program to display factorial of given number.<br>9. Program to accept no and checks if no is palindrome or not.<br>10. Program to find sum of first n natural no's.<br>• Functions<br>11. Write recursive function to print Fibonacci series.<br>12. Write function to check given no is Armstrong or not.<br>13. Program to display factorial of given number using recursion.<br>14. Functions With Argument/non argument and return/no return values.<br>• Array<br>15. Array Declaration<br>16. Program to print minimum Number between an Array.<br>17. Program to perform string comparison using C.<br>• Pointers<br>18. Declaration and Initialization of Pointers<br>19. Accessing String Elements in Pointers. | |

| | | |
|---|---|---|
| | 20. Accessing array Elements using the pointers. | |

- **Course Outcomes:** Students should be able to

5. Design and constructs logic as well as arithmetical circuits
6. Calculate various important parameters of Digital logic families
7. Design & analyze combinational logic and sequential logic circuits
8. Process programs and execution of program.

- **Reference Books:**


8. Ernest O. Doeblin and Dhanesh N Manik, Measurement Systems, Applications and Design,.5th Edition, Tata McGrawHill.
9. A.K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation Dhanpat Rai & Co.
10. Kalsi, Electronic Instrumentation, TMH.
11. Modern Electronic Instrumentation and Measurements Techniques, Cooper and Helfrick, PHI.
12. R. J. Tocci, Digital Systems Principles and Applications, PHI Pvt. Ltd.
13. N.G. Palan, Digital Electronics, Technova Publications.
14. John F. Wakerly, Digital Design Principles and Practices Prentice Hall International Edition

**M. Sc. I Semester II**

| Level | Course Code | Title of the Course | Course Category | No. of Lectures Per Week | Credits |
|---|---|---|---|---|---|
| 6 | **DSC (Discipline Specific Core)** | | | | |
| | MET421 | Power Electronics | Theory | 4 | 4 |
| | MET422 | Applied Electromagnetics and Microwaves | Theory | 4 | 4 |
| | MET423 | 8-bit Microcontrollers and Applications | Theory | 4 | 4 |
| | **DSE (Discipline Specific Elective) (any one out of two)** | | | | |
| | MET424 E-I | HDL and MOS Technology | Theory | 2 | 2 |
| | MET424 E-II | Computer Networks | | | |
| | MET425 | Research Project | RP | 8 | 4 |
| | MEP426 | Practical Course: Lab III (Based on MET 421, 422, 423) | Practical | 4 | 2 |
| | MEP427 | Practical Course: Lab IV (Based on MET 424) | Practical | 4 | 2 |
| **Total** | | | | | **22** |

**Notations (MET xyz):**

**M:** M.Sc., **E:** Electronics, **T:** Theory, **P:** Practical, **x (1 to 4):** Semester number, **yz (1 to 5):** course number, **DSC:** Discipline Specific Core, **DSE:** Discipline Specific Elective

**SEMESTER II**

**DSC: IV MET421: Power Electronics**

- **Course Objectives:** Students will be able to:
  1. Learn the advanced power electronics circuits.
  2. Understand concepts of choppers
  3. Study the designing of Inverters
  4. Study the designing of converters

| Credits=4 | SEMESTER – II<br>MET421: Power Electronics | No. of hours per unit/ credits |
|---|---|---|
| **Credit –I<br>UNIT I** | **Basics of Electrical machines** | **(15)** |
| | Introduction to motors, Types of D.C. Motors, BLDC Motors, Torque Speed Characteristics. Types of Induction Motors. Construction and Working of Synchronous Machines and Stepper Motors. Interface techniques of Stepper Motor with IBM PCs and Digital Circuits. Concept of Full-Step, Half-Step and Micro-stepping in Stepper Motors. | |
| **Credit –1<br>UNIT II** | **Choppers** | **(15)** |
| | Introduction and Classification of Choppers, Control Strategies: Pulse Width Modulation, Constant Pulse Width Variable Frequency, Current Limit Control, Variable Pulse Width and Frequency. Chopper Configurations Single Quadrant Chopper, Four- Quadrant Chopper. Step-Down and Chopper with Resistive Load. Step-Up Chopper. Three-Thyristor Choppers, Resonant Pulse Chopper. | |
| **Credit –1<br>UNIT III** | **Transistorized Inverter Circuits** | **(15)** |
| | **Half Bridge Inverter:** Square Wave Half Bridge Inverter, Quasi-square wave inverter, PWM Inverter, Thyristorized Half Bridge Inverter. Push-Pull Inverter, Single-phase bridge inverter with resistive and inductive load, PWM bridge Inverter, three phase inverters. Voltage Control of Single-Phase Inverter.<br>SPWM, MPWM, Sinusoidal PWM, Modified Sinusoidal pulse width modulation and Phase displacement control. Voltage control of Three Phase inverters. | |
| **Credit –1<br>UNIT IV** | **Thyristorized Inverters** | **(15)** |
| | Forced commutated thyristor inverters. i.e. Auxillary commutated inverters, Mc Murray commutated inverter, Complementary commutated inverters /Mc-Murray Bedford inverter, Current source inverter, Series resonant inverter with unidirectional and bidirectional switches, Parallel | |

| | | |
|---|---|---|
| | resonant inverters, Resonant DC link inverter. | |

- **Course Outcomes:** Student should be able to:
    1. Design a Chopper as per end user's requirement.
    2. Design a Transistorized inverter as per end user's requirement.
    3. Design a Thyristorized inverter as per end user's requirement.
    4. Design PWM converters
- **Reference Books:**

    1. P.C. Sen, Power Electronics
    2. S. R. Doradla, A. Joshi & R.M. Sinha, Thyristor power Controllers. C. K Dubey,
    3. M. Rashid, Power Electronics
    4. S. B. Dewan, G.R. Sleman, A. Strauphan, Power Semiconductor drives- (Wiley Int. Pub.- John Wiley Sons.)

**SEMESTER II**

**DSC: V MET422: Applied Electromagnetics and Microwaves**

- **Course Objectives:** Students will be able to:
  1. Introduce to students the concepts of electromagnetics
  2. Understand the theory of transmission lines and wave guides
  3. Study various parameters of antennas
  4. Study various methods of generation of microwave

| **Credits=4** | **SEMESTER – II**<br>**MET422: Applied Electromagnetics and Microwaves** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **Electromagnetic Waves** | **(15)** |
| | Physical quantities as vectors, gradient, curl, and divergence, rotation operator, covariant and contra-variant vectors, line, surface and volume – integrals, Gauss and Stokes theorem complex plane, polar form of complex number, complex functions, Cauchy-Riemann conditions, orthogonal functions and relation with Laplace equation Maxwell's equations, continuity equation, electric and magnetic wave equations in time domain and frequency domain, wave propagation in conducting and non-conducting media, skin depth and high frequency propagation, boundary conditions at the interface between two mediums, Pointing theorem and its applications | |
| **Credit –1**<br>**UNIT II** | **Transmission Lines** | **(15)** |
| | Types of transmission lines, microstrip lines, two wire transmission line, transmission line equations for voltages and currents, inductance and capacitance per unit length of two wire and coaxial cable transmission line, characteristic impedance, propagation constants, attenuation and phase constants, phase velocity, reflection and transmission coefficients, SWR, line impedance, normalized impedance and admittance, Smith chart construction and applications, single stub and double stub matching, applications to reflection of EM-waves at interfaces for normal incidence | |
| **Credit –1**<br>**UNIT III** | **Waveguides and Components** | **(15)** |
| | Concept of waveguides, frequency range, relation to transmission lines. **Rectangular Waveguides:** TM and TE Modes, concept of cut-off frequency, guide impedance, phase velocity, guide wavelength for TE and TM modes, Applications to TE mode in rectangular waveguide, power losses in rectangular waveguide Circular waveguide introduction only **Optical Fiber:** Principles of Operation and construction, difference between conducting circular waveguide and fiber Different methods of | |

| | | |
|---|---|---|
| | excitation of TE and TM modes in waveguides Cavity Resonators, Q factor of cavity resonators | |
| **Credit –1 UNIT IV** | **Electromagnetic Radiation** | **(15)** |
| | Potentials of electromagnetic fields, retarded potential, radiation from oscillating dipole, concept of near zone and radiation zone, radiation resistance, role of antenna in exciting different TE, TM modes in wave guides.<br>**Antenna Parameters:** gain, directivity, power, aperture, Friis equation, radiation pattern Application Areas: antenna temperature, Signal to Noise Ratio (SNR), remote sensing, RADAR Equation<br>**Antenna Types:** $\lambda/2$ antenna, antenna arrays, horn antennas, parabolic dish antennas, End fire antenna – Yagi Uda, patch antenna, microstrip antennas EMI and EMC<br>**Generation of Microwaves:** Principle, physical structure and working of - Gunn effect diodes, magnetron oscillator, reflex Klystron oscillator. | |

- **Course Outcomes:** Student should be able to:
  1. Calculate power output and efficiency of microwave tubes
  2. Make use of various microwave devices with proper characteristics
  3. Find Micro strip Lines-characteristics
  4. Measure Microwave parameters.
- **Reference Books:**


  1. Samuel Y. Liao, Microwave Devices and Circuits, PHI, 3rd Edition, 2002.
  2. N. Sadiku, Principles of Electromagnetics, Oxford University Press.
  3. Kraus and Fleiseh, Electromagnetics with Applications, McGraw Hill, 5th Edn, 1999.
  4. Electromagnetics, J.D. Kraus, 4th Edn, McGraw Hill, 1992.

**SEMESTER II**

**DSC: VI MET423: 8-bit Microcontrollers and Applications**

- **Course Objectives:** Students will be able to:
  1. To understand the architecture of 8-bit microcontrollers
  2. To learn software techniques to embed codes into the system.
  3. To learn the advanced architectures for advanced Embedded systems
  4. Student should perform I/O port, timer, counter, and interrupt operations.

| **Credits=4** | **SEMESTER – II**<br>**MET423: 8-bit Microcontrollers and Applications** | **No. of hours per unit/ credits** |
|---|---|---|
| **Credit –I**<br>**UNIT I** | **8-bit Microcontroller Architecture** | **(15)** |
| | Review of 8051 architecture, on chip peripherals of 8051, Introduction to PIC microcontrollers, PIC architecture, Concept of pipelining, RISC, I/O ports, timers/counters and other peripherals, memory mapping, Interrupt structure, Comparison of PIC with other microcontrollers and microprocessors | |
| **Credit –1**<br>**UNIT II** | **Programming and Interfacing** | **(15)** |
| | **Instruction Set:** addressing modes, assembly language programming, Programs for bit manipulation, generation of delay and wave forms. PWM control etc. Hardware interface for LEDs, 7segment display, LCD, Keypad interfacing, dc and stepper motor. | |
| **Credit –1**<br>**UNIT III** | **Introduction to AVR Microcontroller** | **(15)** |
| | Architecture (Atmega16), instruction set, addressing modes, memory organization, timers, PWM, I/O ports, ADC, interrupts, serial communication.<br>**Basic Assembly Programs:** arithmetic, logical, code converter, block data transfer, I/O programming for ADC, timer and I/O ports | |
| **Credit –1**<br>**UNIT IV** | **Applications of AVR Microcontroller** | **(15)** |
| | **Design of General-Purpose Target Board:** reset, oscillator circuit, derivatives of AVR, Real world interfacing with the microcontrollers and programming in C for interfacing LED, Seven Segment Display, dot matrix display and LCD displays (text and graphic), keyboard and motors (DC, stepper, and servo), I2C and SPI based RTC, EEPROM, DAC and ADC | |

- **Course Outcomes:** Student should be able to:
  1. Learn architecture of 8-bit microcontrollers
  2. Able to write programs for any application.

3. Design and test advanced Embedded systems using 8-bit microcontrollers.
4. Able to perform interfacings of various real-world devices Understand measurement and measurement systems.

- **Reference Books:**


1. Chuck Helebuyck, Programming PIC microcontrollers with PIC basic
2. Milan Verle, PIC microcontrollers-programming in basic
3. Kirk Zurell, C Programming for Embedded Systems, Pearson Education.
4. Mazidi and Naimi, AVR Microcontroller and Embedded Systems using Assembly and C, Pearson education, 2011.
5. Barnett, Larry D. O'Cull and Sarah A. Cox, Delmar, Embedded C Programming and the Atmel AVR, Cengage Learning, 2007.
6. Mazidi, Mckinlay and Causey, PIC Microcontroller and Embedded Systems, Pearson Education.
7. Stephen Kochan, Hayden, Programming in C, Books/Macmillan.

**SEMESTER II**

**DSE: III MET425 E-I: HDL and MOS technology**

- **Course Objectives:** Students will be able to:
  1. Understand key ideas behind digital system design.
  2. Design CMOS based circuit design necessary as a foundation of VLSI technology.
  3. Solve problems on Digital Systems and CMOS Design techniques.
  4. Qualify aptitude test being conducted by Industries working on VLSI and Embedded system design.

| **Credits=2** | **SEMESTER – II**<br>**MET425 E-I: HDL and MOS technology** | **No. of hours per unit/ credits** |
|---|---|---|
| **UNIT I** | **HDL for Digital System Design** | **(7)** |
| | VERILOG: design flow, EDA tools, data types, modules and ports, operators, gate- level modeling, data flow modeling, behavioral modelling, tasks and functions, timing and delays, test bench, types of test bench, comparison between VERILOG and VHDL language | |
| **UNIT II** | **HDL Simulation and Synthesis** | **(8)** |
| | HDL Flow, The concept of Simulation, Types of simulation, HDL Simulation and Modeling, Simulation Vs Synthesis result, The Synthesis Concept, Synthesis of high level constructs, Timing Analysis of Logic circuits, Clock Skew, Clock Jitter, Combinatorial Logic Synthesis, State machine synthesis, Efficient coding styles, Partitioning for synthesis, Pipelining, Resource sharing, Optimizing arithmetic expressions, The Simulation and Synthesis Tools, FPGA synthesis and implementation. | |
| **UNIT III** | **Introduction & foundation of MOS technology** | **(8)** |
| | IC fabrication Process, Introduction to Integrated Circuit Technology, Types of IC's, Custom and semicustom designs, standard cell, gate array, FPGA, CPLD and PLDs, FPGA Design Flow, design center and foundry. Moore's law<br>Basic principle of MOS transistor, CMOS logic, Construction of p-MOS and n-MOS, MOS Logic Characteristics, Concept of Feature Size, Comparison between TTL and CMOS Technology, CMOS Series Characteristics, TTL Driving CMOS and CMOS Driving TTL. | |
| **UNIT IV** | **CMOS Based Logic Design** | **(7)** |
| | MOS SPICE model and simulation, CMOS layout: design rules, Transistor layout, CMOS inverter, transfer characteristics, Inverter layout, Noise margins, switching characteristics, Propagation Delay, Power Consumption<br>Logic Design:<br>Designing CMOS Structure for Logic Gates and for given Boolean Equations, CMOS based combinational circuit design for Decoder, | |

| | | |
|---|---|---|
| | Encoder Half Adder and Full Adder.<br>Subsystem design<br>Design styles, design concepts: Hierarchy, Regularity, Modularity, Locality. CMOS Sub system design: Adders, Multipliers. | |

- **Course Outcomes:** Student should be able to:
  1. Understand measurement and measurement systems
  2. Design and constructs logic as well as arithmetical circuits
  3. Calculate various important parameters of Digital logic families
  4. Design & analyze combinational logic and sequential logic circuits
- **Reference Books:**


  1. R. J. Tocci, Digital Systems Principles and Applications, PHI Pvt. Ltd.
  2. N. G. Palan, Digital Electronics, Technova Publications.
  3. John F. Wakerly, Digital Design Principles and Practices Prentice Hall International Edition.
  4. R. Jacob Baker, Layout, and Simulation, Wiley India, 2008
  5. Anantha P. Chandrakasan and Jan M. Rabaey, Digital Integrated Circuits: A design perspective, Prentice Hall publication
  6. Douglas A. Pucknell and Kamran Eshraghian, Basic VLSI Design, Prentice Hall Publication

**SEMESTER II**

**DSE: IV MET424 E-II: Computer Networks**

- **Course Objectives:** Students will be able to:
  1. Learn the principles of Linux operating Systems
  2. Study computer networking topologies
  3. Learn OSI reference model
  4. Study internet address

| **Credits=2** | **SEMESTER – II**<br>**MET424 E-II: Computer Networks** | **No. of hours per unit/ credits** |
|---|---|---|
| **UNIT I** | **UNIX Operating System** | **(8)** |
| | Introduction, applications Unix Shell, Kernel and Application layer, file system features and benefits, File Management in utilities: pwd, cd, ls, cat, mv, ln, rm, rmdir, find, cut and paste etc., Internal file structure, Directory and directories used by Unix system, The Shell: Shell commands, I/O redirection, pipes and filters, pipe fitting, wildcard, matching background processing, shell script shell variables, shell as programming language, Unix vi editor. | |
| **UNIT II** | **Computer Networking** | **(8)** |
| | LAN, Cabling and Topologies: Various transmission media, Twisted and untwisted pairs, coaxial cables, fiber-optic cables and characteristics, wireless LAN, Cabling Topologies: hierarchical, bus, ring, star, collapsed star, mesh. Origin and definition of LAN, types and uses of LAN, LAN components: NIC N/W cables, hubs, and OS, LAN types: MAP, ARCnet, Apple Talk etc., MAN and WAN, repeaters, Bridges, Routers, Gateways, Backbones etc. | |
| **UNIT III** | **The O. S. I. reference model** | **(7)** |
| | N/W architecture, OSI reference model, data transmission, FDM, TDM, circuit switching, message switching, packet switching, hybrid switching, LAN static and dynamic channel allocation, LAN protocols, IEEE standard 802 for LAN, comprises of LAN"s, The Internet: Introduction, Architecture. | |
| **UNIT IV** | **Internet addresses** | **(7)** |
| | Three primary classes of IP addresses, dotted decimal notation, network, broadcast and loopback address. Internet Protocol (IP) – Connectionless Datagram Delivery, Routing, Error and Control Messages. User Datagram Protocol (UDP): Introduction, Format of UDP Messages, UDP encapsulation, UDP port numbers. Transmission Control Protocol (TCP): Reliability of transmission, ports, connections and endpoints, Concept of sliding windows, TCP segment format, Establishing, closing and resetting a TCP connection, TCP port numbers, ATM Network. | |

| | | |
|---|---|---|
| | **Applications:** Remote Login (TELNET), File transfer (FTP), Electronic Mail, (SMTP), Future of TCP/IP – Ipv6 (introduction) | |

- **Course Outcomes:** Student should be able to:
  1. Work with Linux operating System and perform shell scripting
  2. Understand various network topologies and Local area network
  3. Know network architecture and importance OSI reference model
  4. Learn various internet protocols.
- **Reference Books:**


  1. Andrew S. Tanenbaum, Computer Networks, Fourth Edition
  2. Behrouz A Forouzan, TCP/IP Protocol Suite, McGraw-hill
  3. Brian W. Kernighan, Rob Pike, The UNIX Programming Environment, PHI Learning PVT LTD
  4. Pramod Koparkar, UNIX for You, Tata McGraw-Hill

**SEMESTER II**

**RP: MET425 Research Project**

| | | |
|---|---|---|
| **Credits 4** | **MET425: Research Project** | **No. of Hours 120** |

**SEMESTER – II**

**MEP426:**

**Lab III: Electronics Design Lab (Hardware and Software Lab)**

**(Based on MEP421, 422, 423 courses)**

- **Course Objectives:** Students will be able to
  1. Learn the advanced power electronics circuits.
  2. Understand concepts and design of choppers, Inverters and converters
  3. Study standing wave and reflection coefficient of Electromagnetic wave
  4. Study Electromagnetic wave propagation and polarization

| Credits=2 | SEMESTER – II<br>MEP426:<br>Lab III: General Electronics Lab (Hardware and Simulation) Based on MEP421, 422, 423 courses) | No. of hours per unit (60)/ Credits |
|---|---|---|
| | 1) To simulate AC voltage control using PSIM simulator<br>2) To simulate half wave rectifier using PSIM simulator<br>3) To study PCB Designing<br>4) To simulate SCR firing circuit using PSIM simulator<br>5) To study and design series voltage regulator using PSIM software<br>6) To simulate BUCK regulator circuit using PSIM<br>7) To simulate BOOST regulator circuit using PSIM<br>8) TO study and design PCB of IC 555 using PROTEL<br>9) To study DC motor using chopper<br>10) To study the ON/OFF using RTD<br>11) To determine the standing wave ratio and reflection coefficient of a given waveguide<br>12) To determine a characteristic of a microstrip transmission line<br>13) Measurement of primary-secondary coupling factor of a given transformer using LCR meter (calculation of transformer model parameters expected)<br>14) To plot Equipotential contours and field lines for given charge distribution<br>15) Use of Smith chart for transmission line pattern and verify using C<br>16) Study of V-I characteristics of Gunn Diode<br>17) Study of O/P power and freq. as a function of voltage characteristic of Gunn Diode | |

| | | |
|---|---|---|
| | 18) Study of Square wave modulation through PIN diode characteristic of Gunn Diode<br>19) Study of Attenuator<br>20) To study the substitution method for attenuation measurement and determine the attenuation due to a component under test | |

- **Course Outcomes:** Students should be able to
  1. Design and analyse power electronics circuits
  2. Find the Losses in optical fibers
  3. Determine coefficients in waveguides
  4. Plot smith charts for transmission lines
- **Reference Books:**

  1. P. C. Sen, Power Electronics
  2. C. K. Dubey, S. R. Doradla, A. Joshi & R.M. Sinha, Thyristor power Controllers.
  3. Power Electronics – By M. Rashid
  4. S. B. Dewan, G.R. Sleman, A. Strauphan, Power Semiconductor drives- (Wiley Int. Pub.- John Wiley Sons.)
  5. John M., Optical Fiber Communication Senior Pearson
  6. Subir Kumar Sarkar, Optical Fiber & Fiber Optic Communication, S Chands
  7. N. Sadiku, Principles of Electromagnetics, Oxford University Press.
  8. Kraus and Fleiseh, Electromagnetics with Applications, McGraw Hill, 5th Edn, 1999.
  9. J. D. Kraus, Electromagnetics, 4th Edn, McGraw Hill, 1992.

**SEMESTER – II**

**MEP427:**

**Lab IV: Electronics Design Lab (Hardware and Software Lab)**

**(Based on MEP424 courses)**

- **Course Objectives:** Students will be able to

1. Learn different Interfacing using 8-bit microcontrollers
2. Study of HDL simulator and applications

| **Credits=2** | **SEMESTER – II**<br>**MEP427:**<br>**Lab IV: General Electronics Lab (Hardware and Simulation) Based on MEP424 courses)** | **No. of hours per unit (60)/ Credits** |
|---|---|---|
| | 1) Dot matrix rolling display<br>2) Use of timer for time delay generation<br>3) LCD / keyboard Interfacing<br>4) Bidirectional stepper motor interfacing / Stepper motor Interfacing<br>5) DC motor control using PWM / intensity control of LED<br>6) Real Time Clock display on LCD / HyperTerminal (I2C)<br>7) Use of internal EEPROM/ Serial EEPROM / EEPROM interface using SPI protocol<br>8) DAC interfacing (square wave, staircase, triangular, sine) use of timer<br>9) On-off controller with hysteresis (ADC)<br>10) Two-digit frequency counter or event counter using timer / interrupt<br>11) Design All logic gates with HDL<br>12) Design 4 bit binary to gray converter with HDL<br>13) Design Half adder with HDL<br>14) Design Full adder with HDL<br>15) Design 4:1 mux with HDL<br>16) Design 2:4 decoder with HDL<br>17) Design SR, JK flip flop with HDL<br>18) Design D, T flip flop with HDL<br>19) Design 4 bit ring counter with HDL<br>20) Design 4 bit register with HDL | |

- **Course Outcomes:** Students should be able to

1. Design circuits for various applications using microcontrollers.
2. Apply the concepts on real- time applications.

3. To be able to do simple programs to complex programs.
4. Design HDLs for Digital logic circuits

- **Reference Books:**


1. Chuck Helebuyck, Programming PIC microcontrollers with PIC basic.
2. Milan Verle., PIC microcontrollers-programming in basic.
3. Kirk Zurell, C Programming for Embedded Systems, Pearson Education.
4. R. J. Tocci, Digital Systems Principles and Applications, PHI Pvt. Ltd.
5. N. G. Palan, Digital Electronics, Technova Publications.

## EVALUATION STRUCTURE

### Theory

| Assessment Category | Internal Evaluation | | | | | ESE | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|
| | CCE- I | CCE- II | Mid Sem | Activity | Total | | | |
| **Theory Papers of 4 Credits** | 10 | 10 | 10 | 10 | **40** | **60** | **100** | 04 |
| **Theory Papers of 2 Credits** | 05 | 05 | 05 | 05 | **20** | **30** | **50** | 02 |

### Practical

| Assessment Category | Internal Evaluation | ESE | Total | Credits |
|---|---|---|---|---|
| **Practical Papers of 2 Credits** | **Journal/Viva/Activity** | **30** | **50** | 02 |
| | **20** | | | |