

**SCHEME OF INSTRUCTION AND EXAMINATION**  
**4/4 B.E**  
**ELECTRONICS & COMMUNICATION ENGINEERING**

**SEMESTER – I**

S.No.	Syllabus Ref. No.	Subject	Scheme of Instruction		Scheme of Examination			
			Periods per week		Duration in Hours	Maximum Marks		Credits
			L	T/D/P		Univ. Exam	Sessionals	
<b>THEORY</b>								
1	EC 411	Radar Systems	4	-	3	75	25	3
2	EC 412	Data Communications and Computer Networks	4	-	3	75	25	3
3	EC 413	VLSI Design	4	-	3	75	25	3
4	EC 414	Electronic Instrumentation	4	-	3	75	25	3
5	ME 419	Industrial Administration and Financial Management	4	-	3	75	25	3
6	---	Elective -II	4	-	3	75	25	3
<b>PRACTICALS</b>								
7	EC 415	Electronic Design and Automation Lab	-	3	3	50	25	2
8	EC 416	Advanced Simulation Lab		3	3	50	25	2
9	EC 417	Project Seminar	-	3	3	--	25	1
		<b>Total</b>	<b>24</b>	<b>9</b>	<b>27</b>	<b>550</b>	<b>225</b>	<b>23</b>

L: Lecture, T: Tutorial, D: Drawing, P: Practical

S.No.	CODE	ELECTIVE – II
1	EC 461	Advances in Microwave Engineering
2	EC 462	Embedded Systems
3	EC 463	Neural Networks and Fuzzy Logic
4	EC 464	Satellite Communication
5	EC 465	DSP Processors Architectures
6	EC 466	Speech processing

**RADAR SYSTEMS**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. To learn the principles of operation of radar systems.
2. Be able to design and simulate radar systems.
3. Be able to know the various types of tracking radars.
4. Be able to understand various types of radar clutters.
5. Be able to know the various types of radar displays.

**Course Outcomes:**

Student will be able to:

1. Understand the principles of operation of pulse radar system.
2. Know the applications of CW and FMCW radar.
3. Understand the working principle of MTI and Pulse Doppler Radar and matched filter concepts.
4. Get familiarization of various radar clutters and Phased array antennas.
5. Compare various tracking radars along with their advantages and disadvantages.
6. Understand various radar displays and radar receiver.

**UNIT-I**

Introduction to radar, radar block diagram and operation, radar frequencies, Applications of radar, Prediction of range performance, minimum detectable signal, receiver noise, probability density function, SNR, Integration of radar pulses, radar cross-section of targets, PRF and range ambiguities, transmitter power, system losses.

**UNIT-II**

Doppler effect, CW radar, FM CW radar, multiple frequency CW radar. MTI radar, delay line canceller, range gated MTI radar, blind speeds, staggered PRF, limitations to the performance of MTI radar, non-coherent MTI radar.

**UNIT-III**

Tracking radar: sequential lobing, conical scan, monopulse: amplitude comparison and phase comparison methods, Low angle tracking, tracking in range, comparison of various trackers, Radar antennas.

#### **UNIT-IV**

Radar Clutter: Introduction to radar clutter, surface clutter radar equation, Land clutter, Sea clutter, statistical models for surface clutter, detection of targets in clutter, Phased array Antennas.

#### **UNIT-V**

Radar receiver: The radar receiver, receiver noise figure, Super heterodyne receiver, importance of Matched filter, Duplexers and receiver protectors, Radar Displays.

#### **Text Books:**

1. Merrill I. Skolnik, "Introduction to Radar Systems", 2/e, MGH, 2001.
2. Mark A. Richards, James A. Scheer and William A. Holm, "Principles of Modern Radar: Basic Principles," YesDee Publishing Pvt. Ltd., India, 2012.

#### **Suggested Reading:**

1. Byron Edde, "Radar: Principles, Technology, Applications", Pearson, 2008
2. G.S.N Raju, "Radar Engineering And Fundamentals Of Navigational Aids", I.K. International publishing house Pvt. Ltd., 2010.

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. To provide a conceptual foundation for the study of data communications using the open Systems interconnect (OSI) model for layered architecture.
2. To study the principles of network protocols and internetworking
3. To understand the Network security and Internet applications.
4. To understand the concepts of switched communication networks.
5. To understand the performance of data link layer protocols for error and flow control.
6. To understand various routing protocols.

**Course Outcomes:**

After completing this course the students will be able to:

1. Identify different tasks of computer communications networks and protocol architectures.
2. Analyze and compare circuit switching and packet switching concepts and understands ATM network concepts.
3. Analyze the performance of various Data link control protocols for flow control and error control.
4. Analyze the services and functions of the networks layer and recognize the different internetworking devices and their functions.
5. Understand how routing is carried out in large open networking environment and the operations of major internet routing protocols such as ICMP, ARP, OSPF and BGP.
6. Understand the importance of basic network security measures such as encryption, Authentication protocols and study standard Internet applications protocols.

**UNIT-I****Introduction:**

Data Communications and Networking for Today's Enterprise, A Communications Model, Data Communications, Networks. The Need for Protocol Architecture and Standardization, the TCP/IP Protocol Architecture, the OSI reference Model, Line Configurations. Basic concepts of networking. Network topologies. Types of Network: LAN, MAN, WAN.

## UNIT-II

**Switched Communications Networks:** Circuit-Switching Networks, Circuit-Switching Concepts Soft switch Architecture, Packet-Switching Principles, X.25, Frame relay. ATM Networks-Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, and ATM Service Categories.

## UNIT-III

**Data Link layer:** Design issues, Services provided to the Network layer, framing, Error Control, Flow Control. Elementary Data Link Control Protocols: Stop and Wait, Sliding Window, Go Back-N, Selective Repeat. High-Level Data Link Control (HDLC).

MAC Sub Layer: Multiple Access Protocols: ALOHA, CSMA, Comparison of IEEE Standards IEEE 802.3, 802.4, 802.11, 802.15, 802.16.

## UNIT-IV

**Network Layer:** Network Layer Design Issues, Routing algorithms: Shortest Path Routing, Flooding, Distance Vector Routing, Hierarchical routing, Broadcast, Multicast, Congestion Control- Congestion Control Algorithms. Quality of service. Internet Working. The Network Layer in Internet-IP Version 4 protocol, IP Addressing, Comparison of IPV4 and IP V6, Internet Control Protocols-ICMP, ARP, OSPF and BGP.

## UNIT-V

**Transport Protocols:** The transport Service, Elements of Transport Layer, TCP and UDP protocol header formats.

**Network Security and Internet Applications:** Cryptography techniques, Authentication Protocols. Applications layer protocols: Domain Name System, SNMP, Electronic Mail, and World Wide Web.

### Textbooks:

1. W. Stallings, "Data and Computer Communications", eight Edition, Prentice Hall -2007
2. A. Tanenbaum and D. Wetherall, "Computer Networks", fifth Edition, Prentice-Hall, 2011.

### Suggested Reading:

1. Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition. McGraw-Hill Forouzan Networking Series, McGraw-Hill, 2007
2. S. Keshav, "An Engineering Approach to Computer Networks", Second Edition, Addison-Wesley Professional Pearson Education, 2001

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. To study the basic concepts of verilog HDL.
2. To learn the various abstraction levels in verilog HDL.
3. To understand simulation and synthesis process/concepts.
4. To learn the various characteristics of MOS transistor.
5. To learn the various concepts required to obtain the digital logic layout diagrams.
6. To learn various subsystem design concepts.

**Course Outcomes:**

The student will be able to

1. Design and simulate various combinational and sequential logic circuits using verilog HDL
2. To simulate and synthesize digital logic designs.
3. Understand characteristic behaviour of MOSFET and layout design rules.
4. Design CMOS based logic circuits.
5. Understand the design concepts of memories.
6. Understand the concepts of VLSI testing.

**UNIT - I**

Introduction to HDLs, Basic Concepts of Verilog, Data Types, System Tasks and Compiler Directives. Gate Level Modeling: Gate Types and Gate Delays. Dataflow Modeling: Continuous Assignment and Delays. Design of Stimulus Block.

**UNIT - II**

Behavioural Modeling: Structured Procedures, Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks. Switch level Modeling.UDP. Design of Mealy and Moore state models using Verilog. Logic Synthesis, Synthesis Design flow, Gate level Netlist.

**UNIT - III**

Introduction to MOS Technology, Basic MOS Transistor action: Enhancement and Depletion Modes. Basic electrical properties of MOS. Threshold voltage and Body Effect. MOS and CMOS circuit Design Process: MOS Layers, Stick diagrams, Lambda based Design rules and Layout diagrams.

## **UNIT – IV**

Design of MOS inverters with different loads. Basic Logic Gates with CMOS: INVERTER, NAND, NOR, AOI and OAI gates. Transmission gate logic circuits, BiCMOS inverter, D flip flop using Transmission gates.

## **UNIT - V**

Subsystem Design: Multiplexor, Comparator, Shifters, Programmable Logic Arrays.

Memories: Design of Dynamic Register Element, 3T, 1T Dynamic RAM Cell, 6T Static RAM Cell. NOR and NAND based ROM Memory Design.

Testing: Introduction to Testing, Fault models, Controllability, Observability.

### **Text Books:**

1. Samir Palnitkar, “Verilog HDL: A guide to Digital design and synthesis”, 2/e , Pearson Education, 2008.
2. Kamran Eshraghian, Douglas A. Pucknell, Sholeh Eshraghian, “Essentials of VLSI circuits and systems”, PHI, 2011.
3. Neil H E Weste, David Harris, Ayan Banerjee “CMOC VLSI Design –A circuit and System Perspective”, 3/e, Pearson Education, 2006.

### **Suggested Reading:**

1. Michael D. Ciletti, “Advanced Digital Design with Verilog HDL”, PHI, 2005.
2. John P. Uyemura, “Introduction to VLSI Circuits and systems”, John Wiley & Sons, 2011.

**ELECTRONIC INSTRUMENTATION**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. To impart a basic knowledge of International Standards for various physical quantities
2. To provide a basic understanding of measurement systems and an in-depth understanding of measurement errors.
3. To expose the students to the many varieties of transducers and measuring instruments, their operating principles, construction.
4. To provide an idea of the strengths and weaknesses of various types of sensors and transducers
5. To introduce students to various types of spectrum analyzers, virtual instrumentation techniques and their applications
6. To provide the students a basic exposure to some of the prominent bio-medical instrumentation systems

**Course Outcomes:**

Students will be able to:

1. Perform accurate measurements for any engineering system with clear idea of the potential errors
2. Know several important standards related to measurements and quality management
3. Select the appropriate passive or active transducers for measurement of physical phenomenon
4. Understand the operating principles of various types of transducers used to measure temperature, displacement, and other physical quantities.
5. Use instruments like spectrum analyzer, DSO and other virtual instrumentation techniques for appropriate measurements.
6. Understand the fundamentals of various Biomedical instrumentation systems

**UNIT– I**

Accuracy, Precision, Resolution and Sensitivity. Errors and their types. Calibration. Standards of measurement, classification of standards, IEEE standards, Elements of ISO 9001, Quality management standards.

**UNIT – II**

Classification of transducers, factors for selection of a transducer, transducers for measurement of velocity, force, Hot wire anemometer. Passive electrical transducers- Strain gauges - gauge



factor types of strain gauges: rosettes, semiconductor strain gauges and strain measurement, LVDT-construction and displacement measurement, capacitive transducer and thickness measurement. Active electrical transducers: Piezo-electric, photo-conductive, photo-voltaic and photo-emissive transducers.

### **UNIT – III**

Characteristics of sound, pressure, power and intensity levels. Microphones and their types. Temperature measurement, resistance wire thermometers, semiconductor thermometers and thermocouples. Humidity measurement, resistive capacitive, aluminum oxide and crystal Hygrometer types. Introduction to Micro-Electro-Mechanical Systems (MEMS).

### **UNIT – IV**

Block diagram, specification and design considerations of different types of DVMs. Spectrum analyzers. Delayed time base oscilloscope, Digital storage oscilloscope. Introduction to Virtual Instrumentation, SCADA. Data Acquisition System- block diagram

### **UNIT – V**

Human physiological systems and related concepts. Bio-potential electrodes Bio-potential recorders - ECG, EEG, EMG and CT scanners, magnetic resonance and imaging systems, Ultrasonic Imaging systems.

### **Text Books:**

1. Albert D. Helfric, and William D. Cooper, “Modern Electronic Instrumentation and Measurement Techniques”, PHI, 2010.
2. H S Kalsi, “Electronic Instrumentation”, 3/e, TMH, 2011.
3. Nakra B.C, and Chaudhry K.K., “Instrumentation, Measurement and Analysis”, TMH, 2004

### **Suggested Readings:**

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 2nd Edition, 2003.
2. Khandpur. R.S., “Handbook of Bio-Medical Instrumentation”, TMH, 2003.
3. Biomedical Instrumentation and Measurements – Leslie Cromwell and F.J. Weibell, E.A. Pfeiffer, PHI, 2nd Ed, 1980.

## ME 419

### INDUSTRIAL ADMINISTRATION AND FINANCIAL MANAGEMENT

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

#### Objectives:

1. To make the students understand the roll importance and functions of Management in Industrial Organization
2. To make the students understand various types of business organizations and organization structures.
3. To make the students understand importance of plant location and plant layout
4. To ensure that the students understand the importance of industrial engineering students like method study and work measurement.
5. To make the students understand the importance of project management techniques
6. To make the students calculate the total cost of a product based on elements of cost

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

1. Understand the role and importance of management and its principles.
2. Understand the need and importance of various types of layouts used in manufacturing industries
3. Apply the techniques of method study and work measurement in industry to enhance productivity
4. Apply the techniques of project management in industry
5. Understand the importance of quality control and plot the control charts
6. Calculate the total cost of the product based on its elements.

#### UNIT-I

**Industrial Organization:** Definition of an organization, types of various business organizations, organization structures and their relative merits and demerits, functions of management.

**Plant location and layouts:** Factors affecting the location of plant and layout, types of layouts and their merits and demerits.

#### UNIT-II

**Work study:** Definitions, objectives of method study and time study, steps in conducting method study, symbols and charts used in method study, principles of motion economy,

calculation of standard time by time study and work sampling, performance rating factor, types of ratings, jobs evaluation and performance appraisal, wages, incentives, bonus, wage payment plans

### **UNIT-III**

**Inspection and quality control:** Types and objectives of inspection, S.Q.C., its principles. Quality control chart and sampling plans, quality circles, introduction to ISO.

**Production planning and control:** Types of manufacture, types of production, principles of PPC and its function, production control charts.

### **UNIT-IV**

**Optimization:** Introduction to linear programming and graphical solutions, assignment problems.

**Project Management:** Introduction to CPM and PERT, determination of critical path.

**Material Management:** Classification of materials, materials planning, duties of purchase manager, determination of economic ordering quantities, types of materials purchase.

### **UNIT-V**

**Cost accounting:** Elements of cost, various costs, types of overheads, break even analysis and its applications, depreciation, methods of calculating depreciation fund, nature of financial management, time value of money, techniques of capital budgeting and methods, cost of capital, financial leverage.

#### **Text Books:**

1. Pandey I.M. , Elements of Financial Management, Vikas Publ. House, New Delhi, 1994
2. James C Van Horne, John M Wachowicz, Jr., “Fundamentals of Financial Management”, 13th edition, Prentice Hall Financial Times.
3. Khanna O.P., Industrial Engineering and Management, Dhanapat Rai & Sons

#### **Suggested Reading:**

1. S.N. Chary, Production and Operations Management, Tata McGraw Hill, 3rd Edition, 2006.
2. Paneer Selvam, Production and Operations Management, Pearson Education, 2007.
3. Joseph Monk, Operations Management, TMH Publishers, New Delhi, 2004.
4. Buffa Elwood S, Modern Production /Operations Management , John Wiley Publishers, Singapore, 2002
5. Everrete E. Adama & Ronald J. Ebert, Production & Operations Management, Prentice Hall of India, 5th Edition, 2005.
6. S.D. Sharma, “Operations Research”, Kedarnath, Ramnath & Co., Meerut,2009

**EC 415**

**ELECTRONIC DESIGN AND AUTOMATION LAB**

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

**Course Objectives:**

1. To simulate and synthesize combinational logic circuits
2. To simulate and synthesize sequential logic circuits
3. To obtain RTL schematic
4. To simulate switch level modules
5. To learn implement procedure for any design on FPGA
6. To study the speed, power and area constraints of FPGA/CPLD

**Course Outcomes:**

The student will be able to

1. Simulate and synthesize combinational logic circuits
2. Simulate and synthesize sequential logic circuits
3. Obtain gate level net-list and RTL diagrams
4. Implement sequence detector using FSM on FPGA
5. Implement mini projects on FPGA/CPLD
6. Design adder using UDP

**Part A**

Write the Code using VERILOG, Simulate and synthesize the following

1. Arithmetic Units: Adders and Subtractors.
2. Multiplexers and De-multiplexers.
3. Encoders, Decoders, Priority Encoder and Comparator.
4. Implementation of logic function using Multiplexers and Decoders.
5. Arithmetic and Logic Unit with minimum of eight instructions.
6. Flip-Flops.
7. Registers/Counters.
8. Sequence Detector using Mealy and Moore type state machines.
9. Implementation of any application of UDP.

**Note:-**

1. All the codes should be implemented appropriately using Gate level, Dataflow and Behavioral Modeling.
2. All the programs should be simulated using test benches.
3. Minimum of two experiments to be implemented on FPGA/CPLD boards.

**Part B**

Switch Level modeling of CMOS circuits

1. Basic Logic Gates: Inverter, NAND and NOR.
2. Half Adder and Half Subtractor.
3. 4:1 Multiplexer.
4. 2:4 Decoder.
5. Design of any basic circuit using CADENCE tool.

**Mini project:**

- i) Design a 8-bit CPU.
- ii) Generation of different waveforms using DAC.
- iii) RTL code for Booth's algorithm for signed binary number multiplication.
- iv) Development of HDL code for MAC unit and realization of FIR Filter.
- v) Design of 4-bit thermometer to Binary Code Converter.

**ADVANCED SIMULATION LAB**

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

**LAB EXPERIMENTS**

1. Familiarization with simulation tools like LabVIEW and Network Simulator2 (NS2)
2. Working with loops, Structures and Mathsceipts
3. (a) Combinational circuits(Adders , Substractors , Mux , Demux, Decoder and Encoder)  
(b) Sequential circuits (Flip flops, counters and registers)
4. (a) Convolution and correlation of signals  
(b) Filters (FIR and IIR)
5. (a) Analog modulation and demodulation schemes(AM and FM)  
(b) Digital carrier modulation and demodulation schemes (ASK and FSK)
6. (a) Time domain analysis (State variable analysis)  
(b) Frequency domain analysis (Nquist and Bode plots)
7. Study of basic features and functions of RTOS (VxWorks)
8. VxWorks Task function programming
9. VxWorks Timer programming
10. VxWorks IPC Programming-I
  - (a) Signals
  - (b) Semaphores
11. VxWorks IPC Programming-II
  - (a) Message Queques
  - (b) Mail boxes
12. Creation of a network with at least four nodes.
13. Transmission between the nodes in a network.
14. Simulation of the data transfer between the nodes using TCP

### **Mini Project cum Design Exercise(s).**

Design and development of any one of the following applications.

- (a) Digital IIR Notch filter
- (b) Multistage design of decimator and interpolator
- (c) Discrete multitone transmitter and receiver
- (d) ALU
- (e) Universal shift registers
- (f) Code converters
- (g) PLL
- (h) Implementation of the Real time scheduling algorithms

**EC 417**

## **PROJECT SEMINAR**

Instruction	3L Periods per week
Sessionals	25 Marks
Credits	1

The objective of the project seminar is to actively involve the student in the initial work required to undertake the final year project. Dealing with a real time problem should be the focus of the under graduate project.

It may comprise of

- Problem definition and specifications.
- A broad understanding of the available techniques to solve a problem of interest.
- Presentation (Oral & written) of the project.

The department should appoint a project coordinator who will coordinate the following.

- Grouping of students as project batch( a maximum of 3 in group )
- Allotment of projects and project guides
- Project monitoring at regular intervals.

Each project group/batch is required to

1. Submit a one page synopsis of the seminar to be delivered for display on notice board.
2. Give a 30-40 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write up on the talk delivered.

Three (3) teachers will be associated with the evaluation of the project seminar for the award of the sessional marks which should be on the basis of performance on all the three items stated above.



**EC 461**

**ADVANCES IN MICROWAVE ENGINEERING  
(Elective-II)**

Instruction	4 periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To prepare students to understand the impedance matching with reactive elements.
2. To understand strip lines and microwave integrated circuits.
3. To understand advanced microwave amplifiers, oscillators and boundary values.
4. To understand the concept of microwave filters.
5. To understand the various microwave matching elements.
6. To understand the basis and test functions.

Course Outcomes: The students will be able to

1. Understand fabrication of passive components and analysis of couplers and MIC's.
2. Analysis of couplers.
3. Familiar with impedance matching techniques.
4. Design single stage amplifiers.
5. Design microwave filters using two methods.
6. Understand analysis methods at microwave frequencies.

**Unit-I**

Microwave integrated circuits-Introduction, circuit forms, Transmission lines for MICs, materials, fabrication, hybrid MIC's, lumped inductor, capacitor and resistor, advantages and difficulties with MIC's.

Strip line, Geometry of enclosed strip line, Microstrip lines- field configuration, losses in lines, quality factor. Coupled line directional couplers, branch line couplers, TEM directional couplers.

**Unit-II**

Impedance Matching with Reactive Elements: Single stub, double stub and triple stub, waveguide reactive elements, quarter wave transformers, theory of small reflections, approximate theory of multisection quarter, wave transformers, binomial and chebyshev transformers, tapered transmission lines.

### **Unit-III**

Design of microwave amplifiers and oscillators - Characteristics of microwave transistor, microwave bipolar transistor, gain and stability, single stage transistor amplifier design , transistor oscillator, Parametric amplifiers.

### **Unit-IV**

Microwave Filters: Introduction of Microwave Filters, Image parameter method of filter design, Filter design by Insertion loss method, specification of power loss ratio.

### **Unit-V**

Techniques for solving EM boundary value problems ( elementary treatment only) – Full wave analysis, frequency and time domain analysis, differential and integral equation method, method of moments(MOM), choice of basis and test functions.

#### **Text Books:**

1. David M. Pozar, “Microwave Engineering”, 4/e, Wiley student edition, 2012.
2. Ramesh Garg, Prakash Bhartia, Inder Bahl and Apisak Ittipiboon, “ Microstrip Antenna Design Hand Book”, Chapter 2, Artech House 2001.

#### **Suggested Reading:**

1. R.E. Collins, “Foundations for Microwave Engineering”, 2/e, John Wiley & Sons, 2003.
2. Om.P. Gandhi, “Microwave Engineering and Applications”, Maxwell Macmillan International editions,1991.
3. Constantine A. Balanis, "Antenna Theory: Analysis and Design", 4th Edition, Wiley, January 2016.

**EMBEDDED SYSTEMS****(Elective - II)**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. To learn about fundamentals of the embedded system design
2. To understand the hardware and software details of the embedded systems.
3. To acquire knowledge on the serial, parallel and network communication protocols.
4. To understand the embedded system design life cycle and co-design issues.
5. To learn about the various embedded software development tools.
6. To design the embedded system for various applications.

**Course Outcomes:**

Student will be able to

1. Know the fundamentals of the embedded systems
2. Know the hardware and software details of the embedded systems.
3. Interface serial, parallel and network communication protocols to embedded systems
4. Know the embedded system design life cycle and co-design issues.
5. Analyze the various embedded system applications
6. Develop the various embedded system applications

**UNIT – I**

Introduction To Embedded Systems: Embedded systems Vs General Computing Systems, History of embedded systems, classifications, applications areas, characteristics and quality attributes of embedded systems, Design metrics and challenges in embedded system design.

**UNIT – II**

Embedded Hardware and Software: Processor embedded into a system, Processor selection for embedded system, embedded hardware units and devices in a system, embedded software in a system and an overview of programming languages, challenges and issues related to embedded software development.

**UNIT – III**

Communication protocols: I<sup>2</sup>C, CAN, USB, Firewire-IEEE 1394 Bus standard, Advanced serial high speed buses. Parallel Bus device protocols: ISA, PCI, PCI-X , ARM Bus, Advanced parallel high speed buses. Internet Enabled Systems-Network protocols: HTTP, TCP/IP, Ethernet. Wireless and mobile system protocols

#### **UNIT – IV**

Embedded System design and co-design issues in system development process, Design cycle in the development phase for an Embedded Systems. Embedded software development tools: Host and Target Machines, Linker/Locators for embedded software, Embedded Software into the Target system. Issues in hardware and software design and co-design

#### **UNIT – V**

Integration and testing of embedded hardware, testing methods, debugging techniques, Laboratory tools and target hardware debugging: Logic Analyzer, simulator, emulator and In-circuit emulator, IDE, RTOS Characteristics, Case Study: Embedded Systems design for automatic vending machines and digital camera.

#### **Text Books:**

1. Raj Kamal, “Embedded Systems-Architecture, Programming and Design,” 3/e, Tata McGraw Hill Education, 2015.
2. Shibu K V, “Introduction to Embedded systems”, 1/e, McGraw Hill Education, 2009.
3. Frank Vahid and Tony Givargis, "Embedded System Design: A Unified Hardware/Software Approach, 1999.

#### **Suggested Reading:**

1. David E.Simon, “An Embedded software primer”, Pearson Education, 2004.
2. Embedded System Design : A Unified Hardware/ Software Introduction, 1/e, Wiley, John & Sons.

**NEURAL NETWORKS AND FUZZY LOGIC****(Elective-II)**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. To introduce different architectures of neural network.
2. Appreciate some of the models describing neural networks.
3. Familiarize with some Application of Neural Networks.
4. Deriving basic concepts of fuzzy logic in systems.
5. Modeling of systems using fuzzy logic and fuzzy operators.
6. Implementation of Fuzzy Logic Controllers and to explore the use of neuro fuzzy controllers.

**Course Outcomes:**

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

1. Comprehend the concepts of feed forward neural networks.
2. Analyze the various feedback networks and neural controllers.
3. Appreciate the concept of fuzziness involved in various systems and fuzzy set theory.
4. Comprehend the Fuzzy logic control and adaptive fuzzy logic.
5. Have a broad knowledge in developing the different algorithms for neural networks.
6. Analyze the application of neuro fuzzy logic control to real time systems.

**UNIT-I****Introduction to Artificial Neural Networks and Concepts**

Neuron physiology, Neuronal Diversity, specifications of the Brain, Neural Attributes, Modeling, Basic Model of a Neuron, Learning in Artificial Neural Networks, Characteristics of ANNs, Important ANN Parameters, Artificial Neural Network Topologies, Learning Algorithms, Discrimination Ability.

**UNIT-II****Neural Network Paradigms**

Mcculloch-Pitts Model, The Perceptron, ADALINE and MADALINE Models, Back propagation learning Algorithm, cerebellum Model Articulation Controllers(CMAC), Adaptive Resonance Theory(ART) Paradigm, Hopfield Model, LAM, Real-Time Models, LVQ, SOM

### **UNIT-III**

#### **Fuzzy Logic**

Propagation logic, The Membership Function, Fuzzy Logic, Fuzzy Rule Generation, Defuzzification of Fuzzy Logic, Time -dependent Fuzzy Logic, Temporary Fuzzy Logic (TFL), Applying Temporal Fuzzy Operators, Defuzzification of Temporal Fuzzy Logic, Examples: Applicability of TFL in Communications Systems.

### **UNIT-IV**

#### **Fuzzy Neural Networks**

Fuzzy Artificial Neural Networks (FANN), Fuzzy Neural Example: Neuro-Fuzzy control, Fuzzy Neural Nets-A Reality.

### **UNIT-V**

#### **Applications Of FLC**

Signal Processing, Image Data Processing, Communications Systems, Intelligent Control, Optimization Techniques, Other Applications.

#### **Text books:**

1. Stamatios V.Kartalopoulos," Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications", Wiley IEEE Press, New Delhi, 2004.
2. Kosko. B, "Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence", PHI, New Delhi, 2008.

#### **Suggested Reading:**

1. Simon Haykin,"Neural Networks: A Compressive Foundation", Pearson,New Delhi, 2005.
2. J.S.R.Jang, C.T.Sun, E.Mizutani,"Neuro-Fuzzy and Softcomputing": A Computational approach to learning and machine intelligence, PHI, New Delhi, 2012.

**EC 464**

**SATELLITE COMMUNICATION  
(Elective - II)**

Instruction	4L	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessionals	25	Marks
Credits	3	

**Course objectives:**

1. To develop awareness about satellite communication system architecture and satellite orbits.
2. To acquire the knowledge about orbital effects and mechanics of launching a satellite.
3. Study of various satellite subsystems.
4. To design a satellite link considering different parameters like noise and losses.
5. To familiarize with the satellite applications.

**Course outcomes:**

Student will be able to:

1. Understand the development history and applications of satellite systems
2. Know the orbital effects and mechanics of launching a satellite would be understood by the student.
3. Analyze the various Satellite subsystems.
4. Understand the role and importance of a satellite transponder.
5. Analyze the link budget of a satellite link for specified C/N ratios.
6. Know the applications of satellite like VSAT and DBS.

**UNIT-I**

**Introduction of satellite communications**

Brief history of satellite communications, Block diagram of earth segment and space segment, Brief introduction of Indian scenario in communication satellites.

**Orbital aspects of Satellite Communication**

Introduction to geo-synchronous and geo-stationary satellites, Kepler's laws (statements and explanation only), applications of satellite communications.

**UNIT-II**

**Orbital Mechanics and Launchers**

Orbital elements, Locating the satellite with respect to the earth, sub-satellite point, look angles, Orbital effects in communication system performance, Orbital perturbations, mechanics of launching a synchronous satellite.

### **UNIT-III**

#### **Satellite sub-systems**

Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system, Communications subsystems (transponders), Space craft antennas, multiple access techniques, comparison of FDMA, TDMA, CDMA.

### **UNIT-IV**

Introduction to satellite link design, considerations for design of satellite system, basic transmission theory, system noise temperature and G/T ratio, design of down link and uplink, design of satellite links for specified C/N, overall C/N for uplink and downlink.

### **UNIT-V**

#### **Introduction to Direct Broadcast Satellite Television**

C band and Ku band home satellite TV, Block diagram of Digital DBS TV Overview of VSAT systems, VSAT network architecture, One way and two way implementation.

#### **Text Books**

1. Timothy Pratt and Charles W Bostian, Jeremy E. Allnutt, "Satellite Communications", 2e, John Wiley, 1986.
2. Dennis Roddy "Satellite Communications", Fourth edition", Mc Graw Hill, 2006.

#### **Suggested Reading:**

1. 1. M. Richharia, "Satellite Communication Systems: Design Principles", Mc Graw Hill, 2/e, 2003.



EC 465

**DSP PROCESSORS ARCHITECTURES**  
**(Elective - II)**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Prerequisite:** Course on Digital Signal Processing.

**Course Objectives:**

1. To learn the architectural differences between DSP and General purpose processor.
2. To study the fixed point and floating point DSP Processors.
3. To study the various application of DSP Processors.

**Course Outcomes:**

Student will able to

1. Differentiate between DSP Processor and General Purpose processor.
2. Implement various number formats on DSP processors.
3. Understand the various parallel processing architectures.
4. Interface the TMS320C54XX architecture to peripherals.
5. Interface the TMS320C67XX architecture to peripherals.
6. Design and implement various signal processing algorithms on DSP processors.

**UNIT- I**

**Introduction to DSP Processors**

Differences between DSP and other micro processor architectures.

Number formats- Fixed point, Floating point and block Floating point formats, IEEE-754 Floating point, Dynamic range and precision, Relation between data word size and instruction word size, Q-notation.

**UNIT-II**

**Fundamentals of Programmable DSPs**

Multiplier and Multiplier Accumulator, Modified Bus structures and memory access in PDSPs – Multiple access memory, multiport memory, SIMD, VLIW Architectures, Pipelining, Special addressing modes in PDSPs, On-chip peripherals.

**UNIT-III**

**Overview of TMS320C54XX**

Types of Fixed point DSPs, Architecture of TMS320C54XX Processor, addressing modes, Instructions set, Pipelining and on-chip peripherals.

## **UNIT-IV**

### **Overview of TMS320C67XX**

Types of Floating point DSPs, Architecture of TMS320C67XX Processor, addressing modes, Instructions set, Pipelining and on-chip peripherals.

## **UNIT-V**

### **Applications of DSP Processor**

Implementation of algorithms on DSP processors - convolution, correlation, FFT, FIR filter, IIR filter, Decimation and Interpolation and subband coding of signals.

### **Text Books:**

1. Avatar Singh and S. Srinivasan, "Digital Signal Processing Implementations Using DSP Microprocessors", Thomson Brooks, 2012.
2. B. Ventakaramani, M. Bhaskar, "Digital Signal Processors Architecture Programming and Applications", Tata Mc Graw Hill, 2006.

### **Suggested Readings:**

1. Sen M. Kuo & WoonSergGan, "Digital Signal Processors Architectures, Implementation and Application", Pearson Practice Hall, 2013.
2. RulphChassaing, "Digital Signal Processing and Application with the C6713 and C6416 DSK", A John Wiley & sons, Inc, Publication, 2005.

**SPEECH PROCESSING****(Elective - II)**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. To provide students with the knowledge of basic characteristics of speech signal in relation to production and hearing of speech by humans.
2. To describe basic algorithms of speech analysis and pitch extraction.
3. To give an overview of applications like text to speech conversion.
4. To give an idea of coding and decoding applications in speech signal processing.
5. To learn the various algorithms for speech recognition like HMM and Dynamic warping.

**Course Outcomes:**

Student will be able to:

1. Understand the basic characteristics of speech signal in relation to production and hearing of speech by humans.
2. Know the basic algorithms of speech analysis.
3. Analyze speech and extract features for speech applications.
4. Design the various applications like recognition, synthesis, and coding of speech.
5. Use HMM for speech recognition.
6. Implement Dynamic warping technique in real time problems.

**UNIT – I**

Fundamentals of Digital speech processing: Discrete time signals and systems, Transform representation of signals and systems ( Z-transform, FT and DFT), fundamentals of digital filters (IIR and FIR), Sampling theorem. Decimation and interpolation of sampled waveforms, Mechanism of speech production.

**UNIT - II**

Time domain models of speech processing: Time dependent processing of speech, Short –time Energy and average magnitude, short time average Zero crossing rate, Speech Vs Silence Discrimination using Energy and Zero crossing, Pitch period estimation, short time auto correlation estimation, Short time average magnitude difference function, pitch period estimation, median smoothing and speech processing.

### **UNIT – III**

Digital representation of the speech waveform: Sampling speech signals, review of statistical model of speech signal, Instantaneous Quantization, Adaptive Quantization, Differential quantization, Delta modulation, Differential PCM, Comparison of systems, LDM to PCM conversion and PCM to ADPCM conversion.

### **UNIT-IV**

Homomorphic speech processing: Introduction, Homomorphic systems for convolution - properties of the complex Cepstrum, computational considerations, complex cepstrum of speech, Pitch detection, Formant estimation, The homomorphic Vocoder. Introduction to Text-to-speech and Articulator speech synthesis.

### **UNIT-V**

Basic principle of Linear predictive Analysis, Solution of the LPC equations, Comparisons between the methods of the solutions of LPC Analysis equations, Frequency Domain interpretation of LPA, Applications of the LPC parameters Speaker recognition systems, Problems in Automatic speech recognition, Dynamic warping, Hidden Markov models, speaker Identification / verification.

### **Text Books**

1. Rabiner L.R and Schafer R .W, “Digital Processing of Speech Signals”, PHI, 1978.
2. Owens F.J., “Signal Processing of Speech”, Macmillan, New Electronics, 1/e, 2000.

### **Suggested Reading:**

1. Daniel Jurefsky & James H. Martin, “Speech and Language Processing”, PHI, 2/e, 2003.
2. Papamchalis, “Practical Approaches to speech coding”, PHI, 1987.

**SCHEME OF INSTRUCTION AND EXAMINATION**  
**4/4 B.E.**  
**ELECTRONICS & COMMUNICATION ENGINEERING**  
**SEMESTER – II**

S.No.	Syllabus Ref. No.	Subject	Scheme of Instruction		Scheme of Examination			
			Periods per week		Duration in Hours	Maximum Marks		Credits
			L	T/D/P		Univ. Exam	Sessionals	
<b>THEORY</b>								
1	EC 421	GPS and Augmentation systems	4	-	3	75	25	3
2	EC	Elective -III	4	-	3	75	25	3
3	--	Open Elective	4	-	3	75	25	3
<b>PRACTICALS</b>								
4	EC 422	Seminar	-	3	-	-	25	1
5	EC 901	Project	-	6	Viva	100	50	9
<b>Total</b>			<b>12</b>	<b>9</b>	<b>9</b>	<b>225</b>	<b>150</b>	<b>19</b>

L: Lecture, T: Tutorial, D: Drawing, P: Practical

S.No.	CODE	ELECTIVE – III	S.No.	CODE	Open Electives
1	EC 471	Design of Fault Tolerant Systems	1	CS 486	JAVA Programming
2	EC 472	Real Time Operating System	2	ME 464	Entrepreneurship
3	EC 473	Elements of Software Defined Radio	3	CE 422	Disaster Mitigation and Management
4	EC 474	Wireless Sensor Networks	4	ME 472	Intellectual Property Rights
5	EC 475	Digital Image Processing	5	ME 555	Human Rights and Legislative Procedure
6	EC 476	Spectral Estimation Techniques	6	EC 481	Nano Technology
7	EC 477	Electromagnetic Interference and Electromagnetic Compatability(EMI & EMC)	7	IT 428	Network Security
			8	CS 411	Artificial Intelligence
			9	IT 429	Internet of Things

EC 421

## GPS AND AUGMENTATION SYSTEMS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Prerequisite:** A prior knowledge of satellite communication and Radio Navigation Aids is required.

### Course Objectives:

1. To explain the basic principle of GPS and its operation.
2. To make the students to understand signal structure, errors, coordinate systems
3. To make the students understand the GPS navigation and observation files and compute the position.
4. Highlight the importance of integrating GPS with other systems.
5. To demonstrate the principle of DGPS and to facilitate the various augmentation systems.
6. To make the students appreciate the significance of augmentation systems.

### Course Outcomes:

Student will be able to:

1. Understand the principle and operation of GPS.
2. Frame various coordinate systems for estimating position.
3. Estimate the various errors and their effect on position estimation.
4. Compute user position from Navigation and Observation data formats.
5. Use GPS in various fields such as navigation, GIS etc.
6. Apply DGPS principle and can also analyze various augmentation systems.

## UNIT-I

### GPS fundamentals

GPS Constellation, Principle of operation, GPS orbits, Orbital mechanics and Satellite position determination, Time references. Dilution of precision: HDOP, VDOP, PDOP & GDOP.

## UNIT-II

### Coordinate systems

Geometry of ellipsoid, geodetic reference system, Geoid and Ellipsoid and Regional datum. World Geodetic System (WGS-84), Indian Geodetic System (IGS), Earth Centered Inertial (ECI), Earth Centered Earth Fixed (ECEF).

Various error sources in GPS: Satellite and Receiver clock errors, ephemeris error, Multipath error, atmospheric errors, the receiver measurement noise and UERE.

### **UNIT-III**

#### **GPS measurements**

GPS signal structure, SPS and PPS services, C/A and P-code and carrier phase measurement, position estimation with pseudo range measurement, Spoofing and anti-Spoofing, GPS navigation and observation data formats.

### **UNIT-IV**

#### **GPS Applications**

Surveying Mapping Marine, air and land Navigation, Military and Space Application. GPS Integration with Geographic Information System (GIS), Inertial Navigation System (INS), Pseudolite and Cellular. Indian Regional Navigation Satellite System (IRNSS).

Differential GPS (DGPS): Principle of DGPS, Types of DGPS: Local Area DGPS (LADPS), Wide Area DGPS (WADGPS).

### **UNIT-V**

#### **GPS Augmentation systems:**

Need for augmentation, RNP parameters. Types of augmentation systems: Satellite Based Augmentation system (SBAS): Wide Area Augmentation System (WAAS), GPS Aided GEO Augmented Navigation (GAGAN). Ground Based Augmentation System (GBAS): Local Area Augmentation System (LAAS).

#### **Text Books:**

1. Ahmed El-Rabbany, "Introduction to GPS", Artech House Publishers, 2/e, Boston 2006.
2. Elliot D Kaplan and Christopher J Hegarty, "Understanding GPS principles and applications", Artech House Publishers, 2/e Boston & London 2005.

#### **Suggested Reading:**

1. B.Hofmann-Wellenhof, H.Lichtenegger, and J.Collins, "GPS Theory and Practice," Springer Verlag, 5/e, 2008.
2. Pratap Misra and Per Enge, "Global Positioning System Signals, Measurement, and Performance," Ganga- Jamuna Press, 2/e, Massachusetts, 2010.
3. Bradford W.Parkinson and James J. Spilker, "Global Positioning system: Theory and Application," Vol.II, American Institution of Aeronautics and Astronautics Inc., Washington, 1996.

**EC 422**

## **SEMINAR**

Instruction  
Sessionals  
Credits

3L Periods per week  
25 Marks  
1

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of state of the art topics in a broad area of his /her specialization.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to following aspects of seminar presentations.

- Literature survey
- Consolidation of available information
- Power point Preparation
- Technical writing

### **Each student is required to:**

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Give twenty(20) minutes presentation through OHP/ PPT/ Slide Projector followed by Ten(10) minutes discussion
3. Submit a report on the seminar topic with list of references and hard copy of the slides.

Seminars are to be scheduled from 3<sup>rd</sup> week to the last week of the semester and any change in schedule should be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar should be from any peer reviewed recent journal publications.



## PROJECT

Instruction	6L Periods per week
University Examination	Viva-voce
University Examination	100 Marks
Sessionals	50 Marks
Credits	9

Dealing with a real time problem should be the focus of under graduate project.

All projects will be monitored at least four times in the II-semester through individual presentations (Project batch wise).

Every student should maintain a project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Sessional marks should be based on the marks, awarded by a project monitoring committee of faculty members as well as the marks given by the guide.

Common norms are established for final documentation of the project report, the students are directed to download from the website regarding the guidelines for preparing the project report and the project report format.

The project report shall be evaluated for 100 Marks by the External Examiner.

If the project work found inadequate in the end examination, the candidate should repeat the project work with a new problem or improve the quality of work and report it again.

Break up for 100 Marks in the end examination:

1. Power point presentation 20 Marks
2. Thesis/Report preparation 40 Marks
3. Viva-voce 40 Marks

**DESIGN OF FAULT TOLERANT SYSTEMS**

**(ELECTIVE - III)**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. The course provides basic concepts of various faults & failures occur in digital systems
2. Test vector generation to identify the faults.
3. To understand concept of redundancy
4. To understand various self checking circuits.
5. To understand built in self test and its testability into logic circuits.

**Course Outcomes:** Students will be able to

1. Identify various types of faults and failures
2. Analyze reliability of systems
3. Implement redundancy concept in digital systems
4. Design of failsafe circuits
5. Design of testable digital circuits
6. Design of built in self test for VLSI circuits

**UNIT – I: BASIC CONCEPTS**

Reliability concepts: Failures and faults, Reliability and failure rate, Relation between Reliability & Mean Time between Failure (MTBF), Maintainability & Availability, reliability of series and parallel systems. Modeling of faults. Introduction to test generation for combinational logic circuits: conventional methods, random testing, transition count testing and signature analysis.

**UNIT – II: FAULT TOLERANT DESIGN**

Basic concepts: Static, Dynamic and Hybrid redundancy. NMR, Triple modular redundancy (TMR) system, self purging redundancy, Siftout Modular Redundancy (SMR). Use of error correcting codes, time redundancy, software redundancy.

### **UNIT – III: SELF CHECKING CIRCUITS AND FAIL-SAFE LOGIC**

Design of totally self checking checkers, checkers using m-out of n-codes, Berger codes and low cost residue code, self-checking sequential machines, partially self-checking circuits. Fail safe Design: Strongly fault secure circuits, fail-safe design of sequential circuits using partition theory and Berger codes, totally self checking PLA design.

### **UNIT- IV: DESIGN FOR TESTABILITY FOR COMBINATIONAL CIRCUITS**

Basic concepts of testability, controllability and observability, the Reed-Muller expansion technique, three level OR-AND-OR design, use of control logic and syndrome testable design.

### **UNIT –V: BUILT IN SELF TEST**

BIST concepts, Built in Digital Circuit Observer (BIDCO), built-in-test of VLSI chips, Design for autonomous self test, designing testability into logic boards, generic offline BIST architecture.

#### **Text Books:**

1. Parag K. Lala, “Fault Tolerant and Fault Testable Hardware Design”, BS Publications, 2002.
2. Konad Chakraborty & Pinaki Mazumdar, “Fault tolerance and Reliability Techniques for high – density random – access memories Reason”, Pearson Education, 2002.
3. Miron Abramovici, Melvin A. Breuer, A. D. Friedman – “Digital Systems Testing and testable Design”, Jaico publications, Wiley-IEEE Press 1994.

#### **Suggested Reading:**

1. N.N. Biswas, “Logic Design Theory”, PHI, 1993.
2. Parag K. Lala, “Digital systems Design using PLD’s”, PHI, 1990.

**REAL TIME OPERATING SYSTEMS**

**(ELECTIVE –III)**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. To understand the need of real time operating system.
2. To learn the basic concepts of interprocess communication (IPC).
3. To analyse various scheduling algorithms related to RTOS.
4. To introduce the elementary concepts of Vx works.
5. To study the basic concepts of UNIX operating system.
6. To understand the design and development of a target system.

**Course Outcomes:**

Student will be able to:

1. Understand Real-time operating system requirements and applications.
2. Categorize different scheduling approaches for real time scheduler.
3. Compare different real time systems.
4. Analyze a module and understand design issues.
5. Develop a real time embedded system module.
6. Build a user end module.

**UNIT-I**

**Introduction to Real Time Systems**

Structures of Operating System (Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures), Operating system objectives and functions, Virtual Computers, Interaction of OS and Hardware architecture, Evolution of operating systems, Batch, multi programming. Multitasking, Multiuser, parallel, distributed and real-time OS.

**UNIT-II**

**Process Management of OS/RTOS**

Hard versus Soft Real-Time System: Jobs and Processors, release time, deadlines, and timing constraints, hard and soft timing constraints, hard real-time systems. Uniprocessor Scheduling: Types of scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread scheduling, Multiprocessor scheduling concept, Real Time scheduling concept.

### **UNIT-III**

#### **Real Time Operating System Concepts**

Foreground and Background Systems, Shared Resource, Critical section of a Code, Multi Tasking, Task, Context switch, Kernel, Scheduler, Preemptive and non-preemptive kernel, Inter Task Communication: Message Mailboxes, Message queues or pipes and Event flags, Semaphores, Interrupts.

### **UNIT-IV**

#### **Introduction to Vxworks/UNIX OS**

**Elementary Concepts of VxWorks:** Multitasking, Task State Transition, Task Control- Task Creation and Activation, Task Stack, Task Names and IDs, Task Options, Task Information, Task Deletion and Deletion Safety.

#### **Fundamental Concepts of UNIX Operating Systems**

Unix Kernel – File system, Concepts of – Process, Concurrent Execution & Interrupts. Process Management – forks & execution. Basic level Programming with system calls, Shell programming and filters.

### **UNIT-V**

#### **Linux development process**

Types of Host /Target Development and debug setup, Generic Architecture of an Embedded Linux System, System start up, Types of Boot configurations, System Memory Layout, Development Tools: Project Workspace, IDE, GNCC cross platform, selecting and configuring kernel, Setting up bootloader.

#### **Text Books:**

1. Tanenbaum,“Modern Operating Systems,” 4/e, Pearson Edition, 2014.
2. Jane W.S.Liu, Real Time Systems, Pearson Education, Asia, 2001.

#### **Suggested Reading:**

1. Jean J Labrosse,“Embedded Systems Building Blocks Complete and Ready-to-use Modules in C” ,2/e, CRC Press ,1999.
2. Karim Yaghmour, Jon Masters, Gilad Ben-Yesset, Philippe Gerum, “Building Embedded Linux Systems”, O’Reilly Media, 2008.
3. Wind River Systems, “VxWorks Programmers Guide 5.5”, Wind River Systems Inc.2002.

EC 473

**ELEMENTS OF SOFTWARE DEFINED RADIO  
(ELECTIVE - III)**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. To make the students understand the difference between Superhetrodyne Radio and Software defined Radio (SDR).
2. To differentiate between Cognitive Radio (CR) and SDR.
3. To give the Knowledge to students about FPGA based architectures with low power consumption.
4. To make the students know about the various SDR signal processing devices.
5. To understand the single node Cognitive radio techniques and basics of Co-operative Spectrum sensing.
6. To make the students aware about the usage and applications of Cognitive radio hardware.

**Course Outcomes:**

The student will be able to:

1. Understand the difference between the Super hetrodyne receiver, SDR and CR.
2. Know the different architectures of SDR.
3. Learn the various signal processing devices of SDR.
4. Understand the difference between single node and multi node spectrum sensing technique .
5. Understand the Energy based sensing technique.
6. Know the applications of SDR.

**UNIT-I**

**Introduction to SDR**

What is Software-Defined Radio, The Requirement for Software-Defined Radio, Legacy Systems, The Benefits of Multi-standard Terminals, Economies of Scale, Global Roaming, Service Upgrading, Adaptive Modulation and Coding, Operational Requirements, Key Requirements, Reconfiguration Mechanisms, , Handset Model, New Base-Station and Network, Architectures, Separation of Digital and RF, Tower-Top Mounting, BTS Hoteling, Smart Antenna Systems, Smart Antenna System Architectures, Power Consumption Issues, Calibration Issues, Projects and Sources of Information on Software Defined Radio.

## **UNIT-II**

### **Basic Architecture of a Software Defined Radio**

Software Defined Radio Architectures, Ideal Software Defined Radio Architecture, Required Hardware Specifications, Digital Aspects of a Software Defined Radio, Digital Hardware, Alternative Digital Processing Options for BTS Applications, Alternative Digital Processing Options for Handset Applications, Current Technology Limitations, A/D Signal-to-Noise Ratio and Power Consumption, Derivation of Minimum Power Consumption, Power Consumption Examples.

## **UNIT-III**

### **Signal Processing Devices and Architectures**

General Purpose Processors, Digital Signal Processors, Field Programmable Gate Arrays, Specialized Processing Units, Tiler Tile Processor, Application-Specific Integrated Circuits, Hybrid Solutions, Choosing a DSP Solution, Comparison of all processors.

## **UNIT-IV**

### **Cognitive Radio : Techniques and signal processing**

History and background, Communication policy and Spectrum Management, Cognitive radio cycle, Cognitive radio architecture, SDR architecture for cognitive radio, Spectrum sensing Single node sensing: energy detection. Introduction and challenges of Co-operative spectrum sensing.

## **UNIT-V**

### **Cognitive Radio: Hardware and applications**

Spectrum allocation models. Spectrum handoff, Cognitive radio performance analysis. Hardware platforms for Cognitive radio (USRP, WARP), details of USRP board, Applications of Cognitive radio.

### **Text books:**

1. Eugene Grayver, "Implementing Software Defined Radio", Springer, New York Heidelberg Dordrecht London, ISBN 978-1-4419-9332-8 (eBook) 2013.
2. Bruce A. Fette, "Cognitive Radio Technology", Elsevier, ISBN 10: 0-7506-7952-2, 2/e, 2006.

### **Suggested Reading:**

1. Peter B. Kenington, "RF and Baseband Techniques for Software Defined Radio", Artech House Publishers, Inc © 2005.
2. Hüseyin Arslan, "Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems", Springer, ISBN 978-1-4020-5541-6 (HB), 2007.

## WIRELESS SENSOR NETWORKS (ELECTIVE - III)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

### Course objectives:

1. To learn basic principles behind a Wireless Sensor Network.
2. To study network protocols, services and applications.
3. To study the importance of issues such as privacy, integrity, authentication, secure localization, secure aggregation, attacks and defense mechanisms.
4. To study simulation of wireless networks.
5. To understand the routing protocols.

### Course Outcomes:

After completion of the course the student shall be able to:

1. Understand the basic characteristics of wireless sensor networks.
2. Understand sensor deployment mechanisms of wireless sensor networks.
3. Analyze various network level protocols for MAC and routing in WSN
4. Identify the importance of time synchronization, localization, coverage and deployment.
5. Analyze the issues related to data processing and aggregation, energy efficiency.
6. Understand dependability issues of WSN such as security and authentication

## UNIT-I

### Overview of Wireless Sensor Networks and Applications

Examples of available sensor networks applications; Enabling Technologies for Wireless Sensor Networks. Design challenges, Contemporary network architectures, Operational and computational models, Performance metrics, Optimization Goals and Figures of Merit, Software and hardware setups

## UNIT-II

### Network Architectures

Sensor deployment mechanisms; Issues of coverage; Node discovery protocols; Localization schemes; Network clustering Single-Node Architecture; Energy Consumption of Sensor Nodes ; Gateway Concepts; Sensor Network Scenarios;



### **UNIT-III**

#### **Physical and Link layers**

Medium access arbitration; Optimization mechanisms; Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses.

### **UNIT-IV**

#### **Data dissemination and routing Query models**

In-network data aggregation;, Topology Control , Clustering, Time Synchronization, Localization and Positioning, Radio energy consumption model; Power management; Sensor Tasking and Control. Routing Protocols- Robust route setup; Coping with energy constraints; Energy-Efficient Routing, Geographic Routing

### **UNIT-V**

#### **Dependability Issues like Security and QoS**

Security challenges; Threat and attack models; Quality of Service provisioning; Clock synchronization; Supporting fault tolerant operation; Sensor Node Hardware – Berkeley Motes

#### **Text Books:**

1. Cauligi S. Raghavendra, University of Southern California; Krishna Sivalingam, University of Maryland Baltimore County, Taieb M. Znati, University of Pittsburg “Wireless Sensor Networks”, Springer, ISBN: 1-4020-7883-8, August 2005.
2. Holger Karl, University of Paderborn, Germany, Andreas Willig, University of Potsdam, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley, ISBN: 0-470-09510-5, June 2005.

#### **Suggested Reading:**

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks- Technology, Protocols, And Applications”, John Wiley, 2007.
2. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

**DIGITAL IMAGE PROCESSING**

**(ELECTIVE - III)**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. To Understand the formation of images are formed and represent digitally.
2. To study transform-domain representation of images.
3. To know the principles of image compression and enhancement .
4. Students would be able to solve the problems related to image restoration.
5. To learn lossy and lossless Compression techniques.

**Course Outcomes:**

Student will be able to:

1. Understand how images are formed, sampled, quantized and represented digitally.
2. Learn the properties and applications of transforms like Fourier, DCT, Haar, DWT and WHT.
3. Use the principles of image compression, enhancement and segmentation for practical applications.
4. Implement the image restoration techniques on the given image.
5. Remove the redundancy in an image.
6. Implement algorithms of image processing using MATLAB in real time systems.

**UNIT – I**

Elements of Digital Image Processing Systems, Digital image representation, elements of visual perception, Image sampling and Quantization, Basic Relationships between pixels.

**UNIT – II**

Properties and Applications of Fourier transform: FFT, Discrete cosine transform, Hadamard transform, Haar transform, Slant transform, DWT and Hotelling transform.

**UNIT – III**

Spatial enhancement techniques: Histogram equalization, direct histogram specification, Local enhancement.

Frequency domain techniques : Low pass, High pass and Homomorphic Filtering, Image Zooming Techniques.

## **UNIT – IV**

Image Degradation model, Algebraic approach to restoration, inverse filtering, Least mean square filter, Constrained least square restoration and interactive restoration. Speckle noise and its removal techniques.

## **UNIT – V**

Redundancies for image compression, Huffman Coding, Arithmetic coding, Bit-plane coding, loss less and lossy predictive coding.

Transform coding techniques: Zonal coding and Threshold coding.

### **Text Books:**

1. Gonzalez R.C. and Woods R.E., “Digital Image Processing” 2/e, PHI, 2005.
2. A.K.Jain, " Fundamentals of Digital Image processing", PHI, 1989.

### **Suggested Reading:**

1. Madhuri A, Joshi, “Digital Image Processing: An algorithmic Approach”, PHI, 2006.
2. U Qidwai, C.H.Chen, “Digital Image Processing,” First Indian Reprint 2013, CRC Press, (Taylor & Francis), Yesdee Publications.

**EC 476**

## **SPECTRAL ESTIMATION TECHNIQUES**

### **Elective-III**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Prerequisite:** Course on Digital Signal Processing and knowledge of Random signals.

#### **Course Objectives:**

1. To learn Random Processes.
2. To study Linear Prediction methods.
3. To understand Power Spectral Estimation techniques.
4. To analyse various spectrum estimation algorithms.
5. To understand the difference between parametric methods of power spectrum estimation.

#### **Course Outcomes:**

Student will be able to:

1. Analyze various Random Processes.
2. Apply Linear Prediction technique for filtering
3. Perform Wiener Filtering for estimation of Spectrum.
4. Estimate power spectrum of random signal in noisy environment.
5. Develop various parametric models for spectral estimation.
6. Understand the Eigen based algorithms for spectrum estimation.

### **UNIT-I**

#### **Random processes**

Stationary random processes, statistical average, statistical averages for joint random processes, Discrete-Time Random signals, Time averages for a Discrete Time Random processes, Mean-Ergodic Process, Correlation Ergodic Processes, Power density Spectrum, Rational power spectra, Relationships between the filter parameters and autocorrelation sequence.

### **UNIT-II**

#### **Forward and Backward linear prediction**

Forward and Backward linear prediction, Relationship of an AR process to linear prediction, Solution of Normal equations- The Levinson- Durbin algorithm, Wiener filters for Filtering and Prediction, FIR Wiener Filter.

### **UNIT-III**

#### **Non-parametric methods for Power Spectrum Estimation**

Estimation of Spectra from finite duration observation of a signal: Computational of the Energy Density Spectrum, Periodogram, Use of DFT in Power Spectrum Estimation. Bartlett's, Welch and Blackman-Tukey methods, Performance Characteristics of Nonparametric Power Spectrum Estimators.

### **UNIT- IV**

#### **Parametric methods for Power Spectrum Estimation**

Relationships between auto correlation sequence and model parameters, Methods for AR model parameters: Yule – Walker method, Burg method, Sequential estimation method. MA and ARMA models for Power Spectrum Estimation.

### **UNIT- V**

Eigen Analysis algorithms for Spectrum estimation- Pisarenko's harmonic decomposition method. MUSIC and ESPRIT algorithms.

#### **Text Books:**

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", 4/e, Pearson Education, 2007.

#### **Suggested Reading:**

1. John G. Proakis, Charles M. Rader, Fuynn Ling, Marc Moonen, Ian K. Proudler, Chrysostomos L Nikas, "Algorithms for statistical Signal Processing", Pearson Education, Asia Publishers, Indian Edition, 1/e, 2002.
2. Alan V. Oppenheim & Ronald W. Schaffer, "Digital Signal Processing," PHI, 2/e, 2010.

EC 477

**ELECTROMAGNETIC INTERFERENCE AND ELECTROMAGNETIC  
COMPATIBILITY (EMI and EMC)**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. The course provides basic information on the different EMI (Electromagnetic Interference) problems occurring in intersystem
2. the possible EMI mitigation techniques in Electronic design.
3. To understand sub-system level design and to measure the emission, immunity level from different systems to couple with the prescribed EMC (Electromagnetic Compatibility) standards.
4. To understand various EMI measurement test facilities.
5. To understand EMI/EMC sources, EMI problems and their solutions at PCB level.

**Course Outcomes:**

Students will be able to:

1. Identify various sources of electromagnetic interference and compatibility that could affect electronic equipments.
2. Know the different grounding and cabling techniques required to minimize the effects of EMI.
3. Understand the various techniques of shielding and bonding involved in the design of an EMI free system
4. Use different instruments to test and measure EMI/EMC parameters.
5. Acquire knowledge of the effective EMC design practices that are critical to avoid unnecessary costs of additional EMC suppression measures.
6. Know the mandatory governmental requirements to minimize a digital product's Electro-Magnetic noise emissions.

**UNIT- I**

**Introduction:** History and concepts of EMI/EMC, Definitions of EMI/EMC, Classification of EMI/EMC. Specifications, National /International standards, limits, Units of specifications, Civilian standards and Military standards.

**Natural and manmade sources of EMI/EMC:** Sources of Electromagnetic noise, typical noise paths, modes of noise coupling, designing for EM compatibility, lightning discharge, Electro-Static Discharge (ESD), Electro-Magnetic Pulse (EMP), Radiated and Conducted Emissions.

## **UNIT- II**

**Grounding and Cabling:** Principles and types of Grounding, Safety and signal grounds, low and high frequency grounding methods, grounding of amplifiers and cable shields, isolation, neutralizing Transformers, shield grounding at high frequencies, digital grounding, types of cables, mechanism of EMI emission/coupling in cables.

## **UNIT- III**

**Shielding and Bonding:** Principles and types of shielding and bonding, effectiveness of shielding, near and far fields / impedances, methods of analysis, total loss due to absorption and reflection effects, composite absorption and reflection losses for electric fields/magnetic fields, magnetic materials as a shield, shield discontinuities, slots and holes, seams and joints, conductive gaskets

Electrical Bonding, Shape and Material for Bond straps, General Characteristics of good bonds.

## **UNIT- IV**

**EMI Measurements:** EMI test instruments and systems, EMI test, EMI shielded and anechoic chamber, reverberating chamber, Open area test site, TEM cell, GTEM cell, comparison of test facilities.

## **UNIT- V**

**Non-ideal behavior of EMC Components:** Wires, Printed Circuit Board (PCB) lands, Effect of component leads, capacitors, inductors, resistors and Digital Circuit Devices. Effect of Component Variability

### **Text Books:**

1. Prasad Kodali.V, “Engineering Electromagnetic Compatibility”, Wiley India Private Limited, Second edition, 2010
2. Clayton R.Paul, “Introduction to Electromagnetic compatibility”, Wiley India Private Limited, Second edition, 2010

### **Suggested Reading:**

1. Keiser, “Principles of Electromagnetic Compatibility”, 3<sup>rd</sup> edition, Artech House, 1987.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT Delhi, Modules 1– 9.
3. Henry W. Ott, “Noise Reduction Techniques in Electronic Systems”, Wiley Inter Science, 2<sup>nd</sup> edition, 2008.

## OBJECT ORIENTED PROGRAMMING WITH JAVA

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

### Course Objectives:

1. Write, compile and execute Java programs.
2. Understand the role of the Java Virtual Machine in achieving platform independence.
3. Use threads in order to create more efficient Java programs.
4. Write, compile and execute event driven programming using AWT classes.

### Course Outcomes:

1. Design, create, build, and debug Java applications and applets.
2. Create multiple threads for achieving multiple tasks.
3. Write programs using graphical user interface (GUI) components and Java's Event Handling models.
4. Use user defined exception handling to customize any type of errors
5. Create collections to organize objects
6. Use inheritance to reuse objects

### Unit-I

**Introduction to OOP :** Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages ,Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Program structures, Installation of JDK 1.6.

**Programming Constructs :** Variables, Primitive Datatypes, Identifiers- Naming Conventions, Keywords, Literals, Operators Binary ,Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control-Branching, Conditional, loops.

### Unit-II

**Classes and Objects :** classes, Objects Creating Objects, Methods, constructors-Constructor overloading, cleaning up unused objects-Garbage collector, Class variable and Methods-Static keyword, this keyword, Command line arguments.

**Inheritance:** Types of Inheritance, Deriving classes using extends keyword, method overloading ,super keyword, final keyword, Abstract class .



### **Unit-III**

**Interfaces, Packages and Exceptions** : Interface, Extending interface, Interface Vs Abstract classes, Packages-Creating packages, using Packages, Access protection, java.lang package. Exception -Introduction, Exception handling techniques- try... catch, throws, finally block, user defined exception.

**MultiThreading** : java.lang.Thread , The main Thread, Creation of new threads, Thread priority, Multithreading- Using isAlive() and join(), Synchronization, suspending and Resuming threads, Communication between Threads.

### **Unit-IV:**

**Input/Output** : Reading and writing data, java.io package.

**Generics and java.util** : Generics,Using Generics in Arguments and Return Types, Defining Your Own Generic Classes, Linked List, Hashset Class, Treemap Class, Hashmap Class,Treemap Class, Collections, Legacy Classes and Interfaces, Difference between Vector and Arraylist , Difference between Enumerations and Iterator.

### **Unit-V:**

**Applets**: Applet class, Applet structure, An Example Applet Program, Applet Life Cycle, paint(),update() and repaint().

**Event Handling** : Introduction, Event Delegation Model, java.awt.event Description, Sources ofEvents, Event Listeners, Adapter classes, Inner classes.

**Abstract Window Toolkit**: Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons,List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar.

### **TEXT BOOK:**

1. Programming in JAVA,2ed, Sachin Malhotra, Saurabh choudary, Oxford University Press

### **Suggested Reading:**

1. The Complete Reference Java, 8ed, Herbert Schildt, TMH
2. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
3. Object Oriented Programming with JAVA, Essentials and Applications, Raj Kumar Bhuyya,Selvi, Chu TMH
4. Introduction to Java Programming, 7th ed, Y Daniel Liang, Pearson

## ME 464

### ENTREPRENEURSHIP

(for Mech, Prod, Civil, EEE & CSE)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

#### Objectives:

1. To understand the essence of Entrepreneurship
2. To know the environment of industry and related opportunities and challenges
3. To know the concept a procedure of idea generation
4. To understand the elements of business plan and its procedure
5. To understand project management and its techniques
6. To know behavioral issues and Time management

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

1. Apply the entrepreneurial process
2. Analyze the feasibility of a new business plan and preparation of Business plan
3. Evaluate entrepreneurial tendency and attitude
4. Brainstorm ideas for new and innovative products or services
5. Use project management techniques like PERT and CPM
6. Analyze behavioural aspects and use time management matrix

#### UNIT-I

**Indian Industrial Environment:** Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

#### UNIT-II

**Identification and characteristics of entrepreneurs:** First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

#### UNIT-III

**Business plan:** Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

## **UNIT-IV**

**Project Management:** During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

## **UNIT-V**

**Behavioral aspects of entrepreneurs:** Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

**Time Management:** Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

### **Text Books:**

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi

### **Suggested Reading:**

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", Tata Me Graw Hill Publishing Company Ltd., 5th Ed., 2005
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.
3. Sudha G.S., "Organizational Behavior", National Publishing House, 1996.

**DISASTER MITIGATION AND MANAGEMENT**

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:**

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. To impart knowledge in students about the nature, mechanism causes, consequences and mitigation measures of the various natural disasters including hydro metrological and geological based disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters including chemical, biological and nuclear warfare agents.
4. To equip the students with the knowledge of various chronological phases in the disaster management cycle.
5. To create awareness about the disaster management framework and legislations in the context of national and global conventions.
6. To enable students to understand the applications of geospatial technologies like remote sensing and geographical information systems in disaster management.

**Course Outcomes:**

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at local level
2. Ability to choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Ability to understand various mechanisms and consequences of natural and human induced disasters for the participatory role of engineers in disaster management.
4. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans
5. Ability to understand various participatory approaches/strategies and their application in disaster management
6. Ability to understand the concepts of remote sensing and geographical information systems for their effective application in disaster management.

## **UNIT-I:**

**Introduction to Natural, human induced and human made disasters** – Meaning, nature, types and effects; International decade of natural disaster reduction (IDNDR); International strategy of natural disaster reduction (ISDR)

## **UNIT-II:**

**Natural Disasters**– Hydro meteorological disasters: Causes, impacts, Early warning systems, structural and non-structural measures for floods, drought and cyclones; Tropical cyclones: Overview, cyclogenesis, drought monitoring and management.; Geographical based disasters: Earthquakes and Tsunami- Overview, causes, impacts, zoning, structural and non-structural mitigation measures; Tsunami generation; Landslides and avalanches: Overview, causes, impacts, zoning and mitigation measures. Case studies related to various hydro meteorological and geographical based disasters.

## **UNIT III:**

**Human induced hazards:** Risks and control measures in a chemical industry, Causes, impacts and mitigation measures for chemical accidents, chemical disaster management, current status and perspectives; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents and traffic accidents .

## **UNIT IV:**

**Use of remote sensing and GIS in disaster mitigation and management;** Scope of application of ICST (Information, communication and space technologies in disaster management, Critical applications& Infrastructure; Potential application of Remote sensing and GIS in disaster management and in various disastrous conditions like earthquakes, drought, Floods, landslides etc.

## **UNIT V:**

**Concept of Disaster Management:** Introduction to disaster management, Relationship between Risk, vulnerability and a disaster, Disaster management cycle, Principles of disaster mitigation: Hazard identification and vulnerability analysis, Early warning systems and forecasting; Infrastructure and development in disaster management; Disaster management in India: National disaster management framework at central, state, district and local levels. Community based disaster management.

**Text Books :**

1. Rajib, S and Krishna Murthy, R.R (2012), "Disaster Management Global Challenges and Local Solutions" Universities Press Hyderabad.
2. Notes / Reading material published by National Disaster Management Institute, Ministry of Home Affairs, Govt. of India.

**Suggested Reading:**

1. Navele, P & Raja, C.K. (2009), Earth and Atmospheric Disasters Management, Natural and Manmade. B.S. Publications, Hyderabad.
2. Fearn-Banks, K (2011), Crises computations approach: A case book approach. Route ledge Publishers, Special Indian Education, New York & London.
3. Battacharya, T. (2012), Disaster Science and Management. Tata McGraw Hill Company, New Delhi.

## ME 472

### INTELLECTUAL PROPERTY RIGHTS

(for Mech, Prod, Civil, ECE, EEE, CSE, IT)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

#### Objectives:

1. To introduce fundamental aspects of IP
2. Introducing all aspects of IPR acts.
3. Creating awareness of multi disciplinary audience
4. Creating awareness for innovation and its importance
5. Exposing to the changes in IPR culture
6. Awareness about techno-business aspects of IPR

**Outcomes:** At the end of the course, a student

1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IP. .
6. Capable of converting creativity into IP and effectively protect it.

#### UNIT-I

**Overview of Intellectual Property:** Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT

**Patents:** Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensors of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements.

## UNIT-II

**Industrial Designs:** What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

## UNIT-III

**Trademarks:** What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

## UNIT-IV

**Copyright:** What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

## UNIT-V

**Enforcement of Intellectual Property Rights:** Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.

**Unfair Competition:** What is unfair competition. Relationship between unfair competition and intellectual property laws.

### Text Books:

1. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India Ltd , 2006
2. B. L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi 2010

### Suggested Reading:

1. Cronish W.R1 Intellectual Property; Patents, copyright, Trad and Allied rights, Sweet & Maxwell, 1993.
2. P. Narayanan, Intellectual Property Law, Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs, Sweet, Maxwell 4<sup>th</sup> Edition.



## ME 555

### HUMAN RIGHTS AND LEGISLATIVE PROCEDURE

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

**Course Objectives:** To help students

1. To understand the value of human rights
2. To understand the Lawful rights available to him and others
3. To create understanding the rights of under privileged and respect them
4. To understand role of an individual in the Civil Society

**Course Outcomes:**

1. At the end of the course student will understand the process of evolution of human rights
2. Will understand constitutional protection available
3. Will understand the conditions of under privileged persons and will adopt a positive attitude towards.
4. Will understand the role of Law in protecting environment and will recognize right to life.

#### Unit-I

Meaning and concept of Human Rights: Notion and classification of Rights, Moral and Legal Rights, Three generations of rights (Civil, and Political Rights, Economic Social and Cultural Rights, Collective/Solidarity Rights). Indian Bill of Rights and Sarodaya. Preamble of Indian Constitution, Fundamental Rights-Directive Principles-Fundamental Duties.

#### Unit-II

Human Rights enforcement mechanism Human Rights Act, 1993, Judicial organs-Supreme Court (Art 32) and High Court (Art 226), Human Rights Commission, National and State Commission of Women/Children/Minority/SC/ST.

#### Unit-III

A Right to development, Socio-Economic and Cultural Effects of Globalization, Right to Education, Transparency in Governance and Right to Information, Consumer Protection act.

#### **Unit-IV**

Environment Rights such as right to clean environment and public safety: Issues of Industrial Pollution, Prevention, Rehabilitation: Safety aspects of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment.

#### **Unit-V**

Role of Advocacy Groups: (a) Professional bodies: Press, media role of Lawyers – Legal Aid., (b) Educational Institutions (c) Role of Corporate Sector (d) N.G.Os .

#### **Text Books:**

1. The history of Human rights by M.r. Ishay, Orient Longman, Newdelhi, 2004.
2. S.N. Chaudhary, Human Rights and Poverty in India: Theoretical Issues, Delhi: Concepts, 2005.
3. Anuradha Kumar, Encyclopedia of Human Rights Development of under Privilege, New Delhi: Sarup, 2002.
4. P.M. Katare and B.C. Barik, Development, Deprivation and Human Rights, Violation, New Delhi: Rawat, 2002.

#### **Suggested Reading:**

1. Venket Iyer, (ed.), Democracy, Human Rights and the Rule of Law: Essays in Honour of Nani Palkhivala, New Delhi: Butterworth's, 2000.
2. R.J. Cook and C.G. Ngwena (ed.), Health and Human Rights, OUP, Clarendon, 2007.
3. Ethics of Science and Technology: Explorations of the Frontiers of Science and Ethics, OUP, Clarendon, 2006.
4. K.P. Saksena, (ed.), Human Rights and the Constitution: Vision and the Reality, New Delhi: Gyan Pub., 2003

## NANO TECHNOLOGY

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

### Course Objectives:

1. To gain the knowledge of different nano materials, properties of materials.
2. To study the concepts of nano science and nano technology.
3. To list out the challenges in the nano technology.
4. To study the structures of various nano particles.
5. To study the process of nano fabrication and fabrication of MEMS.
6. To study various applications of nano materials.

### Course Outcomes:

After a successful completion of the course, students should be able to:

1. Describe and explain Nanotechnology.
2. Describe Nano materials based on their dimensionality.
3. Explain the importance of reduction in materials dimensionality, and its relationship with materials properties.
4. Explain top-down and bottom-up approaches for Nano material fabrication, and give some examples.
5. Give examples on the use of Nanotechnology in biomedical and optical applications.
6. Give examples on the use of Nanotechnology in microelectronics applications.

### UNIT – I

#### Nano Materials

Materials, Electrical and optical properties, Superconducting properties, magnetic properties, mechanical properties, Application of Nanomaterials.

### UNIT – II

#### Introduction to Nano Technology

Evolution of Nanoscience and technology, Introduction to Nanotechnology, Moores law, Bottom – up and Top – down approaches, Challenges in Nanotechnology.

### UNIT – III

#### Nano Structures

Zero dimensional Nano Structures: (Nano Particles) – Introduction, Nano particles through homogeneous nucleation, Nano particles through heterogeneous nucleation, One dimensional Nano structures: (Nano Wires, Nano rods) – Introduction, template based synthesis.

## **UNIT – IV**

### **Nano Fabrication**

Introduction to micro, Nano fabrication, Lithography, Electron beam lithography, Thin film deposition. MEMS: Types of MEMS, Fabrication of MEMS.

## **UNIT – V**

### **Special Nano Materials**

Nano Composites: Introduction, Synthesis procedures, various systems (metal – polymer, metal – ceramics) characterization procedures, applications. Nano Biomaterials: Introduction, Biocompatibility, applications.

### **Text Books:**

1. A S Edelstein & R C Cammarata, “Nano Materials”, Institute of physics publishing, UK 1997.
2. Guozhong cao, “Nano Structures and Nano materials”, Imperial college press, 2/e, 2004.
3. A.K. Bandyopadyay, “Nano Materials”, New Age Publications, 2009.

### **Suggested Reading:**

1. Carl C.Koch, “Nano Structured Materials Synthesis, Properties and Applications”, Jaico Publishing House, 2007.
2. Ghodssi, Reza, Lin, Pinyen, “MEMS materials and Processes Handbook”, 1/e, Springer Publishers, 2010.

**NETWORK SECURITY (for ECE)**

Instruction	4L	Periods per week
Duration of End Examination	3	Hours
End Examination	75	Marks
Sessionals	25	Marks
Credits	3	

**Course Prerequisites:** Data Communications, Computer Networks

**Course Objectives:**

1. To introduce the basics of network security
2. To familiarize with key distribution and security in the transport layer
3. To present wireless network protocols and email security
4. To discuss about Internet protocol security and Intruder detection
5. To impart knowledge about malicious software and firewalls

**Course Outcomes:**

After successful completion of the course, students will be able to

1. Understand the basics of network security and apply related concepts for ensuring security
2. Understand the principles of encryption, cryptography and message authentication
3. Understand the key distribution and security considerations in the transport layer
4. Apply wireless network security protocols and email security
5. Understand IP security and Intrusion detection
6. Detect malicious software and configure a firewall

**UNIT -I**

**Introduction:** Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security, Standards, **Symmetric Encryption and Message Confidentiality:** Symmetric Encryption Principles, **Public-Key Cryptography and Message Authentication:** Approaches to Message Authentication, Secure Hash Functions, Message Authentication Codes, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures

## UNIT - II

**Key Distribution and User Authentication:** Symmetric Key Distribution using Symmetric Encryption, Kerberos, Key Distribution Using Asymmetric Encryption, X.509 Certificates, Public-Key Infrastructure, **Transport-Level Security:** Web Security Considerations, Secure Socket Layer and Transport Layer Security, Transport Layer Security, HTTPS, Secure Shell (SSH)

## UNIT - III

**Wireless Network Security:** IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security, Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-to-End Security, **Electronic Mail Security:** Pretty Good Privacy, S/MIME, Domain Keys Identified Mail

## UNIT - IV

**IP Security:** IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, **Intruders:** Intruders, Intrusion Detection, Password Management

## UNIT - V

**Malicious Software:** Types of Malicious Software, Viruses, Virus Countermeasures, Worms, Distributed Denial of Service Attacks, **Firewalls:** The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations

### Text Books:

1. William Stallings, Network Security Essentials: Applications and Standards, Fourth Edition, Pearson, 2011.
2. William Stallings, Cryptography and Network Security: Principles and Practice, Sixth edition, Pearson, 2013.

### Suggested Reading:

1. Eric Maiwald, “Fundamentals of Network Security”, Tata McGraw Hill, 2011.
2. PallapaVenkataram, “Wireless and Mobile Network Security”, Tata McGraw Hill, 2010.

### Web Resources:

1. [http://www.cisco.com/cisco/web/solutions/small\\_business/resource\\_center/articles/secure\\_my\\_business/what\\_is\\_network\\_security/index.html?referring\\_site=smartnavRD](http://www.cisco.com/cisco/web/solutions/small_business/resource_center/articles/secure_my_business/what_is_network_security/index.html?referring_site=smartnavRD)
2. <http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-857-network-and-computer-security-spring-2014/lecture-notes-and-readings/>

## CS 411

### ARTIFICIAL INTELLIGENCE

Instruction	4L Periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessionals	25 Marks
Credits	3

#### Course Objectives:

1. To list the significance of AI.
2. To discuss the various components that are involved in solving an AI problem.
3. To analyze the various knowledge representation schemes, Reasoning and Learning techniques of AI.
4. Apply the AI concepts to build an expert system to solve the real world problems.

#### Course Outcomes:

After completion of the course, student should be able to:

1. Differentiate between a rudimentary Problem and an AI problem, it's Characteristics and problem solving Techniques.
2. Determine and evaluate the various search strategies.
3. Compare and contrast the various "knowledge representation" schemes of AI.
4. Understand and Analyze the various reasoning techniques involved in solving AI problems.
5. Understand the different learning techniques.
6. Apply the AI techniques to solve the real world problems.

#### UNIT I

**Introduction & Problem Solving:** AI problems, AI Technique, Defining problem as a State-Space Search, Production Systems, Problem Characteristics, Production System Characteristics.

**Heuristic Search Techniques:** Generate – and – test, Hill Climbing, Best – First Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis.

#### UNIT II

**Game Playing:** Overview, Min-Max search Procedure, Adding Alpha-beta Cutoffs, Additional Refinements, Iterative Deepening.

**Knowledge Representation Issues:** Approaches, Issues, Frame Problem,

**Using Predicate Logic:** Representing simple facts in logic, Representing Instance and ISA Relationships, Computable Functions and predicates, Resolution, Natural Deduction.

### **UNIT III**

**Uncertainty and Reasoning Techniques:** Non monotonic reasoning, Logics for Non monotonic reasoning, Implementation issues, Augmenting a problem solver, implementation of Depth First Search and Breadth first search.

**Statistical reasoning:** Probability and Bayes theorem, Certainty factors and Rule-based systems, Bayesian Networks, Dempster-Shafer Theory.

### **UNIT IV**

**Learning:** What is Learning, Rote learning, Learning by taking advice, Learning in problem solving, learning from examples: Induction, Learning by Decision trees.

**Expert System:** Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition.

### **UNIT V**

**Perception and Action:** Real Time Search, Vision, Speech Recognition, ACTION: Navigation, Manipulation, Robot architectures.

**Natural Language Processing:** Introduction, Syntactic Processing, Semantic Analysis, Statistical NLP, Spell Checking.

### **TEXT BOOKS:**

1. Elaine Rich, Kevin Night, Shivashankar B Nair, “Artificial Intelligence”,3rd Edition.,2008
2. Russell Norvig, “Artificial Intelligence-Modern Approach”, 3<sup>rd</sup> edition, 2009.

### **Suggested Reading:**

1. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2012.
2. Nelson M. Mattos , “An Approach to Knowledge Base Management”, Springer Berlin Heidelberg, 1991.



## IT 429

### INTERNET OF THINGS (for ECE)

Instruction	4 L periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessional	25 Marks
Credits	3

**Course Prerequisites:** Programming and Problem Solving, Basic Electronics, Computer Organization

#### Course Objectives:

1. To provide an overview of Internet of Things, building blocks of IoT and the real-world applications
2. To introduce Raspberry Pi device, its interfaces and Django Framework.

#### Course Outcomes:

After successful completion of the course, student will be able to

1. Understand the terminology, enabling technologies and applications of IoT
2. Learn the concept of M2M (machine to machine) and describe the differences between M2M and IoT.
3. Understand the basics of Python Scripting Language which is used in many IoT devices
4. Describe the steps involved in IoT system design methodology
5. Design simple IoT systems using the understanding of the Raspberry Pi board and interfacing sensors and actuators with Raspberry Pi
6. Develop web applications using python based web application framework called Django.

#### Unit I

Introduction & Concepts: Introduction to Internet of Things- Definitions & Characteristics of IoT, Physical Design of IOT-Things in IoT, IoT Protocols, Logical Design of IOT-IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IOT Enabling Technologies-Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IOT Levels & Deployment Templates.

#### Unit II

**Domain Specific IoTs** – IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

**IoT and M2M** – Introduction, M2M, Differences between IoT and M2M, Software Defined Networking, Network Function Virtualization.

### **Unit III**

**Introduction to Python**–Motivation for using Python for designing IoT systems, Language features of Python, Data types- Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules, packaging, file handling, data/time operations, classes, Exception handling, Python packages of Interest for IoT - JSON, XML, HTTPLib, URLLib, SMTPLib

### **Unit IV**

**IoT Platforms Design Methodology:** Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

### **Unit V**

**IoT Physical Devices and End Points:** Basic building blocks of an IoT device, Raspberry Pi-About theRasberry Pi board, Rasberry Pi interfaces-Serial, SPI,I2C, Other IoT Devices-pcDuino, BeagleBone Black, Cubieboard

**IoT Physical Servers and Cloud Offerings-** Introduction to cloud storage models and Communication APIs, WAMP-AutoBahn for IoT, Xivelycloud for IoT

**Python Web Application Framework:** Django Framework-Roles of Model, Template and View

### **Text Books:**

1. ArshdeepBahga and Vijay Madiseti, “Internet of Things - A Hands-on Approach, Universities Press, 2015.

### **Suggested Reading:**

1. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1<sup>st</sup> Edition, Apress Publications, 2013
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014.