With effect from the Academic year 2020-21

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Scheme of Instruction

and

Syllabus of

B.E. (Electronics & Communication Engineering)

V & VI – SEMESTER

AICTE Model Curriculum

2020-2021

UNIVERSITY COLLEGE OF ENGINEERING

(AUTONOMOUS)

OSMANIA UNIVERSITY

HYDERABAD – 500 007, TELANGANA

With effect from the Academic year 2020-21

UNIVERSITY COLLEGE OF ENGINEERING

Vision

The Vision of the Institute is to generate and disseminate knowledge through a harmonious blending of Science, Engineering and Technology. To serve the society by developing a modern technology in students' heightened intellectual, cultural, ethical and humane sensitivities, fostering a scientific temper and promoting professional and technological expertise.

Mission

- To achieve excellence in Teaching and Research
- To generate, disseminate and preserve knowledge
- To enable empowerment through knowledge and information
- Advancement of knowledge in Engineering, Science and Technology
- Promote learning in free thinking and innovative environment
- Cultivate skills, attitudes to promote knowledge creation
- Rendering socially relevant technical services for the community
- To impart new skills of technology development
- To inculcate entrepreneurial talents and technology appreciation programmes
- Technology transfer and incubation

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Vision

"To be in the forefront of advances in Electronics and Communication Engineering education and research to guide and motivate young engineers to face future technological challenges".

Mission

- To inculcate analysis and design for innovative problems in the field of Electronics and Communication Engineering with the help of state of art curricula
- To impart practical training to face real life case studies and inter-disciplinary simple solutions to complex problems.
- To make engineering education an enjoyable learning experience through challenging tutorials, mini-projects, assignments and laboratory exercises.
- To build project team spirit for professional working environment with high ethical values
- To develop overall character that will care for the society and concerned for the Nation through extra-curricular activities

Programme Educational Objectives (PEOs) for BE (ECE) programme

PEO1	To Prepare students to excel in Postgraduate programs or to succeed in Industry/ technical professionals and encourage them to setup their own Industry and/or immediate employment.
PEO2	To provide students with a solid foundation in mathematical, scientific and engineering fundamentals that best suits to the society, R & D, Defense, Government and Industry needs at state and national levels.
PEO3	To teach students with good scientific and engineering skills, so as to comprehend, analyze, design and create novel products and propose solutions for real life problems in and outside the country.
PEO4	To inculcate in students professional and ethical attitude, effective communication skills, team work, multidisciplinary approach and an ability to relate engineering issues to boarder social context.
PEO5	To provide student with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career

Programme Outcomes (POs) of BE (ECE) Programme

Engineering Graduates will be able to:

PO1	**Engineering knowledge**: Graduate will demonstrate knowledge of engineering mathematics, science and technology and electronics and Communication engineering
PO2	**Problem analysis:** Graduates will possess skills in traditional and modern electronics & communication theories and their applications
PO3	**Design/development of solutions:** Graduates will demonstrate the ability to analyze, interpret, design and conduct experiments in areas such as analog & digital electronics, networks, microprocessors and communication technologies
PO4	**Conduct Investigations of Complex Problems:** Graduates will demonstrate ability to design a system, component, or process as per the requirements and specifications
PO5	**Modern tool usage:** Graduates will demonstrate skills to use modern engineering tools and other programming languages.

PO6	**The engineer and society:** Graduates will be aware of contemporary issues and will show the ability to perceive the impact of engineering solutions on the society
PO7	**Environment and sustainability:** Graduates will develop the ability to envision and work in laboratories and to encompass multi-disciplinary tasks in electronics and communications
PO8	**Ethics:** Graduates will possess knowledge of professional and ethical responsibilities
PO9	**Individual and team work:** Graduates can participate and succeed in competitive examinations like GATE, GRE, CAT and Engineering Services.
PO10	**Communication:** Graduates will be able to communicate effectively in both verbal and written forms
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Graduates will develop the confidence foe self education and ability for lifelong learning

Programme Specific Outcomes (PSOs) of BE (ECE) Programme

Engineering Graduates will be able to:

PSO1	To equip students with skills to pursue higher education programs, to excl in electronics and communication industries, multinational companies and other niche contemporary professionals.
PSO2	To strengthen the foundation of students in mathematics, science & technology and related aspects of electronics and communication thereby providing them with fundamentals of problem solving, design, research and development.
PSO3	To train the students to inculcate the ability to solve real life problems by providing them with scientific and engineering breadth that includes comprehension, analysis and realization of novel ideas.
PSO4	To imbibe upon the students the importance of professional and ethical skills. Effective soft skills, team qualities, multidisciplinary perspectives and help them to inculcate these skills in order to relate the engineering issues to diversified social aspects.
PSO5	To strive to provide an enabling environment and garner features such excellence, leadership ethical conduct and life-lasting learning needed for a successful professional career.

With effect from the Academic year 2020-21

SCHEME OF INSTRUCTION
B.E. (ECE)
V – SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC501EC	Linear Control Systems	3	0	0	3	30	70	3
2	PC502EC	Analog Communication	3	0	0	3	30	70	3
3	PC503EC	Digital Communication	3	0	0	3	30	70	3
4	PC504EC	Microprocessor and Microcontroller	3	0	0	3	30	70	3
5	PC505EC	Antenna Wave Propagation	3	0	0	3	30	70	3
6	**Professional Elective – I**		3	0	0	3	30	70	3
	PE 511EC	Digital Image Processing							
	PE 512EC	Electronic Measurements and Instrumentation							
	PE 513EC	Object Oriented Programming Language Systems							
	PE 514EC	Digital System Design using Verilog HDL							
Practicals									
7	PC 551EC	Analog and Digital Communication Laboratory	0	0	2	2	25	50	1
8	PC 552EC	Microprocessor and Microcontroller Laboratory	0	0	2	2	25	50	1
	Total		**18**	**0**	**4**	**22**	**230**	**520**	**20**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
PC : Professional Core
HS : Humanities and Social Sciences
PW : Project Work

With effect from the Academic year 2020-21

SCHEME OF INSTRUCTION
B.E. (Service courses offered to other Departments)
V – SEMESTER

S.No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	ES 501EC	Signals and Systems	2	0	0	2	30	70	2
Total			**2**	**0**	**0**	**2**	**30**	**70**	**2**

L : Lectures

T : Tutorials

P : Practicals

CIE : Continuous Internal Evaluation

SEE : Semester End Examination

BS : Basic Sciences

ES : Engineering Sciences

PC : Professional Core

HS : Humanities and Social Sciences

PC 501EC

LINEAR CONTROL SYSTEMS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To develop mathematical modeling for different control systems.
- To construct state space model for continuous and discrete data systems and analyze them.
- To analyze control system in time domain and determine stability using Routh-Hurwitz criterion and Root-Locus technique.
- To analyze control system in frequency domain and determine stability using Nyquist criterion and bode plots.
- To design compensators for control systems.

Course Outcomes: Student will be

1. Able to develop mathematical models and derive transfer functions for various systems
2. Able to expose to an appropriate state space modeling of system and its analysis and the concept and testing of controllability and observability.
3. Able to analyze the systems in time domain and determine its stability.
4. Able to analyze the systems in frequency domain and determine relative stability.
5. Able to design compensators for a given specifications.

UNIT – I

Introduction to control systems: Basic components, classification of control systems, effects of feedback, mathematical modeling of physical systems, transfer functions, DC and AC position control systems, block diagrams, signal flow graphs.

UNIT – II

State-variable analysis of continuous data systems: state, state variables, state equations, solution of state equations, state transition matrix and its properties, state diagram, relationship between state equations and transfer functions, concept and testing of controllability and observability.

UNIT – III

Time-domain analysis: Typical test signals, steady-state error, unit-step response and time-domain specifications and transient response of a prototype second-order system.

Stability analysis of continuous data systems: Bounded-Input, Bounded-output stability, Zero input and asymptotic stability, Routh-Hurwitz criterion.

Root-Locus technique: Properties and construction of the root loci.

UNIT – IV

Frequency-domain analysis: frequency response and frequency domain specifications, Nyquiststability criterion, Bode plots, relative stability – gain margin and phase margin.

UNIT – V

Design of control systems: Cascade and feedback compensation using Bode plots. Phase lag, phase lead and phase Lag-Lead compensators and their design.

Controllers: Introduction to PI, PD and PID controllers.

Suggested Readings:

1. Benjamin C. Kuo, "*Automatic Control Systems",* Prentice Hall of India, 2009, 7th Edition.
2. I.J.Nagrath and M Gopal, "*Control System Engineering",* New Age International Private Limited, New Delhi, 2008, 5th Edition
3. Katsuhiko Ogata, *"Modern Control Engineering*", Prentice-Hall of India Private Limited, New Delhi, 2003, 4th Edition.

PC 502EC

ANALOG COMMUNICATION

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives: This course aims to:

- To understand the concept of modulation.
- To study various types of analog modulation techniques.
- To understand the analog modulation schemes.
- To study the block diagram and characteristics of transmitters and receivers.
- To study the types of noise and influence analog modulation.

Course Outcomes: Upon completion of this course, students will be:

1 Able to compare the performance of AM, FM and PM schemes with reference to bandwidth.
2 Able to understand generation of AM, FM, PM schemes.
3 Able to evaluate the performance of AM and FM transmitters and receivers.
4 Able to identify sources of noise, noise figure, signal to noise ratio for AM, FM, and PM.
5 Understand the concept of pulse modulation and to compare their performance.

UNIT- I

Linear modulation schemes: need for modulation, double-side band suppressed-carrier (DSB-SC) modulation, conventional amplitude modulation (AM), single side band (SSB) modulation and vestigial-sideband (VSB) modulation. Generation and demodulation of the above, Frequency Division Multiplexing.

UNIT- II

Angle modulation schemes: frequency modulation(FM) and phase modulation(PM), concept of instantaneous frequency, NBFM, WBFM, FM spectrum in terms of Bessel function, direct and indirect(Armstrong's) methods of FM generation, discriminators, phase locked loop(PLL), FM receiver.

UNIT-III

Transmitters and receivers: classification of transmitters, AM and FM radio transmitters. Principles of tuned radio frequency (TRF) and super heterodyne receivers, choice of intermediate frequency (IF), image frequency, tracking alignment, automatic-gain control (AGC), receiver characteristics and measurements, communication receivers.

UNIT – IV

Noise performance of AM, FM and PM systems: Sources of noise, thermal noise, shot noise, noise in linear systems, equivalent noise band width, noise temperature, noise figure. Signal-to noise ratio (SNR) calculations for DSB-SC AM, SSB, FM and PM systems.

UNIT – V

Analog pulse modulation schemes: sampling of continuous-time signals, low pass and band pass sampling, practical aspects of sampling and reconstruction of signals. Pulse amplitude modulation (PAM), Time Division Multiplexing, pulse time modulation schemes-pulse width modulation (PWM) and pulse position modulation (PPM), generation and demodulation.

Suggested Readings:

1. Herbert Taub and Donald L.Schilling, *"Principles of Communication Systems*", 2nd Edition, Tata McGraw-Hill publishing company Limited, New Delhi, 1986.
2. Simon Haykin, *"Communication Systems*", 4th Edition, John WiLey & sons.inc, 2000.
3. George Kennedy, Bernard Davis, *"Electronic Communication Systems",* 4th Edition, Tata McGraw-Hill publishing company Limited, New Delhi, 1993.

PC 503EC

DIGITAL COMMUNICATION

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives: This course aims to:

- To interpret the principles of information theory.
- To understand wave form coding techniques.
- To get familiarized with various error coding techniques.
- To analyze various digital carrier modulation techniques.
- To understand the concept of spread spectrum modulation.

Course Outcomes: Upon completion of this course, students will be:

1. Able to acquires knowledge about information theory and assesses entropy and efficiency of various channels.
2. Able to learn to design an optimum receiver and analyze the error performance of base band and band pass data transmission.
3. Able to understand to design block codes, convolution and cyclic codes.
4. Able to apply suitable digital carrier modulation techniques and coding techniques for various applications for improved spectral efficiency.
5. Able to analyze the performance of spread spectrum communication system.

UNIT- I

Information Theory: Introduction, Information entropy, properties of entropy, information rate, types of information sources, channels, types of channels, joint entropy, conditional entropy, redundancy, mutual information, channel capacity.

UNIT- II

Digital Coding Techniques: Elements of digital communication system, sampling theorem, quantization noise, source coding techniques: PCM, DPCM, DM, noise in PCM, DM system. Performance comparison of above systems.

UNIT-III

Error Control Coding: Binary discrete channels, types of transmission errors, need for error control coding , Coding theory: Introduction, source coding/decoding, Huffman coding, , Shannonfano coding, linear block codes, binary cyclic codes, characteristics of BCH codes, convolution codes ,tree diagram, comparison of the above codes,

UNIT – IV

Digital carrier modulation techniques: optimum receiver, coherent and non-coherent ASK, FSK, PSK, DPSK, MSK, and QPSK schemes, M-ary signalling schemes, and synchronization methods.

UNIT – V

Spread spectrum modulation: introduction, generation and characteristics of PN sequences. Direct sequence spread spectrum system; frequency hopping spread spectrum system and their application, acquisition scheme for spread spectrum receivers, tracking of FH and DS signals.

Suggested Readings:

1. K Sam Shanmugam, *"Digital and Analog Communication Systems*", John Wiley & sons, 1979.
2. John G.Proakis, *"Digital Communications*", 4th Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 2003.
3. P Ramakrishna Rao, "*Digital Communication*", Tata McGraw- Hill Education Private Limited, New Delhi, 2011.

PC 504EC

MICROPROCESSOR AND MICROCONTROLLER

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To understand the microprocessor architecture with the help of 8086.
- To study the block diagram and peripheral ICs of microprocessor.
- To understand and differentiate between a microprocessor and a microcontroller.
- To study the architecture and pin out of the 8051.
- To understand the instructions and program the 8051.

Course Outcomes: Student will be

1. Able to acquire an overview of what a processor and controller are and differentiate between them.
2. Able to understand the architecture of a microprocessor and microcontroller to enable to design applications using them.
3. Able to apply theoretical learning to practical real time problems for automation.
4. Able to understand the architecture of a microcontroller.
5. Able to analyze and design real world applications and interface peripheral devices to the microprocessor.

UNIT – I

Introduction to 8086: The 8086 Microprocessor Family- Overview, 8086 architecture, segmented memory, Maximum and Minimum mode of operation, addressing modes, Memory read and write bus cycles, memory interfacing,

UNIT – II

Assembly Language Programming: Instructions for data transfer, arithmetic, logical, simple sequence program Jumps, Flags, and Conditional jumps, Loops and Constructs, Instruction Timing and Delay Loops ; String instructions, Procedures and Macros, Assembler Directives, Interrupts in 8086.

UNIT – III

Peripherals: Programmable Peripheral Interface 8255 – examples using DAC, ADC, stepper motor etc., DMA controllers, Programmable Interrupt Controller 8259, Programmable Interval Timer 8254, USART 8251.

UNIT – IV

Introduction to microcontroller: Difference between microcontroller and microprocessor, 8051microcontroller architecture. 8051 registers. Memory organizations-program memory and data memory, internal RAM and bit addressable memory, special functions registers.

UNIT - V

8051 assembly language programming: instruction set – arithmetic, logical, data transfer, branching and others, addressing modes, programming using different instructions, Timers/counters of 8051. Interfacing 8051 with peripherals – LCD, Stepper motor, ADC, DAC, PWM, and Relay.

Suggested Readings:

1. Douglas V.Hall, *"Microprocessors and Interfacing Programming and Hardware"*, 2nd Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 1994.
2. Walter A.Triebel and Avatar singh, *"The 8088 and 8086 Microprocessors Programming, Interfacing,c Software, Hardware and Applications"*, Prentice-Hall of India Private Limited, New Delhi, 1996.
3. Muhammad Ali Mazidi, Janice GillispieMazidi and RolinD.McKinlay, *"The 8051 Microcontroller and Embedded Systems using Assembly and C"*, 2nd Edition, Pearson education, 2009.

PC 505EC

ANTENNA WAVE PROPAGATION

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To understand the various antenna parameters give insight of the radiation phenomena
- To have thorough understanding of radiation characteristics of different types of antennas.
- To study the characteristics of array antennas having directional radiation characteristics.
- To give insight on aperture antennas and modern antennas.
- To understand the concepts of wave propagation and create awareness about the different types of propagation of radio waves at different frequencies.

Course Outcomes:

1. The student acquires knowledge about the basic antenna parameters and radiation concepts.
2. The student learns to analyze wire antennas in detail.
3. The student attains engineering fundamentals to analyze and design antenna arrays.
4. The student can classify, analyze and design aperture and modern antennas.
5. The student gains ability to identify and explain different modes of propagation in different regions of atmosphere.

UNIT- I

Fundamentals of Antenna theory: Principle of radiation, Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain, Antenna Apertures, Effective Height, Illustrative Problems. Retarded Potentials – Helmholtz Theorem Thin Linear Wire Antennas – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, near field and far field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height. Loop Antennas – Introduction, Small Loop, Comparison of Far Fields of Small Loop and Short Dipole.

UNIT - II

Antenna Arrays: Basic two element array,N element uniform linear array, Pattern multiplication, Broadside and End fire array, Planar array, Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial array, Tschebysev array.

UNIT - III

Practical Antennas: Yagi-uda antenna, V- Antenna, Rhombic antenna, Travelling wave antennas, Microstrip antennas– Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry, Design equations and Characteristics.

UNIT - IV

Aperture and Modern Antennas: - Reflector Antennas – Introduction, Flar Sheetand Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods,and Reflector Types – Related Features, Illustrative Problems. Horn Antennas – Types, Fermat's Principle, Radiation from sectorial and pyramidal horns, Design Considerations of Pyramidal Horns,Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications

UNIT - V

Wave propagation: Ground wave propagation. Space and surface waves, Tropospheric refraction and reflection. Sky wave propagation – Virtual height, critical frequency, Maximum usable frequency – Skip distance, Fading, Multi hop propagation

Suggested Reading:

1. Constantine A. Balanis, *"Modern Antenna Handbook*", a John Wiley & Sons, Inc., Publication, 2008.
2. John D.Kraus, Ronald J.Marhefka and Ahmed S.Khan, "*Antennas for All Applications"* 3rd Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 2006.
3. K.D.Prasad, *"Antennas and Wave Propagation*", Khanna or Satya Publications.

PE 511EC

DIGITAL IMAGE PROCESSING

(PROFESSIONAL ELECTIVE –I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Prerequisite: This course requires the knowledge of Digital Signal Processing

Course Objectives: This course aims to:

- Understand the image formation and its digital representation.
- Learn digital image fundamentals. Be exposed to simple image processing techniques.
- Learn representation of images in frequency domain and enhancement techniques.
- Be familiar with image compression and segmentation techniques. Learn to represent image in form of features.
- Students would be able to solve the problems related to image compression and restoration.

Course Outcomes: Upon completion of this course, students will be able to:

1 Understand how images are formed, sampled and quantized.
2 Apply various transforms like Fourier, DCT, Haar, DWT and Hadamard Transform to different applications.
3 Apply image enhancement techniques for practical applications
4 Implement the image restoration techniques.
5 Implement image compression techniques by removing the redundancy.

UNIT – I

Digital Image Fundamentals: Image sensing, acquisition, Image formation model, sampling and Quantization, Basic relationships between pixels; neighbors of a pixel, adjacency, connectivity, regions and boundaries. Image formation in the eye, its capabilities for brightness adaptation and discrimination. Categorization of images according to their source. Gamma ray imaging, x-ray imaging, imaging in the Ultra Violet band, visible and infrared bands, Microwave band and Radio band.

UNIT – II

Image Transforms: 2D Fourier transform, Properties of 2D Fourier transform, Walsh, Hadamard, Slant, Haar, Discrete cosine transform and Hotelling transform. Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing.

UNIT – III

Image Enhancement: Spatial domain techniques: Contrast stretching, histogram equalization and histogram specification method, Neighborhood averaging and adaptive Median filter. Frequency domain methods: Ideal Low pass, Butterworth and Gaussian Low pass filters. Ideal High pass, Butterworth and Gaussian High pass filters. Homomorphic filtering.

UNIT – IV

Image Restoration: Mathematical expression for degraded image, estimation of degradation functions: image observation, experimentation and by modeling. Inverse filter Wiener filter, Geometric transformation, periodic noise reduction method.

UNIT – V

Image Segmentation and Compression: Detection of discontinuities, point detection methods, line detection. Edge detection methods: Gradient operation, Laplacian, Prewitt, Sobel, Laplacian of a Gaussian and Canny edge detectors. Image compression: Functional block diagram of a general image compression system and description of each unit, various types of redundancies, coding redundancy, psycho visual redundancy spatial and temporal redundancy, Huffman coding, LZW coding.

Suggested Readings:

1. Rafael C. Gonzales, Richard E. Woods, "*Digital Image Processing*", Third Edition, Pearson Education, 2010.
2. Anil K Jain, "*Fundamentals of Digital Image Processing"*, Prentice-Hall of India Private Limited, New Delhi, 1995.
3. Milan Sonka, Vaclav Havel and Roger Boyle, "*Digital Image Processing and Computer vision"*, Cengage Learning India Pvt. Limited, 2008.
4. Willliam K Pratt, *"Digital Image Processing",* John Willey, 2002.
5. Malay K. Pakhira, "*Digital Image Processing and Pattern Recognition*", First Edition, PHI Learning Pvt. Ltd., 2011.

PE 512EC

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

(PROFESSIONAL ELECTIVE –I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To familiarize with various Static and Dynamic Characteristics of Instruments, SI units of measuring electrical quantities and Various Display devices.
- To learn the working principles of various types of DVMs and Wave analyzers.
- To understand the working of Simple CRO and design concepts of various types of CROs.
- To understand the working and design concepts of various transducers for the measurement of quantities like temperature, displacement, force, pressure etc.
- To understand the importance of DAS, its types and the concept of Virtual instrumentation.

Course Outcomes:

1. Analyze the various characteristics of instruments and familiar with the SI units of measurements. And understand the working principles of Display devices.
2. Analyze the design aspects of various DVMs and wave analyzers
3. Analyze and design concepts of CROs and different CROs for different applications
4. Analyze various models of Active and Passive Transducer circuits.
5. Analyze the DAS and virtual instruments.

UNIT - I

Measurements, Units and Display Devices: Performance characteristics of Instruments, Static and Dynamic characteristics, Error in Measurement, Types of Errors, Statistical analysis of errors, Limiting errors, Systems of Units, SI units, Electric and Magnetic Units, Fundamental and derived units Display devices: Light emitting diodes, Liquid crystal display and other displays including $3\frac{1}{2}$-digit displays

UNIT – II

Digital Voltmeters and Signal analysers : Comparison of Digital and Analog meters, Analog to Digital conversion, Ramp-type Digital Voltmeter, Staircase Ramp Digital Voltmeter, Successive approximation Digital Voltmeter, Dual-slope Digital Voltmeter, General specifications of DVM Basic Wave analysers, Heterodyne Wave analysers, Harmonic Distortion analyser, Spectrum analysers.

UNIT –III

Oscilloscopes: Basic Principle, CRT features, Block diagram of Oscilloscope, Vertical amplifier, Continuous Sweep and Triggered Sweep CRO, Delay line in Triggered Sweep, Oscilloscope Controls, Waveform Display, Measurement of frequency and Phase using Lissajous method, Applications and Advantages of CRO

Types of CRO: Dual Beam CRO, Dual Trace CRO, Sampling CRO, Storage Oscilloscope, Digital Storage Oscilloscope.

UNIT – IV

Transducers : Introduction, Electrical Transducer, Selecting a Transducer, Active and Passive Transducers, Resistive transducers, Strain gauges, Temperature measurements, Thermistors, Thermocouples, LVDT, Inductive transducers, Capacitive Transducers, Piezoelectric Transducers, Photo electric Transducer, Digital Transducers.

UNIT –V

Data Acquisition System and Virtual Instrumentation: Introduction, Data Acquisition system, Objective of a DAS, Signal Conditioning of the inputs,Single channel DAS, Multichannel DAS, Data loggers, Introduction to Virtual Instrumentation,

IEEE 488 bus

Suggested Reading:

1. Albert D.Helfrick and William D.Cooper, "*Modern Electronic Instrumentation and Measurement Techniques*", Prentice-Hall of India Private Limited, New Delhi, 1996.
2. H S Klasi, "*Electronic Instrumentation*". Tata McGraw-Hill Company Limited, New Delhi, 2004.
3. David A.Bell, *"Electronic Instrumentation and Measurements*", 2nd Edition, Prentice-Hall of India Private Limited, New Delhi, 1994.

PE 513EC

OBJECT ORIENTED PROGRAMMING LANGUAGE SYSTEMS

(PROFESSIONAL ELECTIVE –I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- Introduces Object Oriented Programming concepts using the C++ language.
- Introduces the principles of data abstraction, inheritance and polymorphism;
- Introduces the principles of virtual functions and polymorphism
- Introduces handling formatted I/O and unformatted I/O
- Introduces exception handling

Course Outcomes:

1. Able to develop programs with reusability
2. Understand different types of constructors and initialization of objects
3. Handle exceptions in programming
4. Develop applications for a range of problems using object-oriented programming techniques

UNIT - I

Basic Concepts of OOP, Benefits of OOP, Object Oriented Languages, Features of OOP. How OOP Differ from POP. Applications of OOP, A Simple C++ Program, Structure of C++ Program. Keywords, Identifiers and Constants, Basic Data Types, User Defined Data Types, Derived Data Types, Dynamic Initialization of Variables, Reference Variables, Operators in C++, Scope Resolution Operator, Member Dereferencing Operators, Memory Management Operators.

UNIT- II

Functions, Classes and Objects: Introduction of Classes, Specifying a Class, Defining a Member Functions, A C++ Program with Class Access Specifies, Inline functions, Nesting of Member Functions, Memory Allocation for Objects, Static Data Members, Static Member Functions, Arrays of Objects, Objects as Function Arguments, Default Arguments, Const Arguments, Function Overloading, Friend Functions

UNIT- III

Constructors, Destructors, Inheritance: Introduction, Constructors, Parameterized Constructors, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic initialization of Objects, Copy Constructors, Dynamic Constructors, Destructors. Introduction to inheritance, Defining Derived Classes, Single Inheritance, Multiple Inheritance, Multi-Level Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Abstract Classes, Constructors in Derived Classes, Containership, Operator overloading, Rules for Operator overloading, overloading of binary and unary operators .

UNIT-IV

Pointers, Virtual Functions and Polymorphism: Introduction, Memory Management, new Operator and delete Operator, Pointers to Objects, this Pointer, Pointers to Derived Classes, Polymorphism, compile time polymorphism, Run time polymorphism, Virtual Functions, Pure Virtual Functions, Virtual Base Classes, Virtual Destructors.

UNIT - V

Templates and Exception handling: Introduction, Class Templates, Class Templates with Multiple Parameters, Function Templates, Function Templates with Multiple Parameters, Member Function Templates. Basics of Exception Handling, Types of exceptions, Exception Handing Mechanism, Throwing and Catching Mechanism, Rethrowing an Exception, Specifying Exceptions

Suggested Readings:

1. Walter Savitch, *"Problem Solving with C++",* 6th Edition, Pearson Education Publishing, 2009.
2. SB Lippman, J Lajoie, *"C++ Primer"*, 3rd Edition, AW Publishing Company, 2007.
3. Paul Dietel, Harvey Dietel*, "C How to Program"*, 6th Edition, PHI, 2010.
4. BjarneStroustrup, *"The C++ Programming Language",* 3rd Edition, Pearson Education.
5. Ashok N.Kamthane, *"Programming in C++"* 2nd Edition, Pearson Education Publishing.

PE 514EC

DIGITAL SYSTEM DESIGN USING VERILOG HDL

(PROFESSIONAL ELECTIVE –I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To familiarize with various modeling styles: structural and dataflow using Verilog HDL.
- To familiarize with behavioral modeling of digital systems using Verilog HDL
- To familiarize with various ICs available (combinational units) and their usage and to design them using Verilog HDL.
- To familiarize with various Register and counter ICs available in the market and develop their function using Verilog HDL.
- To design and develop real time applications such as adders, multipliers, Divider, ALU and DSP filter.

Course Outcomes: Student will be

1. Able to implement and distinguish different Verilog HDL modeling styles.
2. Able to construct and analyze Verilog HDL models of combinational and sequential circuits.
3. Able to make a choice among various ICs available in the market (combinational and sequential)
4. Able to understand types of memories and their design using Verilog HDL
5. Able to design and develop Verilog HDL modeling and test bench for digital systems for the given specifications.

UNIT – I

Structural modeling: Overview of Digital Design with Verilog HDL, modules and ports, gate-level modeling and design examples.

Dataflow modeling: dataflow modeling, operands and operators. Switch Level Modeling: CMOS switches and bidirectional switches and design examples. Introduction to test bench design.

UNIT – II

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, multi-way branching, Loops, Sequential and Parallel blocks, Generate blocks. Combinational, sequential logic modules and design examples.

UNIT-III

Digital Integrated Circuits: Classification of Integrated Circuits, Comparison of Various Logic Families Combinational Logic ICs – Specifications and Applications of TTL-74XX & Code Converters, Decoders, De-multiplexers, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, De-multiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor and Magnitude Comparators.

UNIT-IV

Sequential Logic IC's and Memories: Familiarity with commonly available TTL 74XX, CMOS 40XX Series ICs – All Types of Flip-flops, Asynchronous and synchronous Counters, Decade Counters, Shift Registers.

Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture and applications, Static & Dynamic RAMs.

UNIT –V

Real time implementations: Fixed-Point Arithmetic modules: Addition, Multiplication, Division, Arithmetic and Logic Unit (ALU), Timer, Universal Asynchronous Receiver and Transmitter (UART), DSP modules: FIR and IIR filters, CPU design: Data path and control units.

Suggested Readings:

1. Samir Palnitkar, *"Verilog HDL A Guide to Digital Design and Synthesis,"* 2nd Edition, Pearson Education, 2006.
2. R.P.Jain, *"Modern Digital Electronics",* Tata McGraw Hill, 4th Edition, 2009.
3. Ming-Bo Lin, *"Digital System Designs and Practices: Using Verilog HDL and FPGA*," Wiley India Edition, 2008.
4. J. Bhasker, *"A Verilog HDL Primer,"* 2nd Edition, BS Publications, 2001.

PC 551EC

ANALOG AND DIGITAL COMMUNICATION LABORATORY

Instruction: 2 periods per week *Duration of SEE: 3hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Course Objectives:

- To perform Analog modulation and demodulation techniques and measure modulation index.
- To perform experiments on Radio Receivers to measure their performance parameters.
- To perform Pulse analog modulation and demodulation techniques and understand.
- To perform Pulse digital modulation and demodulation techniques and understand.
- To perform carrier modulation techniques.

Course Outcomes: Student will be

1. Able to acquire knowledge of performing modulation and demodulation and analyze the effects of various parameters on the process.
2. Able to acquire knowledge of operation of various radio receiver sub systems.
3. Able to acquire in-depth understanding of pulse analog and pulse digital modulation techniques.
4. Able to acquire skill to perform carrier modulation schemes using MATLAB.

List of Experiments

Cycle-I

1. AM generation and Demodulation
2. FM generation and Demodulation
3. Spectrum Analyzer and Analysis of AM and FM Signals
4. Radio Receiver measurements
5. AGC Characteristics of Radio Receiver
6. Squelch Circuit and Frequency Multiplier Circuit
7. Pre-emphasis and De-emphasis Circuits

Cycle-II

8. Sampling and Reconstruction of Sine Wave
9. PAM generation and Demodulation
10. PWM generation and Demodulation
11. PPM generation and Demodulation
12. PCM generation and Demodulation
13. Delta Modulation
14. Spectrum Analyser and Analysis of PAM and PWM Signals
15. ASK,FSK,PSK,QPSK and DPSK modulation and Demodulation using MATLAB

Note: At least 10 experiments need to be completed in a semester (5 from analog and 5 from digital communication systems).

Suggested Readings:

1. Simon Haykin*, "Communication Systems",* 4th Edition, John Wiley &sons.inc, 2000.
2. George Kennedy, Bernard Davis, *"Electronic Communication Systems"*, 4th Edition, Tata McGraw-Hill publishing company Limited, New Delhi, 1993.
3. K.C. Raveendranathan *"Communication systems Modelling and simulation using Matlab and Simulink"* Universities Press 2011.

PC 552EC

MICROPROCESSOR AND MICROCONTROLLER LABORATORY

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Course Objectives:

- To study the 8085 microprocessor and implement various basic programs on it.
- To study the 8086 microprocessor and implement basic programs on it.
- To write assembly language programs in 8086 for string manipulations.
- To interface the 8086 to stepper motor, ADC, DAC etc.
- To program the 8051 using Keil IDE.

Course Outcomes: Student will be

1. Able to write assembly language programs for arithmetic operations using 8086.
2. Able to implement simple programs on 8086.
3. Able to perform string manipulation operations in 8086.
4. Able to interface the 8086 to peripherals like stepper motor, ADC, DAC etc.
5. Able to understand the Keil IDE and simulate 8051 programs on it.

List of Experiments:

1. Addition, subtraction using 8085
2. Multiplication and division using 8085
3. Simple programs on 8086 kits
4. Searching and sorting using 8086 assembly language
5. String operations like concatenation and swapping using 8086
6. DAC interface to 8086
7. ADC interface to 8086
8. Stepper motor interface to 8086
9. Study of Keil software for 8051
10. Basic programs using 8051 instructions
11. Flashing LED program using 8051
12. Timer program to generate square wave on ports of 8051

Suggested Readings:

1. Ramesh S.Gaonkar, *"Microprocessor Architecture programming and Applications with the 8085",* 5th Edition, Penram International publishing (India) private Limited, 1999.
2. Douglas V.Hall, *"Microprocessors and Interfacing programming and Hardware",* 2nd Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 1994.
3. Muhammad Ali Mazidi, Janice GillispieMazidi and RolinD.McKinlay, *"The 8051 Microcontroller and Embedded Systems using Assembly and C*", 2nd Edition, Pearson education, 2009.

V – SEMESTER

B.E. (Service courses offered to other Departments)

ES 501EC

SIGNALS AND SYSTEMS

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 2

Course Objectives:

- To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
- To understand Sampling theorem, with time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transform.
- To present the concepts of convolution and correlation integrals and also understand the properties in the context of signals/systems and lay down the foundation for advanced courses.

Course Outcomes: Student will be

1 Apply the knowledge of linear algebra topics like vector space, basis, dimension, inner product, norm and orthogonal basis to signals.
2 Analyse the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
3 Understand the process of sampling and the effects of under sampling. Classify systems based on their properties and determine the response of LSI system using convolution.
4 Analyze system properties based on impulse response and Fourier analysis. Apply the Laplace transform and Z- transform for analyze of continuous-time and discrete-time signals and systems.

UNIT-I

Some useful operations on signals: Time shifting, Time scaling, Time inversion. Signal models: Impulse function, Unit step function, Exponential function, Even and odd signals. Systems: Linear and Non-linear systems, Constant parameter and time varying parameter systems, Static and dynamic systems, Causal and Non-causal systems, Lumped Parameter and distributed parameter systems, Continuous-time and discrete-time systems, Analog and digital systems.

UNIT-II

Fourier Series: Signals and Vectors, Signal Comparison: correlation, Signal representation by orthogonal signal set, Trigonometric Fourier Series, Exponential Fourier Series, LTI system response to periodic inputs.

UNIT-III

Continuous-Time Signal Analysis: Fourier Transform: Aperiodic signal representation by Fourier integral, Fourier Transform of some useful functions, Properties of Fourier Transform, Signal transmission through LTI Systems, ideal and practical filters, Signal energy. Laplace transform: Definition, some properties of Laplace transform, solution of differential equations using laplace transform.

UNIT-IV

Discrete-time signals and systems: Introduction, some useful discrete-time signal models, Sampling continuous-time sinusoids and aliasing, Useful signal operations, examples of discrete-time systems. Fourier Analysis of discrete-time signals, periodic signal representation of discrete-time Fourier Series, aperiodic signal representation by Fourier integral.

UNIT-V

Discrete-time signal analysis: Z-Transform, some properties of Z-Transform, Solution to Linear difference equations using Ztransform, System realization. Relation between Laplace transform and Ztransform. DTFT: Definition, Properties of DTFT, comparison of continuous-time signal analysis with discrete-time signal analysis.

Suggested Reading:

1. B. P. Lathi, Linear Systems and Signals, Oxford University Press, 2nd Edition, 2009
2. Alan V O P Penheim, A. S. Wlisky , Signals and Systems, 2nd Edition, Prentice Hall.
3. Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, Signals and Systems, 4th Edition, Pearson 1998.
4. Douglas K. Linder, Introduction to Signals and Systems, McGraw Hill, 1999
5. P. Ramakrishna Rao, Signals and Systems, TMH.

With effect from the Academic year 2020-21

SCHEME OF INSTRUCTION
B.E. (ECE)
VI – SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC 601EC	Digital Signal Processing	3	0	0	3	30	70	3
2	PC 602EC	VLSI Design	3	0	0	3	30	70	3
3	PC 603EC	Data Communication and Computer Networks	3	0	0	3	30	70	3
4	**Professional Elective–II**		3	0	0	3	30	70	3
	PE 621EC	Operating Systems							
	PE 622EC	Pattern Recognition							
	PE 623EC	Information Theory and Coding							
	PE 624EC	Scripting Languages							
5	**Professional Elective –III**		3	0	0	3	30	70	3
	PE 631EC	Embedded System Design							
	PE 632EC	Adaptive Filter Theory and Applications							
	PE 633EC	Neural Networks and Fuzzy Logic							
6	OE #	**Open Elective-I**	3	0	0	3	30	70	3
7	HS 501LA	Professional Practice Law & Ethics	3	0	0	3	30	70	3
8	MC 902AS	Essence of Indian Traditional Knowledge	3	0	0	3	30	70	0
Practicals									
9	PC 651EC	Digital Signal Processing Laboratory	0	0	2	2	25	50	1
10	PC 652EC	Electronic Design and Automation Laboratory	0	0	2	2	25	50	1
11	PW 961EC	Summer Internship*	6-weeks						
	Total		**21**	**0**	**4**	**28**	**290**	**660**	**23**

***Students have to undergo summer internship of 6 Weeks duration at the end of semester VI and valuation will be done in VII semester.**

L	:	Lectures
T	:	Tutorials
P	:	Practicals
CIE	:	Continuous Internal Evaluation
SEE	:	Semester End Examination
PC	:	Professional Core
PE	:	Professional Elective
OE	:	Open Elective
HS	:	Humanities and Social Sciences
PW	:	Project Work

Open Elective-I

1. OE601BM Engineering Applications in Medicine
2. OE602CE Disaster Management
3. OE 603EC Electronic Instrumentation
4. OE 604EC Principles of Electronic Communication
5. OE605ME 3D Printing Technology
6. OE606ME Finite Element Method

PC 601EC

DIGITAL SIGNAL PROCESSING

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To study the DFT and FFT algorithms.
- To understand the concept of FIR and IIR filters.
- To study the types of filters.
- To understand Multi rate signal processing.
- To study the architecture of TMS processor.

Course Outcomes: Student will be

1 Able to find DFT of a given signal through Fast Fourier Transform techniques.
2 Able to design FIR and IIR type digital filters.
3 Able to identify filter structures and evaluate the coefficient quantization effects.
4 Able to understand sample rate conversion techniques.
5 Able to compare the architectures of DSP and General Purpose Processors.

UNIT-I

Introduction: Review of Discrete Time Fourier Transform, Concept of frequency in continuous and discrete time signals, DFT and its properties, linear convolution, circular convolution. Computational complexity of direct Computation of DFT, Fast Fourier Transform, DIT and DIF, FFT algorithms for RADIX-2 case, in-place computation, Bit reversal, Finite word length effects in FFT algorithms, Use of FFT in Linear Filtering.

UNIT-II

FIR Filters: FIR digital filter design techniques. Properties of FIR digital filters, design of FIR filters using windows and frequency sampling techniques, linear phase characteristics. Realization diagrams for IIR and FIR filters, finite word length effects.

UNIT-III

IIR Filters: Analog filter design – Butterworth and Chebyshev approximations, IIR digital filter design techniques, impulse invariant technique. Bilinear transform technique. Comparison of FIR and IIR filters, frequency transformations.

UNIT- IV

Multirate signal processing: Introduction, decimation by a factor D, interpolation by a factor I, sampling rate conversion by a rational factor I/D, design of practical sampling rate converter, S/W implementation of sampling rate converter, application of Multirate signal processing.

UNIT-V

DSP Processors: Introduction to Fixed point Digital Signal Processors, TMS 320C54XX processor- architecture, addressing modes, instruction set, Assembly programming, programming issues, Applications of DSP processors.

Suggested Readings:

1. John G.Proakis and Dimitris G. Manolakis, *"Digital Signal Processing principles, Algorithms and Applications"*, 3rd Edition, Prentice-Hall of India Private Limited, New Delhi, 1997.
2. Alan V. Oppenheim and Ronald W. Schafer, "*Discrete Time Signal Processing*", 3rd edition, Prentice Hall, Upper Saddle River, NJ,2010
3. Sanjit K. Mitra, "*Digital Signal Processing: A Computer-Based Approach*", 4/e, McGraw-Hill, New York,2011
4. Avatar sing and S.Srinivasan, *"Digital Signal Processing implementation using DSP Microprocessors with Examples from TMS320C54XX"*, Thomson Books Icole, 2004.

PC 602EC

VLSI DESIGN

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To provide a perspective on Digital Design in the Deep Sub-micron Technology.
- To focus on CMOS and Bi CMOS Short-channel Transistor Models.
- To Study CMOS Inverter elaborately.
- To explore static and dynamic implementations of combinational and sequential circuit designs and introduce Testability of VLSI circuits.

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

1. Have an understanding of the Fabrication processes and the comparison between different state-of-the-art CMOS technologies.
2. Acquire the knowledge in understanding CMOS Inverter characteristics. Illustrate circuit diagrams, stick diagrams and layouts.
3. Design and analyze various Combinational Logic circuits in different models.
4. Design and analyze various Arithmetic Blocks and Memory structures.
5. Understand various fault models and test patterns.

UNIT – I

Design Abstraction in Digital circuits, Fabrication process flow of nMOS and pMOS transistors, Overview of CMOS and BiCMOS technologies, MOSFET Transistor under static conditions, channel Length Modulation, Velocity Saturation, Sub-threshold Condition, Threshold variations, MOS structure Capacitance, CMOS Latch up, Technology scaling.

UNIT – II

CMOS Inverter, Voltage Transfer Characteristics, Static Power Consumption, Dynamic Power Consumption, Propagation Delay, Power-Energy and Energy-Delay Product, Layout Design of basic gates, Silicon on Insulation Technology, FinFET, Comparison of SOI and FinFET.

UNIT – III

Designing Combinational Logic gates in CMOS: Complementary CMOS, Ratioed Logic, Pass Transistor Logic, Dynamic CMOS logic-basic principle, Signal integrity issues in Dynamic Design, domino logic, np-CMOS logic, Merits and Demerits of above logic styles. Designing sequential logic: Bistability Principle, Multiplexer based latch, Dynamic latch, Pipelining.

UNIT – IV

Designing Arithmetic Building Blocks: Adder, Binary Adder, Full Adder, and Mirror Adder, Transmission gate-based Adder, Manchester Carry Chain Adder, Carry Bypass Adder, Carry Look ahead Adder, Carry Save Adder, Multiplier, Carry Save Multiplier, Barrel

Shifter, and Logarithmic Shifter. Design of Memory Structures: ROM cells, PROM, EPROM, EEPROM, Flash Memory, SDRAM and DRAM.

UNIT – V

Implementation of strategies for Digital ICs, Testing of VLSI circuits: VLSI Chip Yield, Test procedures; Design for Testability- Ad Hoc Testing, Scab Based testing, Boundary Scan Design, Built in Self-Test, Built-in logic block observer, Test Pattern Generator, Automatic Test Pattern Generation (ATPG).

Suggested Readings:

1. JAN.M. Rabaey, A. Chandrakasan and B. Nikholic, *"Digital Integrated Circuits – A Design Perspective"*, 2nd Edition, PHI, 2007.
2. David A Hodges, H. Jackson and R. A. Saleh, "*Analysis and Design of Digital Integrated Circuits in Deep Submicron Technology"*, 3rd Edition, Tata McGraw Hill, 2007.
3. John. P. Uymera, "*Introduction to VLSI Circuits and system"*, student edition, John Wiley and Sons, 2003.

PC 603EC

DATA COMMUNICATION AND COMPUTER NETWORKS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To provide a conceptual foundation for the study of data communications using the open Systems interconnect (OSI) model for layer edarchitecture.
- To study the principles of network protocols and internet working
- To understand the Network security and Internet applications.
- To understand the concepts of switched communication networks.
- To understand the performance of data link layer protocols for error and flow control.
- To understand various routing protocols and network security.

Course Outcomes:

1 Understand the working of various network topologies and circuit and packets witching
2 Comprehend the role of data link layers and significance of MAC protocols
3 Understand the networking protocols and Internet protocols
4 Understand the transport layer working with TCP, UDP and ATM protocols
5 Comprehend the functionality of application layer and importance of network security.

UNIT - I

Data communication: A Communication Model, The Need for Protocol Architecture and Standardization, Network Types: LAN, WAN, MAN. Network Topologies: Bus, Star, Ring, Hybrid. Line configurations. Reference Models: OSI,TCP/IP.
Circuit switching: Circuit Switching Principles and concepts.
Packet switching: Virtual circuit and Datagram subnets, X.25.

UNIT - II

Data Link Layer: Need for Data Link Control, Design issues, Framing, Error Detection and Correction, Flow control Protocols: Stop and Wait, Sliding Window, ARQ Protocols, HDLC.
MAC Sub Layer: Multiple Access Protocols: ALOHA, CSMA, Wireless LAN. IEEE 802.2, 802.3, 802.4, 802.11, 802.15, 802.16 standards. Bridges and Routers.

UNIT - III

Network Layer: Network layer Services, Routing algorithms: Shortest Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast, Distance Vector Routing, and Congestion Control Algorithms.

Internet Working: The Network Layer in Internet: IPV4, IPV6, Comparison of IPV4 and IPV6, IP Addressing, ATM Networks.

UNIT - IV

Transport Layer: Transport Services, Elements of Transport Layer, Connection management, TCP and UDP protocols, ATM AAL Layer Protocol.

UNIT - V

Application Layer: Domain Name System, SNMP, Electronic Mail, World Wide Web. **Network Security:** Cryptography Symmetric Key and Public Key algorithms, Digital Signatures, Authentication Protocols.

Suggested Reading:

1. Andrew S Tanenbaum, *"Computer Networks*," 5/e, Pearson Education,2011.
2. Behrouz A. Forouzan, *"Data Communication and Networking*,"3/e, TMH,2008.
3. William Stallings*, "Data and Computer Communications,"* 8/e, PHI,2004.
4. Douglas EComer, *"Computer Networks and Internet",* Pearson Education Asia,2000.
5. PrakashC. Gupta, *"Data Communications and Computer Networks",* PHI learning,2013

PE 621EC

OPERATING SYSTEMS

(PROFESSIONAL ELECTIVE –II)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To introduce the concepts of OS structure and process synchronization
- To study different memory management strategies
- To familiarize the implementation of file system
- To understand the principles of system security and protection
- To discuss the design principles and structure of Windows 7 and Linux

Course Outcomes: Student will be able to

1. Evaluate different process scheduling algorithms
2. Describe the steps in address translation and different page replacement strategies
3. Compare different file allocation methods and decide appropriate allocation strategy for given type of file
4. Understand the concepts of system protection and security process
5. Explain the mechanisms available in an OS to control access to resource

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Multithreaded Programming, Process scheduling, Process synchronization, Deadlocks.

UNIT-II

Memory management strategies with example architectures: Swapping, Contiguous allocation,
Paging, Segmentation, Segmentation with paging, Virtual memory management: Demand paging, Page replacement, Thrashing.

UNIT-III

File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation of file systems, Mass storage structures, I/O systems

UNIT-IV

System Protection: Principles and Domain, Access Matrix and implementation, Access control and access rights, Capability based systems, and Language based Protection,
System Security: Problem, Program threats, cryptography, user authentication, implementing security defences, Firewalling, Computer security Classification

UNIT-V

Case Studies: The Linux System–Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process communication. Windows 7 –Design principles, System components, Terminal services and fast user switching File systems, Networking, Programmer interface.

Suggested Reading:

1. Abraham Silberschatz, Peter B Galvin, *"Operating System Concepts*", 9th edition, Wiley, 2016
2. William Stallings, *"Operating Systems-Internals and Design Principles*", 8th edition, Pearson, 2014
3. Andrew S Tanenbaum, *"Modern Operating Systems",* 4th edition, Pearson, 2016.

PE 622EC

PATTERN RECOGNITION

(PROFESSIONAL ELECTIVE –II)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To provide the students both supervised and unsupervised pattern classification methods
- To provide different parameter estimation techniques required in data classification task.
- To provide methods how to estimate the shape of the given data distribution.
- To provide the students both data reduction and unsupervised classification methods and statistical based methods
- To provide different learning algorithms and application of a deep neural network.

Course Outcomes: Student will be

1. Able to learn supervised classification techniques based on Bayesian decision theory.
2. Able to learn parameter estimation and density estimation methods required for data classification
3. Students able to learn the concept of data reduction and support vector and nearest neighbor classifiers.
4. Able to learn data clustering methods employed in partitioning the data.
5. Able to learn neural networks and deep convolutional networks and its application for numerals and image data classification

UNIT – I

Introduction to Pattern Recognition: Pattern recognition system, Bayesian decision theory, two category classifier, minimum error rate classification, discriminant functions and decision surfaces, two category cases. Discriminant functions for normal density function.

UNIT – II

Maximum likelihood and Bayesian parameter estimation Techniques: General principles, parameter estimation from a multivariate distribution. Component analysis and discriminants: Principle component analysis and Fisher linear Discriminant.

UNIT – III

Non-parametric Techniques: Introduction, density estimation, Parzen window. Nearest Neighbor rule, convergence and error rate for the Nearest Neighbor rule, Metrics and nearest Neighbor classification: Properties of metrics and tangent distance.

UNIT – IV

Linear discriminant functions and Decision surfaces: Two category and multi-category cases, Generalized discriminant functions .Data description and clustering: similarity measures, criterion functions for clustering, k means and fuzzy k means clustering techniques and Support vector machine.

UNIT – V

Neural networks and deep learning: Model of an artificial neuron, different learning rules, perceptron and its training algorithm, multilayer neural network, back propagation algorithm, deep convolutional neural networks, architecture, training algorithm and its application to digit data set classification.

Suggested Readings:

1. Richard O.Duda, Peter E Heart, David G.Stork, "*Pattern Classification",* John Wiley and Sons 2002.
2. Rafael C.Gonzalez and Richard E. Woods, "*Digital Image processing",* Pearson, NY 2018.
3. B.Yegnanarayana, "*Artificial Neural Networks*", Prentice Hall, New Delhi 2007.

PE 623EC

INFORMATION THEORY AND CODING

(PROFESSIONAL ELECTIVE –II)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To acquire the knowledge in measurement of information and errors.
- Understand the importance of various codes for communication systems
- To design encoder and decoder of various codes.
- To know the applicability of source and channel codes
- To learn about emerging applications of error–control coding.

Course Outcomes: Upon completing this course, the student will be able to

1. Learn measurement of information and errors.
2. Design encoders and decoders for linear block codes
3. Apply cyclic codes for error correction and detection.
4. Design encoders and decoders for convolution codes
5. Understand encoders and decoders for BCH codes

UNIT - I

Coding for Reliable Digital Transmission and storage: Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.Channel Coding Channel capacity, binary symmetric channel, binary erasure channel, Shannon's channel coding theorem, Huffman coding

UNIT - II

Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

UNIT - III

Cyclic Codes: Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

UNIT - IV

Convolutional Codes: Encoding of Convolutional Codes- Structural and Distance Properties, state, tree, trellis diagrams, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

UNIT - V

BCH Codes: Minimum distance and BCH bounds, Decoding procedure for BCH codes, Syndrome computation and iterative algorithms, Error locations polynomials for single and double error correction.

Suggested Readings:

1. K. Sam Shanmugam, *"Digital and analog communication systems*", John Wiley India Pvt. Ltd, 1996.
2. Simon Haykin, *"Digital communication"*, John Wiley India Pvt. Ltd, 2008.
3. Muralidhar Kulkarni, K.S. Shivaprakasha, "*Information Theory and Coding"*, Wiley India Pvt. Ltd, 2015, ISBN: 978-81-265-5305-1.
4. Shu Lin, Daniel J. Costello, Jr, *"Error Control Coding- Fundamentals and Applications",* Prentice Hall, Inc 2014.
5. Man Young Rhee, "*Error Correcting Coding Theory*" McGraw – Hill Publishing 1989

PE 624EC

SCRIPTING LANGUAGES

(PROFESSIONAL ELECTIVE –II)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To understand the UNIX and Shell environments.
- To study the Linux kernel and commands.
- To understand the ability of PERL scripting language.
- To study the Python scripting language.

Course Outcomes: Student will be

1 Able to use UNIX and Linux based systems to perform various tasks.
2 Able to use shell scripting to run programs of any scripting language.
3 Able to compile large programming sets in the Perl and Python environment.
4 Able to effectively apply knowledge of Perl and Python to new situations and learn from the experience.
5 Able to Use Python scripting language for Web application development.

UNIT – I

Linux: Introduction to Linux, File System of the Linux, General usage of Linux kernel & basic commands, Permissions for file, directory and users, searching a file & directory, zipping and unzipping concepts, Overview of scripting languages.

UNIT – II

Shell: The Shell as a Process, Creating a Command File, VI Editor, UNIX Power Tools, Redirection and Pipelines, Variables, Conditional Constructs, Looping Constructs, Shell Functions, Parameters, Pattern Matching. Exporting, Signals And Traps, Built-In Commands, Bourne-Again Shell, Error Debugging, Advanced Shell Scripting Commands.

UNIT – III

PERL Basics-I:PERL basics, file handles, operators, control structures, regular expressions, built in data types, operators, statements and declarations- simple, compound, loop statements, global and scoped declarations, Pattern matching - regular expression, pattern matching operators, character classes, positions, capturing and clustering.

UNIT – IV

PERL Basics-II: Lists and Hashes, Subroutines- syntax, semantics, proto types, format variables, references, data structures- arrays of arrays, hashes of arrays, hashes of functions. Inter process communication, - signals, files, pipes, sockets. PERL debugger.

UNIT – V

Python: Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling, Integrated Web Applications in Python – Building Small, Efficient Python Web Systems, Web Application Framework.

Suggested Readings:

1. David Barron, *"The World of Scripting Languages",* Wiley Publications.
2. Larry Wall, Tom Christiansen, John Orwant, *"Programming PERL*", Oreilly publications, 3rd Ed.
3. Steve Holden and David Beazley, *"Python Web Programming*", New Riders Publications.

PE 631EC

EMBEDDED SYSTEM DESIGN

(PROFESSIONAL ELECTIVE –III)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- To gain knowledge to design embedded systems.
- To understand the processor selection criteria for Embedded System Design.
- To gain the knowledge of ARM Cortex on Zynq for embedded systems.
- To gain the knowledge of tool chain for embedded systems.
- To understand the importance of RTOS in building real time systems

Course Outcomes: Student will be able to

1. Design an embedded system.
2. Distinguish between RISC and CISC
3. Use the ARM Cortex for design of embedded system
4. Use Embedded Software Development Tools for Designing Embedded System applications
5. Apply their understanding in building real time systems.

UNIT-I

Introduction To Embedded Systems: The Embedded Design Life Cycle - Product Specification, Hardware/Software Partitioning, Iteration And Implementation, Detailed Hardware (selection fo processor) and Software Design, Hardware/Software Integration, Product Testing And Release, Maintenance and Upgradation.

UNIT-II

ARM Embedded Systems: The RISC design philosophy, The ARM design philosophy, ARM processor fundamentals, registers, current program status register, pipeline, exceptions, interrupts, and vector table, core extensions, architecture revisions, ARM processor families.

UNIT-III

Embedded processing with ARM CORTEX on Zynq: Fundamentals of FPGA, types of FPGA, case study of Xilinx FPGA, Processing System, programmable logic, programmable logic interfaces, security, Zynq 7000 family members, Zynq versus standard FPGA, Zynq versus standard processor.

UNIT-IV

Embedded Software Development Tools: Host and Target Machines, Cross Compilers, Cross Assemblers, Tool Chains, Linkers/Locators for Embedded Software, Address Resolution, Locator Maps. Getting Embedded Software Into Target System: PROM programmer, ROM emulator, In Circuit- Emulators, Monitors, Testing on Your Host Machine - Instruction Set Simulators, Logic Analysers.

UNIT-V

Introduction to Real Time Operating Systems: Tasks and task states, tasks and Data, Semaphores and shared data. Operating system services: Message queues, mailboxes and pipes, timer functions, events, memory management, Interrupt routines in an RTOS environment.

Suggested Readings:

1. Arnold S Berger, "*Embedded Systems Design*", South Asian edition, CMP Books, 2005.
2. Andrew Sloss, Dominic Symes, Chris Wright, *"ARM System Developer's Guide: Designing and Optimizing System Software"*, Elsevier, 2004.
3. Louise H Crockett, Ross.A.Elliot et *al " The Zynq Book*" , Edition 1, Strathclyde academic media, July 2014.
4. David E Simon, *"An Embedded software primer"*, Pearson, 2012

PE 632EC

ADAPTIVE FILTER THEORY AND APPLICATIONS

(PROFESSIONAL ELECTIVE –III)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- To understand the adaptive filter.
- To study LMS and convergence of LMS.
- To understand the applications of adaptive filter.
- To study the kalman filter and vector kalman filter.
- To Understand the concept of vector kalman filter

Course Outcomes: Student will be

1. Able to understand adaptive filter.
2. Able to understand LMS algorithm and practical application of LMS algorithm.
3. Able to understand applications of adaptive filter.
4. Able to understand kalman filter
5. Able to understand vector kalman filter for practical applications.

UNIT - I

Approaches to the development of adaptive filter theory. Introduction to filtering, smoothing and prediction. Wiener filter theory, introduction; Error performance surface; Normal equation; Principle of orthogonality; Minimum mean squared error; example.

UNIT - II

Gradient algorithms; Learning curves; LMS gradient algorithm; LMS stochastic gradient algorithms; convergence of LMS algorithms.

UNIT - III

Applications of adaptive filter to adaptive noise cancelling, Echo cancellation in telephone circuits and adaptive beam forming.

UNIT - IV

Kalman Filter theory; Introduction; recursive minimum mean square estimation for scalar random variables; statement of the kalman filtering problem: the innovations process; Estimation of state using the innovations process; Filtering examples.

UNIT V

Vector Kalman filter formulation. Examples. Application of kalman filter to target tracking.

Suggested Reading:

1. Sophoclas, J. Orphanidies, *"Optimum signal processing an introduction*", McMillan, 1985.
2. Simon Haykins, *"Adaptive signal processing*", PHI, 1986.
3. Bernard Widrow, *"Adaptive signal processing*", PHI, 1986.
4. Bozic. SM., "*Digital and Kalman Filtering".*

PE 633EC

NEURAL NETWORKS AND FUZZY LOGIC

(PROFESSIONAL ELECTIVE –III)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- To understand the basics of Neural Networks and essentials of Artificial Neural Networks
- To train different Feedback Neural Networks Single Layer and Multilayer Feed Forward Networks.
- To understand the concepts of Associate Memories and introduces Fuzzy sets and Fuzzy Logic system components.
- Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
- Provide an emphasis on the differences and similarities between fuzzy sets and classical sets theories.

Course Outcomes: After completing this course, the student will be able to

1. Understand principles of neural networks.
2. Apply basic principles of ANN in solutions that require problem solving, inference, perception, knowledge representation, and learning.
3. Demonstrate an ability to share in discussions of NN, its current scope and limitations, and societal implications
4. Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications
5. Understand basic knowledge of fuzzy sets and fuzzy logic and different applications of these models to solve engineering and other problems.

UNIT –I

Introduction to Neural Networks: Introduction, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Essentials of Artificial Neural Networks: Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Applications of ANN.

UNIT- II

Feed Forward Neural Networks: Single Layer: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Multilayer: Generalized Delta Rule, Derivation of Back propagation (BP) Training, Summary of Back propagation Algorithm, Kolmogorov Theorem

UNIT–III

Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem Architecture of Hopfield Network: Discrete and Continuous versions

UNIT- IV

Classical & Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT - V

Logic System Components: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods. Fuzzy logic applications

Suggested Readings:

1. James A Freeman and Davis Skapura, *"Neural Networks"*, Pearson Education, 2002.
2. B. Yeganaranarana, "*Artificial Neural Networks*", Prentice Hall, New Delhi, 2007.
3. Bart Kosko, *"Neural Networks and Fuzzy Logic System*", PHI Publications.

OE 601BM

ENGINEERING APPLICATIONS IN MEDICINE

(OPEN ELECTIVE-I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- Provide a basic knowledge of human physiology to engineering graduate students.
- Understand the applications of various branches of engineering in Medicine.

Course Outcomes:

1. Importance and evolution of medical health care
2. Applications of solid and fluid mechanics in bio medical systems
3. Evaluation of Brain machine interface based systems
4. understand the characteristics and design challenges in signal processing of bio-mechanical systems
5. Choose replacement materials for various implants

UNIT – I

Evolution of Modern healthcare, Major organ systems- Cardiovascular, Respiratory, Nervous, Skeletal, Muscular. Homeostasis. Physiological signals and their diagnostic importance.

UNIT – II

Solid mechanics-Analysis of muscle force and joint reaction force for the limb joints. Fluid mechanics-Factors governing and opposing blood flow, Wind-Kessel model, Application of HagenPoiseuille flow to blood flow.

UNIT – III

Brain-Computer Interface: Brain signals for BCIs, Generic setup for a BCI, Feature extraction and Feature translation involved in BCIs. Typical applications-Word forming, Device control.

UNIT –IV

Bioelectricity-Excitable cells, Resting potential, Action potential, Accommodation, Strength-Duration Curve, and Propagation of impulses in myelinated and unmyelinated nerves. Medical Instrumentation system-Functions, Characteristics, Design Challenges. Signal Processing-QRS detection.

UNIT –V

Materials and Tissue Replacements-Types of Biomaterials- Metals, Polymers, Ceramics and Composites and their applications in Soft and Hard tissue replacements. Implants-Manufacturing process, Design, fixation.

Suggested Reading:

1. John Enderle,Susan m. Blanchard and Joseph Bronzino, Introduction to Biomedical Engineering, Second Edition, Elsevier, 2005.
2. Joseph D.Bronzino, Biomedical Engineering Fundamentals, 3rd Edition, CRC press, 2006.
3. Ozkaya, Nordin. M, Fundamentals of Biomechanics, Springer International Publishing, 4th Edition, 2017.

OE 602CE

DISASTER MANAGEMENT

(OPEN ELECTIVE-I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

Course Outcomes:

1. The students will be able to understand impact on Natural and manmade disasters.
2. Able to classify disasters and destructions due to cyclones
3. Able to understand disaster management applied in India

UNIT – I

Introduction to Disasters: Concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks.

Natural and Manmade disasters, impact of drought, review of past disasters and drought in India, its classification and characteristics. Classification of drought, causes, Impacts (including social, economic. political, environmental, health, psychosocial, etc.).

UNIT – II

Disaster: Classifications, Causes, Impacts including social, economic, political, environmental, health, psychosocial etc.

Differential Impacts - in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, climate change.

Cyclones and Floods: Tropical cyclones & Local storms, Destruction by tropical cyclones and local storms, Cumulative atmospheric hazards/ disasters, Cold waves, Heat waves, Causes of floods, Rood hazards in India.

UNIT-III

Approaches to Disaster Risk Reduction: Disaster cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural non-structural sources, roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRis/ULBs), states, Centre, and other stake-holders.

UNIT-IV

Inter-relationship between Disasters and Development: Factors affecting Vulnerabilities, differential impacts, impact of development projects such as darns, embankments, changes in Land-use etc. Climate Change Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT-V

Disaster Risk Management in India: Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, OM Act and Policy, other related policies, plans, programmes and legislation)

Field Work and Case Studies: The field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located.

Suggested Reading:

1. Sharma V. K. (1999). *Disaster Management, National Centre for Disaster Management*, IIPE, Delhi.
2. Gupta Anil K, and Sreeja S. Nair. (2011). *Environmental Knowledge for Disaster Risk Management*, NIDM, New Delhi.
3. Nick. (1991). *Disaster Management: A Disaster Manager's Handbook*. Asian Development Bank, Manila Philippines.
4. Kapur, et al. (2005). *Disasters in India Studies of grim reality*, Rawat Publishers, Jaipur.
5. Pelling Mark, (2003). *The Vulnerability of Cities: Natural Disaster and Social Resilience Earthscan publishers*, London.

OE 603EC

ELECTRONIC INSTRUMENTATION

(OPEN ELECTIVE-I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives:

- To familiarize with various measurement parameters and Standards of measurement.
- To learn the working principles of various types of Microphones and Hygrometers.
- To understand the operation and applications of CRO.
- To understand about the operation of various transducers.
- To understand the importance of biomedical instrumentation and Virtual instrumentation.

Course Outcomes:

1. Analyze the various characteristics of measurement parameters and Standards of measurement.
2. Evaluate the operation and application of microphones
3. Use the CROs for various applications and explore its features.
4. Explore various types of Transducers and their characteristics.
5. Analyze the operation of various biomedical instruments and the features of Virtual Instrumentation.

UNIT – I

Measurement parameters: History of instrumentation. Error in Measurement, Types of Errors, Statistical analysis of errors, Limiting errors, Standards of measurement, IEEE and ISO standards.

UNIT – II

Microphones and Hygrometers: Microphones: Microphones and their types, Humidity measurement, resistive, capacitive, aluminium-oxide and crystal Hygrometer types – Operationand applications.

UNIT – III

CRO: Basic Principle of CRT, its features, Block diagram and operation of CRO, Oscilloscope Controls, Waveform display, Measurement of frequency and Phase using Lissajous method, Applications and Advantages of CRO.

UNIT –IV

Transducers: Introduction, Electrical Transducer, Factors for Selecting a Transducer, Active and Passive Transducers, Operation and applications of Resistive transducers, Strain gauges and Thermistors.

UNIT –V

Biomedical and Virtual Instrumentation: Biomedical instrumentation, Bio-potential electrodes, Principles of operation and applications of ECG, EEG, EMG, X-ray machines, CT scanners and Introduction to virtual instrumentation.

Suggested Reading:

1. Albert D.Helfrick and William D.Cooper, *"Modern Electronic Instrumentation and Measurement Techniques",* Prentice-Hall of India Private Limited, New Delhi, 1996.
2. H S Klasi, *"Electronic Instrumentation", Tata* McGraw-Hill Company Limited, New Delhi, 2004.
3. David A.Bell, *"Electronic Instrumentation and Measurements",* 2nd Edition, Prentice-Hall of India Private Limited, New Delhi, 1994.
4. R.S.Khandpur, *"Handbook of biomedical Instrumentation",* Tata McGraw- Hill publishing company Limited, New Delhi, 2000.

OE 604EC

PRINCIPLES OF ELECTRONIC COMMUNICATION

(OPEN ELECTIVE-I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- Provide an introduction to fundamental concepts in the understanding of communications systems.
- Provide an introduction to network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
- Provide an introduction to the evolution of wireless systems and current wireless technologies.

Course Outcomes: Student will be able to

1. Understand the working of analog and digital communication systems
2. Understand the OSI network model and the working of data transmission
3. Understand the concepts of modulation and demodulations
4. Understand the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.
5. Understand the principles of optical communications systems

UNIT- I

Introduction to communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels, Signal Transmission Concepts-Baseband transmission and Broadband transmission, Communication parameters-Transmitted power, Channel bandwidth and Noise, Need for modulation Signal Radiation and Propagation-Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT- II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT- III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet, Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer – TCP, UDP.

UNIT- IV

Telecommunication Systems: Telephones, Telephone system, Paging systems, Internet Telephony. Optical Communications: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT- V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, And OFDM. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

Suggested Readings:

1. Louis E. Frenzel, "*Principles of Electronic Communication Systems*", 3e, McGraw Hill publications, 2008.
2. Behrouz A. Forouzan, *"Data Communications and Networking",* 5e TMH, 2012.
3. Kennady, Davis, "*Electronic Communications systems*", 4e, TMH, 1999.

OE 605ME

3D PRINTING TECHNOLOGY

(OPEN ELECTIVE-I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- To understand the fundamental concepts of 3D Printing, its advantages and limitations.
- To classify various types of 3D Printing Processes and know their working principle, advantages, limitations etc.
- To have a holistic view of various applications of these technologies in relevant fields such as Mechanical, Bio-medical, Aerospace, electronics etc

Course Outcomes: Student will be able to

1. Understand the fundamentals of 3D Printing Technology, its process chain and classify various types of 3D Printing process
2. Learn about the working principle, advantages, limitations and applications of various types of liquid and solid based 3D Printing Systems
3. Understand the various types of Powder based 3D Printing systems, their advantages, limitations and applications.
4. Understand the various types of 3D Printing Data formats, STL file errors and features of the 3D Printing Softwares
5. Learn the versatile applications of 3D Printing Technology in various fields like automobile, aerospace, biomedical, Electronic industries etc

UNIT-I

Introduction: Prototyping fund3D Printingentals, Historical development, Fund3D Printingentals of 3D PRINTING, Advantages and Limitations of 3D PRINTING , Commonly used Terms, Classification of 3D PRINTING process, 3D PRINTING Process Chain: Fund3D Printingental Automated Processes, Process Chain.

UNIT-II

Liquid-based 3D Printing Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies

Solid-based 3D Printing Systems: L3D Printinginated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT-III

Powder Based 3D Printing Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Laser Engineered Net Shaping (LENS), Electron Be3D Printing Melting.

UNIT-IV

3D Printing Data Formats: STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Rapid Prototyping Software's: Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

UNIT-V

Applications of 3D Printing: Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewellery Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules. Printed electronics, Biopolymers, Packaging

Suggested Reading:

1 Chua C.K., Leong K.F. and LIM C.S, Rapid prototyping; Principles and Applications, World Scientific Publications , Third Edition, 2010.

2 D.T. Ph3D Printing and S.S. Dimov, Rapid Manufacturing, Springer, 2001.

3 TerryWohlers, Wholers Report 2000, Wohlers Associates, 2000.

4 PaulF.Jacobs, Rapid Prototyping & Manufacturing ASME Press, 1996

OE 606ME

FINITE ELEMENT METHOD

(OPEN ELECTIVE-I)

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 3

Course Objectives:

- To understand the theory and application of the finite element method for analyzing structural systems.
- To learn Approximation theory for structural problems as the basis for finite element methods
- To learn formulations for a variety of elements in one, two, and three dimensions. Implementations of element formulations will be examined using Matlab.
- To understand modeling and analysis of structures using planar, solid, and plate elements

Course Outcomes: Student will be able to

1. Understands the concept of Finite Element Method and realize its limitations
2. formulate 1D, 2D and 3D element and distinguish between linear and higher order elements
3. Applying 1D , 2D and 3D elements to solve different static problems
4. Applying 1D , 2D and 3D elements to solve dynamic problems

UNIT - I:

Introduction to Finite Element Method, solution method using FEM, descretisation, Boundary conditions, load application, types of elements comparison, Stress and Equilibrium, Boundary conditions. Strain-Displacement relations. Stress-strain relations. One Dimensionla problems: Finite element modeling, coordinates and shape functions. Potential Energy approach: Assembly of Gloabal stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions. Quadratic shape functions.

UNIT - II:

Analysis of trusses and frames: Element stiffness matrix for a truss member. Analysis of plane truss with number of unknowns not exceeding two at each node. Analysis of frames with two translations and a rotational degree of freedom at each node. Analysis of Beams: Element stiffness matrix for two nodded, two degrees of freedom per node beam element.

UNIT - III:

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Finite element modeling of Axisymmetirc solids subjected to Axisymmetric loading with triangular elements.

UNIT - IV:

Two dimensional four nodded isoprarametric elements and numerical integration. Steady state heat transfer analysis: Ond dimensional analysis of a find and two dimensional analysis of thin palate. Analysis of uniform shaft subjected to torsion.

UNIT - V:

Dynamic Analysis: Formulation of finite element mode, element matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and a beam.

Time dependent field problems: Application to one dimensional heat flow in a rod. Finite element formation to three dimensional problems in stress analysis. Types of elements used. Convergence requirements and geometric isotropy. Local, natural and global coordinates. Introduction to Finite Element Analysis Software.

Suggested Readings:

1. Tirupathi R. Chandraputla and Ashok, D. Belgundu" Introduction to Finite Elements in Engineering", pearson Education, 2002, 3 rd Edition.
2. Rao S.S.,"The Finite Element Methods in Engineering", pergamon Press, 1989.
3. Segerlind, L.J. "Applied Finite Element Analysis", Wiley Publication, 1984.
4. Reddy J.N., "An Introduction to Finite Element Method", McGraw-Hill Company, 1984.

HS 501LA

PROFESSIONAL PRACTICE LAW & ETHICS

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 Marks *SEE: 70 Marks*

Credits: 3

Course Objectives:

- *To make the students understand the types of roles they are expected to play in the Society*
- *To know the different types of contracts, legal aspects of Arbitration and IPRs etc...*

As practitioners of the engineering profession to develop some ideas of the legal and practical aspects of their profession

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

1. *The students will understand the importance of professional practice, Law and Ethics in their personal lives and professional careers.*
2. *The students will learn the rights and responsibilities as an employee, team member and a global citizen.*

UNIT – I

Professional Practice and Ethics: Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders.

UNIT – II

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract, Indemnity and guarantee, Bailment, pledge , Contract of Agency, Sale of goods Act -1930.

UNIT – III

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and Court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; LokAdalats.

UNIT – IV

Engagement of Labour and other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work;

Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other - Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

UNIT – V

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970, Traditional Knowledge, Geographical Indications and Bio technology.

Suggested readings:

Text books:

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ravinder Kaur, Legal Aspects of Business, 4e, general principles of contract law By RK Bangia.

Reference books:

1. RERA Act, 2017.
2. Wadhera (2004), *Intellectual Property Rights*, Universal Law Publishing Co.
3. T. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
4. O.P. Malhotra, *Law of Industrial Disputes*, N.M. Tripathi Publishers.

MC 902AS

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: Nil

Course Objectives:

- The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
- Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic healthcare system.

Course Outcomes: Student will be able to

1. Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.
2. To explain holistic life style of yoga science
3. Understand basic structure of Indian knowledge system

Course Content

Basic Structure of Indian Knowledge System (i) वेद, (ii) उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्वेद, स्थापत्य आदि) (iii) वेदांग (शिक्षा, कल्प, निरुत, व्याकरण, ज्योतिष छंद), (iv) उपाइग (धर्म शास्त्र, मीमांसा, पुराण, तर्कशास्त्र)

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies.

Suggested Text/Reference Books

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya VidyaBhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya VidyaBhavan
3. Fritz of Capra, Tao of Physics
4. Fritz of Capra, The wave of Life
5. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am
6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
7. GN Jha(Eng. Trans.) Ed. R N Jha, Yoga-darshanam with VyasaBhashya, VidyanidhiPrakasham, Delhi, 2016
8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, VidyanidhiPrakasham, Delhi, 2016
9. P R Sharma (English translation), ShodashangHridayam

PC 651EC

DIGITAL SIGNAL PROCESSING LABORATORY

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 Marks *SEE: 50 Marks*
Credits: 1

Course Objectives:

- To understand the concept of basic signals and to generate them using MATLAB.
- To understand the concept of N-point FFT algorithm.
- To understand the concept of analog and digital filters and simulation using MATLAB.
- To study the architecture of TMS320 C54x.
- To understand the concept of Linear Convolution and simulate it using CCSTUDIO/Visual DSP ++.

Course Outcomes: Student will be

1. Able to develop various DSP Algorithms using MATLAB Software package.
2. Able to analyze and Observe Magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filter using window techniques.
3. Able to analyze and Observe Magnitude and phase characteristics (Frequency response Characteristics) of digital IIR-Butterworth, Chebyshev filters.
4. Able to design and Implement DSP algorithms in software using a computer language suchas C with TMS320C54x fixed point Processor.

List of Experiments

1. (a)Generation of basic signals based on recursive difference equations.
   (b) Operations on Basic sequences
2. (a) Linear and Circular Convolutions in time domain and frequency domain
   (b) Determination of autocorrelation and Power Spectrum of a given signal(s)
3. (a) Fast Fourier Transform – DIT and DIF algorithm
   (b) Spectrum analysis using DFT
4. (a) Generation of windows – Rectangular, Hamming and Hanning window
   (b) Design of LPF, HPF, BPF and BSF using windowing technique
5. (a) Design of Butterworth Filter using Impulse Invariant and Bilinear transformation
   (b) Design of Chebyshev Filter using Impulse Invariant and Bilinear transformation
6. (a) Implementation of Decimation and Interpolation Process.
   (b) Implementation of I/D sampling rate converters.
7. (a) Study of TMS320C54X DSP processor
   (b) Arithmetic operation using TMS320C54XX
8. MAC operation using various addressing modes
9. (a) Linear Convolution
   (b) Circular Convolution
10. (a) FFT Implementation
    (b) Waveform Generation – Sine wave and Square wave
11. Implementation of FIR filter on DSP processor
12. Implementation of IIR filter on DSP processor

PC 652EC

ELECTRONIC DESIGN AND AUTOMATION LABORATORY

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 Marks *SEE: 50 Marks*
Credits: 1

Course Objectives:

- To design and analyze building blocks for a Digital System using HDL platform.
- To understand a Digital System using HDL platform
- To design and analyze CMOS circuits using back-end platform.
- To draw layout of basic CMOS circuits.

Course Outcomes: Students will be able to

1. Demonstrate basic building blocks of a Digital System using HDL platform
2. Realize a basic Digital System in HDL platform
3. Demonstrate basic building blocks of a Digital System using schematic modeling
4. Demonstrate Layout design and parasitic extraction of CMOS Inverter.
5. Evaluate the performance parameters of CMOS inverter at different levels of design abstractions

List of Experiments:

Part A (Digital VLSI front-end Design)

1. Develop VERILOGHDL code and Test bench for the following:
   a. Multiplexer, Decoder, Encoder, Parity Generator, D flip-flop, four-bit adder and magnitude comparator using structural modeling
   b. Four-bit parallel adder/subtractor, zero/one detector and JK flip-flop using data flow modeling
   c. Arithmetic and logic unit, D, SR and JK flip-flops with synchronous and asynchronous resets, universal shift register and BCD- seven segment decoder using behavioral modeling
   d. Asynchronous, Synchronous, Ring and Johnson counters.
   e. Sequence Detector using Mealy and Moore type state machines.
2. Develop VERILOG HDL code for eight to three priority encoder using structural modeling and develop a test bench to cover all the functionalities. Assume each gate has a zero delay and three-simulation units delay.

3. Develop VERILOG HDL code for a four-bit carry look-ahead adder in structural modeling. Develop test bench to cover all the functionalities. Assume case (i) zero gate delay and case (ii) inverter: 2 and NAND/NOR gates: 4 simulation units.

4. Develop VERILOG HDL code for four to sixteen decoder using two-to-four decoders and other combinational logic. Develop test bench to cover all the functionalities. Assume case (i) zero gate delay and case (ii) inverter: 2 and NAND/NOR gates: 4 simulation units.

5. Using conditional operator, write Verilog HDL code to shift input *data* right arithmetic by the number of positions specified by another input *shift*. Develop test bench to cover all the functionalities.

6. Write Verilog HDL code to realize all bit Zero/One detector. Develop test bench to cover all the functionalities.
7. Develop Verilog HDL code to realize a MOD-10 synchronous decimal up counter with asynchronous reset and clear inputs. Develop test bench to cover all the functionalities.

8. Develop VERILOG HDL code for the state machine of control unit of GCD processor.

9. Develop Verilog HDL code to realize a four-bit universal shift register. Develop test bench to cover all the functionalities.

10. Develop Verilog HDL code to realize a four-bit ring counter with asynchronous reset and clear inputs. Develop test bench to cover all the functionalities.

11. Develop Verilog HDL code to realize a four-bit twisted ring counter with asynchronous reset and clear inputs. Develop test bench to cover all the functionalities.

12. Design a clock generator where its output *clk* is initialized to 0 and has a period of 500 time units and a duty cycle of 70 %.

13. Design four-bit binary to gray converter and gray to binary converter.

14. Acquaint with Synthesis and FPGA porting of the code.

Part B (Digital VLSI back-end Design)

1. Design and analyze the following CMOS circuits:
    a. Inverterusing static, ratioed, dynamic and domino logic styles
    b. Two-input NAND gate
    c. Two-input NOR gate
    d. Two-to-one Multiplexer using transmission gate
    e. Design a one-bit full adder circuit
    f. Design a one-bit SRAM cell.
2. Draw the layout and evaluate the performance of CMOS Inverter and two-input CMOS NAND gate.

PW 961EC

SUMMER INTERNSHIP*

Instruction: 6 weeks *CIE: 50 marks*
Credits: 2

Course Objectives:

- To give an experience to the students in solving real life practical problems with all its constraints.
- To give an opportunity to integrate different aspects of learning with reference to real life problems.
- To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.

Course Outcomes: Student will be

1. Able to design/develop a small and simple product in hardware or software.
2. Able to complete the task or realize a prespecified target, with limited scope, rather than taking up a complex task and leave it.
3. Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to prespecified criteria.
4. Able to implement the selected solution and document the same.

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Electronics Industry / R & D Organization / National Laboratory for a period of 8 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.

After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of sessionals are to be based on the performance of the student at the work place to be judged by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.

***Students have to undergo summer internship of 6 Weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester.**