Electronics and Communication Engineering

Scheme for Semester V

S. No	Course Code	Course Title	Scheme of Examination		L	T	P	Hrs/ Wk	Credits
			CIE	SEE					
1	**PC501EC**	**Linear ICs and Application**	30	70	3	1	0	4	3
2	PC502EC	**Analog Communication**	30	70	3	0	0	3	3
3	PC503EC	**Digital Signal Processing**	30	70	3	1	0	4	3
4	PC504EC	**Automatic Control Systems**	30	70	3	1	0	4	3
5	PC505EC	**Computer Organization & Architecture**	30	70	3	1	0	4	3
6	PC506EC	**Digital System Design with Verilog HDL**	30	70	3	0	0	3	3
7	PC551EC	**IC Applications lab**	25	50	0	0	2	2	1
8	PC552EC	**Systems and Signal Processing Lab**	25	50	0	0	2	2	1
9	PC553EC	**Industrial Visit**							
		Total	**230**	**520**	**18**	**4**	**4**	**26**	**20**

Course Code	Course Title						Core / Elective
PC501EC	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
AEC	L	T	D	P			
	3	1	-	-	30	70	3

Course Objectives:

1.Describe various configurations of Op-amp.
2.Describe the basic principles and practical limitations of Op-amp.
3. Describe the various linear and non linear applications of Op-amp.
4. Describe frequency generators , active filters and voltage regulators.
5.Discuss the operation of the most commonly used D/A and A/D converters .

Course Outcomes:

1 .Illustrate various configurations of Op-amp.
2. Illustrate the basic principles and practical limitations of Op-amp.
3. Design Linear and Non-linear circuits using Op-amp
4. Analyze Frequency generators active filters and voltage regulators.
5. Design and analyze ADC & DAC converters.

Unit I

Differential Amplifiers: Classification, DC and AC analysis of single / dual input Balanced and unbalanced output Configurations of Differential amplifiers using BJTs, Level Translator.
Operational Amplifier: Ideal, Practical, General (741) bipolar Operational Amplifier, AC and DC performance characteristics, Frequency Compensation, Open-loop and close-loop configurations, 741 Manufacturers data sheet- description, specifications and packages.

Unit II

Operational Amplifier Applications-I: Adder, subtractor, Ideal and practical integrator & differentiator, Voltage to current converter , current to voltage converter, differential amplifier, instrumentation amplifier, Log and antilog amplifiers.

Unit III

Operational Amplifier Applications -II: Comparator, Precision rectifier, Peak detector, Clippers, Clampers, Sample-and-Hold circuits.

Active Filters Introduction – First order, Second order Active filters – LP, HP, BP, BR and All pass.

Unit IV

Waveform Generators: Square wave, Monostable Multivibrator, Schmitt Trigger, saw tooth & Triangular wave generators. Voltage Controlled Oscillator, PLL, NE 555 and its applications. Function Generator –8038.

Unit V

Voltage Regulators: Basic of voltage Regulators, Linear regulators using opamp, IC Regulators 78XX and 723.

Data Converters: Introduction, Digital to Analog Converters : Weighted Resistor DAC & Inverted R-2R Ladder DAC. Analog to digital Converters: Parallel Comparator ADC, Successive Approximation ADC and Dual Slope ADC. DAC and ADC specifications.

Suggested Readings:

1. David A Bell, "Operational Amplifiers and Linear ICs," 3/e, Oxford Publications, 2011.
2. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits," 4/e, PHI, 2010.
3. D.Roy Chowdhury, Shail B.Jain, "Linear Integrated Circuits", 4/e, New / Age International (P) Ltd., 2008.

Course Code	Course Title						Core/Elective
PC502EC	ANALOG COMMUNICATIONS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	30	70	3

Course Objectives:

- To analyze the analog communication system requirements
- To understand the generation & detection of various analog modulation techniques
- To analyze the noise performance of analog modulation techniques
- To understand AM and FM receivers
- To understand the pulse modulation techniques

Course Outcome:

- Understand analog communication system
- Compare and analyze analog modulation techniques
- Calculate noise performance of analog modulation techniques
- Design AM and FM receivers
- Differentiate between pulse modulation techniques & continuous modulation techniques.

Unit-I

Linear Modulation schemes: Need for modulation, conventional Amplitude Modulation (AM). Double side band suppressed carrier (DSB –SC)modulation ,Hilbert transform, properties of Hilbert transform. Pre-envelop. Complex envelope representation of band pass signals, In-phase and Quadrature component representation of band pass signals. Low pass representation of bandpass systems. Single side band (SSB) modulation and Vestigial-sideband (VSB) modulation. Modulation and demodulation of all the modulation schemes, COSTAS loop.

Unit - II

Angle modulation schemes: Frequency Modulation (FM) and Phase modulation (PM), Concept of instantaneous phase and frequency. Types of FM modulation: Narrow band FM and wide band FM. FM spectrum in terms of Bessel functions. Direct and indirect (Armstrong's) methods of FM generation. Balanced discriminator, Foster–Seeley discriminator ,Zero crossing detector and Ratio detector for FM demodulation. Amplitude Limiter in FM.

Unit-III

Analog pulse modulation schemes: Sampling of continuous time signals. Sampling of low pass and band pass signals. Types of sampling. Pulse Amplitude Modulation (PAM) generation and demodulation. Pulse time modulation schemes: PWM and PPM generation and detection. Time Division Multiplexing.

Unit-IV

Transmitters and Receivers: Classification of transmitters. High level and low level AM transmitters. FM transmitters. Principle of operation of Tuned radio frequency (TRF) and superheterodyne receivers. Selection of RF amplifier. Choice of Intermediate frequency. Image frequency and its rejection ratio Receiver characteristics: Sensitivity,Selectivity, Fidelity, Double spotting, Automatic Gain Control.

Unit-V

Noise Sources and types. Atmospheric noise, Shot noise and thermal noise. Noise temperature. Noise in two-port network: noise figure, equivalent noise temperature and noise bandwidth. Noise figure and equivalent noise temperature of cascade stages. Narrow band noise representation. S/N ratio and Figure of merit calculations in AM, DSB-SC, SSB and FM systems,Pre-Emphasis and De-Emphasis.

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Suggested Reading:

I. Simon Haykin, "*Communication Systems*," 2/e, Wiley India, 2011.

II. B.P. Lathi, Zhi Ding, "Modern Digital and Analog Communication Systems", 4/e, Oxford University Press, 2016

III. P. Ramakrishna Rao, "*Analog Communication*," 1/e, TMH, 2011.

Course Code	Course Title						Core / Elective
PC503EC	**DIGITAL SIGNAL PROCESSING**						Core
Prerequisite SATT	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-		30	70	3

Course Objectives:

Ø Describe the necessity and efficiency of digital signal processing.
Ø Design and implementation of FIR and IIR digital filters.
Ø Describe the basics of Multirate digital signal processing and its application.
Ø Describe the DSP processor architecture for the efficient implementation of digital filters.

Course Outcomes:

Ø Necessity and use of digital signal processing and its application.
Ø Analyze FIR and IIR digital filters.
Ø Applications of Multirate digital signal processing.
Ø Acquaintance of DSP processor and its architecture.

UNIT I: Discrete and Fast Fourier Transform:

Discrete Fourier Transform (DFT), Computation of DFT- Linear and Circular Convolution, FFT algorithms: Radix-2 case, Decimation in Time and Decimation in Frequency algorithms- in place computation- bit reversal.

UNIT II: Digital Filter (IIR) Design:

Butterworth and Chebychev approximation- IIR digital filter design techniques- Impulse Invariant technique- Bilinear transformation technique- Digital Butterworth&Chebyshev filters.

UNIT III: Digital Filters (FIR) Design:

Amplitude and phase responses for FIR filters- Linear phase filters- Windowing techniques for design of Linear phase FIR filters- Rectangular, Bartlett, Hamming, Hanning, Kaiser windows- realization of filters- Finite word length effects, Comparison between FIR and IIR filters.

UNIT IV: Multirate Digital Signal Processing:

Introduction- Decimation by factor D and interpolation by a factor I- Sampling Rate conversion by a Rational factor I/D- Implementation of Sampling Rate conversion- Multistage implementation of Sampling Rate conversion- Sampling conversion by a Arbitrary factor, Application of Multirate Signal Processing.

UNIT V: Introduction to DSP Processors:

Difference between DSP and other microprocessors architecture- their comparison and need for ASP, RISC and CPU- General purpose DSP processors: TMS 320C 54XX processors, architecture, addressing modes- instruction set.

Suggested Reading:

1. Alan V. Oppenheim and Ronald W. Schafer, *"Digital Signal Processing"*, 2/e, PHI, 2010.
2. John G. Praokis and Dimtris G. Manolakis, *"Digital Signal Processing: Principles, Algorithms and Application"*, 4/e, PHI, 2007.
3. Avathar Singh and S. Srinivasan, *"Digital Signal Processing using DSP Micrprocessor"*, 2/e, Thomson Books, 2004.

Course Code	Course Title						Core/Elective
PC504EC	AUTOMATIC CONTROL SYSTEMS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SATT	3	1	-	-	30	70	3

Course Objectives:

· To Analyze the stability and performance of dynamic systems in both time and frequency domain.

· To design feedback controllers, such as PID, lead and lag compensators, to meet desired system performance specifications.

· To provide knowledge of state variable models and fundamental notions of state model design.

· To understand the classical methods of control engineering and physical system modeling by linear differential equations.

- To understand state space representation of control systems

Course Outcomes:

- Convert a given control system into equivalent block diagram and transfer function
- Analyze system stability using time domain techniques
- Analyze system stability using frequency domain techniques
- Design a digital control system in the discrete time domain
- Analyze a control system in the state space representation.

UNIT – I

Control System fundamentals and Components: Classification of control systems including Open and Closed loop systems,. Transfer function representation: Block diagram representation, Block diagram algebra and reduction and Signal flow graphs and Mason's gain formula.

UNIT – II

Time Response: Transfer function and types of input. Transient response of second order system for step input. Time domain specifications. Characteristic Equation of Feedback control systems Types of systems, static error coefficients, error series,

Stability: Concept of Stability, Routh-Hurwitz criterion for stability, Root locus technique and its construction.

UNIT – III

Frequency response plots: Bode plots, frequency domain specifications. Gain and Phase margin. Principle of argument. Nyquist plot and Nyquist criterion for stability.

Compensation: Cascade and feedback compensation. Phase lag, lead and lag-lead compensators. PID controller.

UNIT – IV

Discrete Control Systems: Digital control, advantages and disadvantages, Digital control system architecture. The discrete transfer function. Sampled data system. Transfer function of sample data systems. Analysis of Discrete data systems.

UNIT – V

State space representation: Concept of state and state variables. State models of linear time invariant systems, State transition matrix, Solution of state equations. Controllability and Observability.

Suggested Reading:

1. Nagrath, I.J, and Gopal, M., "*Control System Engineering*", 5/e, New Age Publishers, 2009
2. Nagoor Kani*.," Control systems*", Second Edition, RBA Publications.
3. Ogata, K., "*Modern Control Engineering*", 5/e, PHI.

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>Core/ Elective</td></tr>
<tr><td>PC505EC</td><td colspan="6">COMPUTER ORGANIZATION AND ARCHITECTURE</td><td>Core</td></tr>
<tr><td rowspan="2">Prerequisite</td><td colspan="4">Contact Hours per Week</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td><td rowspan="2">Credits</td></tr>
<tr><td rowspan="2">STLD</td><td>L</td><td>T</td><td>D</td><td>P</td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>-</td><td>30</td><td>70</td><td>3</td></tr>
<tr><td colspan="8">Course Objectives:
1. Implement the fixed-point and floating-point addition, subtraction, multiplication & Division.
2. Describe the basic structure and operation of a digital computer.
3. Discuss the different ways of communicating with I/O devices and standard I/O interfaces.
4. Analyze the hierarchical memory system including cache memories and virtual memory.
5. Understand issues affecting modern processors.
Course Outcomes:
● Perform mathematical operations on fixed and floating point digital data
● Illustrate the operation of a digital computer
● Understand I/O interfacing of a computer
● Interface microprocessor with memory devices
● Understand latest trends in microprocessors</td></tr>
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Unit- I

Data representation and Computer arithmetic: Introduction to Computer Systems, Organization and architecture, evolution and computer generations; Fixed point representation of numbers, digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non restoring algorithms. Floating point representation with IEEE standards and its arithmetic operations.

Unit-II

Basic Computer organization and Design: Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control,

instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: configuration, instructions, Program interrupt, Interrupt cycle, Micro programmed Control organization, address sequencing, micro instruction format and microprogram sequencer.

Unit-III

Central Processing Unit: General register organization, stack organization, instruction formats, addressing modes, Data transfer and manipulation, Program control. CISC and RISC: features and comparison. Pipeline and vector Processing , Parallel Processing, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.

Unit-IV

Input-output organization: I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output Processor , CPU-IOP communication, I/O channel.

Unit- V

Memory organization: Memory hierarchy, Primary memory, Auxiliary memory, Associative memory, Cache memory: mapping functions, Virtual memory: address mapping using pages, Memory management.

Suggested Reading:

1. Morris Mano, M., "*Computer System Architecture*," 3/e, Pearson Education, 2005.
2. William Stallings, "*Computer Organization and Architecture: Designing for performance*," 7/e, Pearson Education, 2006.
3. John P. Hayes, "*Computer Architecture and Organization*," 3/e, TMH, 1998.

Course Code	Course Title						
PC506EC	Digital Design through Verilog HDL						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
STLD	L	T	D	P			
	3	0	-	-	30	70	3

Course Objectives:

1. Describe verilog HDL and develop digital circuits using gate level and data flow modeling
2. Develop verilog HDL code for digital circuits using switch level and behavioral modeling
3. Design and develop of digital circuits using Finite State Machines(FSM)
4. Prepare Algorithmic State Machines(ASM) of Digital design
5. Describes designing with Programmable Logic Devices(PLD's).

Course Outcomes:

· Appreciate the constructs and conventions of the verilog HDL programming in gate level and data flow modeling.

· Generalize combinational circuits in behavioral modeling and concepts of switch level modeling

· Design and analyze digital systems and finite state machines.

· Comprehend advanced features of verilog HDL and apply them to design complex real time digital system using ASMs

· Design various circuits for memory devices and annotate the ASIC/FPGA design flow

Unit I

Introduction to HDLs,Overview of Digital Design with Verilog HDL, Basic Concepts, Data types, System tasks and Compiler Directives. Hierarchical modeling, concepts of modules and ports. Gate level Modeling, Dataflow modeling-Continuous Assignments, Timing and Delays. Programming Language Interface.

Design of Arithmetic Circuits using Gate level/ Data flow modeling **–** Adders, Subtractors**,** 4-bit Binary and BCD adders and 8-bit Comparators.
Verification: Functional verification, simulation types, Design of stimulus block.

Unit II

Switch Level Modeling and examples. Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, and Conditional Statements, multi-way branching, Loops, Sequential and Parallel blocks, Generate blocks. Tasks and Functions.
Behavioral/dataflow modeling of basic MSI combinational logic modules: ALUs, Encoders, Decoders, Multiplexers, Demultiplexers, Parity generator/checker circuits, Bus Structure.
Basic concepts of Static timing analysis, Logic synthesis

Unit III

Behavioral modeling of sequential logic modules: Latches, Flip Flops, counters and shift registers applications.
Synchronous Sequential Circuits: **A**nalysis and synthesis of synchronous sequential circuits: Mealy and Moore FSM models for completely and incompletely specified circuits, *State Minimization* - Partitioning Minimization Procedure, sequence detector with verilog HDL modeling. Design of a Modulo-8 Counter using the Sequential Circuit Approach and its verilog implementation. One-Hot Encoding .

Unit IV

Algorithmic State Machines (ASMs): ASM chart, ASM block, simplifications and timing considerations with design example. ASMD chart for binary multiplier and Verilog HDL code, one hot state controller.
Asynchronous Sequential logic: Analysis procedure-Transition table, flow table, race conditions. Hazards with design example of Vending-Machine Controller

Unit V

Introduction to ASIC's: Full-custom, standard-cell and Gate array based ASICs. SPLDs: PROM, PAL, GAL, PLA. FPGA and CPLD simplified architecture and applications. ASIC/FPGA Design flow, CAD tools. Combinational circuit Design with Programmable logic Devices (PLDs).

Suggested Reading:

1.Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis," 2nd Edition, Pearson Education, 2006.
2.M. Morris Mano, Michael D. Ciletti, "Digital Design", 4th edition, Pearson Education.
3.Michael John Sebastian Smith, *Application Specific Integrated Circuits*, Pearson Education Asia, 3rd edition 2001.
4.Stephen Brown and Zvonko Vranesic,"*Fundamentals of Digital Logic with Verilog Design*",McGraw Hill.

Course Code	Course Title						Core / Elective
PC551EC	INTEGRATED CIRCUITS APPLICATIONS LAB.						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
NIL	L	T	D	P			
	0	0	0	2	30	70	3

Course Objectives:

1. Design and analyze the various linear application of Op-amp.
2. Design and analyze the active filters circuit using Op-amp.
3. Design and analyze oscillators and Multivibrators using Op-amp.
4. Analyze the performance of multivibrators, Linear & Non-Linear Op-amp. circuits using PSPICE.
5. Analyze ADC & DAC circuits.

Course Outcomes:

1. Implement operational amplifiers Linear & Non-linear circuits.
2. Implement Active filters using Op-amps.
3. Implement oscillators, Multivibrators,etc., using Op-amps.
4. Use PSPICE software for circuit design using Op-amp.
5. Illustrate Op-amp for advanced application such as ADC, DAC, etc.

List of Experiments:

1. Measurement of op-Amp. Parameters , Voltage follower.
2. Inverting and non- Inverting amplifiers using Op-Amp.
3. Integrator & Differentiator circuits using Op-Amp.
4. Active filters : LP, HP and BP filters using Op-Amp.
5. Clipper and clamper circuit using Op-Amp.
6. Triangular wave generator using Op-Amp.
7. Monostable and Astable multivibrator using Op-Amp.
8. Monostable and Astable multivibrator using 555 timer.
9. IC voltage regulator.
10. Voltage controlled oscillator – NE565

11. 4- bit DAC using Op-Amp.
12. 4 – bit ADC using Op-Amp.
13. & 14.Analysis and design of circuit using SPICE tools.

General Note:

A total of not less than 10 experiments should be carried out during the semester.

Suggested Readings:

1. D.Roy Chowdhary, B.Jain Shail - Linear Integrated circuit, 4th Edition.

Course Code	Course Title						Core / Elective
PC552EC	SYSTEMS AND SIGNAL PROCESSING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	-	-	-	2	25	50	1

Course Objectives:

1. Implement the basic algorithms of DFT,IDFT ,FFT and IFFT.
2. Design FIR Filter with specific magnitude and phase requirements.
3. Design IIR Filter with specific magnitude and phase requirements.
4. Describe the basics of Multirate signal processing.
5. Design and implement digital filters on DSP processors.

Course Outcomes:

1 . Illustrate various signal processing algorithms.
2. Analyze FIR Filter with specific magnitude and phase requirements.
3. Analyze IIR Filter with specific magnitude and phase requirements.
4. Illustrate the basics of Multirate signal processing.
5. Analyze digital filters on DSP processors.

PART-A(Signal Processing Experiments)

1. Introduction to Software used with details of some basics.
2. DFT and FFT algorithm.
3. Linear convolutions.
4. Circular Convolutions.
5. FIR filter design using different window functions.
6. IIR filter design: Butterworth and Chebyshev.
7. Interpolation and Decimation.
8. Implementation of multi-rate systems.
9. Time response of non –linear systems.
10. Design of P,PI,PD and PID controllers(any two)

PART-B(DSP Processor Experiments)

1. Introduction to DSP processor kits and Software used with details of some basics.
2. Solution of difference equations.
3. Impulse Response.
4. Linear Convolution.
5. Circular Convolution.
6. Study of procedure to work in real-time.
7. Fast Fourier Transform Algorithms.
8. Design of FIR (LP/HP) USING windows: (a) Rectangular (b) Triangular (c) Hamming windows.
9. Design of IIR (HP/LP) filters.

NOTE:

1. Minimum of 5 from Part A and 5 from Part B is Compulsory.
2. For Section 'A' MATLAB with different toolboxes like signal processing, signal processing Block set and SIMULINK / MATHEMATICA / any popular software can be used.

Suggested Reading:

1. Jaydeep Chakravorthy, ''Introduction to MATLAB Programming :Toolbox and Simulink",1/e, University Press,2014.

Course Code	Course Title						Core / Elective
PC553EC	Industrial Visit						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
NIL	L	T	D	P			
	0	0	0	0	Grade	Nil	Nil

Scheme of VI Semester

S. No	Course Code	Course Title	Scheme of Examination		L	T	P	Hrs/ Wk	Credits
			CIE	SEE					
1	PC601EC	**Digital Communication**	30	70	3	1	0	4	3
2	PC602EC	**Antennas and wave propagation**	30	70	3	1	0	4	3
3	PC603EC	**Microprocessor and Microcontroller**	30	70	3	1	0	4	3
4	HS604EC	**Managerial Economics & Accountancy**	30	70	3	0	0	3	3
5		**Professional Elective-I**	30	70	3	0	0	3	3
6		**Open Elective-I**	30	70	3	0	0	3	3
7	PC651EC	**Communication Lab**	25	50	0	0	2	2	1
8	PC652EC	**Microprocessor and Microcontroller Lab**	25	50	0	0	2	2	1
		Total	**230**	**470**	**18**	**3**	**4**	**25**	**20**

Professional Elective-I	Open Elective-I
• PE 671 EC Digital Image Processing • PE 672 EC Data Communication and computer networking • PE 673 EC Optical Communication • PE 674 EC Digital TV Engineering	OE 601 BE Micro Electro- Mechanical Systems (MEMS) OE 601 CE Disaster Management *OE 601 CS Operating Systems OE 602 CS OOP using Java *OE 601 EC Principles of Embedded Systems *OE 602 EC Digital System Design using Verilog HDL OE 601EE Reliability Engineering OE 601 ME Industrial Robotics 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.**

With effect from academic year 2018-2019

Course Code	Course Title						Core/Elective
PC601EC	DIGITAL COMMUNICATION						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SATT, PTSP, AC	3	1	-	-	30	70	3

Course Objectives:

1. Familiarize the students with elements of digital communication system and waveform coding techniques like PCM, DPCM, DM and ADM.
2. Introduce the concepts of information theory and source coding
3. Familiarize the students with channel coding techniques such as LBC, BCC and convolution codes
4. Introduce the concepts of baseband digital data transmission and analyze the error performance of different digital carrier modulation schemes like ASK, FSK, PSK etc.
5. Familiarize the students with the concepts of spread spectrum communication with emphasis on DSSS and FHSS

Course Outcomes:

1. Classify the different types of digital modulation techniques PCM, DPCM, DM and ADM and compare their performance by SNR.
2. Illustrate the classification of channels and Source coding methods.
3. Distinguish different types of Error control codes along with their encoding/decoding algorithms.
4. Examine the Performance of different Digital Carrier Modulation schemes of Coherent and Non-coherent type based on Probability of error.
5. Generation of PN sequence using Spread Spectrum and characterize the Acquisition Schemes for Receivers to track the signals.

UNIT – I

Elements of Digital Communication System, Comparison of Digital and Analog Communication Systems, *Waveform Coding:* Analog to Digital Conversion, Quantization and Encoding

techniques, PCM. Companding in PCM systems - u law and A law, Applications of PCM: Introduction to Linear Prediction Theory. Modulation and demodulation of DPCM, DM and ADM. Comparison of PCM, DPCM, DM and ADM. SNR_Q of PCM and DM

UNIT – II

Information Theory and Source Coding: Uncertainty, Information and entropy. Source coding, Shannon – Fano and Huffman coding. Discrete memoryless channel – Probability relations in a channel, priori & posteriori entropies, mutual information, Channel capacity - Binary Symmetric Channel, Binary Erasure Channel, , cascaded channels, information rate. Shannon-Hartley Theorem – Shannon Bound.

UNIT – III

Channel Coding: Types of transmission errors, need for error control coding, *Linear Block Codes (LBC):* description of LBC, generation, Syndrome and error detection, Minimum distance of Linear block code, error correction and error detection capabilities, Standard array and syndrome decoding, Hamming codes. *Binary cyclic codes (BCC):* Description of cyclic codes, encoding, decoding and error correction using shift registers. *Convolution codes:* description, encoding – code tree, state diagram.

UNIT – IV

Introduction to Base band digital data transmission – block diagram, ISI, eye pattern

Digital Carrier Modulation Schemes — Description and generation of ASK, FSK, PSK. optimum receiver – matched filter, correlation receiver. Gaussian error probability -Coherent detection of Binary ASK, FSK, PSK. DPSK. Comparison of digital carrier modulation schemes. M-ary signaling schemes – Introduction, QPSK,Synchronization methods.

UNIT – V

Spread Spectrum Communication: Advantages of Spread Spectrum, generation and characteristics of PN sequences. Direct sequence spread spectrum and Frequency hopping spread spectrum systems and their applications. Acquisition and Tracking of DSSS and FHSS signals.

Suggested Reading:

1. Simon Haykin, “Communication systems” 4/e, Wiley India 2011
2. Sam Shanmugam K, “Digital and Analog Communication systems”, Wiley 1979.
3. B.P.Lathi, “Modern digital and analog communication systems” 3/e, Oxford University Press. 1998

With effect from academic year 2018-2019

Course Code	Course Title						Core/Elective
PC602EC	**ANTENNAS AND WAVE PROPAGATION**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
EMTL	3	1	-	-	30	70	3

Course Objectives:

1. To Familiarize the students with the basic principles of antennas and introduce the antenna terminology.
2. To Introduce different types of wire antennas and make proficient in analytical skills For understanding practical antennas.
3. To familiarize with the design of different types of antennas for various frequency ranges and latest developments in the practical antennas.
4. To Introduce need for antenna arrays and the concepts of measurements of antennas.
5. To Introduce the various modes of Radio Wave propagation used .

Course Outcomes:

1. To Illustrate the basic principles of antennas and learn the antenna terminology.
2. To design different types of wire antennas and make proficient in analytical skills for understanding practical antennas.
3. To design different types of antennas for various frequency ranges and get updated With latest developments in the practical antennas.
4. To Apply the principles of antennas, to design antenna arrays and measure various parameters of antennas.
5. To Identify and understand the suitable modes of Radio Wave propagation used in current practice

Unit – I

Introduction, Fundamental Concepts- Physical concept of radiation, Radiation pattern, Isotropic Radiator, Front–to-back ratio, Antenna Field Regions, Radiation Intensity, Beam Area, Beam

Efficiency, Reciprocity, Directivity and Gain, Antenna Apertures, Antenna Polarization, Antenna impedance, Antenna temperature, Friis transmission equation, Retarded potential.

Unit – II

Current Distributions, Radiation from Infinitesimal Dipole, Half wave Dipole and Quarter wave Monopole, Loop Antennas - Introduction, Small Loop, Far field pattern of circular loop with uniform current, Comparison of far fields of small loop and short dipole, Slot Antennas, Helical Antennas-Helical Geometry, Helix modes, Practical Design considerations for Monofilar Helical Antenna in Axial and Normal Modes, wideband characteristics, radiation efficiency.

Unit – III

V-antenna, Rhombic Antenna, Yagi-Uda Antenna, Folded Dipoles & their Characteristics, Log-periodic Antenna, Aperture Antennas- Huygens' principle, Radiation from apertures, Babinet's principle, Radiation from Horns and design considerations, Parabolic Reflector and cassegrain Antennas, Lens Antennas, Micro Strip Antennas- Basic characteristics, feeding Methods, Design of Rectangular Patch Antennas, Smart Antennas- Fixed weight Beam Forming basics and Adaptive Beamforming,

Unit – IV

Array of point sources, two element array with equal and unequal amplitudes, different phases, linear n- element array with uniform distribution, Broadside and End fire arrays, Principle of Pattern Multiplication, Effect of inter element phase shift on beam scanning, Binomial array, Synthesis of Antenna arrays using Schelkunoff Polynomial method, Woodward-Lawson method.

Antenna Measurements: Introduction, Antenna Test Site and sources of errors, Radiation Hazards, Patterns to be Measured, Radiation, Gain and Impedance Measurement Techniques.

Unit – V

Ground wave propagation, Space and Surface waves, Troposphere refraction and reflection, Duct propagation, Sky wave propagation, Regular and irregular variations in ionosphere. Line of sight propagation.

Suggested Reading:

1. J. D. Kraus, R. J. Marhefka & Ahmad S. Khan, "Antennas and wave Propagation", McGraw-Hill, 4rth Edition, 2010.
2. Constantine A. Balanis, "Antenna Theory: Analysis and Design", Wiley, 3rd edition, 2005
3. Edward C. Jordan and Kenneth G. Balmain, “Electromagnetic Waves and Radiating Systems,” 2/e, PHI, 2001

Course Code	Course Title						Core/Elective
PC603EC	MICROPROCESSORS AND MICROCONTROLLERS						CORE
Prerequisite	Contact Hours per Week:4				CIE	SEE	Credits
	L	T	D	P			
COA	3	1	-	-	30	70	3

Course objectives:

1. Understand architecture & programming of 8086 microprocessor and 8051 microcontrollers.
2. Design Interfacing of memory , 8255,8257 and 8251 to 8086 processor
3. Differentiation of 8086 and 8051 in terms of internal architecture, memory, programming.
4. Design Interfacing & Programming of I/O ports, timers and UART using 8051.
5. Design Interfacing of real time devices like ADC, DAC and stepper motor with 8051.

Course Outcomes:

1. Explain the architecture of 8086 microprocessor and recognize different types of addressing modes.
2. Write assembly language programming using 8086 microprocessor instruction set.
3. Interface different peripherals to 8086 microprocessor.
4. Explain the architecture of 8051 architecture and write Assembly/C language programming using 8051 microcontroller.
5. Interface different peripherals to 8051 microcontroller.

UNIT-I: Intel 8086/8088 architecture, Segmented memory, Minimum and Maximum modes of operation, Timing diagram, addressing modes, Instruction set, assembly language programming using data transfer, arithmetic, logical and branching instructions

UNIT-II: Assembler directives, macros, procedures,assembly language programming using string manipulation instructions, 8086 Interrupt structure, IO and Memory Interfacing concepts using 8086, IC Chip Peripherals-8255 PPI, 8257 DMA controller, 8251 USART

Unit-III: 8051 Microcontroller – Internal architecture and pin configuration, 8051 addressing modes, instruction set, Bit addressable features. I/O Port structures, assembly language programming using data transfer, arithmetic, logical and branch instructions.

UNIT IV: 8051 Timers/Counters, Serial data communication and its programming, 8051 interrupts, Interrupt vector table, Interrupt programming.

UNIT V: Interfacing of 8051 with LCD, ADC, DAC, external memory, Stepper Motor interfacing.

Suggested Reading:

1. Ray A.K &Bhurchandhi K.M, "Advanced Microprocessor and Peripherals," 2/e, TMH, 2007.
2. Mazidi M.A, Mazidi J.G &Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C," 2/e, Pearson Education, 2007
3. Ayala K.J, "The 8051 Micro Controller Architecture, programming and Application," Penram International, 2007.

With effect from the academic year 2018 – 2019

Course Code	Course Title						Core/Elective
HS604EC	**Managerial Economics and Accountancy**						Core
Prerequisite	Contact Hours per Week:2				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course objectives:

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

Course Outcomes:

- 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.

With effect from academic year 2018-2019

Course Code	Course Title						Core/Elective
PC651EC	COMMUNICATION LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	25	50	1

Course Objectives:

· Demonstrate AM, FM, Mixer, PAM, PWM and PPM techniques.

· Understand multiplexing techniques.

· Understand and simulate digital modulation (i.e., ASK, FSK, BPSK, QPSK) generation and detection.

· Model analog, pulse modulation, PCM, Delta and Digital modulation techniques using CAD tools

· Obtain data formats.

Course Outcomes:

· Understand and simulate modulation and demodulation of AM and FM.

· Construct pre-emphasis and de-emphasis at the transmitter and receiver respectively

· Understand and simulate the PAM,PWM&PPM circuits

· Understand baseband transmission (i.e., PCM, DPCM, DM, ADM) generation and detection.

· Understand error detection and correction.

· Obtain modem characteristics.

Part-A

1.AM generation and detection

2.FM generation and detection

3.Pre emphasis and De-emphasis circuits

4.Multiplexing Techniques (FDM and TDM)

5.Mixer Characteristics

6.Sampling , PAM, PWM, and PPM generation and detection

7.Generation and Detection of Analog and Pulse modulation techniques by using MATLAB/Simulink/Labview

Part-B

1.PCM generation and detection
2.Data formats / channel encoding and decoding.
3.Linear and Adaptive Delta Modulation and Demodulation
4.Modem characteristics.
5.ASK generation and Detection.
6.FSK and Minimum Shift Keying generation and Detection.
7.Phase shift keying methods (BPSK, QPSK) generation and Detection.
8.Generation and Detection of PCM, Delta modulation and Digital modulation Schemes (ASK. FSK, BPSK,QPSK) by using MATLAB/Simulink/Lab-view.

General Note: At least 12 experiments are to be conducted.

With effect from the academic year 2018 – 2019

Course Code	Course Title						Core/Elective
PC652EC	MICROPROCESSOR AND MICROCONTROLLERS LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	25	50	1

Course objectives:

1. Apply Assembly language programs on 8086 trainer kit in standalone/serial mode
2. Classify interface modules into input /output and Memory interfaces with 8086
3. Develop and execute the embedded C programming concepts of 8051 microcontroller.
4. Design and develop 8051embedded C programs for various interface modules.
5. Develop Interface with serial and I2C bus.

Course Outcomes:

1. Apply different addressing modes & Model programs using 8086 Instruction set
2. Exaine the usage of string instructions of 8086 for string manipulation, Comparison
3. Develop interfacing applications using 8086 processor
4. Design different programs using C cross compilers for 8051 controller
5. Develop interfacing applications using 8051 controller

PART- A

1. Use of 8086 trainer kit and execution of programs. (Instruction set for simple Programs using 4 to 5 lines of instruction code under different addressing modes for data transfer, manipulation, Arithmetic operations)
2. Branching operations and logical operations in a given data.
3. Multiplication and division.
4. Single byte, multi byte Binary and BCD addition and subtraction
5. Code conversions.
6. String Searching and Sorting.
7. Interface a stepper motor to 8086 using 8255 PPI
8. Interface a USART 8251 to 8086 for serial data transfer/Receive

PART–B

[Experiments for 8051 using any C- Cross Compiler & appropriate hardware]

1. Familiarity and use of 8051/8031 Microcontroller trainer, and execution of programs.

2. Instruction set for simple Programs (using 4 to 5 lines of instruction code).
3. Timer and counter operations & programming using 8051.
4. Serial communications using UART
5. Programming using interrupts
6. Interfacing 8051 with DAC to generate waveforms.
7. Interfacing traffic signal control using 8051.
8. Program to control stepper motor using 8051.
9. ADC interfacing with 8051
10. Serial RTC interfacing with 8051
11. LCD interfacing with 8051

Note:

1. Preliminary explanation of the features and use of the tools must be made in 2/3 theory periods.
2. A total of not less than 12 experiments must be carried out during the semester with at least 6 from each part.

Suggested Reading:

1. Myke Predko – *Programming and Customizing the 8051 Microcontroller,* TMH, 2005
2. Mazidi M.A, Mazidi J.G &Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C," 2/e, Pearson Education, 2007

PROFESSIONAL ELECTIVE-I

WITH EFFECT FROM THE ACADEMIC YEAR 2018 – 2019

WITH EFFECT FROM THE ACADEMIC YEAR 2018 – 2019

Course Code	Course Title						Core/Elective
PE 671 EC	**Digital Image Processing**						Elective
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
-	3				30	70	3

- *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:

- *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, brightness, adaptation and discrimination. Categorization of images according to their source..of EM radiation.

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 line And 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 various types of redundancies, Huffman coding, , Arithmetic 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.

Course Code	Course Title						Core/Elective
PC 672 EC	**Data communication and computer networking**						Elective
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
-	3				30	70	3

Course Objectives:

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

UNIT-I

Data communication: A Communication Model, The Need for Protocol Architecture and Standardization, Network Types: LAN, WAN, MAN. Network Topologies: Bus, Star, Ring, Hybrid. Line configurations. Reference Models: OSI, TCP/IP .

Circuit switching: Circuit Switching Principles and concepts.
Packet switching: Virtual circuit and Datagram subnets, X.25.

UNIT-II

Data Link Layer: Need for Data Link Control, Design issues, Framing, Error Detection and Correction, Flow control Protocols: Stop and Wait, Sliding Window, ARQ Protocols, HDLC.

MAC Sub Layer: Multiple Access Protocols: ALOHA, CSMA, Wireless LAN. IEEE 802.2, 802.3, 802.4,802.11,802.15, 802.16 standards. Bridges and Routers.

UNIT-III

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

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

UNIT-IV

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

UNIT-V

Application Layer: Domain Name System, SNMP, Electronic Mail, World Wide Web.

Network Security: Cryptography Symmetric Key and Public Key algorithms, Digital Signatures, Authentication Protocols.

Suggested Reading:

1. Andrew S Tanenbaum, "Computer Networks," 5/e, Pearson Education, 2011.

2. Behrouz A. Forouzan, "Data Communication and Networking,"3/e, TMH, 2008.

3. William Stallings, "Data and Computer Communications," 8/e, PHI, 2004.

WITH EFFECT FROM THE ACADEMIC YEAR 2018 – 2019

Course Code	Course Title						Core/Elective
PE 673EC	**Optical Communication**						Elective
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
-	3				30	70	3

Course Objectives:

1. Learn concepts of propagation through optical fiber Fiber modes and configurations, Losses and dispersion through optical fiber.
2. Understand operating principles of light sources and detectors used in optical transmitters and Receivers.
3. Design an optical link in view of loss and dispersion.

Course Outcomes:

UNIT-I

Evolution of fiber optic system, Elements of Optical Fiber Transmission link, Ray Optics, Optical Fiber Modes and Configurations, Mode theory of Circular Waveguides, Overview Low frequency data transportation of Modes and Key concepts, Linearly Polarized Modes, Single Mode Fibers and Graded Index fiber structure and.

UNIT-II

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides-Information Capacity determination, Group Delay, Material Dispersion, Waveguide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in Guided Index fibers, Mode Coupling, Types of OFC Connectors and issues involved Design Optimization of Single and cut-off wavelength.

UNIT-III

Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency, LED power, Modulation of LED, laser Diodes, Modes and Threshold condition, Rate equations, External

Quantum efficiency, Resonant frequencies, Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers, Power Launching and coupling, Lensing schemes, Fiber-to-Fiber joints, Fiber splicing.

UNIT-IV

PIN and APD diodes, Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise, Comparison of Photo detectors, Fundamental Receiver Operation, preamplifiers, Error Sources, Receiver Configuration, Probability of Error, Quantum Limit.

UNIT-V

Point-to-Point link system considerations -Link Power budget, Rise - time budget, Noise Effects on System Performance, Operational Principles of WDM and Applications. Erbium-doped Amplifiers. Introductory concepts of SONET/SDH Network. Multiple signal interface in fibers, Bandwidth utilization, Interface with nano-electronic devices.

Suggested Reading:

1. Gourd Keiser, *"Optical Fiber Communication,"* 4/e, TMH, 2000.
2. J.Senior, *"Optical Communication, Principles and Practice,"* PHI, 1994.
3. J.Gower, *"Optical Communication System,"* PHI, 2001.
4. Binh, *"Digital Optical Communications,"* First Indian Reprint 2013, (Taylor & Francis), Yesdee Publications.

WITH EFFECT FROM THE ACADEMIC YEAR 2018 – 2019

Course Code	Course Title						Core/Elective
PE 674 EC	**Digital TV engineering**						Elective
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
-	3				30	70	3

Course objectives:

- **Study the different camera and picture tubes.**
- **Know about various standard TV channels.**
- **Study about TV receiver, sync separation, detector etc.,**
- **Study about color signal encoding ,decoding and receiver.**

UNIT–I:

Introduction: TV transmitter and receivers, synchronization. Geometric form and aspect ratio, image continuity, interlaced scanning, picture resolution, Composite video signal, TV standards. Camera tubes: image Orthicon, Plumbicon, vidicon, silicon Diode Array vidicon, Comparison of camera tubes, Monochrome TV camera, TV Signal Transmission and Propagation: Picture Signal transmission, positive and negative modulation, VSB transmission, sound signal transmission, standard channel BW,TV transmitter, TV signal propagation, interference, TV broadcast channels, TV transmission Antennas.

UNIT –II:

Monochrome TV Receiver: RF tuner, IF subsystem, video amplifier, sound section, sync separation and processing, deflection circuits, scanning circuits, AGC, noise cancellation, video and inter carrier sound signal detection, vision IF subsystem of Black and White receivers, Receiver sound system: FM detection, FM Sound detectors, and typical applications.

UNIT –III:

Sync Separation and Detection: TV Receiver Tuners, Tuner operation, VHF and UHF tuners, digital tuning techniques, remote control of receiver functions. Sync Separation, AFC and Deflection Oscillators: Synchronous separation, k noise in sync pulses, separation of frame and line sync pulses. AFC, single ended AFC circuit, Deflection Oscillators, deflection drive Ics, Receiver Antennas, Picture Tubes.

UNIT–IV:

Color Television: Colour signal generation, additive colour mixing, video signals for colours, colour difference signals, encoding, Perception of brightness and colours luminance signal, Encoding of colour difference signals, formation of chrominance signals, color cameras, Colour picture tubes. Color Signal Encoding and Decoding: NTSC colour system PAL colour system, PAL encoder, PAL-D Decoder, chrome signal amplifiers, separation of U and V signals, colour burst separation, Burst phase discriminator, ACC amplifier, Reference oscillator, Indent and colour killer circuits, U& V demodulators.

UNIT –V:

Color Receiver: Introduction to colour receiver, Electron tuners, IF subsystem, Y-signal channel, Chroma decoder, Separation of U & V Color, Phasors, synchronous demodulators, Sub carrier generation, raster circuits.

Digital TV: Introduction to Digital TV, Digital Satellite TV, Direct to Home Satellite TV, Digital TV Transmitter, Digital TV Receiver, Digital Terrestrial TV, LCD TV, LED TV, CCD Image Sensors, HDTV.

References

1. Television and Video Engineering- A.M.Dhake, 2nd Edition.

2. Modern Television Practice – Principles, Technology and Service- R.R.Gallatin, New Age International Publication, 2002.
3. Monochrome and Colour TV- R.R. Gulati, New Age International Publication, 2002.

OPEN ELECTIVE-I

WITH EFFECT FROM THE ACADEMIC YEAR 2018 – 2019

Course Code	Course Title						Core/Elective
OE 601BE	**Micro Electro- Mechanical Systems(MEMS)**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course objectives:

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

Course Outcomes:

The Student will be

1. Able to design the micro devices, micro systems using the MEMS fabrication process.
2. Able 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.

WITH EFFECT FROM THE ACADEMIC YEAR 2018 – 2019

Course Code	Course Title						Core/Elective
OE 601CE	**Disaster Management**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course objectives:

1. To provide students an exposure to disasters, their significance and types.
2. To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
3. To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).
4. To enhance awareness of institutional processes in the country.
5. 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:

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

UNIT – I

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

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

UNIT – II

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

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

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

UNIT – III

Approaches to Disaster Risk Reduction: Disaster cycle - its analysis, Phases, Culture of safety, prevention,mitigation and preparedness community based DRR, Structural- 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*, N a t i o n a l 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.

WITH EFFECT FROM THE ACADEMIC YEAR 2018 – 2019

Course Code	Course Title						Core/Elective
OE 601CS	**Operating Systems**						Elective
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
-	3				30	70	3

Course objectives:

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

Course Outcomes:

Student will be:

7. Explain the components and functions of operating systems.
9. Apply the principles of concurrency.
10. Compare and contrast various memory management schemes.
11. 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.

Course Code	Course Title						Core/Elective
OE 601 CS	**Operating Systems**						Elective
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
-	3				30	70	3

Course objectives:

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

Course Outcomes:

1. Explain the components and functions of operating systems.
2. Analyze various Scheduling algorithms.
3. Apply the principles of concurrency.
4. Compare and contrast various memory management schemes.
5. 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.

WITH EFFECT FROM THE ACADEMIC YEAR 2018 – 2019

Course Code	Course Title						Core/Elective
OE 602 CS	**OOP using Java**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course objectives:

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

Course Outcomes:

Student will be :

1. Able to develop java applications using OO concepts and packages.
2. Able to write multi threaded programs with synchronization.
3. Able to implement real world applications using java collection frame work and I/O classes.
4. 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.

WITH EFFECT FROM THE ACADEMIC YEAR 2018 – 2019

Course Code	Course Title						Core/Elective
OE 601 EC	**Principles of Embedded Systems**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course objectives:

1. To understand the fundamentals of embedded systems.
2. To study the block diagram and advanced hardware fundamentals.
3. To study the software architecture of embedded systems.
4. To learn the tool chain of embedded systems.
5. To understand the tools and debugging process of embedded systems.

Course Outcomes:

Student will be :

1. Able to acquire an overview of what an embedded system implies.
2. Able to understand the architecture of a microprocessor and microcontroller to enable to design embedded applications using them.
3. Able to apply theoretical learning to practical real time problems for automation.
4. Able to understand how to build and debug an embedded system application.
5. 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.

Course Code	Course Title						Open Elective
OE 602 EC	Digital Design using Verilog HDL						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
STLD or DELD	L	T	D	P			
	3	-	-	-	30	70	3

Course Objectives:

1. Describe Verilog hardware description languages (HDL).
2. Develop Verilog HDL code for combinational digital circuits.
3. Develop Verilog HDL code for sequential digital circuits..
4. Develop Verilog HDL code for digital circuits using switch level modeling and describes system tasks, functions and compiler directives
5. Describes designing with FPGA and CPLD.

Course Outcomes:

After completion of this course, students should be able to:

1. Understand syntax of various commands, data types and operators available with verilog HDL
2. To design and simulate combinational circuits in verilog
3. To design and simulate sequential and concurrent techniques in verilog
4. Write Switch level models of digital circuits
5. Implement models on FPGAs and CPLDs.

Unit I

Introduction to Verilog HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis Tools

Verilog Data types and Operators, Binary data manipulation, Combinational and Sequential logic design, Structural Models of Combinational Logic, Logic Simulation, Design Verification and Test Methodology, Propagation Delay, Truth Table models using Verilog.

Unit II

Combinational Logic Circuit Design using Verilog: Combinational circuits building blocks: Multiplexers, Decoders , Encoders , Code converters, Arithmetic comparison circuits , Verilog

for combinational circuits , Adders-Half Adder, Full Adder, Ripple-Carry Adder, Carry Lookahead Adder, Subtraction, Multiplication.

Unit III

Sequential Logic Circuit Design using Verilog: Flip-flops, registers & counters, synchronous sequential circuits: Basic design steps, Mealy State model, Design of FSM using CAD tools, Serial Adder Example, State Minimization, Design of Counter using sequential Circuit approach.

Unit IV

Switch Level Modeling: Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, Instantiation with Strengths and Delays, Strength Contention with Trireg Nets.
System Tasks, Functions and Compiler Directives: Parameters, Path Delays, Module Parameters. System Tasks and Functions, File Based Tasks and Functions, Computer Directives, Hierarchical Access, User Defined Primitives.

Unit V

Designing with FPGAs and CPLDs: Simple PLDs,ComplexPLDs,Xilinx 3000 Series FPGAs, Designing with FPGAs, Using a One-Hot State Assignment, Altera Complex Programmable Logic Devices (CPLDs), Altera FLEX 10K Series CPLDs.

Suggested Reading:

1. T.R. Padmanabhan, B Bala Tripura Sundari, *Design Through Verilog HDL*, Wiley 2009.
2. Samir Palnitkar, *Verilog HDL,* 2nd Edition, Pearson Education, 2009.
3. Stephen Brown, Zvonko Vranesic , *Fundamentals of Digital Logic with Verilog Design* -, TMH, 2nd Edition 2003.

WITH EFFECT FROM THE ACADEMIC YEAR 2018 – 2019

Course Code	Course Title						Core/Elective
OE 601 EE	**Reliability Engineering**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course objectives:

1. *T*o understand the concepts of different types of probability distributions. importance of reliability evaluation of networks.
2. 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 :

1. Able to understand the meaning of discrete and continuous random variables and their significance, causes of failures of a system.
2. Able to acquire the knowledge of different distribution functions and their applications.
3. 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.

WITH EFFECT FROM THE ACADEMIC YEAR 2018 – 2019

Course Code	Course Title						Core/Elective
OE 601 ME	**Industrial Robotics**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course objectives:

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

Course Outcomes:

Student will be :

1. 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.
2. Able to demonstrate an ability to apply spatial transformation to obtain forward/Inverse kinematics equation of robot manipulators using analytical/numerical/simulation tools.
3. Able to apply knowledge and choose the best & economically suitable sensors/end effectors required for specific applications
4. Able to understand the importance of robot vision and apply the learnt techniques to get the required information from input images.
5. Able to design and develop a industrial robot for a given purpose economically
6. 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.

WITH EFFECT FROM THE ACADEMIC YEAR 2018 – 2019

Course Code	Course Title						Core/Elective
OE 601 LA	**Intellectual Property Rights**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course objectives:

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

Course Outcomes:

Student will be :

1. 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.
2. Able to Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
3. Able to identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautionary 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.