DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Scheme of Instruction
and
Syllabi of

B.E. V & VI- SEMESTERS

2017-2018

UNIVERSITY COLLEGE OF ENGINEERING
(AUTONOMOUS)
OSMANIA UNIVERSITY
HYDERABAD – 500 007, TELANGANA

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	PC 501 EC	Analog Communication	3	1	0	4	30	70	3
2	PC 502 EC	Digital Communication	3	1	0	4	30	70	3
3	PC 503 EC	Integrated Circuit Applications	3	1	0	4	30	70	3
4	PC 504 EC	Linear Control Systems	3	1	0	4	30	70	3
5	PC 505 EC	Transmission Lines and Antennas	3	1	0	4	30	70	3
6	PC 506 EC	Computer Architecture and Organization	3	1	0	4	30	70	3
7	HS 901MB	Managerial Economics and Accountancy	3	0	0	3	30	70	3
Practicals									
8	PC 551 EC	Communication Engineering Laboratory	0	0	2	2	25	50	1
9	PC 552 EC	Integrated Circuits Laboratory	0	0	2	2	25	50	1
	Total		**21**	**6**	**4**	**31**	**260**	**590**	**23**

L : Lectures T : Tutorials

P : Practicals CIE : Continuous Internal Evaluation

SEE : Semester End Examination PC : Professional Core

HS : Humanities and Social Sciences

PC 501 EC

Analog Communication

Credits:3

Instruction: (3L + 1T) hrs per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*

Course Objectives:

- *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:

Student will be

- *Able to compare the performance of AM, FM and PM schemes with reference to bandwidth.*
- *Able to understand generation of AM,FM,PM schemes.*
- *Able to evaluate the performance of AM and FM transmitters and receivers.*
- *Able to identify sources of noise, noise figure, signal to noise ratio for AM,FM, and PM.*

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, "*Communiaction 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 502 EC

Digital Communication

Credits: 3

Instruction: (3L + 1T) hrs per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*

Course Objectives:

- *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:

Student will be

- *Able to acquires knowledge about information theory and assesses entropy and efficiency of various channels.*
- *Able to learn to design an optimum receiver and analyze the error performance of base band and band pass data transmission.*
- *Able to understand to design block codes, convolution and cyclic codes.*
- *Able to apply suitable digital carrier modulation techniques and coding techniques for various applications for improved spectral efficiency.*
- *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, , Shannon-fano 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 signaling schemes, 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 Communiaction*", Tata McGraw- Hill Education Private Limited, New Delhi, 2011.

PC 503 EC

Integrated Circuit Applications

Credits: 3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To gain the knowledge on 555 timer, 565 and 566 ICs.*
- *To understand the basic principles of different types of IC Regulators and data converters.*
- *To understand the characteristics of logic families.*
- *To gain the knowledge about IC combinational circuits.*
- *To gain the knowledge about IC sequential circuits.*

Course Outcomes:

Student will be

- *Able to develop and build different waveform generators and multivibrators using 555 timer.*
- *Able to design IC regulators (using 78XX, 79XX) and to evaluate the specifications of ADCs and DACs.*
- *Able to acquire knowledge about characteristics of digital ICs, interfacing of logic families and their related ICs.*
- *Able to analyze, design and build combinational circuits using digital ICs.*
- *Able to classify, analyze and design registers, counters and different sequential circuits.*

UNIT – I

Timer: Introduction to 555 Timer and its functional diagram. 555 as a monostable, astable multivibrators and their applications. Schmitt trigger circuit. Voltage controlled oscillator – Phase locked Loops, Description of IC 565 and 566, Frequency multiplication and frequency synthesis.

UNIT – II

IC Regulators: Introduction, monolithic voltage regulators, analysis and design of regulators using 78xx, 79xx.

Data Converters: Introduction to ADC and DAC, basic Digital to Analog conversion techniques, Weighted resistor DAC, Inverted R-2R ladder DAC, parallel comparator ADC, successive approximation ADC, Dual slope ADC, Flash type ADC, applications of ADC and DAC.

UNIT – III

Digital Integrated Circuit Logic Families: Introduction, Digital IC Technology (characteristics of digital ICs), TTL - Operation, O/p configurations & characteristics, Improved TTL Series, Connecting TTL Outputs together and Tristate TTL, ECL, CMOS, IC interfacing. IC interfacing, TTL driving CMOS and CMOS driving TTL.

UNIT – IV

IC Combinational Logic Circuits: Demultiplexer, Decoders, Drivers for LED & LCD Displays, Multiplexers & Encoders - applications, Digital comparator, Adder, Subtractor – Serial, Parallel, 2's Complement, BCD, Multiplier, Parity generators /checkers.

UNIT – V

IC Sequential Logic Circuits: Asynchronous - Counters with MOD numbers, IC counters, Synchronous - UP/DOWN counters, Presettable, IC counters, Cascading of BCD Counters, Applications, Decoding a counter and Decoding glitches.

Shift Registers: IC Registers and their applications.

Suggested Readings:

1. Ramakanth A Gayakwad, "*Op-Amps and Linear Integrated Circuits*", 3rd Edition, Prentice-Hall of India Limited, New Delhi, 1995.
2. Ronald J Tocci and Neal S.Widmer, "*Digital Systems principles and Applications*", 6th Edition, Prentice-Hall of India Private Limited, New Delhi, 2000.
3. D.Roy Chowdary and Shail B Jain, "*Linear Integrated Circuits*", 3rd Edition, New Age International (P) Limited, New Delhi, 2008.

PC 504 EC

Linear Control Systems

Credits: 3

Instruction: (3L + 1T) hrs per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*

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

- *Able to develop mathematical models and derive transfer functions for various systems.*
- *Able to expose to an appropriate state space modeling of system and its analysis and the concept and testing of controllability and observability.*
- *Able to analyze the systems in time domain and determine its stability.*
- *Able to analyze the systems in frequency domain and determine relative stability.*
- *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.

State-variable analysis of discrete data systems: transfer functions, state equations and solution of state equations, state diagrams, stability and stability tests.

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, Nyquist stability 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 505 EC

Transmission Lines and Antennas

Credits: 3

Instruction: (3L + 1T) hrs per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*

Course Objectives:

- *To understand the properties of transmission lines.*
- *To study the Smith chart and its applications.*
- *To understand the various Antenna parameters.*
- *To study the directional antennas.*
- *To understand the concepts of wave propagation learn its types.*

Course Outcomes:

Student will be

- *Able to attain engineering fundamentals to analyze the nature of electromagnetic wave propagation in guided medium and solve engineering problems in the related applications.*
- *Able to acquire knowledge about reflection of plane waves in a guided media and mathematical tool used to solve complex engineering problems.*
- *Able to learn the basic antenna parameters, antenna radiation concepts and will be able to analyze the linear antennas.*
- *Able to classify, analyze and design the antenna arrays and explain various antennas in VHF and UHF range.*
- *Able to identify and explain different modes of propagation in different regions of atmosphere.*

UNIT – I

Transmission line theory: Properties of transmission lines, circuit representation, transmission line theory, input impedance, low loss RF and UHF lines, distortion less line, loading, standing waves, reflection coefficient and VSWR, input impedance of various line sections.

UNIT – II

RF lines: Properties of λ/4, λ/2, λ/8 lines, transmission line as a circuit element, quarter wave transformer for matching, smith chart and its application to solve transmission line problems, single stub and double stub matching, introduction to planar transmission lines.

UNIT – III

Introduction to Antenna theory: Principle of radiation, vector potential, oscillating electric dipole, quarter wave monopole, near field and far field radiation pattern. reciprocity theorem applied to antennas, radiation resistance, antenna parameters: gain, directivity, efficiency, side lobe level, noise temperature, effective aperture.

UNIT – IV

Practical antennas: Linear array antennas: broad side and end fire arrays, multiplication of patterns, binomial arrays. dipole with parasitic, yagi-uda antenna, rhombic antenna, travelling wave antennas, broadband antennas, microstrip antennas(qualitative treatment only).

UNIT – V

Wave propagation: Ground wave propagation, space and surface waves, tropospheric refraction and reflection, sky wave propagation, regular and irregular variations in ionosphere, critical frequency, maximum usable frequency for ionosphere layer.

Suggested Readings:

1. Matthew N,O. Sadiku, *Principles of Electromagnetics*, 4th edition, Oxford University Press, 2009.
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.

PC 506 EC

Computer Architecture and Organization

Credits:3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To familiarize with Central Processing Unit (CPU) concepts.*
- *To understand register, architecture, addressing modes and instruction set of Intel microprocessor.*
- *To design data path and control units of Central Processing Unit (CPU).*
- *To know IO processor and cache memory organization.*
- *To understand CPU performance enhancement strategies.*

Course Outcomes:

Student will be

- *Able to design Arithmetic and Logic Unit for the given specifications.*
- *Able to develop programs of Intel Microprocessor.*
- *Able to demonstrate data path and control unit realizations of CPU.*
- *Able to analyze replacement policies in cache memory organization.*
- *Able to incorporate pipeline concept in a Central Processing Unit (CPU).*

UNIT – I

CPU Organization: Common bus structure, Arithmetic, Logic and Shift Unit using multiplexer, Register, Instructions, Design of CPU. Example: Intel 8085 – Programming model, Addressing modes, overview of Instruction set, Design of flowchart for CPU operation.

UNIT – II

Data Path Design: Fixed-Point Arithmetic: Addition, Subtraction, Multiplication -Robertson's, Booth's algorithms, Array Multiplier and Wallace tree multiplication, Division - Restoring and Non-restoring algorithms, floating point arithmetic and BCD Adder, Shifter: Barrel shifter and Logarithmic shifter, Examples: HDL descriptions of Fixed-Point and Floating-Point arithmetic.

UNIT – III

Control Design: Basic concepts, Hardwired Control unit design approach: classical and one-hot methods, Micro-programmed Control unit approach: basic concept, micro-program sequencer, Design examples: control unit designs for GCD processor, DMA controller and CPU control unit.

UNIT – IV

Memory and System Organization: Memory Organization: Memory hierarchy, Main memory: RAM, ROM, DRAM, Multi-level memory, cache memory: principles, address mapping techniques, replacement policies, System Organization: communication methods, IO and system control: Programmed IO, DMA and interrupts and Input-Output Processor (IOP), Examples: Memory ICs, Three-level cache hierarchy in Intel Pentium Processor.

UNIT – V

Parallel Processing: Reduced Instruction Set Computer (RISC): characteristics and architecture, Parallel processing: Pipeline – Arithmetic and Instruction, Pipeline Conflicts, Instruction Level Parallelism: super-pipeline, super-scalar architectures.

Suggested Readings:

1. Morris Mano M, *Computer System Architecture*, 3rd edition, Prentice Hall India, 2007.
2. William Stallings, *Computer Organization and Architecture*, *Design for Performance,* 7th edition, Prentice Hall India, 2006.
3. John P. Hayes, *Computer Architecture and Organization*, 3rd edition, McGraw Hill, 1998.

HS 901 MB

Managerial Economics and Accountancy

Credits:3

Instruction: (3L) hrs per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*

Course Objectives:

- *To learn important concepts of Managerial Economics and apply them to evaluate business decisions.*
- *To understand various parameters that determine the consumers' behavior.*
- *To evaluate the factors that affect production.*
- *To understand the concepts of capital budgeting and payback period.*
- *To study the concepts of various book-keeping methods.*

Course Outcomes:

Student will be Able to

- *Apply the fundamental concepts of managerial economics to evaluate business decisions.*
- *Understand types of Demand and factors related to it.*
- *Identify different types of markets and determine price –output under perfect competition.*
- *Determine working capital requirement and payback period.*
- *Analyze and interpret financial statements through ratios.*

UNIT – I

Meaning and Nature of Managerial Economics: Managerial Economics and its usefulness to Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equimarginalism, Opportunity costs, Discounting, Time Perspective, Risk and Uncertainty, Profits, Case study method.

UNIT – II

Consumer Behavior: Law of Demand, Determinants, Types of Demand; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium. (Theory questions and small numerical problem can be asked).

UNIT – III

Theory of Production and Markets: Production Function, Law of Variable Proportion, ISO quants, Economics of Scale, Cost of Production (Types and their measurement), Concept of Opportunity Cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price - Output determination under Perfect Competition and Monopoly (theory and problems can be asked).

UNIT – IV

Capital Management: Significance, determination and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems. (Theory questions and numerical problems on

estimating working capital requirements and evaluation of capital budgeting opportunities can be asked).

UNIT – V

Book-keeping: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance, concept and preparation of Final Accounts with simple adjustments, Analysis and interpretation of Financial Statements through Ratios.
(Theory questions and numerical problems on preparation of final accounts, cash book, petty cash book, bank reconciliation statement, calculation of some ratios).

Suggested Readings:

1. Mehta P.L., *Managerial Economics —Analysis, Problems and Cases ,* Sulthan Chand & Sons Educational Publishers, 2011.
2. Maheswari S.N., *Introduction to Accountancy* , Vikas Publishing House, 2005.
3. Pandey I.M., *Financial Management* , Vikas Publishing House, 2009.

PC 551 EC

Communication Engineering Laboratory

Credits: 1

Instruction : (2P) hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

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

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

List of experiments

1. AM generation and Demodulation
2. FM generation and Demodulation
3. Radio Receiver measurements
4. AGC Characteristics of Radio Receiver
5. Squelch Circuit and Frequency Multiplier Circuit
6. Pre-emphasis and De-emphasis Circuits
7. PAM generation and Demodulation
8. PWM generation and Demodulation
9. PPM generation and Demodulation
10. PCM generation and Demodulation
11. Delta Modulation
12. 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 " *Communuication systems Modelling and simulation using Matlab and Simulink*" Universities Press 2011 .

PC 552 EC

Integrated Circuits Laboratory

Credits: 1

Instruction: (2P) hrs per week *Duration of SEE: 3 hours*
CIE: 25 Marks *SEE: 50 Marks*

Course Objectives:

- *To study the 555 timer characteristics and understand its applications.*
- *To verify the operation of Op-amp as rectifier circuits and V to I and I to V converters.*
- *To understand the applications of SSI gates, Multiplexers.*
- *To verify the characteristics of digital arithmetic circuits.*
- *To design counters.*

Course Outcomes:

Student will be

- *Able to define significance of Op Amps and their importance.*
- *Able to build circuits using linear IC's.*
- *Ability to use OP Amp in linear applications.*
- *Able to use OP Amp as function generator.*
- *Able to use OP Amp as analog to digital and digital to analog converter.*

List of Experiments:

1. Op-amp as Rectifier circuits
2. Op-amp as Voltage to current converter and current to voltage converter
3. 555 timer as Astable and VCO
4. 555 timer as Monostable and Pulse width modulator
5. 555 timer as Triggered sweep generator
6. 555 timer as Saw tooth generator
7. 555 timer as Frequency Scalar
8. Application of SSI gates
9. Applications of Decoders/Demultiplexers and Multiplexers
10. Digital Arithmetic circuits
11. Counters and data registers using FlipFlops
12. IC Counters

Suggested Readings:

1. Ronald J Tocci and Neal S.Widmer, " Digital Systems principles and Application", 6th Edition, Prentice-Hall of India Private Limited, New Delhi, 2000.

2.D.Roy Choudary and Shail B.Jain, "Linear Integrated Circuits", 3rd Edition, New Age International (p) Limited, Publishers, New Delhi, 2008.

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 601 EC	Digital Signal Processing	3	1	0	4	30	70	3
2	PC 602 EC	Digital System Design using Verilog HDL	3	1	0	4	30	70	3
3	PC 603 EC	Microprocessor and Microcontroller	3	1	0	4	30	70	3
4	PC 604 EC	Data Communication and Computer Networks	3	1	0	4	30	70	3
5	PE #	Professional Elective-I	3	0	0	3	30	70	3
6	PE #	Professional Elective - II	3	0	0	3	30	70	3
7	OE #	Open Elective-I	3	0	0	3	30	70	3
Practicals									
8	PC 651 EC	Microprocessor and Microcontroller Laboratory	0	0	2	2	25	50	1
9	PC 652 EC	DSP Laboratory	0	0	2	2	25	50	1
10	PW 961 EC	Summer Internship*							
	Total		**21**	**4**	**4**	**29**	**260**	**590**	**23**

***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.**

PE # Professional Elective-I

PE 601 EC Scripting Languages
PE 602 CS Operating Systems
PE 603 CS Object Oriented Programming with C++

PE # Professionl Elective-II:

PE 604 EC Digital Image Processing
PE 605 EC Electronic Measurement and Instrumentation
PE 606 EC Fault Detection in Digital Systems

OE # Open Elective-I:

OE 601 BE Micro Electro- Mechanical Systems (MEMS)
OE 602 BE Engineering Applications in Medicine
OE 601 CE Disaster Management
OE 602 CE Geo Spatial Techniques
*OE 601 CS Operating Systems
OE 602 CS OOP using Java
*OE 601 EC Embedded Systems
*OE 602 EC Digital System Design using Verilog HDL
OE 601EE Reliability Engineering
OE 601 ME Industrial Robotics
OE 602 ME Material Handling
OE 601 LA Intellectual Property Rights

*** OE 601 CS, *OE 601 EC and *OE 602 EC Electives are not offered to the students of Electronics and Communication Engineering Department.**

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

PC 601 EC

Digital Signal Processing

Credits:3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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

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

UNIT – I

Review of Discrete Fourier Transform and its properties, linear convolution, circular convolution. Computation of the 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.

UNIT – II

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

UNIT – III

IIR Filters: Butterworth and Chebyshev approximations. IIR digital filter design techniques, impulse invariant technique. Bilinear transform technique. Digital butterworth filters, comparision 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: Computer architectures for signal processing, general purpose DSP processors, TMS 320C54XX processor- architecture, addressing modes, instruction set.

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. Chi-Tsong Chen, "*One-dimensional Digital Signal Processing*", Mareel dekker.INC, Newyork and Basel,1979.
3. Avatar sing and S.Srinivasan, "*Digital Signal Processing implementation using DSP Microprocessors with Examples from TMS320C54XX*", Thomson Books Icole, 2004.

PC 602 EC

Digital System Design using Verilog HDL

Credits: 3

Instruction : (3L+1TS) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To familiarize with various modeling styles: structural, dataflow and behavioral of Verilog HDL.*
- *To develop combinational and sequential circuits using various modeling styles of Verilog HDL.*
- *To design and develop Verilog HDL models of data path and control units of Central Processing Unit (CPU).*
- *To learn Synthesis and FPGA design flow.*
- *To design and develop real time applications: Booth's multiplier, Divider, hardwired control for basic CPU and FIR filter.*

Course Outcomes:

Student will be

- *Able to implement and distinguish different Verilog HDL modeling styles.*
- *Able to construct and analyze Verilog HDL models of combinational and sequential circuits.*
- *Able to design and develop Verilog HDL modeling and test bench for digital systems for the given specifications.*
- *Able to outline FPGA design flow and timing analysis.*

UNIT – I

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

UNIT – II

Dataflow and Switch level modeling: dataflow modeling, operands and operators. Switch Level Modeling: CMOS switches and bidirectional switches and design examples.

Unit III

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 IV

Synthesis and Verification: Tasks and Functions: Differences between Tasks and Functions. Verilog HDL synthesis, Application Specific IC (ASIC) and Field Programmable Gate Array (FPGA) design flow. Verification: Timing analysis and Test bench design. Design examples.

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. Ming-Bo Lin, *Digital System Designs and Practices: Using Verilog HDL and FPGA,"* Wiley India Edition, 2008.
3. J. Bhasker, "*A Verilog HDL Primer*," 2nd Edition, BS Publications, 2001.

PC 603 EC

Microprocessor and Microcontroller

Credits: 3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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 8051.*
- *To understand the instructions and program the 8051.*

Course Outcomes:

Student will be

- *Able to acquire an overview of what a processor and controller are and differentiate between them.*
- *Able to understand the architecture of a microprocessor and microcontroller to enable to design applications using them.*
- *Able to apply theoretical learning to practical real time problems for automation.*
- *Able to Program using assembly language instructions for any application of processors.*
- *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., Direct Memory Access 8257, Programmable Interrupt Controller 8259 , Programmable Interval Timer 8254, USART 8251.

UNIT – IV

Introduction to microcontroller: Difference between microcontroller and microprocessor, 8051 microcontroller 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.

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,Software, Hardware and Applications*", Prentice-Hall of India Private Limited, New Delhi, 1996.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D.McKinlay, "*The 8051 Microcontroller and Embedded Systems using Assembly and C*", 2nd Edition, Pearson education, 2009.

PC 604 EC

Data Communication and Computer Networks

Credits: 3

Instruction : (3L + 1T) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To familiarize the student with basic concepts and terminology of computer networks.*
- *To understand the ISO/OSI and TCP/IP protocols of communication Networks.*
- *To study the various LAN protocols and routing protocols for networks.*
- *To expose the student to advanced Networks design and maintenance of computer network.*

Course Outcomes:

Student will be

- *Able to understand the fundamentals of networks and issues involved.*
- *Able to Categorize services offered by all layers in TCP/IP protocol stack.*
- *Able to Analyze a network under congestion and propose solutions for reliable data transfer.*
- *Able to Identify the issues and challenges in the architecture of a computer network.*

UNIT – I

Introduction to Communication Networks: Data Communication, Class of communication services networks, Categories of networks, Topology, Protocols and Standards, The OSI Model, Layers in the OSI Model, TCP/IP Protocol model.

UNIT – II

Physical Layer: Transmission modes, DTE-DCE Interface, Modems, Guided media, Unguided media, Synchronization and framing, Error and flow control.
Data link layer: Data link protocol, Alternating bit protocol, selective repeat protocol, Go back N protocol.

UNIT – III

Local area networks: LAN Topology, Architecture of LAN, ALOHA protocol, Ethernet and 802.3,Token Ring network, Token Bus network,FDDI,DQDB,WLAN802.11,Connectingdevices, Backbone networks.

UNIT – IV

Network layer and Transport layer: Switching, multiplexing, routing (One example of dynamic and static routing), congestion control, Network design, TCP, UDP and TP4. TCP/IP Protocol Suite- IP protocol, IP addresses.
Session layer and presentation:, Encryption, public key cryptography, Data compression, Syntax Conversion.

UNIT – V

Application layer and Integration of services: TELNET, FTP, SMTP, HTTP ,Integrated services local Network , telephone network, ISDN, Broad band ISDN, Introduction to ATM, ATM- Design goals architecture and layers.

Suggested Readings:

1. Jean Walrand, *Communication Networks*: A first Course. WCB/McGraw-Hill, 1998.
2. Prakash C. Gupta *Data communications and Computer Networks* 2nd Edition, Prentice Hall of India, New Delhi, 2014.
3. Behrouz A. Forouzan, *Data Communications and Networking*, 2nd Edition, Tata McGraw-Hill, New Delhi, 2003.

PC 651 EC

Microprocessor and Microcontroller Laboratory

Credits: 1

Instruction : (2P) hrs per week *Duration of SEE : 3 hours*
CIE : 25 Marks *SEE : 50 Marks*

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

- *Able to write assembly language programs for arithmetic operations using 8086.*
- *Able to implement simple programs on 8086.*
- *Able to perform string manipulation operations in 8086.*
- *Able to interface the 8086 to peripherals like stepper motor, ADC, DAC etc.*
- *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 Gillispie Mazidi and Rolin D.McKinlay, "*The 8051 Microcontroller and Embedded Systems using Assembly and C*", 2nd Edition, Pearson education, 2009.

PC 652 EC

DSP Laboratory

Credits: 1

Instruction: (2P) hrs per week *Duration of SEE: 3 hours*
CIE: 25 Marks *SEE: 50 Marks*

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

- *Able to develop various DSP Algorithms using MATLAB Software package.*
- *Able to analyze and Observe Magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filter using window techniques.*
- *Able to analyze and Observe Magnitude and phase characteristics (Frequency response Characteristics) of digital IIR-Butterworth, Chebyshev filters.*
- *Able to design and Implement DSP algorithms in software using a computer language such as 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

Note:
At least 10 experiments need to be completed in a semester (5 from using MATLAB and 5 from using DSP processor).

Suggested Readings:

1. *Digital Signal Processing Principles Algorithms & applications* John .G.Proakis Dimitris G.Manolakis, Pearson Education/PHI 2007.
2. *Digital Signal Processors- Architecture, Programming and applications* – B.Venkata Ramani, M.Bhaskar, Tata MchrawHill,2002.

PW 961 EC

Summer Internship*

Credits: 2

Instruction: 08 Weeks *CIE: 50 Marks*

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

- *Able to design/develop a small and simple product in hardware or software.*
- *Able to complete the task or realize a prespecified target, with limited scope, rather than taking up a complex task and leave it.*
- *Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to prespecified criteria.*
- *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 co-ordinate 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.**

PROFESSIONAL ELECTIVE-I

PE 601 EC

SCRIPTING LANGUAGES

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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

- *Able to Use Unix and Linux based systems to perform various tasks.*
- *Able to Compile large programming sets in the Python environment.*
- *Able to Use Python scripting language for Web application development.*
- *Able to Effectively apply knowledge of Perl, Python to new situations and learn from the experience.*

UNIT – I SHELL

Shell: The Shell As A Process, Creating A Command File, VI Editior, 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, Awk Revisited, Advanced Shell Scripting Commands.

UNIT – II

Linux Basics and Scripting Languages Overview: 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, Introduction and Overview of scripting languages.

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 602 CS

Operating Systems

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To understand CPU, Memory, File and Device management.*
- *To learn about concurrency control, protection and security.*
- *To gain knowledge of Linux and Windows NT internals.*

Course Outcome

Student will be able to

- *Explain the components and functions of operating systems.*
- *Analyze various Scheduling algorithms.*
- *Apply the principles of concurrency.*
- *Compare and contrast various memory management schemes.*
- *Perform administrative tasks on Linux Windows Systems.*

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Threads, Inter process communication. CPU scheduling algorithms, Process synchronization, Critical section problem, Semaphores, Monitors.

UNIT-II

Memory management, Swapping, Contiguous allocation, Paging, Static and Dynamic partitions, Demand paging, Page replacement algorithms, Thrashing, Segmentation, Segmentation with paging. File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation.

UNIT-III

Deadlocks: Necessary conditions, Resource allocation graph, Methods for handling deadlocks, Prevention, Avoidance, Detection and Recovery. Protection: Goals, Domain of protection, Access matrix. Security: Authentication, Threat monitoring, Encryption.

UNIT-IV

Device Management: Disk scheduling methods, Disk management, Device drivers and interfaces, CPU- Device interactions, I/O optimization.

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 NT – General Architecture, The NT kernel, The NT executive.

Suggested Readings:

1. Abraham Silberschatz, Peter B Galvin, *Operating System Concepts*, Addison Wesley, 2006
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 603 CS

Object Oriented Programming with C++

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To introduce fundamental object oriented concepts of Java programming Language - such as classes, inheritance packages and interfaces.*
- *To introduce concepts of exception handling and multi threading.*
- *To use various classes and interfaces in java collection framework and utility classes.*
- *To understand the concepts of GUI programming using AWT controls.*
- *To introduce Java I/O streams and serialization.*

Course Outcomes:

Student will be able to

- *Explain the advantages of object oriented programming.*
- *Understand different types of constructors and initialization of objects.*
- *Write C++ programs using the concepts of inheritance and polymorphism.*
- *Implement simple data structures in C++.*

UNIT – I

Introduction to C++: Programming paradigms, Object Oriented Programming Concepts, Advantages and Applications of OOPs.
Variables and assignments, Data types, expressions, Simple flow control and Control structures.

UNIT – II

Functions: Call by value, call by reference. Parameters using procedural abstraction; Testing and debugging functions. I/O Streams as an introduction to classes and objects.
Introduction to arrays, Arrays in functions, Programming with arrays and multidimensional arrays. Structures, Classes, Abstract data types.

UNIT – III

Strings, Pointers and Dynamic Arrays, Recursion, Constructors, Destructors, Copy Constructors.
Inheritance: The notation of inheritance, derived classes, overriding, Virtual Base Class.

UNIT – IV

Static Polymorphism: Function and Operator overloading, Friend function, Runtime Polymorphism, Virtual functions, and Exception Handling. Function Templates, and Class Templates.

UNIT – V

Pointers and Linked Lists: Nodes and linked lists, Implementation of stacks and queues using arrays and linked lists, Operation on linked lists- inserting a node, deleting a node, searching for a node.

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. Bjarne Stroustrup, "*The C++ Programming Language"*, 3rd Edition, Pearson Education.

PROFESSIONAL ELECTIVE-II

PE 604 EC

Digital Image Processing

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To provide an introduction to the basic concepts and methodologies for Digital Image processing.*
- *To familiar with spatial and transform domain techniques used in Image Enhancement, Restoration and Segmentation of Images.*
- *To gain knowledge about various Image transforms used in Image processing and Image compression problems.*
- *To understand various methods employed for edge , line and isolated points detection in an image.*

Course Outcomes:

Student will be

- *Able to develop a foundation that can be used as the basis for higher study and research in the Image processing area.*
- *Able to design various filters for processing and deblurring of images without destroying fine details like edges and lines.*
- *Able to apply image processing techniques for processing and analysis of remotely sensed, Microscope, Radar and Medical images.*
- *Able to understand the need for Digital Image processing techniques for Machine vision applications and concept of image compression.*

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.

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 Lowpass filters. Ideal Highpass, Butterworth and Gaussian Highpass 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. Rafeal C.Gonzalez, Richars E.Woods , *Digital Image Processing* ", Pearsons Education, 2009, 3rd Edition.
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.

PE 605 EC

Electronic Measurement and Instrumentation

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To understand the various Standards of measurement.*
- *To study the operation of various transducers.*
- *To know the methods of temperature and humidity measurement.*
- *To understand the different types of Oscilloscopes.*
- *To familiarize with various Biomedical Instruments.*

Course Outcomes:

Student will be

- *Able to understand the various Standards of measurement.*
- *Exposed to the operating principles of various transducers.*
- *Able to learn about various methods of temperature and humidity measurement.*
- *Able to understand the operation, features and applications of different types of Oscilloscope.*
- *Able to learn about the various types of Biomedical Instruments.*

UNIT – I

Measurement parameters: Accuracy, Precision, Resolution and Sensitivity, Errors and their types, Standards of Measurement, Classification of Standards, IEEE Standards, Elements of ISO 9001, Quality of Management Standards.

UNIT – II

Transducers: Transducers, Factors for selection of a transducer, Transducer Classifications, Passive electrical transducer- Strain gauges and Strain measurement, LVDT and displacement Measurement, Capacity transducer and thickness measurement, Active electrical transducers: Piezoelectric, Photoconductive, Photovoltaic and Photo emissive transducers.

UNIT – III

Microphones: Microphones and their types, Temperature measurement, resistance wires thermometers, semiconductor thermometers and thermocouples. Humidity measurement, resistive, capacitive, aluminium-oxide and crystal Hygrometer types.

UNIT – IV

DVMs and Oscilloscope: Block diagram and operation of ramp type, integrating type and dual slope integrating type DVM's, Distortion analyzers, Spectrum analyzers, IEEE 488 Interface and Protocol, Delayed time base Oscilloscope, Salient features of Mixed signal oscilloscope, Sampling Oscilloscope and Digital storage oscilloscope.

UNIT – V

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

Suggested Readings:

1. Albert D.Helfrick and William D.Cooper, "*Modern Electronic Instrumentation and Measurement Techniques*", Prentice-Hall of India Private Limited, New Delhi, 1996.

2. David A.Bell, "*Electronic Instrumentation and Measurements*", 2nd Edition, Prentice-Hall of India Private Limited, New Delhi, 1994.

3. R.S.Khandpur, "*Handbook of biomedical Instrumentation*", Tata McGraw- Hill publishing company Limited, New Delhi, 2000.

PE 606 EC

Fault Detection in Digital Systems

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To represent physical faults by logical faults and understand fault simulation methods.*
- *To understand various methods for deriving economical fault detection test experiments and compare them.*
- *To be able to generate tests for fault detection in sequential circuits.*
- *To use coding techniques to generate test patterns using self checking circuits.*
- *To address the problem of test generation for SSFs using TG algorithms.*

Course Outcomes:

Student will be

- *Able to understand various design and modeling concepts thoroughly.*
- *Able to device test inputs using various methods and compare the complexity of the techniques qualitatively.*
- *Able to design detection test sets for sequential circuits.*
- *Able to understand the usage of self checking codes for fault detection.*
- *Able to understand various algorithms and compare their implementation costs qualitatively.*

UNIT – I

Introduction: Modeling and testing digital circuits at different levels of abstraction, Types of testing, Errors and Faults, Fault classification and modeling, Hazards, Test generation and evaluation.

UNIT – II

Fault detection in Combinational Circuits: detection of single stuck faults using Fault Table method, path sensitisation, Boolean difference method and Spoof method, fault detection in two level and multi level circuits, Bridging fault model, detection of non feedback and feedback bridging faults, bridging fault simulation and test generation.

UNIT – III

Fault Detection in Sequential Circuits: State identification with homing and distinguishing experiments, Design of fault detection experiment for diagnosable machines.

UNIT – IV

Self Checking Design: Basic concepts, application of Error-detecting and Error-correcting codes, multiple bit errors, checking circuits and self checking, self-checking checkers, parity-check functions, totally self checking m/n code checkers, totally self-checking equality checkers, self checking Berger code checkers, self checking sequential circuits.

UNIT – V

Test Generation algorithms for SSFs: Combinational circuits-Fault oriented ATG- algorithms and selection criteria, fault independent ATG, ATG for sequential circuits using iterative array model.

Suggested Readings:

1. Samuel C Lee "*Digital Circuits and Logic Design*". PHI Pvt. Ltd. 2000.
2. Zvi Kohavi " *Switching and Finite Automata Theory*", TMH.2nd edition.
3. M.Abramovici, M.Breuer, A.Friedman, " *Digital System Testing and testable design*", Jaico publications.

OPEN ELECTIVE-I

OE 601 BE

Micro Electro- Mechanical Systems(MEMS)

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.*
- *To introduce various sensors and actuators.*
- *To introduce different materials used for MEMS.*
- *To educate on the applications of MEMS to various disciplines.*

Course Outcomes:

Student will be

- *Ability to design the micro devices, micro systems using the MEMS fabrication process.*
- *Ability to understand the operation of micro devices, micro systems and their applications.*

UNIT I
INTRODUCTION
Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis –Flexural beam bending- Torsional deflection.

UNIT II
SENSORS AND ACTUATORS-I
Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators –Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

UNIT III
SENSORS AND ACTUATORS-II
Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV
MICROMACHINING
Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching –Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch -Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

UNIT V

POLYMER AND OPTICAL MEMS

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene –Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS –Lenses and Mirrors – Actuators for Active Optical MEMS.

Suggested Readings:

1. Tai Ran Hsu, "*MEMS & Micro systems Design and Manufacture*" Tata McGraw Hill, New Delhi, 2002.
2. Chang Liu, '*Foundations of MEMS'*, Pearson Education Inc., 2012.
3. Stephen D Senturia, '*Microsystem Design*', Springer Publication, 2000.
4. Mohamed Gad-el-Hak, editor, "*The MEMS Handbook*", CRC press Baco Raton, 2001.

OE 602 BE

Engineering Applications in Medicine

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

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

Course Outcomes:

Student will be

- *Able to learn the concepts of Brain-computer interface and apply them in real time applications.*
- *Able to learn the physiological concepts and apply innovative engineering principles.*

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 Hagen-Poiseuille 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, 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 Readings:

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 601 CE

Disaster Management

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

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.*
- *To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live,with due sensitivity.*

Course Outcomes:

Student will be

- *Able to understand impact on Natural and manmade disasters.*
- *Able to classify disasters and destructions due to cyclones.*
- *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- nonstructural

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 Readings:

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 602 CE

Geo Spatial Techniques

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *Description about various spatial and non-spatial data types, and data base management techniques.*
- *Development of the concepts and professional skills in utility of geospatial techniques.*
- *Enhancement of knowledge of geospatial techniques to field problems.*

Course Outcomes:

Student will be

- *Able to understand and apply GIS tools.*
- *Able to analyse and process data to apply to the GIS tools.*
- *Able to assimilate knowledge on field problems using remote sensing.*

UNIT – I

Introduction: Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems.

Projections and Coordinate Systems: Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations, map analysis.

UNIT – II

Data Acquisition and Data Management*:* data types, spatial, non spatial (attribute) data, data structure and database management, data format, vector and raster data representation, object structural model filters and files data in computer, key board entry, manual digitizing, scanner, aerial photographic data, remotely sensed data, digital data, cartographic database, digital elevation data, data compression, data storage and maintenance, data quality and standards, precision, accuracy, error and data uncertainty.

Data Processing: Geometric errors and corrections, types of systematic and non systematic errors, radiometric errors and corrections, internal and external errors.

UNIT – III

Data Modeling: Spatial data analysis, data retrieval query, simple analysis, recode overlay, vector data model, raster data model, digital elevation model, cost and path analysis, knowledge based system.

GIS Analysis and Functions: Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non spatial data.

UNIT – IV

Applications of GIS: Environmental and natural resource management, soil and water resources, agriculture, land use planning, geology and municipal applications, urban planning and project management, GIS for decision making under uncertainty, software scenario functions, standard GIS packages, introduction to Global Positioning Systems (GPS) and its applications.

UNIT – V

Introduction to Remote Sensing: General background of remote sensing technology, objectives and limitations of remote sensing, electro-magnetic radiation, characteristics, interaction with earth surface and atmosphere, remote sensing platforms and sensors, satellite characteristics, digital image processing, IRS series and high resolution satellites, software scenario functions, remote sensing applications to watershed modeling, environmental modeling, urban planning and management.

Suggested Readings:

1. Burrough, P. A., and McDonnell R. A. (1998), '*Principles of Geographical Information Systems'*, Oxford University Press, New York.
2. Choudhury S., Chakrabarti, D., and Choudhury S. (2009), '*An Introduction to Geographic Information Technology'*, I.K. International Publishing House (P) Ltd, New Delhi.
3. Kang-tsung Chang. (2006), '*Introduction to Geographical information Systems'*, Tata McGraw-Hill Publishing Company Ltd., Third Edition, New Delhi.
4. Lilysand T.M., and Kiefer R.W. (2002), '*Remote Sensing and Image Interpretation'*, John Wiley and Sons, Fourth Edition, New York.
5. Sabins F.F. Jr. (1978), '*Remote Sensing Principles and Interpretations'*, W.H. Freeman and Company, San Francisco.
6. Tor Bernhardsen. (2002), '*Geographical Information System',* Wiley India (P) Ltd., Third Edition, New Delhi.

OE 601 CS

Operating Systems

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To understand CPU, Memory, File and Device management.*
- *To learn about concurrency control, protection and security.*
- *To gain knowledge of Linux and Windows NT internals.*

Course Outcome:

Student will be able to

- *Explain the components and functions of operating systems.*
- *Analyze various Scheduling algorithms.*
- *Apply the principles of concurrency.*
- *Compare and contrast various memory management schemes.*
- *Perform administrative tasks on Linux Windows Systems.*

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Threads, Inter process communication. CPU scheduling algorithms, Process synchronization, Critical section problem, Semaphores, Monitors.

UNIT-II

Memory management, Swapping, Contiguous allocation, Paging, Static and Dynamic partitions, Demand paging, Page replacement algorithms, Thrashing, Segmentation, Segmentation with paging. File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation.

UNIT-III

Deadlocks: Necessary conditions, Resource allocation graph, Methods for handling deadlocks, Prevention, Avoidance, Detection and Recovery. Protection: Goals, Domain of protection, Access matrix. Security: Authentication, Threat monitoring, Encryption.

UNIT-IV

Device Management: Disk scheduling methods, Disk management, Device drivers and interfaces, CPU- Device interactions, I/O optimization.

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 NT – General Architecture, The NT kernel, The NT executive.

Suggested Readings:

1.Abraham Silberschatz, Peter B Galvin, *Operating System Concepts*, Addison Wesley, 2006.
2.William Stallings, *Operating Systems-Internals and Design Principles,* 8th edition, Pearson, 2014.
3.Andrew S Tanenbaum, *Modern Operating Systems,* 4th edition, Pearson, 2016.

OE 602 CS

OOP using Java

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To introduce fundamental object oriented concepts of Java programming Language - such as classes, inheritance packages and interfaces.*
- *To introduce concepts of exception handling and multi threading.*
- *To use various classes and interfaces in java collection framework and utility classes.*
- *To understand the concepts of GUI programming using AWT controls.*
- *To introduce Java I/O streams and serialization.*

Course Outcomes

Student will be

- *Able to develop java applications using OO concepts and packages.*
- *Able to write multi threaded programs with synchronization.*
- *Able to implement real world applications using java collection frame work and I/O classes.*
- *Able to write Event driven GUI programs using AWT/Swing.*

UNIT – I

Object Oriented System Development: understanding object oriented development, understanding object oriented concepts, benefits of object oriented development.

Java Programming Fundamentals: Introduction, overview of Java, data types, variables and arrays, operators, control statements.

UNIT – II

Java Programming OO concepts: classes, methods, inheritance, packages and interfaces.Exceptional Handling, Multithreaded Programming.

UNIT – III

I/O Basics, Reading Console Input and Output, Reading and Writing Files, Print Writer Class, String Handling, Exploring Java.Lang, Collections Overview, Collection Interfaces, Collection Classes, Iterators, Random Access Interface, Maps, Comparators, Arrays, Legacy Classes and Interfaces, String Tokenizer.

UNIT – IV

Introducing AWT working With Graphics: AWT Classes, Working with Graphics.

Event Handling: Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces.

AWT Controls: Control Fundamentals, Labels, Using Buttons, Applying Check Boxes, CheckboxGroup, Choice Controls, Using Lists, Managing Scroll Bars, Using TextField, Using TextArea, Understanding Layout Managers, Menu bars and Menus, Dialog Boxes, FileDialog,

Handling events by Extending AWT Components, Exploring the controls, Menus and Layout Managers.

UNIT – V

Java I/O Classes and Interfaces, Files, Stream and Byte Classes, Character Streams, Serialization.

Suggested Readings:

1. Herbert Schildt, *The Complete Reference JAVA*, Tata McGraw Hill, 7thEdition, 2005.
2. James M Slack, *Programming and Problem Solving with JAVA,* Thomson learning, 2002.
3. C.Thomas Wu*, An Introduction to Object-Oriented Programming with Java,* Tata McGraw Hill, 5thEdition, 2005.

OE 601 EC

Embedded Systems

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To understand the fundamentals of embedded systems.*
- *To study the block diagram and advanced hardware fundamentals.*
- *To study the software architecture of embedded systems.*
- *To learn the tool chain of embedded systems.*
- *To understand the tools and debugging process of embedded systems.*

Course Outcomes:

Student will be

- *Able to acquire an overview of what an embedded system implies.*
- *Able to understand the architecture of a microprocessor and microcontroller to enable to design embedded applications using them.*
- *Able to apply theoretical learning to practical real time problems for automation.*
- *Able to understand how to build and debug an embedded system application.*
- *Able to analyze and design real world applications and interface peripheral devices to the microprocessor.*

UNIT – I

Fundamentals of embedded systems: Definition of Embedded system, Examples of Embedded Systems, Typical Hardware, Terminology, Gates, A few other basic considerations, Timing Diagrams, Memory.

UNIT – II

Advanced hardware fundamentals: Microprocessors, Buses, Direct Memory Access, Interrupts, Other Common Parts, Built-Ins on the Microprocessor, Conventions used in Schematics, Microprocessor Architecture, Interrupts Basics, Shared Data Problem, Interrupt Latency.

UNIT – III

Software architecture of embedded systems: Round- Robin, Round-Robin with Interrupts, Function- Queue- Scheduling Architecture, Real- Time Operating System Architecture, Selecting an Architecture.

UNIT – IV

Embedded software development tools: Host and Target Machines, Cross compilers, Cross Assemblers and Tool Chains, Linkers /Locaters for Embedded Software, Getting Embedded Software into Target System: PROM programmers, ROM Emulators, In-Circuit Emulators.

UNIT – V

Debugging techniques: Testing on your host machine, Instruction Set Simulators, The assert Macro, Using Laboratory Tools.

Suggested Readings:

1. David. E. Simon, "*An Embedded Software Primer*", Low price edition, Pearson Education, New Delhi, 2006.
2. Frank Vahid and Tony Givargis "*Embedded System Design: A Unified Hardware/Software. Approach*". John Wiley & Sons, October 2001.
3. Rajkamal, "*Embedded systems: Programming, architecture and Design*", second edition, McGraw-Hill Education (India), March 2009.

OE 602 EC

Digital System Design using Verilog HDL

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To familiarize with various modeling styles: structural, dataflow and behavioral of Verilog HDL.*
- *To develop combinational and sequential circuits using various modeling styles of Verilog HDL.*
- *To design and develop Verilog HDL models of data path and control units of Central Processing Unit (CPU).*
- *To learn Synthesis and FPGA design flow.*
- *To design and develop real time applications: Booth's multiplier, Divider, hardwired control for basic CPU and FIR filter.*

Course Outcomes:

Student will be

- *Able to implement and distinguish different Verilog HDL modeling styles.*
- *Able to construct and analyze Verilog HDL models of combinational and sequential circuits.*
- *Able to design and develop Verilog HDL modeling and test bench for digital systems for the given specifications.*
- *Able to outline FPGA design flow and timing analysis.*

UNIT – I
Structural modeling: Overview of Digital Design with Verilog HDL, Basic concepts, modules and ports, gate-level modeling, hazards and design examples .

UNIT – II
Dataflow and Switch level modeling: dataflow modeling, operands and operators. Switch Level Modeling: CMOS switches and bidirectional switches and design examples.

Unit III
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 IV
Synthesis and Verification: Tasks and Functions: Differences between Tasks and Functions. Verilog HDL synthesis, Application Specific IC (ASIC) and Field Programmable Gate Array (FPGA) design flow. Verification: Timing analysis and Test bench design. Design examples.

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. Ming-Bo Lin, *Digital System Designs and Practices: Using Verilog HDL and FPGA,"* Wiley India Edition, 2008.
3. J. Bhasker, "*A Verilog HDL Primer*," 2nd Edition, BS Publications, 2001.

OE 601 EE

Reliability Engineering

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To understand the concepts of different types of probability distributions. importance of reliability evaluation of networks.*
- *To make the students understand about Reliability, availability model of Power Systems and markov modeling of Power Plants. with identical and no identical units.*

Course Outcomes:

Student will be

- *Able to understand the meaning of discrete and continuous random variables and their significance, causes of failures of a system.*
- *Able to acquire the knowledge of different distribution functions and their applications.*
- *Able to develop reliability block diagrams and evaluation of reliability of different systems.*

UNIT- I
Discrete and Continuous random variables, probability density function and cumulative distribution function. Mean and Variance. Binomial, Poisson, Exponential and Weibull distributions.

UNIT - II
Failure and causes of failure. Failure rate and failure density. Reliability function and MTTF. Bath tub curve for different systems. Parametric methods for above distributions. Non - Parametric methods from field data.

UNIT- III
Reliability block diagram. Series and parallel systems. Network reduction technique, Examples. Evaluation of failure rate, MTTF and reliability, Active and Standby Redundancy, r out of n configuration. Non-series - parallel systems. Path based and cut set methods.

UNIT- IV
Availability, MTTR and MTBF, Markov models and State transition matrices. Reliability models for single component. two components, Load sharing and standby systems. Reliability and availability models of two unit parallel system with repair and standby systems with repair.

UNIT V
Repairable Systems. maintainability. Preventive maintenance, Evaluation of reliability and J1TTF. Overhauling and replacement. Optimum maintenance policy. Markov model of a power plant with identical units and non-identical units. Capacity outage probability table. Frequency of failures and Cumulative frequency.

Suggested Reading:

1. Charles E.Ebeling, *Reliability and MAintainabelity Engineering,*Mc Graw Hill Inetrnational Edition, 1997.
2. BAlaguruswamy*, Reliability Engineering*,Tata McGraw Hill Publishing company Ltd,1984.
3. R.N.Allan*. Reliability Evaluation of Engineering Systems*,Pitman Publishing,1996.
4. Endrenyi. *Reliability Modelling in Electric Power Systems*. JohnWiley & Sons,1978.

OE 601 ME

Industrial Robotics

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To familiarize the student with the anatomy of robot and their applications.*
- *To provide knowledge about various kinds of end effectors usage.*
- *To equip the students with information about various sensors used in industrial robots.*
- *To make the student understand the importance of spatial transformation of robots using forward and inverse kinematics.*
- *To specify and provide the knowledge of techniques involved in robot vision in industry.*
- *To equip students with latest robot languages implemented in industrial manipulators.*

Course Outcomes:

Student will be

- *Able to demonstrate knowledge of the relationship between mechanical structures of industrial robots and their operational workspace characteristics and Have an understanding of the functionality and limitations of robot actuators and sensors.*
- *Able to demonstrate an ability to apply spatial transformation to obtain forward/Inverse kinematics equation of robot manipulators using analytical/numerical/simulation tools.*
- *Able to apply knowledge and choose the best & economically suitable sensors/end effectors required for specific applications.*
- *Able to understand the importance of robot vision and apply the learnt techniques to get the required information from input images.*
- *Able to design and develop a industrial robot for a given purpose economically.*
- *Appreciate the current state and potential for robotics in new application areas.*

UNIT – I

Introduction to Robotics: Basic structure of Robots. Degree of freedom of Robots. Work envelope. Classification of Robots based on Drive Technology, Work-Envelope and motion control methods. Application of Robots in Industry, Repeatability, Precision and Accuracy as applied to Robots, Specifications of robots used for various applications.

End effectors – Grippers: Mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers, RCC grippers – Two fingered and three fingered grippers – Internal grippers and external grippers – Selection and design considerations.

UNIT – II

Requirements of a sensor, principles and applications of the following types of sensors – Position of sensors (Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic position sensors) – Range sensors (Triangulation principle, Structured, Lighting approach, Time of flight range finders, Laser range meters) – Proximity sensors (Inductive, Hall effect, Capacitive, Ultrasonic and Optical proximity sensors) – Touch sensors (Binary sensors, Analog sensors) – Wrist Sensors – Compliance Sensors – Slip Sensors.

Unit III

Kinematic Analysis of robots: Rotation matrix. Homogeneous transformation matrix, Denavit & Hartenberg representation, Euler and RPY angles representation. Representation of absolute position and orientation in terms of joint parameters, Direct Kinematics of manipulators, Inverse kinematics of Robot arm for position and orientation. Redundancy in Robots. Static force analysis.

Unit IV

Introduction to techniques used in Robot vision. Image acquisition, illumination techniques, imaging geometry, basic relationship pixels, preprocessing, segmentation & description of 3 dimensional structures, their recognition and interpretation.

Types of Camera, frame grabbing , sensing and digitizing image data – Signal conversion – Image Storage – Lighting techniques – Image processing and analysis – Data reduction – Segmentation – Feature extraction – Object recognition – and various algorithms – Applications – Inspection, identification, visual serving and navigation.

Unit V

Robot programming languages: Characteristics of robot level languages, task level languages.

Teach pendant programming – Lead through programming – Robot programming languages – VAL programming – Motion commands – Sensor commands – End effecter commands – Simple programs.

RGV – AGV – Implementation of robots in industries – Various steps - Safety considerations for robot operations.Economic analysis of robots – Pay back method, EUAC method and Rate of return method.

Suggested Readings:

1. Groover M P, "*Industrial Robotics*", McGraw Hill Publications, 1999.
2. Fu. K.S., Gon Zalez R.C., Lee C.S.G. "*Robotics, Control-sensing vision and Intelligence*", McGraw Hill, Int. Ed., 1987.
3. Spong and Vidyasagar, "*Robot Dynamics & Control*", John Wiley and Sons, Ed.,1990.
4. Mittal and Nagrath, "*Industrial Robotics",* Tata McGraw Hill Publications, 2004.
5 Saha & Subir kumar saha, *'robotics',* TMH, India.

OE 602 ME

Material Handling

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To know about the working principle of various material handling equipments.*
- *To understand the Material handling relates to the loading, unloading and movement of all types of materials.*
- *To understand the estimation of storage space and maintenance of material handling equipments.*

Course Outcomes:

Student will be

- *Able to understand various conveying systems that available in industry.*
- *Able to understand various bulk solids handling systems and their design features.*
- *Able to understand and various modern material handling systems and their integration.*
- *Able to calculate number of MH systems required, storage space, cost and maintenance.*

UNIT – I
Mechanical Handling Systems: Belt Conveyors and Desing, Bucket Elevators, Package conveyors, Chain and Flight Conveyors, Screw Conveyors, Vibratory Conveyors, Cranes and Hoists.

UNIT – II
Pneumatic and Hydraulic Conveying Systems: Modes of Conveying and High pressure conveying systems,Low Velocity Conveying System. Components of Pneumatic Conveying Systems: General Requirements, Fans and Blowers, Boots-Type Blowers, Sliding-Vane Rotary Compressors, Screw Compressors, Reciprocating Compressors, Vacuum Pumps.

Unit III
Bulk Solids Handling: Particle and Bulk Properties. Adhesion, Cohesion and Moisture Content. Gravity Flowof Bulk Solids: Static and Dynamic Pressure Distribution in Bulk Solids. Modes of Flow: Mass Flow, Funnel Flow and Expanded Flow from Hoppers, Bins and Silos.

Unit IV
Modern Material Handling Systems: Constructional features of (i) AGV (ii) Automated storage and retrieval systems. Sensors used in AGVs and ASRS.Bar code systems and RFID systems: Fundamentals and their integration with computer-based information systems.

Unit V
Total MH Throughput: Calculation for no. of MH systems; storage space estimation based on no of aisles. Maintenance of MH equipment, spare parts management, cost of materials handling, cost per unit load computations.

Suggested Readings:

1. Dr. Mahesh Varma, "*Construction Equipment and its Planning & Application*", Metropolitan Book Co.(P) Ltd., New Delhi, India 1997.
2. James M. Apple, "*Material Handling Systems Design*", The Ronald Press Company, New York, USA, 1972.
3. Woodcock CR. and Mason J.S., "*Bulk Solids Handling: An Introduction to Practice Technology",* Leonard Hill USA, Chapman and Hall, New York.
4. M P Groover etal, "*Industrial Robotics*", Me Graw Hill, 1999.

OE 601 LA

Intellectual Property Rights

Credits: 3

Instruction : (3L) hrs per week *Duration of SEE : 3 hours*
CIE : 30 Marks *SEE : 70 Marks*

Course Objectives:

- *To create awareness on Engineering Ethics providing basic knowledge about ethics, moral issues & moral dilemmas and professional ideals.*
- *To understanding, define and differentiate different types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.*
- *To expose to the Legal management of IP and understanding of real life practice of Intellectual Property Management.*

Course Outcomes:

Student will be

- *Able to identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.*
- *Able to Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.*
- *Able to identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights and duties in products and technology development.*

Unit-I:
Meaning, Nature, Classification and protection of Intellectual Property — The main forms of Intellectual Property — Copyright, Trademarks, Patents, Designs (Industrial and Layout) -- Geographical Indications - Plant Varieties Protection and Biotechnology – Traditional Knowledge – Indigenous Knowledge –etc.

Unit-II:

Introduction to the leading International instruments concerning Intellectual Property Rights — The Berne Convention — Universal Copyright Convention — The Paris Union — Patent Co-operation Treaty -- The World Intellectual Property Organization (WIPO) and the UNEESCO, International Trade Agreements concerning IPR — WTO — TRIPS.

Unit-III :

Select aspects of the Law of Copyright in India — The Copy Right Act, 1957 - Historical evolution — Meaning of copyright — Copyright in literary, dramatic and musical works, computer programmes and cinematograph films — Neighbouring rights — Rights of performers and broadcasters, etc. — Ownership and Assignment of copyright — Author's special rights — Notion of infringement — Criteria of infringement — Infringement of copyright in films, literary and dramatic works — Authorities under the Act — Remedies for infringement of copyright.

Unit-IV:

Intellectual Property in Trademarks and the rationale of their protection - The Trade Marks Act, 1999 — Definition of Trademarks — Distinction between Trademark and Property Mark - Registration — Passing off —Infringement of Trademark — Criteria of Infringement — Remedies. The Designs Act, 2000 — Definition and characteristics of Design — Law in India — Protection and rights of design holders — Copyright in design — Registration — Remedies for infringement.

Unit-V:

Patents — Concept of Patent — Historical overview of the Patents Law in India — Patentable Inventions — Kinds of Patents — Procedure for obtaining patent — The Patents Act, 1970 — Rights and obligations of a patentee — Term of patent protection — Use and exercise of rights — Exclusive Marketing Rights — Right to Secrecy — The notion of 'abuse' of patent rights — Infringement of patent rights and remedies available.

Suggested Readings:

1. P. Narayanan: *Patent Law*, Eastern Law House, 1995.
2. Roy Chowdhary, S.K. & Other: *Law of Trademark, Copyrights, Patents and Designs,* Kamal Law House, 1999.
3. John Holyoak and Paul Torremans: *Intellectual Property Law*.
4. B.L. Wadhera: *Intellectual Property Law*, Universal Publishers, 2nd Ed. 2000.
5. W.R. Cornish: *Intellectual Property Law*, Universal Publishers, 3rd Ed. 2001.
6. Cornish, W. R. "*Intellectual Property Law*" Eastern Law House, Second Edition, 1997.
7. Jacob, R and Alexander, D. "*A guide book to intellectual property, Patents, trademarks*. Copy rights and designs. Sweet & Maxwell, 1993.