Departmental Curriculum

2nd Year: 3rd Semester

A. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	EC301	Electronic Devices	3	0	0	3	3
2.	EC302	Digital System Design	3	0	0	3	3
3.	EC303	Signals and Systems	3	0	0	3	3
4.	EC304	Network Theory	3	0	0	3	3
5.	ES-CS301	Data Structure & Algorithm (ES)	3	0	0	3	3
6.	BS-M301	Probability & Statistics(BS)	3	0	0	3	3
		Total Theory				18	18
B. Practical							
7.	EC391	Electronic Devices Lab.	0	0	2	2	1
8.	EC392	Digital System Design Lab.	0	0	2	2	1
9	ES-CS391	Data Structure Lab(ES)	0	0	2	2	1
					Total Practical	6	3
					Total Credits	24	21
C. Non Credit Course							
	MC381	Environmental Science	0	0	2	2	0

Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	EC401	Analog Communication	3	0	0	3	3
2.	EC402	Analog Electronic Circuits	3	0	0	3	3
3.	EC403	Microprocessor &Microcontrollers	3	0	0	3	3
4.	ES-CS401	Design and Analysis of Algorithm(ES)	3	0	0	3	3
5.	BS-M401	Numerical Methods(BS)	2	0	0	2	2
6.	BS-B401	Biology for Engineers	2	1	0	3	3
Total Theory						14	17
B. Practical							
6.	EC491	Analog Communication Lab	0	0	2	2	1
7.	EC492	Analog Electronic Circuits Lab.	0	0	2	2	1
8	EC493	Microprocessor & Microcontrollers Lab	0	0	2	2	1
9	BS-M(CS)491	Numerical Methods Lab	0	0	2	2	1
10	HS-HU481	Soft Skill Development Lab	0	0	2	2	1
Total Practical						10	5
Total Credits						24	22

3rd Year: 5th Semester

A. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	EC501	Electromagnetic Waves	3	0	0	3	3
2.	EC502	Computer Architecture	3	0	0	3	3
3.	EC503	Digital Communication & Stochastic Process	3	1	0	4	3.5
4.	EC504	Digital Signal Processing	3	0	0	3	3
5.	PE-EC505	Program Elective I	3	0	0	3	3
6.	OE-EC506 A/B/C/D	Open Elective I	3	0	0	3	3
7	MC-HU501	Effective Technical Communication	3	0	0	3	0
Total Theory						22	18.5
B. Practical							
8.	EC591	Electromagnetic Wave Lab	0	0	2	2	1
9.	EC592	Digital Communication Lab.	0	0	2	2	1
10.	EC593	Digital Signal Processing Lab.	0	0	2	2	1
Total Practical						6	3
Total Credits						28	21.5

3rd Year: 6th Semester

C. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	EC601	Control System & Instrumentation	3	0	0	3	3
2.	EC602	Computer Network	3	0	0	3	3
3.	PE-EC603	Program Elective II	3	0	0	3	3
4.	OE-	Open Elective II	3	0	0	3	3

	EC604						
5.	HS-HU601	Economics for Engineers	3	0	0	3	3
Total Theory						15	15
D. Practical							
6.	EC691	Computer Network Lab.	0	0	2	2	1
7.	EC692	Control System and Instrumentation Lab.	0	0	2	2	1
8.	EC681	Mini Project/ Electronic Design Workshop	0	0	4	4	2
Total Practical						8	4
Total Credits						23	19
9	MC681	Universal Human Values	2	0	0	2	0

4th Year: 7th Semester

D. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	PE-EC701	Program Elective -3	3	0	0	3	3
2.	PE-EC702	Program Elective -4	3	0	0	3	3
3.	PE-EC703	Program Elective -5	3	0	0	3	3
4.	OE-EC704	Open Elective - 3	3	0	0	3	3
5.	HS-HU701	Principles of Management	2	0	0	2	2
Total Theory						16	14
E. Practical							
6	EC781	Industrial Training	During Semester Break(6th & 7th)				1
6.	EC782	Project Stage – I	0	0	8	8	4
Total Practical						8	5
Total Credits						24	19

4th Year 8th Semester

E. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	PE-EC801	Program Elective – 6	3	0	0	3	3
2.	PE-EC802	Program Elective - 7	3	0	0	3	3
3.	OE-EC803	Open Elective - 4	3	0	0	3	3
4.	OE-EC804	Open Elective - 5	3	0	0	3	3
Total Theory						12	12
F. Practical							
5.	EC881	Project Stage – II	0	0	15	15	7.5
6.	EC891	Grand Viva					1.5
Total Practical						15	9
Total Contact /Credits						27	21

Syllabus & Course Outcomes

3rd Semester

EC301: Electronic Devices

Course Outcome (CO)

Student Will be able to:

CO1	Understand the concepts of Energy Bands and Charge Carriers in Semiconductors
CO2	Realize the working Diodes and BJT
CO3	Identify with the functioning of MOS devices
CO4	Comprehend the working of Optoelectronic Devices

CO-PO Mapping

COs	PROGRAM OUTCOMES(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1	3	2	1	1	1	1	-	3	2	2	1	3
CO 2	3	2	2	2	1	-	1	3	2	2	-	3
CO 3	3	2	2	2	1	-	-	3	2	2	-	3

CO 4	3	1	1	1	-	2	1	3	2	2	1	3

Syllabus (EC 301)

Module I 6L

Energy bands & Current Carriers in Semiconductors: Bonding Forces in Solids, Energy Bands theory in crystals (Qualitative Analysis), Metals, Semiconductors, & Insulators, Fermi-Level, Intrinsic and Extrinsic Semiconductors, Concept of Holes, Carrier Concentration. and Mobility, diffusion and drift of carriers, continuity equation, Injected minority carrier charge, Recombination and generation ofcharge carriers. Generation and recombination of carriers; Poisson and continuity equation

Module II 10L

P-N junction: Physical Description of p-n junction, Basic device technologies for fabrication of a p-n junction, I-Vcharacteristics, and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode,**Bipolar Junction Transistor**: Basic Construction, I-V characteristics, Ebers-Moll Model.

Module III 6L

MOSFET: MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor

MODULE IV 10L

Opto–Electronics: Optical absorption in semiconductors, photovoltaic effects, solar cells (p-n junction), Photoconductors, Photodiode, PIN photodiode, Avalanche photodiode, Phototransistor, LED, Semiconductor Laser (p-n junction), **Integrated circuit**: fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

Books

1. G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson,2014.
2. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
3. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley &Sons, 2006.
4. C.T. Sah, “Fundamentals of solid state electronics,” World Scientific Publishing Co. Inc, 1991.
5. Y. Tsividis and M. Colin, “Operation and Modeling of the MOS Transistor,” Oxford Univ.Press,2011.

EC302: Digital System Design

Course Outcome (CO)

Student Will be able to:

CO1	Design and analyze combinational logic circuits
CO2	Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder
CO3	Design & analyze synchronous sequential logic circuits

CO-PO Mapping

COs	PROGRAM OUTCOMES(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	1	-	3	2	2	1	3
CO2	3	2	2	1	-	-	1	3	2	2	-	3
CO3	3	2	2	1	1	-	-	3	2	2	1	3
Avg	3	2	1.66	1	1	1	1	3	2	2	1	3

Syllabus (EC 302)

Module I 10 L

Review of Number System, Signed and Unsigned Number.

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh's map, Binary codes, Code Conversion.

MSI devices like Comparators, Multiplexers, Encoder, Decoder, Half and

Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Fast adders, Barrel shifter and ALU.

Module II 6L

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM. Designing synchronous circuits like Synchronous Counter, Pulse train generator, Pseudo Random Binary Sequence generator,

Module III 8L

Logic Families and Semiconductor Memories: TTL, ECL, CMOS families

Semiconductor Memories, Concept of Programmable logic devices like FPGA. Logicimplementation using Programmable Devices.

Different types of A/D and D/A conversion techniques. Sample & Hold Cirtcuit

Module IV 8L

VLSI Design flow: Design entry Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

Books

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill, 4th edition, 2009.
2. Schilling & Belove, Digital Integrated Electronics, Tata McGraw Hill,
2. Douglas Perry, “VHDL”, Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, “Digital Electronics- An introduction to theory and practice”, PHI, 2nd edition ,2006.
4. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989
5. Charles Roth, “Digital System Design using VHDL”, Tata McGraw Hill 2nd edition 2012.

EC303: Signals and System

Course Outcome (CO)

Student Will be able to:

CO1	Analyze different types of signals
CO2	Represent continuous and discrete systems in time and frequency domain using different transforms
CO3	Investigate whether the system is stable
CO4	Sampling and reconstruction of a signal

CO-PO Mapping

COs	PROGRAM OUTCOMES(POs)											
	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO 1	3	2	1	1	1	1	-	3	2	2	1	3
CO 2	3	2	2	1	1	-	1	3	2	2	-	3
CO 3	3	2	2	1	1	1	-	3	2	2	1	3
CO 4	3	2	2	1	1	-	-	3	2	2	-	2
Avg	3	2	1.7 5	1	1	1	1	3	2	2	1	2.75

Syllabus (EC 303)

Module I **6L**

Signals and systems as seen in everyday life, and in various branches of engineering and science.
Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

Module II **6L**

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift invariant systems. System representation through differential equations.

Module III **8L**

Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases.

Module IV **8L**

Evolution of Transforms: Fourier Transform, Laplace Transform , Z-transform (single sided and Double sided) The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, , solution to differential equations and system behavior using Laplace Transformation. The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis.

Module V **4L**

The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.

Books

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia).
7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH.
9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
10. Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.
11. R. Anand, Signals and Systems, Khanna Publishing House, 2018.

EC304: Network Theory

Course Outcome (CO)

Student Will be able to:

CO1	Identify various signals, sources and systems.
CO2	Explain different engineering problems by the application of various theorems and methods.
CO3	Construct mathematical model of a given electric circuit using modern engineering tools and solve it using technique of domain transformation for practical related problems.
CO4	Measure different network problems using graph theory concept
CO5	Design the given electric circuit in terms of two port network, graph theory and filters and engage in life-long learning.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EC-304.1	3	3	3	2	2	1	-	-	1	-	1	1	3	2	2
EC-304.2	3	3	3	2	2	1	-	1	-	2	-	1	3	2	2

EC-304.3	3	3	3	2	2	1	1	-	2	3	1	1	3	2	2
EC-304.4	3	3	3	2	2	1	-	1	-	1	1	1	3	2	2
EC-304.5	3	3	3	2	2	1	-	-	2	-	1	1	3	2	2
Average	3	3	3	2	2	1	-	1	-	2	3	1	3	2	2

Syllabus (EC 304)

Module I 8L

Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality. Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. circuits.

Module II 6L

Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

Module III 6L

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

Module IV 12L

Transient behaviour, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and Two four port network and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.

Books

1. Ashfaq Husain, Networks & Systems, Khanna Publishing House, New Delhi, 2018.

2. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000

3. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994

4. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education

ES-CS301 Data Structure & Algorithms

Course Outcome (CO)

CO1	Implement linear and non linear data structures using linked list.
CO2	Apply various data structures such as stack, queue and tree to solve the problems.
CO3	Implement various searching and sorting techniques.
CO4	Analyze the complexity of the algorithms.
CO5	Choose appropriate data structure while designing the applications..

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EC-304.1	3	3	3	2	2	1	-	-	-	-	-	1	3	2	2
EC-304.2	3	3	3	2	2	1	-	-	-	-	-	1	3	2	2
EC-304.3	3	3	3	2	2	1	1	-	2	-	1	1	3	2	2
EC-304.4	3	3	3	2	2	1	-	2	1	3	3	1	3	2	2
EC-	3	3	3	2	2	1	2	-	1	1	-	1	3	2	2

30 4. 5															

Syllabus (ES-CS301)

Module 1 6L

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Module 2: 8L

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation - corresponding algorithms and complexity analysis. ADT queue,

Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Module 3: **8L**

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Module 4: 8L

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

pass, high pass and band reject filters.

Books

1. Data Structures & Algorithms using C, R.S. Salaria, Khanna Publishing House, NewDelhi, 2018.

"Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press.

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition byMark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.
3. Expert Data Structures with C, R. B. Patel, Khanna Publishing House, New Delhi

BS-M301 Probality and Statics

Course Outcome (CO)

On successful completion of the learning sessions of the course, the student will be able to:

COURSE OUTCOMES (COs)	
CODE	**DESCRIPTION**
BS-M 301.CO 1	Learn the ideas of probability and random variables, calculate probabilities using conditional probability, rule of total probability and Bayes' theorem.
BS-M 301.CO 2	Illustrate various discrete and continuous probability distribution with their properties and their applications in physical and engineering environment.
BS-M 301.CO 3	Understand the basic ideas of statistics with different characterization of a univariate and bivariate data set.
BS-M 301.CO 4	Apply statistical tools for analyzing data samples and drawing inference on a given data set.

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	2	1	1	-	-	-	-	-	2
CO2	3	3	2	1	2	2	2	-	2	-	1	2
CO3	3	3	1	2	2	-	1	-	2	-	2	1
CO4	3	3	2	2	3	2	-	-	-	-	1	2
Average	3	3	2.67	2.33	2.67	1.67	1.5	-	2	-	1.33	1.75

Syllabus (BS-M301)

Module 1: Basic Probability: **8L**

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Module 2: Continuous Probability Distributions: **4L**

Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities.

Module 3: Bivariate Distributions: **4L**

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Module 4: Basic Statistics: **6L**

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression - Rank correlation.

Module 5: Applied Statistics: **6L**

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Module 6: Small samples: **4L**

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Books

(i) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
(ii) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
(iii) S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
(iv) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
(v) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
(vi) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
(vii) Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
(viii) Chandrika Prasad & Reena Garg, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi, 2018.
(ix) Manish Sharma & Amit Gupta, Business Statistics, Khanna Book Publishing Company, New Delhi, 2012.

MC381 Environmental Science

Course Outcome (CO)

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

CO1	Gain knowledge about environment and ecosystem.
CO2	Students will learn about natural resource, its importance and environmental impacts of human activities on natural resource.
CO3	Gain knowledge about the conservation of biodiversity and its importance..
CO4	Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures.
CO5	Students will learn about increase in population growth and its impact on environment

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	1	-	-	-	-	-	1	3	2	2

CO2	3	3	3	2	2	1	-	-	-	-	-	1	3	2	2
CO3	3	3	3	2	2	1	1	-	2	-	1	1	3	2	2
CO4	3	3	3	2	2	1	-	2	1	3	3	1	3	2	2
CO5	3	3	3	2	2	1	2	-	1	1	-	1	3	2	2

Syllabus (MC381)

Purpose: We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethos. There is a direct application of this wisdom even in modern times.

Idea of an activity based course on environment protection is to sensitize the students on the above issues through following two type of activities.

(a) ***Awareness Activities:***

i) Small group meetings about water management, promotion of recycle use, generation ofless waste, avoiding electricity waste

ii) Slogan making event
iii) Poster making event
iv) Cycle rally
v) Lectures from experts

(b) ***Actual Activities:***

i) Plantation
ii) Gifting a tree to see its full growth
iii) Cleanliness drive
iv) Drive for segregation of waste
v) To live some big environmentalist for a week or so to understand his work
vi) To work in kitchen garden for mess
vii) To know about the different varieties of plants
viii) Shutting down the fans and ACs of the campus for an hour or so

Books

M.P. Poonia & S.C. Sharma, Environmental Studies, Khanna Publishing House, New Delhi, 201

EC391 Electronics Devices Lab

Course Outcome (CO)

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

CO1:	Ability to understand the characteristics of BJT and FET and how to Determine different parameters for designing purpose.
CO2:	Compute the parameters from the characteristics of JFET and MOSFET devices.
CO3:	Able to measure Transistor based single stage R-C coupled voltage amplifier .

CO-PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1	3	3	3	3	2	-	2	-	3	-	-	3
CO 2	3	3	2	3	2	-	2	-	3	-	1	3
CO 3	3	3	3	3	2	1	2	-	3	-	-	3

Syllabus (EC391)

1. identifying and study of different components like resistor, capacitors, diodes, LED, Transistors, FET(JFET & MOSFET) etc
2. Study of different instruments used in the laboratories like, power supply, Oscilloscope, Multi-meter etc.
3. CHARACTERISTICS OF PN JUNCTION DIODE
   a) To Plot the Volt Ampere Characteristics of PN Junction Diode under Forward and Reverse Bias Conditions.
   b) To find the Cut-in voltage, Static Resistance, Dynamic Resistance for Forward Bias &Reverse Bias
4. CHARACTERISTICS OF ZENER DIODE & LOAD REGULATION
   a) To Obtain the Forward Bias and Reverse Bias characteristics of a Zener diode.
   b) Find out the Zener Break down Voltage from the Characteristics.
   c) To Obtain the Load Regulation Characteristics.
5. COMMON BASE BIPOLAR TRANSISTOR CHARACTERISTICS
   a) To plot the Input and Output characteristics of a transistor connected in Common Base Configuration and to find the h – parameters from the characteristics.
6. COMMON EMITTER BIPOLAR TRANSISTOR CHARACTERISTICS
   a) To plot the Input and Output characteristics of a transistor connected in Common Emitter Configuration and to find the h – parameters from the characteristics
7. DESIGN SELF BIAS BJT CIRCUIT
8. JFET DRAIN & TRANSFER CHARACTERISTICS (COMMON SOURCE)
   a) Drain characteristics
   b) Transfer Characteristics.
   c) To find rd, gm, and μ from the characteristics.
9. Study Characteristics of Photo transistor
10. Study Characteristics of LED & LDR

EC392 Digital System Design Lab

Course Outcome (CO)

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

EC392.1	Construct digital circuit to examine Boolean algebra, truth table of different logic gates.
EC392.2	Design various combinational and sequential circuits after analyzing their timing properties.
EC392.3	Demonstrate Interfacing of digital circuits with ADC & DAC.

CO-PO Mapping

SUBJECT CODE	COs	PROGRAM OUTCOMES(POs)											
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC392	**EC392**.1	3	2	2	1	-	-	1	-	2	-	-	2
	EC392.2	3	3	3	2	2	2	2	1	2	3	-	3
	EC392.3	3	1	-	1	1	3	2	1	2	2	1	3
	AVERAGE	3	2	1.66	1.33	3	1.66	1.66	0.66	2	1.66	0.33	2.66

Syllabus (EC392)

1. Introduction to Digital Electronics Lab- Nomenclature of Digital Ics, Specifications, Study of the Data Sheet, Concept of Vcc and Ground, Verification of the Truth Tables of Logic Gates using TTL ICs.
2. Implementation of the Given Boolean Function using Logic Gates in

Both Sop and Pos Forms.

3. Verification of State Tables of Rs, J-k, T and D Flip-Flops using NAND & NOR Gates
4. Implementation and Verification of Decoder/De-Multiplexer and Encoder using Logic Gates.
5. Implementation of 4x1 Multiplexer using Logic Gates.
6. Implementation of 4-Bit Parallel Adder Using 7483 IC.
7. Design , and Verify the 4- Bit Synchronous Counter
8. Design, and Verify the 4-Bit Asynchronous Counter.
9. Simulation of MOS Inverter with different loads using PSPICE software
10. Simulation of CMOS Inverter for different parameters *Kn*, *Kp* as a design variable in suitablecircuit simulator software.
11. Design of a 4-bit Multiplexer using VHDL\Verilog
12. Design of a decade counter using VHDL\Verilog.
13. Design of a 3-input NAND gate and its simulation using suitable logic simulator

Books

1. Douglas L.Perry**,** "VHDL: Programming by Example", McGraw-Hill, 2002.
2. Charles H. Roth, Lizy Kurian John, "Digital systems design using VHDL", Thomson, 2008.

ES-CS391:Data Structure & Algorithms

Course Outcome (CO)

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

CO1:	Students will be able to understand the basic data structures and their applications.
CO2:	Students will be able to apply Linea Data Structure that can be implemented using different data structures.
CO3:	Students will be able to analyze the different sorting and searching algorithms mentioned in the course, their implementation and performance analysis.
CO4	Students will be able to construct and evaluate algorithms to solve a problem by choosing an appropriate data structure.

CO-PO Mapping

CO'S	PO'S											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC504B.1	3	2		3	-	2	1	-	2	-	3	3
EC504B.2	3	2	1	1	1	2	3	1	1	2	2	3

EC504B.3	3	2	2	2	1	2	3	3	3	3	2	2
EC504B.4	3	3	2	-	-	-	3	-	-	3	-	3
Avg	3.00	2.25	1.67	2.00	1.00	2.00	2.50	2.00	2.00	2.67	2.33	2.75

Syllabus (ES-CS391)

Experiments should include but not limited to :

Implementation of array operations:

Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements

Merging Problem : Evaluation of expressions operations on Multiple stacks & queues :

Implementation of linked lists: inserting, deleting, and inverting a linked list.

Implementation of stacks & queues using linked lists:

Polynomial addition, Polynomial multiplication

Sparse Matrices : Multiplication, addition

Recursive and Nonrecursive traversal of Trees

Threaded binary tree traversal. AVL tree implementation

Application of Trees. Application of sorting and searching algorithms

Hash tables implementation: searching, inserting and deleting, searching & sorting techniques

Syllabus & Course Outcomes

4th Semester

EC401: Analog Communication

Course Outcome (CO)

CO1	Understand different modulation and demodulation schemes for Analog communications.
CO2	Design Analog communication systems to meet desired application requirements.
CO3	Evaluate fundamental communication system parameters, such as bandwidth,
CO4	Understand noise as a random process and its effect on communication receivers.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	2	3	-	3	2	3	-	3	-
CO2	3	2	2	1	2	2	3	3	3	2	-	1
CO3	1	3	3	1	-	3	2	2	2	-	2	3
CO4	1	2	3	3	-	3	2	-	1	2	1	-

Syllabus (EC401)

Mod-1 Introduction to Analog Communication:

8L Elements of communication system - Transmitters, Transmission channels &receivers (1), Concept of modulation, its needs (1).

Continuous Wave Linear Modulation:

a) Amplitude modulation(AM-DSB/TC): Time domain representation of AM signal (expression derived using a single tone message), modulation index , frequency domain (spectral) representations, illustration of the carrier and side band components; transmission bandwidth for AM; Phasor diagram of an AM signal; Calculation of Transmitted power & sideband power & Efficiency ; concept of under, over and critical modulation of AM-DSB-TC.

b) Other Amplitude Modulations: Double side band suppressed carrier (DSBSC) modulation: time and frequency domain expressions, bandwidth and transmission power for DSB. Single side band modulation (SSB) both TC & SC and only the basic concept of VSB, Spectra and band-width.

Mod-2 Generation & Detection of Amplitude Modulation:

8L

a) Generation of AM: Concept of i) Gated and ii) Square law modulators, Balanced Modulator.

b) Generation of SSB: Filter method, Phase shift method and the Third method Demodulation for Linear Modulation:

Demodulation of AM signals: Detection of AM by envelope detector ,

Synchronous detection for AM-SC, Effects of Frequency & Phase mismatch, Corrections. Principle of Super

heterodyne receivers: Super heterodyning principle, intermediate frequency, Local oscillator frequency, image frequency.

Mod-3 Angle Modulation:

8L

a) Frequency Modulation (FM) and Phase Modulation (PM): Time and Frequency domain representations, Spectral representation of FM and PM for a single tone message, Bessel's functions and Fourier series. ; Phasor diagram ;

b) Generation of FM & PM: Narrow and Wide-band angle modulation, Basic block diagram representation of generation of FM & PM, Concept of VCO & Reactance modulator

c) Demodulation of FM and PM: Concept of frequency discriminators , Phase Locked Loop

Mod 4 - Multiplexing

8L

a) Frequency Division Multiplexing, Time Division Multiplexing, (FDM)

b) Stereo - AM and FM: Basic concepts with block diagrams

c) Random Signals and Noise in Communication System:

i) Noise in Communication systems - Internal & External noise, Noise Temperature, Signal-to-Noise ratio, White noise, thermal noise, Figure of Merit.

ii)Noise performance in Analog Communication systems: SNR calculation for DSB/TC, DSB-SC, SSB-TC, SSB-SC & FM

d) Conditional probability, communication example, joint probability, statistical independence, random variable-continuous and discrete, cumulative distribution function, probability density function – Gaussian, Rayleigh and Rician.

Books

1. Taub and Schilling , “Principles of Communication Systems”, 2nd ed., Mc-Graw Hill
2. B.P.Lathi -Communication Systems- BS Publications
3. Carlson—Communication System,4/e , Mc-Graw Hill
4. Proakis & Salehi Fundamentals of Communication Systems- Pearson
5. Singh & Sapre—Communication Systems: 2/e, TMH
6. P K Ghosh- Principles of Electrical Communications- University Press
7. L.W.Couch Ii, “Digital and Analog Communication Systems”, 2/e, Macmillan Publishing
8. Blake, Electronic Communication Systems- Cengage Learning

EC402: Analog Circuits

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Analyze the characteristics of diodes and transistors, and their related circuits.
CO2	Comprehend the working of various classes of amplifiers and topologies
CO3	Design sinusoidal and non-sinusoidal oscillators and multivibrators
CO4	Understand the functioning of Differential amplifiers and OP-AMP based circuits.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	1	2	2	3	1	-	3
CO2	3	3	3	3	2	2	2	-	3	1	1	1
CO3	3	2	3	3	2	-	1	2	3	-	2	3
CO4	3	3	3	3	3	1	2	1	2	2	1	3

Syllabus (EC402)

Module I

1

0L

Diode Circuits: Rectifiers, Clipper, Clamper

Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans- resistance amplifier.

Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

Module II

6

L

High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc.,

Module III

6

L

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators(phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), Multivibrators (Monostable, Astable and Bistable)

Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load.

Module IV

1

0L

Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR.
OP-AMP: Basic structure and characteristics, inverting and non-inverting amplifiers

OP-AMP applications: Integrator and differentiator, summing amplifier, Log-Antilog amplifiers, , Schmitt trigger and its applications.

Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Prerequisite: Knowledge of basic electronic components (resistors, inductors, diode, etc) and mathematics.

Books

1. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
2. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College11 Publishing, Edition IV
6. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition
7. A.K. Maini, Analog Electronics, Khanna Publishing House, New Delhi, AICTE Recommended- 2018.

EC403 Microprocessor & Microcontroller

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Apply the fundamental concept of digital electronics to Microprocessor based system, 8085,8086,8051
CO2	. Describe the relationship between software and hardware part of microprocessor
CO3	Distinguish the properties of Microprocessor and Microcontroller.
CO4	Illustrate interfacing of different peripheral devices with microprocessor

CO-PO Mapping

Subject Code	CO'S	PROGRRAMME OUTCOME (PO'S)											
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC403	EC403.1	3	2	1	1	-	1	-	-	2	1	-	3
	EC403.2	3	3	2	2	1	1	-	-	3	1	1	3

	EC403.3	2	2	2	1	-	2	1	-	2	2	1	3
	EC403.4	3	3	3	2	1	2	1	2	2	1	1	3
	AVG	2.8	2.4	2.2	1.8	0.6	1.4	0.8	0.8	2.4	1.6	1.2	3

Syllabus (EC403)

Module I

1

0L

Microprocessors 8085 and 8086- Pin description, memory, data structure/ access. Overview of microcomputer systems and their building blocks, memory interfacing, concepts of interrupts and Direct Memory Access (DMA), instruction sets of microprocessors (with examples of 8085 and 8086

Module II

8

L

Interfacing with peripherals- timer, serial I / O, parallel I / O, A/D and D/A converters; Arithmetic coprocessors, System level interfacing design.

Module III

8

L

Concepts of virtual memory, Cache memory; Advanced coprocessor architectures- 286, 486, Pentium; Microcontrollers 8051 systems- pin and port description.

Module IV

6

L

Introduction to RISC processors; ARM microcontrollers interface design.

Books

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the8085/8080A, Penram International Publishing, 1996
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware andsoftware interface. Morgan Kaufman Publishers.
3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.
4. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.
5. Keneth Ayala, keneth. J. Ayala- The 8086 Microprocessor: Programming and interfacing the PC-West Pub.

ES CS401: Design and Analysis of Algorithm

Course Outcome (CO)

CO1	Describe different types of Algorithms
CO2	Estimate performance of an Algorithm
CO3	Compare different types of design techniques of Algorithms
CO4	Choose Appropriate design techniques or Algorithms for solving problems
CO5	Develop Algorithms for real time scenarios

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	1	2	2	3	1	-	3
CO2	3	3	3	3	2	2	2	-	3	1	1	1
CO3	3	-	3	-	2	-	1	2	3	-	2	3
CO4	3	3	3	3	3	1	2	1	2	2	1	3
CO5	1	2	1	3	2	-	-	3	3	2	1	-

Syllabus (ES CS401)

Objectives of the course

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis. synthesize efficient algorithms in common engineering design situations.

Detailed contents:

Module 1: **8L**

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds - best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Module 2: **8L**

Fundamental Algorithmic Strategies: Brute-Force, Greedy,Dynamic Programming, Branchand-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving , Bin Packing, Knap Sack TSP. Heuristics - characteristics and their application domains.

Module 3: **6L**

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Module 4: **6L**

Tractable and Intractable Problems: Computability of Algorithms, Computability classes - P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

Module 5: **4L**

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP - P SPACE

Books

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms - E. Horowitz et al.
3. Design & Analysis of Algorithms – Gajendra Sharma, Khanna Publishing House.
4. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
5. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
6. Algorithms—A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley,

6.1.1.1. Reading, MA.

BS-M401: Numerical Methods (BS)

Course Outcome (CO)

CO1	Solve first and second order ordinary differential equation arising in flow problems using single step numerical methods
CO2	Determine the extremals of functional and solve the simple problems of the Calculus of variations
CO3	Solve the mathematical formulation of linear programming problem
CO4	Solve the applications of transport problems and theory of games.
CO5	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	2	3	2	-	2	2	3	2	-	3
CO2	3	3	3	3	2	2	-	-	-	1	1	1
CO3	3	-	3	-	2	-	1	2	3	-	2	-
CO4	3	3	-	3	3	1	-	1	-	2	-	3
CO5	1	2	1	3	2	-	-	3	3	2	1	-

Syllabus (BS-M401)

Module I **10L**

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-pointarithmetic, Propagation of errors.

Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided differenceInterpolation.
Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.

Module II **8L**

Numerical solution of a system of linear equations:
Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.

Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphsonmethod.

Module III

4

L

Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-
Corrector methods and Finite Difference
method.

Books

(6

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Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. R.S. Salaria, Computer Oriented Numerical Methods, Khanna

Publishing House.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

BS-B401: Biology for Engineers

Course Outcome (CO)

After studying the course, the student will be able to:

CO1	Understand the biological concepts from an engineering perspective
CO2	Understand the concepts of biological sensing and its challenges
CO3	Understand development of artificial systems mimicking human action
CO4	Integrate biological principles for developing next generation technologies

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	2	3	2	-	-	2	-	2	-	3
CO2	3	3	3	-	2	2	-	-	-	1	1	1
CO3	3	-	3	-	-	-	-	-	-	-	2	-
CO4	3	3	-	3	3	1	-	1	-	-	-	-

Syllabus (BS-B401)

Module 1.

Introduction

Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Module 2.

Classification

Purpose: To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes.
(c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion - aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Module 3.

Genetics

Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"

Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasisto be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Module 4.

Biomolecules

Purpose: To convey that all forms of life has the same building blocks and yet the manifestations areas diverse as one can imagine
Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbonunits and lipids.

Module 5.

Enzymes

Purpose: To convey that without catalysis life would not have existed on earth

Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Module 6.

Information Transfer

Purpose: The molecular basis of coding and decoding genetic information is universal

Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structurefrom single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Module 7.

Macromolecular analysis

Purpose: How to analyses biological processes at the reductionistic level

Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Module 8.

Metabolism

Purpose: The fundamental principles of energy transactions are the same in physical and biological world.

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of K_{eq} and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Module 9.

Microbiology

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and
media compositions. Growth kinetics.

Books

1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.;Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

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EC491: Analog Communication Lab

Course Outcome (CO)

After studying the course, the student will be able to:

EC 491.1	Students are able to demonstrate analog modulation techniques.
EC 491.2	Construct various receiver circuits.
EC 491.3	Measure and analyze receiver characteristics.
EC 491.4	Able to visualize signals by the simulation softwares

CO-PO Mapping

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 491.1	3	-	-	1	-	-	-	-	2	2	-	-
EC 491.2	3	-	2	-	-	-	-	-	2	2	-	-
EC 491.3	2	2	-	-	-	-	-	-	2	1	-	-
EC 491.4	3	-	-	-	3	-	-	-	-	1	-	-

Syllabus (EC491)

1. Measurement of modulation index of an AM signal.
2. Measurement of output power with varying modulation index an AM signal(for both DSB- &SSB).
3. Measurement of distortion of the demodulated output with varying modulation index of an AMsignal (for both DSB-SC & SSB).
4. Measurement of power of different frequency components of a frequency modulated signal &the measurement of the bandwidth.
5. Design and set up a PLL using VCO & to measure the lock frequency.
6. Design and set up a FM demodulator using PLL.
7. Measurement of SNR of a RF amplifier.
8. Measurement of selectivity, sensitivity, fidelity of a superheterodyne receiver.
9. One innovative experiment.

EC492: Analog Electronic Circuits Lab

Course Outcome (CO)

CO1: Students will able to set up testing procedure and select proper instruments to evaluate performance characteristics of electronic circuit to analyze their operation different operating conditions.
CO2: Students will be able to Practice different types of wiring and instruments connections keeping in mind technical, safety issues.
CO3: Students will be Prepare professional quality textual and graphical presentations of laboratory data and Computational results, incorporating accepted data analysis.

CO-PO Mapping

SUBJECT CODE	COs	PROGRAM OUTCOMES (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC-492	CO1	2	2	1	1	-	-	2	1	2	-	1	1
	CO2	2	1	2	1	-	1	2	2	1	-	-	1
	CO3	2	2	1	2	1	-	3	1	2	-	1	1

Syllabus (EC492)

1. Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative).
2. Design and set up the following rectifiers with and without filters and to determine ripple factor and rectifier efficiency:
   (a). Full Wave Rectifier (b). Bridge Rectifier
3. Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain-bandwidth product from its frequency response.
4. Set-up and study the working of complementary symmetry class B push pull power
   amplifier and calculate the efficiency
5. Realize BJT Darlington Emitter follower with and without bootstrapping and determine the gain, input and output impedances
6. Conduct an experiment on Series Voltage Regulator using Zener diode and power transistor to determine line and load regulation characteristics.
7. Design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation.
   R-C Phase shift Oscillator/Wien Bridge Oscillator
8. Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
9. Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.

EC493: Microprocessor & Microcontroller Lab

Course Outcome (CO)

After studying the course, the student will be able to:

EC493.1	Demonstrate the microprocessor and microcontroller-based systems.
EC493.2	Design real-time application-based projects after analyzing abstract problems using assembly language programming.
EC493.3	Complete assignments by sharing task responsibilities with the help of team-based laboratory activity.

CO-PO Mapping

CO'S	**PROGRAM OUTCOMES (POs)**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC493.1	2	1	1	1	-	-	-	-	2	2	-	3
EC493.2	2	3	2	2	2	2	2	1	2	2	1	2
EC493.3	1	2	1	2	1	2	1	3	3	3	2	2

Syllabus (EC493)

1. Familiarization with 8085 & 8051simulator on PC.
2. Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic,Logical) on the KIT. Assignments based on above
3. **Programming using kit and simulator for:**
   - i) Table look up
   - ii) Copying a block of memory
   - iii) Shifting a block of memory
   - iv) Packing and unpacking of BCD numbers
   - v) Addition of BCD numbers
   - vi) Binary to ASCII conversion
   - vii) String Matching, Multiplication using shift and add method and Booth's Algorithm
4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g.subroutine for delay, reading switch state and glowing LEDs accordingly.
5. Study of timing diagram of an instruction on oscilloscope..
6. Interfacing of 8255: Keyboard and Multi-digit Display with multiplexing using 8255
7. Study of 8051 Micro controller kit and writing programs as mentioned in S/L3. Write programsto interface of Keyboard, DAC and ADC using the kit.
8. Serial communication between two trainer kits

BS-M491: Numerical Methods Lab (BS)

Course Outcome (CO)

After studying the course, the student will be able to:

CO1	Understand the basic concept of various statistical and numerical methods
CO2	Apply the statistical and numerical methods to engineering subjects
CO3	Apply the different numerical techniques to transportation problems
CO4	Understand applications of probability theory
CO5	Use regression and correlational analysis to process transportation data

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	-	2	-	1	2	-	3
CO2	3	3	3	3	-	2	-	-	-	1	1	1
CO3	1	-	3	-	3	-	1	2	-	-	2	-
CO4	3	2	-	3	3	1	-	1	-	3	-	3
CO5	1	2	1	2	-	-	-	3	3	2	1	-

Syllabus (BS-M491)

Assignments on Newton forward /backward, Lagrange's interpolation.

2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.

3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.

4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.

5. Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.

6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

Syllabus & Course Outcomes

5th Semester

EC501: Electromagnetic Waves

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Understand characteristics and wave propagation on high frequency transmission lines and its characteristics
CO2	Characterize uniform plane wave and Calculate reflection and transmission of waves at media interface
CO3	Analyze wave propagation on metallic waveguides in modal form
CO4	Understand principle of radiation and radiation characteristics of an antenna

CO-PO Mapping

Subject Code	COs	Program Outcomes (POs)											
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 501	CO 1	2	-	2	-	3	2	1	2	-	-	2	2
	CO 2	-	3	-	-	2	2	-	3	1	1	-	-
	CO 3	2	-	2	1	2	-	2	3	-		1	-
	CO 4	2	-	-	-	2	-	-	2	-	1	1	2
	Avg.	2	3	2	1	2	2	2	3	1	1	1	2

Syllabus (EC501)

Module 1

6Hrs

Basics of Vectors, Vector calculus, Maxwell's Equations, Basic laws of Electromagnetic,Poynting Vector, Boundary conditions at Media Interface.

Module II

8Hrs

Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wavepolarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Surface current and power loss in a conductor

Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refractionat dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

Module III

8Hrs

Transmission Lines- Equations of Voltage and Current on TX line, Propagationconstant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Module IV

6Hrs

Wave propagation in parallel planewaveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Module V

6Hrs

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated byhertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna,

Books

1. Electromagnetic Fields and Waves, Khanna Publishing House, New Delhi, 2018.
2. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005

3. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
4. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
5. David Cheng, Electromagnetics, Prentice Hall

EC502: Computer Architecture

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	learn how computers work
CO2	know basic principles of computer's working
CO3	analyze the performance of computers
CO4	know how computers are designed and built
CO5	Understand issues affecting modern processors (caches, pipelines etc.).

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	-	2	-	1	2	-	3
CO2	3	1	2	3	-	2	-	-	-	1	1	1
CO3	1	3	3	-	3	-	-	-	-	-	2	-
CO4	3	2	-	3	3	1	-	1	-	3	-	3
CO5	1	2	1	1	-	-	-	-	3	2	1	-

Syllabus (EC502)

Basic Structure of Computers, Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Ques, Subroutines.

Processor organization, Information representation, number formats.

Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats
Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit. Microprogrammed computers - CPU control unit

Memory organization, device characteristics, RAM, ROM, Memory management, Concept ofCache & associative memories, Virtual memory.
System organization, Input - Output systems, Interrupt, DMA,

Standard I/O interfaces Concept of parallel processing, Pipelining,

Forms of parallel processing, interconnect network

Books

1. V.Carl Hammacher, “Computer Organisation”, Fifth Edition.
2. A.S.Tanenbum, “Structured Computer Organisation”, PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming”, II, Englewood Chiffs,N.J., Prentice Hall Edition
4. M.M.Mano, “Computer System Architecture”, Edition
5. C.W.Gear, “Computer Organization and Programming”, McGraw Hill, N.V. Edition
6. Hayes J.P, “Computer Architecture and Organization”, PHI, Second edition

EC503: Digital Communication and Stochastic

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	understand the concept of Stochastic Process in Communication System
CO2	represent various signals in different mathematical forms
CO3	analyze baseband transmission mode of digital data
CO4	analyze different career modulation techniques considering noise aspects

CO-PO Mapping

Subject Code	COs	Program Outcomes (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC503	CO1	2	-	2	-	3	2	-	2	-	-	-	2
	CO2	-	3	-	-	2	2	-	3	1	-	-	-
	CO3	2	-	2	1	2	-	-	3	-		-	-
	CO4	2	-	-	-	2	-	-	2	-	-	-	2

Syllabus (EC503)

Mod-1 **8L**

Introduction to Stochastic Processes (SPs):

Definition and examples of SPs, classification of random processes according to state space and parameter space, elementary problems. Stationary and ergodic processes, correlation coefficient, covariance, auto correlation function and its properties, random binary wave, power spectral density.
Definition and examples of Markov Chains, transition probability matrix, Chapman Kolmogorov equations; calculation of n-step transition probabilities.

Mod-2 **6L**

Signal Vector Representation:

Analogy between signal and vector, distinguishibility of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point , signal constellation, geometric interpretation of signals, likelihood functions, Schwartz inequality, Gram-Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule, decision boundary, optimum correlation receiver; probability of error , error function, complementary error function, Type-I and Type-II errors.

Mod-3 **10L**

Digital Data Transmission:

Concept of sampling, Pulse Amplitude Modulation (PAM), interlacing and multiplexing of samples, Pulse Code Modulation (PCM), quantization, uniform and non-uniform quantization, quantization noise, binary encoding, A-Law and μ -law companding, differential PCM, delta modulation and adaptive delta modulation.
Digital transmission components, source, multiplexer, line coder, regenerative repeater, concept of line coding – polar/unipolar/bipolar NRZ and RZ, Manchester, differential encoding and their PSDs, pulse

shaping, Inter Symbol Interference (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction

Mod-4 **10L**

Digital Modulation Techniques:

Types of Digital Modulation, coherent and non-coherent Binary Modulation Techniques, basic digital carrier modulation techniques: ASK, FSK and PS

Coherent Binary Phase Shift Keying (BPSK), geometrical representation of BPSK signal; error probability of BPSK, generation and detection of BPSK Signal, power spectrum of BPSK. Concept of M-ary Communication, M-ary phase shift keying, the average probability of symbol error for coherent M-ary PSK, power spectra of MPSK, Quadrature Phase Shift Keying (QPSK), error probability of QPSK signal, generation and detection of QPSK signals, power spectra of QPSK signals, Offset Quadrature Phase shift Queuing (OQPSK), Coherent Frequency Shift Keying (FSK), Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal, Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, Gaussian Minimum Shift Keying: GMSK, basic concept of OFDM, constellation diagram,

Some performance issues for different digital modulation techniques - Error Vector Magnitude (EVM), Eye Pattern and Relative Constellation Error (RCE), Conceptual idea for Vector Signal Analyzer (VSA)

Books

1) Digital Communications, S. Haykin, Wiley India.
2) Principles of Communication Systems, H. Taub and D.L.Schilling, TMH Publishing Co.
3) Wireless Communication and Networks : 3G and Beyond, I. SahaMisra, TMH Education.
4) Digital Communications, J.G.Proakis, TMH Publishing Co.
5) S.M. Ross,Stochastic Processes, 2nd Edition, Wiley, 1996 (WSE

Edition).

References:

1) Digital Communications Fundamentals andApplications, B. Sklar and P.K.Ray, Pearson.
2) Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
3) Digital Communication, A. Bhattacharya, TMH Publishing Co.
4) J. Medhi,Stochastic Processes, 3rd Edition, New Age International, 2009.

EC504: Digital Signal Processing

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Represent signals mathematically in continuous and discrete time and frequency domain
CO2	Get the response of an LSI system to different signals
CO3	Design of different types of digital filters for various applications

CO-PO Mapping

COs	PROGRAM OUTCOMES(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	1	-	3	2	2	1	3
CO2	3	2	2	1	-	-	1	3	2	2	-	3
CO3	3	2	2	1	1	-	-	3	2	2	1	3
Avg	3	2	1.66	1	1	1	1	3	2	2	1	3

Syllabus (EC504)

Module I

8Hrs

Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Z-Transform and ROC, Analysis of LSI systems, frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT),Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems

Module II

8Hrs

Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low pass, Band pass, Band stopand High pass filters.

Module III

10Hrs

Effect of finite register length in FIR filter design. Parametric and non-parametric spectralestimation. Introduction to multirate signal processing.
Application of DSP.

Module IV

Origin of Wavelets, Classification(CWT & DWT), Filter Bank

Books

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D.J.DeFatta, J. G. Lucas and W.S.Hodgkiss, Digital Signal Processing, John Wiley&Sons, 1988.

1. Represent signals mathematically in continuous and discrete time and frequency domain
2. Get the response of an LSI system to different signals
3. Design of different types of digital filters for various applications

EC591: Electromagnetic Wave Laboratory

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

EC591.1	Able to explain the concepts of different types of guided structures like transmission lines, it's different case studies and determination of parameters in hardware or software simulation based system.
EC591.2	Able to summarize the concept of radiation pattern of different types of antennas and to know the determination procedure of antenna parameters.
EC591.3	Able to discuss the role of Spectrum Analyzer to study different filters

CO-PO Mapping

COs	POs											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
EC591.1	2	1	-	-	-	-	-	-	2	-	-	-
EC591.2	2	-	-	-	1	-	-	-	2	-	-	-
EC591.3	-	-	-	-	2	-	-	-	-	2	-	1

Syllabus (EC591)

Module I:

1. Plotting of Standing Wave Pattern along a transmission line when the line is open-circuited, short-circuited and terminated by a resistive load at the load end.
2. Input Impedance of a terminated coaxial line using shift in minima technique.
3. Study of Smith chart on Matlab platform.
4. Simulation study of Smith chart - Single and double stub matching.

Module II:

5. Radiation Pattern of dipole antenna.

6. Radiation Pattern of a folded-dipole antenna.
7. Radiation pattern of a 3-element Yagi-Uda Antenna.
8. Beam width, gain and radiation pattern of a 3-element, 5-element and 7-element. Yagi-Uda antenna - Comparative study.
9. Radiation pattern, Gain, Directivity of a Pyramidal Horn Antenna.

EC592: Digital Communication Laboratory

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

EC592.1	Students will able to demonstrate digital modulation techniques and select proper instruments to evaluate performance characteristics of different modulation techniques to analyze their operation different operating conditions.
EC592.2	Students will be able to construct various modulators and demodulator circuits.
EC592.3	Students will be able to prepare laboratory data and computational results, incorporating accepted data analysis and analyze different simulation studies.

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC592.1	3	3	2	-	2	-	-	-	1	-	1	1
EC592.2	2	3	2	-	3	-	-	-	1	-	1	1
EC592.3	2	2	3	-	1	-	-	-	1	-	1	1

Syllabus (EC592)

- Design, implementation and study of all the properties of 7-length and 15-length pnsequences using shift register.
- Study of PAM and demodulation.
- Study of PCM and demodulation.
- Study of line coders: polar/unipolar/bipolar NRZ, RZ and Manchester.
- Study of delta modulator and demodulator.
- Study of adaptive delta modulator and demodulator.
- Study of BPSK modulator and demodulator.
- Study of BFSK modulator and demodulator.
- Study of ASK modulator and demodulator.
- Study of QPSK modulator and demodulator.
- Simulation study of probability of symbol error for BPSK modulation.
- Simulation study of probability of symbol error for BFSK modulation.

EC593: Digital Signal Processing Laboratory

Course Outcome (CO)

At the end of the course, student will be able to:

Sl. No. of CO	Impact of corresponding CO
CO1	Experimental observation of DSP and its applications using Embedded C and MATLAB Software.
CO2	Develop digital filters using hardware and MATLABSoftware.
CO3	Implement DSP algorithms in embedded system.
CO4	Analyze the signals in frequency domain using FFT.

CO-PO Mapping

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	-	2	-	-	3	2	-	2	2
CO2	2	2	2	-	3	1	-	3	1	-	2	3
CO3	2	2	3	1	3	1	-	3	2	-	2	3
CO4	2	2	2	1	2	1	1	2	2	1	1	3

Syllabus (EC593)

Simulation Laboratory using standard Simulator:

1. Sampled sinusoidal signal, various sequences and different arithmetic operations.
2. Convolution of two sequences using graphical methods and using commandsverification of the properties of convolution.
3. Z-transform of various sequences - verification of the properties of Z-transform.
4. Twiddle factors - verification of the properties.
5. DFTs / IDFTs using matrix multiplication and also using commands.
6. Circular convolution of two sequences using graphical methods and using commands,differentiation between linear and circular convolutions.
7. Verifications of the different algorithms associated with filtering of long data sequencesand Overlap -add and Overlap-save methods.
8. Butterworth filter design with different set of parameters.
9. FIR filter design using rectangular, Hamming and

Blackman windows.Hardware Laboratory using DSP

Processor and Xilinx FPGA:

MC-HU501: Effective Techical Communication

Course Outcome (CO)

At the end of the course, student will be able to:

Sl. No. of CO	Impact of corresponding CO
CO1	Build confidence in listening, speaking, reading and writing English professionally.
CO2	Enable the students to think and speak effectively on everyday topics, including topics related to technical concepts
CO3	Equip students with the basics of Academic writing
CO4	Developing industry-ready attitude towards professional communication.
CO5	Prepare for competitive exams like TOEFL, IELTS

The classes need to be taken in ICT enabled classrooms, as well as in the Language lab.

CO-PO Mapping

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	-	2	-	-	3	2	-	2	2
CO2	2	-	2	-	-	1	-	3	1	-	2	3
CO3	2	2	-	1	-	1	-	-	2	-	2	3
CO4	2	2	2	1	2	1	1	2	2	1	1	3
CO5	2	3	1	3	1	-	-	2	3	1	3	-

Syllabus (MC-HU501)

Module-I:

Conversational Skills(6hours)

1. General Conversation
   - **Warm-up sessions**

     Basics of Communication, verbal and non-verbal communication how tobe a good speaker, effective body language.

Practice sessions on:

- ✓ Introducing oneself
- ✓ Debates on topics like Is India really developing, Indian culture VSwestern culture, whether robots will overtake humans one day.
- ✓ Just a Minute Sessions (JAMS)
- ✓ Situational Dialogues and Role play : where students can enact everydaysituations in their personal and professional lives

Module-II: (6hours)

Intensive Practice Sessions

2.1 **Group Discussion** on topics like dangers of social media, is internet killing the print media, ***Artificial Intelligence, IOT, Cloud Computing,Cyber security***

Module-III:

3.1 Organisational Writing(4 hours)

- Job application letter and CV writing
- E-Mail writing

3.2 Academic Writing(8 hours)

Techniques for good Technical Writing: Academic Writing and Thesiswriting

- Avoiding plagiarism
- Project Proposal
- Statement of Purpose
- Journal Articles

Module-IV: (6 hours)

4.1 Principles and practices of Personal Interview: (Practice sessions)

- Do's and Don'ts of facing an interview.
- SWOC Analysis
- Rigorous practices of mock-interviews

Module-V:

Presentations(4 hours)

- Fundamentals of presentation skills
- Presentation sessions on Technical topics

Module-VI:(6hours)

Books

1. Technical Communication: Principles and Practice, Meenakshi Raman and Sangeeta Sharma, Oxford University Press, 2015
2. Effective Communication Skills, Kulbhushan Kumar, Khanna Publishing House, New Delhi (AICTE Recommended-2018)
3. Thesis Writing: A Manual for Researches , F. Abdul Rahim, New Age International Limited, 1996
4. Professional Presentation, Malcolm Goodale, Cambridge University Press, 2005
5. Academic Writing: a Practical Guide for Students, Stephen Bailey London: Routledge Falmer
6. Barron's TOEFL IBT 2016 Guide(with DVD) Pamela J.Sharpe, New Delhi: Galgotia, 2013.

PE-EC505A: Nano Electronics

Course Outcome (CO)

At the end of the course, students will demonstrate the ability to:

CO1. Revisit and comprehend the basic of nanotechnology.

CO2. Realize the limitations of normal MOSFET and need of scaling them into nano scale devices

CO3. Conceptualize the quantum transport phenomena and working principles of nano-electronic devices.

CO4. Understand the recent trends of microelectronics and nano-electronics.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	3	1	1	2	1	1	-	-	-	1	2	1
CO2:	3	2	2	1	1	-	2	1	1	1	1	2
CO3:	2	3	1	2	1	2	3	2	-	-	1	2
CO4	1	2	2	-	3	1	2	1	1	-	2	2

Syllabus (PE-EC505A)

Syllabus

Module I: Introduction to nanotechnology, meso structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. KronigPenny Model. Brillouin Zones.

Module II: Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.).

Module III: Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors

Module IV: Carbon nanotube electronics, Bandstructure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation.

Books

Reference Books: 1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.

2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.

3. K.E. Drexler, Nanosystems, Wiley, 1992.

4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.

5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

PE-EC505B: Speech and Audio Processing

Course Outcome (CO)

At the end of the course, students will demonstrate the ability to:

CO1: Understand the speech production and perception process.

CO2: Analyze speech signals in time and frequency domain.

CO3: Design and implement algorithms for processing speech signals.

CO4: Build a simple speech recognition/TTS system.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	3	1	1	2	1	1	-	-	-	1	2	1
CO2:	3	2	2	1	1	-	2	1	1	1	1	2
CO3:	2	3	1	2	1	2	3	2	-	-	1	2
CO4	1	2	2	-	3	1	2	1	1	-	2	2

Syllabus (PE-EC505B)

Introduction- Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques - parametric, waveform and hybrid ; Requirements of speech codecs -quality, coding delays, robustness.

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters,convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Linear Prediction of Speech- Basic concepts of linear prediction; LinearPrediction Analysis of nonstationary signals -prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Speech Quantization- Scalar quantization-uniform quantizer, optimum quantizer,logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization - distortion measures, codebook design, codebook types.

Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency - LPC to LSF conversions, quantization based on LSF.

Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model.

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search - state-save method, zero- input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

Books

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students" Edition), 2004.
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C.Chu, WileyInter science, 2003.

PE-EC505C: Power Electronics

Course Outcome (CO)

At the end of the course, students will demonstrate the ability to:

Course outcome codes	Statement
PE-EC-505C.1	To state the characteristics of different power electronic switches along with their turn-on, turn-off, triggering and protection circuits.
PE-EC-505C.2	To classify various phase controlled rectifiers.
PE-EC-505C.3	To demonstrate working of phase controlled converters.
PE-EC-505C.4	To explain the operation of AC voltage controller & cycloconverters.
PE-EC-505C.5	To choose different power converters in commercial and industrial applications

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PE-EC-505 C.1	3	3	3	2	2	1	-	-	-	-	-	1	3	2	2
PE-EC-505 C.2	3	3	3	2	2	1	-	-	-	-	-	1	3	2	2
PE-EC-505 C.3	3	3	3	2	2	1	-	-	-	-	-	1	3	2	2
PE-EC-505 C.4	3	3	3	2	2	1	-	-	-	-	-	1	3	2	2
PE-EC-505 C.5	3	3	3	2	2	1	-	-	-	-	-	1	3	2	2

Average	3	3	3	2	2	1	-	-	-	-	-	1	3	2	2

Syllabus (PE-EC505C)

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLEand level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers - TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonantconverter - series loaded half bridge DC-DC converter.

Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Books

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V.R.Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age InternationalPublishers. SCR manual from GE, USA.

OE-EC506A Soft Skill and Interpersonal Communication

Course Outcome (CO)

At the end of the course, students will demonstrate the ability to:

Course outcome codes	Statement
CO1	Improve the listening and speaking competence of the learners
CO2	Build the confidence of the learners to face job interviews and take part in group discussions
CO3	Train the learners in interpersonal skills and business etiquettes
CO4	Build teamwork and leadership skills of the learners .
CO5	Train the learners to effectively manage time and boost productivity

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	3	1	1	2	1	1	-	-	-	1	2	1
CO2:	3	2	-	-	1	-	-	1	1	1	1	2
CO3:	2	3	1	2	-	2	-	2	-	-	1	2
CO4	1	2	2	-	3	1	2	1	1	-	2	2
CO5	2	2	1	-	2	-	1	-	-	1	2	1

Syllabus (OE-EC506A)

UNIT I - SELF ANALYSIS **2 hours**

SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem.

UNIT II - CREATIVITY **3 hours**

Out of box thinking, Lateral Thinking.

UNIT III - ATTITUDE **3 hours**

Factors influencing Attitude, Challenges and lessons from Attitude, Etiquette.

UNIT IV - MOTIVATION **2 hours**

Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators.

UNIT V - GOAL SETTING **4 hours**

Wish List, SMART Goals, Blue print for success, Short Term, Long Term, Life Time Goals.

Time management

Value of time, Diagnosing Time Management, Weekly Planner To do list, Prioritizing work.

UNIT VII - INTERPERSONAL SKILLS **6 hours**

Gratitude

Understanding the relationship between Leadership Networking & Team work. AssessingInterpersonal Skills Situation description of Interpersonal Skill.

Team Work: Necessity of Team Work Personally, Socially and Educationally

UNIT VIII - LEADERSHIP **2 hours**

Skills for a good Leader, Assessment of Leadership Skills

UNIT IX - STRESS MANAGEMENT **4 hours**

Causes of Stress and its impact, how to manage & distress, Circle of control, Stress Busters.

Emotional Intelligence

What is Emotional Intelligence, emotional quotient why Emotional Intelligence matters, EmotionScales. Managing Emotions.

UNIT X - CONFLICT RESOLUTION **2 hours**

Conflicts in Human Relations – Reasons Case Studies, Approaches to conflict resolution.

UNIT V - DECISION MAKING **4 hours**

Importance and necessity of Decision Making, Process and practical way of Decision Making, Weighing Positives & Negatives

OE-EC506B: Cyber Law & Intellectual Property Rights

Course Outcome (CO)

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

Course outcome codes	Statement
CO1	understand the role of intellectual property rights
CO2	identify the main types of intellectual property rights
CO3	understand the steps for successful registration and protection of intellectual property rights at national,regional and international levels
CO4	understand the legal aspects for intellectual property protection

CO-PO Mapping

CO'S	PO'S											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	1	1	3	-	2	-	2
CO2	2	2	2	2	3	3	1	3	-	-	-	2
CO3	-	3	3	3	2	1	1	3	2	2	1	3
CO4	2	3	3	2	3	-	2	3	3	3	3	3

Syllabus (OE-EC506B)

Cyber World :

An Overview, The internet and online resources ,Security of information, Digital signature

An Overview Cyber Law:

Introduction about the cyber space , Regulation of cyber space – introducing cyber law Scope of Cyber laws – ecommerce; online contracts; IPRs (copyright, trademarks and software patenting);e-taxation; e-governance and cyber crimes, Cyber law in India with special reference to Information Technology (Amendment) Act, 2008

IPR:

Introduction : Origin and Genesis of IPR , Theories of IPR – Locke's, Hegel andMarxian Ethical,moral andhuman rights perspectives of IPR, Intellectual PropertyRights: International Relevance, Internationalization of IP protection – ParisConvention, Berne Convention, TRIPS Agreement – basic principles and minimum standards – limits of one-size-fit for all flexibilities under TRIPS

Intellectual Property: Issues and Challenges:

Geographical Indications, Layout designs of Integrated Circuits and Protection of Plant Varieties and Farmers' Rights. Copyright protection with reference to performers rights and Artist rights, Global governance towards Patents , Trade Marks: Legal recognition, Comparative analysis in India, EU and USA, Trade secrets : Legal recognition, Comparative analysis in India, EU and USA

Intellectual Property: Contemporary Trends

Benefit sharing and contractual agreements – International Treaty on Plant Genetic Resources for Food and Agriculture – issues on patent policy and farmers' rights- CBD, Nagoya Protocol and Indian law, UNESCO – protection of folklore/cultural expressions Developments in WIPO on traditional knowledge and traditional cultural expressions

Books

1. Duggal Pavan, Cyber Law - An exhaustive section wise Commentary on The Information Technology Act along with Rules, Regulations, Policies, Notifications etc. UNIVERSAL LAW PUBLISHING CO. PVT. LTD. C-FF-1A, Dilkhush Industrial Estate, (Near Azad Pur Metro Station) G. T. Karnal Road, Delhi -110033, INDIA2014

Reference Book

1. Intellectual Property Rights in India : General Issues and Implications Prankrishna Pal
2. Jonathan Rosenoer, "Cyberlaw: the Law of the Internet", Springer-verlag, 1997.
3. Gupta & Gupta, Information Security and Cyber Laws, Khanna Publishing House, New Delhi.

3. W. Cornish & Llewelyn – Intellectual Property: Patent, Copyrights, Trade Marks & Allied Rights",London Sweet & Maxwell.
4. Nard Madison- The Intellectual Property, Aspian Publication.
5. Carlosm Correa- Oxford commentaries on GATT/ WTO Agreements trade Related aspects of Intellectual Property Rights, Oxford University Press.
6. Cornish William – Intellectual Property. Cambridge University Press.

OE-EC506C: Human Resource Management

Course Outcome (CO)

At the end of the course the students will be able to :

Course outcome codes	Statement
CO1	know the professional and personal qualities of a HR manager.
CO2	learn different methods of selecting human resources through recruitment, training and performance appraisal system.
CO3	know how to develop a favourable working environment in an organisation through participation in management and maintain a good industrial relation for benefit of the society.
CO4	know about consequence of industrial dispute and employee indiscipline of an organization.

CO-PO Mapping

CO'S	PO'S											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	1	1	3	-	2	-	2
CO2	2	2	1	3	3	3	-	3	-	-	-	1
CO3	-	3	3	3	2	1	1	3	2	2	1	3
CO4	2	3	1	2	3	-	2	3	2	2	2	3

Syllabus (OE-EC506C)

UNIT-1-Human Resource Management :

Meaning & Definition, Functions, Scope & Objectives, Qualities of a HR Manager

UNIT-2-Human Resource Planning :

Meaning & Definition, Importance of HRP,HRP Process. Barriers of HRP, Factors of soundHRP.Recruitment – Meaning & Definition, Sources of Recruitment, Recruitment Process, Effective Recruitment. Training & Performance Appraisal- Definition & Objective ,Areas of Training, Meaning & Definition of Performance Appraisal, process, Effective principles of performance Appraisal.

UNIT-3- Industrial Relations :

Concept & Meaning, Objective & Importance, Reasons of poor Industrial Relation. Industrial Disputes- Meaning & Definition, Causes of Industrial Dispute, Prevention of Industrial Dispute, Conditions for good Industrial Relation.

UNIT-4- Workers Participation in Management :

Meaning & Need, Forms of Participation, Scheme of participation

,Merits & Demerits. Collective Bargain- Meaning & Definition, Objective & Importance, Process of Collective Bargain, Effective Condition. Employee Discipline-Guidelines for action, Penalties & Punishment, Rewards of Discipline.

Books

1. uman Resource Management. P. Subba Rao, Himalaya Publishing House, 2012.
2. Human Resource Management. K.Aswathappa. Mc GRAW HILL Education, 2013.

Reference Book

1. Human Resource Development Management . A. M.Seikh S.Chand, 2003.
2. Human Resource Management . S.S.Khanka, S. Chand, 2014.

Syllabus & Course Outcomes

6th Semester

EC601: Control System and Instrumentation

Course Outcome (CO)

At the end of this course students will demonstrate the ability to:

CO1: Develop a system and calculate its steady state behavior along with stability using different tests
CO2: Design various controllers
CO3: Solve linear, nonlinear and optimal control problems
CO4: Study with CRO, Wave analyzer, Spectrum analyzer knowing their functional details

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	1	-	-	-	-	-	-
CO2	2	2	2	2	1	2	1	-	-	1	-	1
CO3	2	2	2	2	1	1	-	-	-	1	-	-
CO4	2	1	-	-	2	1	1	1	-	-	-	1

Syllabus (EC 601)

Introduction to control problem- Industrial control examples, Transfer function, open loop and closedloop (Feedback) control systems, Block diagram and Signal Flow Graph (SFG) analysis.

Feedback control systems- Stability concept- relative stability, Routh stability criteria, steady state error(SE), steady state accuracy, disturbance rejection, insensitivity and robustness, proportional (P), integral (I) and derivative (D)controller, Realization of PID controllers with op-amp and digital implementation. Feed forward and multi loop control configurations.

Time response of second order systems, Steady state Error (SE) and error constants, Performancespecifications
in time domain. Root locus method of design. Lead and Lag compensations.

Frequency response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots.
Nyquist stability
criterion. Performance specifications in frequency domain.

State Variable Analysis- Concepts of state, state variable, State Transition Matrix (STM),

Solution for state variable of homogeneous and nonhomogeneous state equations, Transfer function with state spaceapproach, Concepts of
controllability and observability of systems.

Nonlinear control systems- Basic concepts and analysis- Describing function.
Introduction to optimalcontrol problem,
regulator problem, output regulator, tracking problem.

CRO- measurement with it and its function with block diagram representation. Wave and Spectrumanalyzers-
requirements of these instruments and their functions with block diagrams. LVDT.
DC and ACservomotors,
tacho generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumaticactuators.

Books

1. Automatic Control System: Benjamin Kuo, PHI
2. Control Systems: A.Ambikapathy, Khanna Publishing House (AICTE Recommended 2018)
3. Modern Control Engineering, Katsuhiko Ogatha, PHI, 5e
4. A.D. Helfrick and W. D. Cooper., "Modern Electronic Instrumentation and MeasurementTechniques", PHI (EEE).
5. Ernest O. Doeblin., "Measurement Systems" , MGH.
6. Control System Engineering, I.J.Nagrath, M.Gopal, New Age, 5e
7. Design of Feedback Control System, Raymond T Stepfani, Oxford University Press, 4e

EC602: Computer Network

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Students will be able to explain and illustrate the application of each layer of OSI and TCP/IP reference model
CO2	Students will be able to explain different protocols.
CO3	analyze the performance of computers
CO4	Students will be able to assess the functions of different layers.

CO-PO Mapping

CO'S	PO'S											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	3	-	3	-	2	2	3	-	-	-	2	2
CO2	3	3	1	2	1	2	3	3	-	2	2	1
CO3	2	3	-	-	3	1	2	3	-	-	2	2
CO4	2	2	3	2	-	2	2	2	3	2	-	-

Syllabus (EC 602)

Basic Structure of Computers, Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Ques, Subroutines.

Processor organization, Information representation, number formats.

Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, andCPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size,multiplier control unit. Microprogrammed computers - CPU control unit

Memory organization, device characteristics, RAM, ROM, Memory management, Concept of Cache& associative memories, Virtual memory.
System organization, Input - Output systems, Interrupt, DMA, Standard I/O

interfaces Concept of parallel processing, Pipelining, Forms of parallel

processing, interconnect network

Books

1. V.Carl Hammacher, “Computer Organisation”, Fifth Edition.
2. A.S.Tanenbum, “Structured Computer Organisation”, PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming”, II, Englewood Chiffs, N.J.,Prentice Hall Edition
4. M.M.Mano, “Computer System Architecture”, Edition
5. C.W.Gear, “Computer Organization and Programming”, McGraw Hill, N.V. Edition
6. Hayes J.P, “Computer Architecture and Organization”, PHI, Second edition
7. Bhavneet Sidhu, Computer Networks, Khanna Publishing House, New Delhi.

HS-HU601: Economics for Engineers

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Summarize the basic concepts of economics and cost analysis related to engineering
CO2	Associate the value engineering and its functions with engineering activities
CO3	Distinguish various methods of cash flow
CO4	Discuss various methods of Maintenance and Replacement policy
CO5	Associate economics, cost analysis to engineering functions for effective decisioning

CO-PO Mapping

CO'S	PO'S											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	1	2	2	3	-	-	1	2	2
CO2	3	3	1	2	1	2	1	3	-	2	1	1
CO3	2	3	-	-	3	1	2	1	-	-	2	2
CO4	-	2	1	2	3	2	2	1	3	2	-	-
CO5	2	1	2	-	1	-	1	-	1	3	2	2

Syllabus (HS-HU601)

Module-I

1. Economic Decisions Making - Overview, Problems, Role, Decision making process.
2. Engineering Costs & Estimation - Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - PerUnit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.

Module-II

3. Cash Flow, Interest and Equivalence: Cash Flow - Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest.
4. Cash Flow & Rate Of Return Analysis - Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.

Module-III

5. Inflation And Price Change - Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.
6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies,Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.
7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.

Module-IV

8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.
9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.
10. Accounting - Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Books

1. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House, New Delhi.
2. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , TataMcGraw-Hill
3. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
4. John A. White, Kenneth E.Case,David B.Pratt : Principle of Engineering Economic Analysis, JohnWiley
5. Sullivan and Wicks: Engineering Economy, Pearson
6. R.Paneer Seelvan: Engineering Economics, PHI
7. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

EC691: Computer Network Lab

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Demonstrate the socket program using TCP & UDP
CO2	Develop simple applications using TCP & UDP
CO3	Design the code for Data link layer protocol simulation
CO4	Examine the performances of Routing protocol
CO5	Experiment with congestion control algorithm using network simulator

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	2	1	-	3	2	2	3
CO2	3	3	3	2	3	3	2	3	3	2	2	3
CO3	3	3	3	2	2	1	2	1	3	2	2	3
CO4	3	3	3	2	2	2	1	3	3	2	2	3
CO5	3	3	3	1	2	2	1	2	3	2	2	3

Syllabus (EC691)

- IPC (Message queue)
- NIC Installation & Configuration (Windows/Linux)
- Familiarization with
    - Networking cables (CAT5, UTP)
    - Connectors (RJ45, T-connector)
    - Hubs, Switches
- TCP/UDP Socket Programming
- Multicast & Broadcast Sockets
- Implementation of a Prototype Multithreaded Server
- Implementation of
    - Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
    - Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
    - Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

EC692: Control and Instrumentation Laboratory

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Understand basic MATLAB functions
CO2	Determine System stability using MATLAB
CO3	Design the code for controllers and static
CO4	Analyse Electrical signals and amplifiers

CO-PO Mapping

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO1 2
CO1	3	3	2	1	3	2	1	2	3	2	2	1
CO2	3	1	2	2	-	1	2	3	-	3	2	2
CO3	3	2	3	-	2	1	-	1	-	2	2	3
CO4	3	3	1	3	2	2	1	3	3	2	2	1

Syllabus (EC692)

1. Familiarization with MATLAB control system toolbox and representation of pole zero andtransfer function of control system.
2. Determination of transfer function of a given system from its state model and its vice-versa.
3. Determination of impulse & step response for 2^{nd} order under damped system on CRO &calculation of control system specifications for variation of system design.
4. Determination of root Locus from transfer function and evaluation of system parameters likemarginal value of gain, frequency etc. of a given control system.
5. Drawing of Nyquist plot and Bode plot from transfer function of a control system andestimation of relative system parameters like gain margin, phase margin etc.
6. Design PI, PD and PID controller for specified system requirements.
7. Study of static (accuracy, precision, repeatability, linearity) and dynamic (fidelity, speed ofresponse) characteristics of a measuring instrument.
8. Design and study of Instrumentation Amplifier.
9. Study and analysis of electrical signal with CRO.

EC681: Mini Project/ Electronic Design Workshop

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Conceive a problem statement
CO2	Survey previous related literature
CO3	Design, implement and test the prototype/algorithm
CO4	Write comprehensive report on mini project work

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	2	1	2	3	1	2	3
CO2	3	1	2	2	2	1	2	-	3	3	2	2
CO3	3	2	3	1	2	1	-	1	1	2	2	3
CO4	3	3	1	3	2	2	1	1	3	2	1	1

Syllabus (EC681)

1. The mini-project is a team activity having 3-4 students in a team. This is electronic productdesign work with a focus on electronic circuit design.

2. The mini project may be a complete hardware or a combination of hardware and software.The software part in mini project should be less than 50% of the total work.

3. Mini Project should cater to a small system required in laboratory or real life.

4. It should encompass components, devices, analog or digital ICs, micro controller with whichfunctional familiarity is introduced.

5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.

6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.

7. The student is expected to exert on design, development and testing of the proposed work asper the schedule.

8. Art work and Layout should be made using CAD based PCB simulation software. Dueconsiderations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

9. Completed mini project and documentation in the form of mini project report is to besubmitted at the end of semester.

10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, frontpanel design and mechanical aspects of the product, and guidelines for documentation /report writing.

PE-EC603A: Introduction to MEMS

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Appreciate the underlying working principles of MEMS and NEMS devices.
CO2	Design and model MEM devices.

CO-PO Mapping

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO1 2
CO1	2	-	2	1	3	2	1	2	-	-	2	2
CO2	-	3	-	-	2	2	-	3	1	1	-	-

Syllabus (PE-EC603A)

1. The mini-project is a team activity having 3-4 students in a team. This is electronic productdesign work with a focus on electronic circuit design.

2. The mini project may be a complete hardware or a combination of hardware and software.The software part in mini project should be less than 50% of the total work.

3. Mini Project should cater to a small system required in laboratory or real life.

4. It should encompass components, devices, analog or digital ICs, micro controller with whichfunctional familiarity is introduced.

5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.

6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.

7. The student is expected to exert on design, development and testing of the proposed work asper the schedule.

8. Art work and Layout should be made using CAD based PCB simulation software. Dueconsiderations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

9. Completed mini project and documentation in the form of mini project report is to besubmitted at the end of semester.

10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, frontpanel design and mechanical aspects of the product, and guidelines for documentation /report writing.

Books

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro andSmart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-andMicroengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, andGyroscopes, Elsevier, New York, 2000.

PE-EC603B: Bio-Medical Electronics

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Understand the application of the electronic systems in biological and medical applications.
CO2	Understand the practical limitations on the electronic components while handling bio-substances.
CO3	Understand and analyze the biological processes like other electronic processes.

CO-PO Mapping

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO1 2
CO1	2	3	2	1	3	2	1	2	-	-	1	1
CO2	1	3	-	2	2	2	-	3	1	1	-	-
CO3	2	-	2	1	3	2	1	2	-	2	2	2

Syllabus (PE-EC603A)

Brief introduction to human physiology.

Biomedical transducers: displacement,velocity, force, acceleration, flow, temperature, potential,dissolved ions and gases. Bio-electrodes and bio-potential amplifiers for ECG, EMG, EEG, etc.

Measurement of blood temperature, pressure and flow. Impedanceplethysmography. Ultrasonic, X- ray and nuclear imaging.

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificialkidney, aids for thehandicapped. Safety aspects.

Books

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982

PE-EC603C : CMOS VLSI Design

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Understand basics of VLSI Design, Review of MOSFET with basic physics and design concepts, VLSI Design Principals.
CO2	Learn the fabrication steps of MOSFET using n-well process and p-well process.
CO3	Implement various kinds of digital circuits implemented by CMOS, complex static CMOS circuit design with problem analysis.
CO4	Able to analyse various kinds of digital circuits implemented by CMOS, complex dynamic CMOS circuit.
CO5	Able to explain goals of partitioning, floor planning and placement, Global routing

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	2	-	-	2	-	3
CO2	3	3	2	3	2	-	2	-	-	3	-	3
CO3	3	3	2	3	3	-	3	-	-	2	-	2
CO4	3	3	3	2	3	-	3	-	-	3	-	3

Syllabus (PE-EC603C)

VLSI Methodologies: Introduction to VLSI design, Moore's Law, VLSI Design flow, Designhierarchy, VLSI
Design style: Full custom, Gate array, standard-cell, Macro cell based design, Field programmabledevices, design quality.
MOSFET: Electrical characteristics of MOSFET, Threshold voltage, Body effect, current expression (gradual channel approximation method), Channel length modulation, MOSFET scaling: constant fieldand constant voltage scaling, Short-channel effects.

Unit process in VLSI and IC fabrication: Unit process in VLSI: Wafer preparation, Oxidation, Diffusion, Ion implantation, Deposition, Metallization, Etching and Lithography. nMOS fabrication, n-well and p-well process .

CMOS Logic Circuits: General CMOS logic structure, VTC of inverter, noise margin, Different types of inverter (resistive load, enhancement and depletion nMOS load and CMOS), Switching characteristic (propagation delay and parasitic capacitance estimation), NAND, NOR and other complex CMOS logic circuits, Sizing of CMOS logic circuits, CMOS Power: static and dynamic powerdissipation, latch-up, sizing for large capacitive load,. Dynamic CMOS logic circuits, charge leakage and charge sharing problem, dynamic gate cascading problem, Domino and
NORA logic, Introduction of sequential CMOS logic circuits, Stick diagram. Layout and Layout designrules.

Physical Design Automation: Objectives and goals of partitioning, floor planning and placement,Global routing.

Books

1. Digital Integrated Circuits A Design Perspective -Jan M. Rabaey, Prentice-HallPublication, 2nd Edition.
2. VLSI Design and EDA Tools – Angsuman Sarkar, Swapnadip De & Chandan KumarSarkar, Scitech Publication(India) PVT, LTD
3. Basic VLSI Design – D. Pucknell & Eshraghian _PHI, 3rd Edition.
4. Principle of CMOS VLSI Design – Neil H. E. Weste – Pearson Edition, 2nd Edition.
5. CMOS Circuit Design – R. Jacob Baker, Harry W. Li, David E. Boyce – PHI,2003.

PE-EC603D : Information Theory and Coding

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Understand the concept of information and entropy
CO2	Define Shannon's theorem for coding
CO3	Calculation of channel capacity
CO4	Apply coding techniques

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	-	1	2	-	1	1	-	2
CO2	3	2	3	2	1	2	-	-	2	1	-	3
CO3	3	2	3	3	1	2	2	1	2	1	-	2
CO4	3	3	2	3	1	2	1	1	3	2	1	3

Syllabus (PE-EC603D)

Basics of information theory, entropy for discrete ensembles; Shannon's noiseless coding Theorem; Encoding of discrete sources.
Markov sources; Shannon's noisy coding theorem and converse for discrete channels; Calculation of channel capacity and bounds for discrete channels; Application to continuous channels.

Techniques of coding and decoding; Huffman codes and uniquely detectable codes; Cyclic codes, convolutional arithmetic codes

Books

1. N. Abramson, Information and Coding, McGraw Hill, 1963.
2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
3. R.B. Ash, Information Theory, Prentice Hall, 1970.
4. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

OE-EC604A : Electronic Measurement & Measuring

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Describe the fundamental concepts and principles of instrumentation
CO2	Explain the operation of various instruments required in measurements
CO3	Apply the measurement techniques for different types of tests
CO4	To select specific instruments for specific measurement function.
CO5	Understand principle of operation and working of different electronic instruments Students will understand functioning, specification and application of signal analyzinginstruments

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	-	1	3	-	1	1	-	2
CO2	3	1	3	2	1	2	-	-	2	2	-	3
CO3	2	2	2	3	-	2	2	1	2	1	-	2
CO4	3	-	2	2	1	2	1	1	-	2	1	3
CO5	3	2	1	2	1	2	-	-	2	1	-	3

Syllabus (PE-EC603D)

UNIT I:

Block Schematics of Measuring Systems:
Performance characteristics, Static characteristics, Accuracy, Precision,Resolution, Types of Errors,Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmetersand Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT II:

Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Capacitance-Voltage Meters, Signal Generators: AF, RF Signal Generators,Sweep Frequency Generators, Pulseand Square wave Generators, Function Generators,
Arbitrary waveform Generator.

UNIT III:

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes,
High Frequency CRO Considerations, Delay lines,
Applications: Measurement of Time, Period and Frequency.
Special Purpose Oscilloscopes:Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, StorageOscilloscopes, Digital Storage CROs.

UNIT IV:

Transducers:Classification, Strain Gauges, Bounded, unbounded; Force and DisplacementTransducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Piezoelectric Transducers, MagnetoStrictiveTransducers.

UNIT V:

Bridges:Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.
Measurement of Physical Parameters:Flow Measurement, Displacement Meters, Liquid levelMeasurement, Measurement of Humidity and Moisture, Velocity, Pressure
-High Pressure,
Vacuum level, Temperature
-Measurements, Data Acquisition Systems.

Books

1. Electronic instrumentation: H.S.Kalsi, TMH, 2nd Edition 2004.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D.Cooper: PHI, 5th Edition, 2003

3. Measurement Systems, Emest O. Doebelin and Dhanesh N Manik, 6th Ed., TMH.
4. Electronic Measurements and Instrumentations by K. Lal Kishore, Pearson Education, 2010.
5. Industrial Instrumentation: T. R. Padmanabham Spiriger 2009.
6. Electronic Instrumentation and Measurements, J.G. Joshi, Khanna Publishing House.
7. Electronic Instrumentation and Measurements, David A. Bell, Oxford Uiv. Press, 1997.2.Electronic
8. Measurements and Instrumentation: B. M. Oliver, J. M. Cage TMH Reprint.

OE-EC604B : Operating System

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	understand the difference between different types of modern operating systems, virtual machines andtheir structure of implementation and applications
CO2	understand the difference between process & thread, issues of scheduling of user-level processes /threads and their issues & use of locks, semaphores, monitors for synchronizing multiprogramming with multithreaded systems and implement them in multithreaded programs
CO3	understand the concepts of deadlock in operating systems and how they can be managed /avoided and implement them in multiprogramming
CO4	understand the design and management concepts along with issues and challenges of main memory, virtual memory and file system.
CO5	understand the types of I/O management, disk scheduling, protection and security problems facedbyoperating systems and how to minimize these problems.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	1	1	3	-	1	1	-	2
CO2	3	3	-	2	1	2	-	-	2	2	-	-
CO3	2	2	1	2	-	-	2	-	2	-	-	2
CO4	3	-	2	2	-	2	1	1	-	2	1	-
CO5	3	2	3	2	1	2	-	-	2	1	-	3

Syllabus (OE-EC604B)

Introduction:

Operating system and functions, Evolution of operating system, Batch, Interactive, Time Sharing, RealTime System, Multi-Threading System.

Operating System Structure:

System Components, System structure, Operating System Services.

Concurrent Processes:

Process concept, Principle of Concurrency, Critical Section problem, Semaphores, Classical problemsin Concurrency, Inter Process Communication, Introduction to monitor, Process Generation, Process Scheduling.

CPU Scheduling:

Scheduling Concept, Performance Criteria SchedulingAlgorithm, Evolution, MultiprocessorScheduling**.**

Deadlock:

System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery fromdeadlock combined, approach**.**

Memory Management:

Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept,

Demand paging, Performance,Page replacement algorithms, Allocation of frames, Thrashing.

I/O Management & Disk Scheduling:

I/O devices and organization of I/O function, I/O Buffering, DISK I/O, Operating System DesignIssues.

File System:

File Concept, File Organization and Access Mechanism, File Directories, File Sharing, ImplementationIssues.

Operating system Protection & Security:

Introduction to distributed operating system, Case Studies - The UNIX operating system

Books

1. Operating System Concepts, A. Silverschwatz, P. Galvin & G.Gange , Willey
2. Operating System Concepts, Ekta Walia, Khanna Publishing House
3. Operating System Concepts, Milenekovic, McGraw Hill
4. An introduction to operating system, Dietel, Addision Wesley

OE-EC604C : Object Oriented Programming

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	differentiate between structures oriented programming and object oriented programming.
CO2	use object oriented programming language like C++ and associated libraries to develop objectorientedprograms.
CO3	understand and apply various object oriented features like inheritance, data abstraction, encapsulation andpolymorphism to solve various computing problems using C++ language.
CO4	apply concepts of operator-overloading, constructors and destructors..
CO5	apply exception handling and use built-in classes from STL.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	1	2	3	-	1	1	-	2
CO2	3	-	-	3	1	2	-	-	2	2	-	-
CO3	2	3	3	2	-	-	2	-	1	-	-	3
CO4	3	-	2	1	-	2	-	1	-	2	1	-
CO5	3	1	3	2	1	2	-	-	2	1	-	3

Syllabus (OE-EC604C)

paradigm:

Evolution of programming paradigm, structured versus object-oriented development, Introduction toObject oriented programming concepts: Objects, classes, encapsulation and abstraction, inheritance, polymorphism, dynamic binding, message passing.

Moving from C to C++:

Introduction to C++, streams based I/O, name space, scope resolution operator (::), variable declarationat the point of use, variable aliases-reference variables, strict type checking, parameter passing by reference, inline function, function overloading, default arguments.

Object and Classes:

Specifying and using classes, access specifies: private, public, functions and data members, defaultarguments, function overloading, friend functions, static members. Objects: memory considerations for objects, new and delete operators.

Constructors - default constructor, parameterized constructor, constructor with dynamic allocation,copy constructor, destructors.

Operator overloading- overloading through friend and member functionsBinary operators: arithmetic,relational, assignment , insertion, extractionUnary operators: unary minus , post and pre-increment, post and pre- decrement, Conversion functions : class to basic, basic to class, class to class.

Inheritance:

Derived and base classes, Class hierarchies, public, private, and protected derivations, constructors in derived classes, destructors in derived classes, constructors invocation and data members initializationin derived classes, classes within classes, virtual base class.

Polymorphism:

Pointer to objects, pointer to derived class object, this pointer, run time and compile timepolymorphism, virtual functions, pure virtual functions, abstract class, virtual destructor.**Files and Streams:**

Introduction to file handling, hierarchy of file stream classes, opening and closing of files, file modes,file pointers and their manipulators, sequential access, random access.

Exception handling and Templates :

Introduction to exception handling, throw point outside try, Multiple catch, Catch-all, throwing objects.Introduction to templates, class templates, function templates

Books

1. Object Oriented Programming with C++, E. Balaguruswamy, 6th Edition, 2013 TMG Hill
2. Object Oriented Programming with C++, R.S. Salaria, Khanna Publishing House, New Delhi.
3. Object Oriented Programming with C++, Reema Thareja, OXFORD University Press, 1st Edition,2015.
4. C++ completes reference, Herbert Schildt, TMG Hill, 4th Edition, 2002.
5. C++ How to Program, Deitel and Deitel, Pearson Education Asia, 8th Edition, 2011.

MC681 : Universal Human Values

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Understand and analyse the essentials of human values and skills, self exploration, happiness and prosperity
CO2	Evaluate coexistence of the "I" with the body.
CO3	Identify and evaluate the role of harmony in family, society and universal order.
CO4	Understand and associate the holistic perception of harmony at all levels of existence
CO5	Develop appropriate technologies and management patterns to create harmony in professional and personal lives.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	3	-	-	-	1
CO2	-	-	-	-	-	-	1	-	-	-	-	-
CO3	-	-	-	-	-	2	1	-	-	-	-	-
CO4	-	-	-	-	-	2	2	-	-	-	-	1
CO5	-	-	-	-	-	2	2	3	-	-	-	1

Syllabus (MC681)

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for ValueEducation

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' andExperientialValidation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment ofaspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensureSanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as thefoundational values of relationship

14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution,Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

Visualizing a universal harmonious order in society- Undivided Society, Universal Order-fromfamily to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence asCoexistence

17. Understanding the harmony in the Nature
18. Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation in nature
19. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
20. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on ProfessionalEthics

21. Natural acceptance of human values
22. Definitiveness of Ethical Human Conduct
23. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
24. Competence in professional ethics: a. Ability to utilize the professional competence foraugmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
25. Case studies of typical holistic technologies, management models and production systems
26. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. Atthe level of society: as mutually enriching institutions and organizations
27. Sum up Include practice Exercises and Case Studies will be taken up in Practice

(tutorial) Sessions eg. todiscuss the conduct as an engineer or scientist etc

Books

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010
2. Professional Ethics and Human Values by Premvir Kapoor, Khanna Publishing House, NewDelhi, 2018
3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

7th Semester

HS-HU701 : Principles of Management

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, and have same basic knowledge on international aspect of management
CO2	To understand the planning process in the organization
CO3	To understand the concept of organization
CO4	Demonstrate the ability to directing ,leadership and communicate effectively
CO5	To analysis isolate issues and formulate best control methods.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	2	2	1	3	1
CO2	-	-	-	-	-	2	-	2	2	-	2	1
CO3	-	-	-	-	-	2	-	2	2	-	-	1
CO4	-	-	-	-	-	2	-	2	2	3	2	1
CO5	-	-	-	-	-	2	-	2	2	-	-	1

Syllabus (HS-HU701)

Module-I

1. Basic concepts of management: Definition - Essence, Functions, Roles, Level.
2. Functions of Management: Planning - Concept, Nature, Types, Analysis, Management by objectives; Organisation Structure -Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organisational Effectiveness.

Module-II

3. Management and Society - Concept, External Environment, CSR, Corporate Governance, Ethical Standards.

4. People Management - Overview, Job design, Recruitment & Selection, Training &Development, Stress Management.
5. Managerial Competencies - Communication, Motivation, Team Effectiveness,Conflict Management, Creativity, Entrepreneurship.

Module-III

6. Leadership: Concept, Nature, Styles.
7. Decision making: Concept, Nature, Process, Tools & techniques.
8. Economic, Financial & Quantitative Analysis - Production, Markets, National Income Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, QuantitativeMethods - Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control.

Module-IV

9. Customer Management - Market Planning & Research, Marketing Mix, Advertising &Brand Management.
10. Operations & Technology Management - Production & Operations Management,Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.

Books

1. Principles of Management, Premvir Kapoor, Khanna Publishing House, New Delhi
2. Management: Principles, Processes & Practices - Bhat, A & Kumar, A (OUP).

3. Essentials for Management - Koontz, Revised edition, Tata McGraw Hill (TMH)
4. Management - Stoner, James A. F. (Pearson)
5. Management - Ghuman, Tata McGraw Hill(TMH)

PE-EC701A : Microwave Theory and Technique

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	analyze the Microwave waveguide, Planar transmission lines with the help of High frequency circuit elements.
CO2	estimate the direction of waves through passive waveguide components and representation of Scattering matrix.
CO3	illustrate the construction and working principle of Microwave tubes, Semiconductor Microwave Devices and their typical characteristics and applications.
CO4	demonstrate the design of microwave amplifier and able to know the process of parameter measurements using test bench.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	1	2	2	1	1	-	2
CO2	2	2	1	2	1	1	2	2	1	2	2	2
CO3	2	2	3	2	2	1	2	2	-	-	-	3
CO4	2	2	3	2	2	1	2	2	1	2	2	3

Syllabus (PE-EC701A)

Introduction to Microwaves-History of Microwaves, Microwave Frequency bands;Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.

Mathematical Model of Microwave Transmission-Concept of Mode, Features ofTEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

Analysis of RF and Microwave Transmission Lines- Coaxial line, Rectangularwaveguide, Circular waveguide, Strip line, Micro strip line.

Microwave Network Analysis- Equivalent voltages and currents for non-TEMlines, Network parameters for microwave circuits, Scattering Parameters.

Passive and Active Microwave Devices- Microwave passive components:Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

Microwave Design Principles-Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.

Microwave Antennas-Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas.

Microwave Measurements- Power, Frequency and impedance measurement atmicrowave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters.

Microwave Systems- Radar, Terrestrial and Satellite Communication, Radio Aidsto Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves,

Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

Books

1. R.E. Collins, Microwave Circuits, McGraw Hill
2. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house

PE-EC701B : Satellite Communication

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Visualize the architecture of satellite systems as a means of high speed, highrange communication system
CO2	State various aspects related to satellite systems such as orbital equations, sub-systemsin a satellite, link budget, modulation and multiple access schemes
CO3	Solve numerical problems related to orbital motion and design of link budget for thegiven parameters and conditions

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	-	-	1	2	-	1	1	-	2
CO2	3	1	3	2	1	2	3	-	1	1	-	-
CO3	3	2	3	-	1	-	2	1	2	1	-	2

Syllabus (PE-EC701A)

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

Typical Phenomena in Satellite Communication:Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.
Satellite link budget

Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

Modulation and Multiple Access Schemes:Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

Books

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications:Wiley India. 2nd edition 2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

PE-EC701C : Mobile Communication and Networks

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Understand the working principles of the mobile communication systems.
CO2	Understand the relation between the user features and underlying technology.
CO3	Analyze mobile communication systems for improved performance

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	3	2	1	2	-	-	2	2
CO2	-	3	-	-	2	2	-	3	1	1	-	-
CO3	2	-	2	1	2	-	2	3	-		1	-

Syllabus (PE-EC701A)

Cellular concepts-Cell structure, frequency reuse, cell splitting, channelassignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

Signal propagation-Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.

Capacity of flat and frequency selective channels. Antennas-Antennas for mobileterminal- monopole antennas, PIFA, base station antennas and arrays.

Multiple access schemes-FDMA, TDMA, CDMA and SDMA. Modulation schemes-BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

Receiver structure- Diversity receivers- selection and MRC receivers, RAKEreceiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.

MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

Books

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley,1995.
5. VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall,1996

PE-EC702A : Adaptive Signal Processing

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Understand the non-linear control and the need and significance of changing thecontrol parameters w.r.t. real-time situation.
CO2	Mathematically represent the 'adaptability requirement'
CO3	Understand the mathematical treatment for the modeling and design of the signalprocessing systems.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	3	2	1	2	-	-	-	2
CO2	-	2	-	-	3	2	-	1	1	1	-	-
CO3	3	-	2	1	2	-	1	3	-		1	-

Syllabus (PE-EC701A)

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complexvalued The LMS algorithm (real, complex), convergence analysis, weight errorcorrelation matrix, excess mean square error and mis-adjustment

Variants of the LMS algorithm: the sign LMS family, normalized LMSalgorithm, block LMSand
FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. Signal space concepts - introduction to finite dimensional vectorspace theory, subspace,basis,
dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram- Schmidt orthogonalization, concepts of orthogonal projection,orthogonal decomposition of
vector spaces.

Vector space of random variables, correlation as inner product, forward andbackward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Introduction to recursive least squares (RLS), vector space formulation of RLSestimation, pseudoinverse of a matrix, time updating of inner products, development of RLS latticefilters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array

Books

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

PE-EC702B : Digital Image and Video Processing

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Mathematically represent the various types of images and analyze them
CO2	Process these images for the enhancement of certain properties or for optimized use of the resources.
CO3	Develop algorithms for image compression and coding .

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	1	-	3	2	2	1	3
CO2	3	2	2	1	-	-	1	3	2	2	-	3
CO3	3	2	2	1	1	-	-	3	2	2	1	3

Syllabus (PE-EC701A)

Digital Image Fundamentals-Elements of visual perception, image sensing andacquisition, image sampling and quantization, basic relationships between pixels - neighborhood, adjacency, connectivity, distance measures.

Image Enhancements and Filtering-Gray level transformations, histogramequalization and specifications, pixel-domain smoothing filters - linear and order-statistics, pixel-domain sharpening filters - first and second derivative, two-dimensional DFT and its inverse, frequency domain filters -low-pass and high-pass.

Color Image Processing-Color models-RGB, YUV, HSI; Color transformations-formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Image Segmentation- Detection of discontinuities, edge linking and boundarydetection, thresholding - global and adaptive, region-based segmentation.

Wavelets and Multi-resolution image processing- Uncertainty principles of FourierTransform, Timefrequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Subband filter banks, wavelet packets.

Image Compression-Redundancy-inter-pixel and psycho-visual; Losslesscompression - predictive, entropy; Lossy compression-predictive and transform coding; Discrete Cosine Transform; Still image compression standards-JPEG and JPEG-2000.

Fundamentals of Video Coding-Inter-frame redundancy, motion estimationtechniques - full-search, fast search strategies, forward and backward motion prediction, frame classification - I, P and B; Video sequence hierarchy- Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards - MPEG and H.26X.

Video Segmentation-Temporal segmentation-shot boundary detection, hard-cutsand soft-cuts; spatial segmentation- motion-based; Video object detection and tracking.

Books

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004
3. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015

PE-EC702C : Embedded System

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Understand the concept and design process of embedded systems.
CO2	Understand device and communication buses for device network.
CO3	Understand device drivers and interrupt service mechanism
CO4	Apply threads, tasks, process, semaphores and RPC for IPC.
CO5	Develop embedded systems modules using RTOS.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	2
CO5	2	-	1	-	1	-	-	-	-	-	-	2

Syllabus (PE-EC701A)

Overview of Embedded System: Embedded System, Embedded Processor in System, Components of EmbeddedSystem, Brief introduction to Embedded software in system, Design Process in Embedded System.

Embedded Hardware:

Processor & Memory: Brief overview of 8051 Architecture and real world interfacing, Introduction to advanced Processor Architectures-ARM, Processor and Memory organization, Parallelism in instruction level, Processor and memory selection.

I/O Types: Serial and Parallel communication Ports, Timer and Counting devices, Watchdog timers, real timeclock, Serial bus Communication Protocols- I2C, CAN, and Parallel Communication Protocol-ISA.

Interrupt Service Mechanism: Concept of ISR, different interrupt sources, Interrupt handling Mechanism,Multiple Interrupts, Interrupt Latency and deadline.

Embedded Software Development-

Software Development: Programming concept in ALP (assembly language programming) and High level language-C, Processor directives, functions and macros and other programming elements, Embedded C++ concept only.

RTOS(Real time operating System)- OS overview, Process, Interrupt and memory management, RTOS overview, Basic Design rule using RTOS, Task scheduling using Priority based scheduling, cyclic scheduling and round robin scheduling.

Embedded system Design using PIC microcontroller: Introduction toMicrochip PIC16 family, PIC16F873 processor architecture- features, memory organization, on chip peripherals, Watchdog timer, ADC, Data EEPROM, Asynchronous serial port, SPI mode, I2C mode, Interfacing with LCD, ADC, sensors, stepper motor, key board, DAC.

Case study of different types of Embedded System: Design of Automated Chocolate Vending Machine, DigitalCamera.

Books

1. Microcontrollers Theory and Application, Ajay V. Deshmukh, TMH, 2011.
2. Embedded Systems: Architecture, Programming & Design, Raj Kamal, TMH, 2011319

PE-EC703A : Neural Network and Fuzzy Logic Control

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	analyze and classify neural networks and its implementation algorithms
CO2	apply suitable algorithms on different cases
CO3	apply fuzzy logic and neural networks
CO3	analyze the applications of Neural Network and Fuzzy logic in image processing.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	3	2	1	2	-	-	-	2
CO2	-	2	-	-	1	2	-	1	-	1	-	1
CO3	3	-	-	1	-	-	1	1	-	-	1	2
CO4	2	-	3	1	2	-	-	3	2	1	-	-

Syllabus (PE-EC703A)

Neural Networks and Pattern Association:

Differences between biological and artificial neural networks – Typical architecture – Common activationfunctions– McCulloch – Pitts neuron – Simple neural nets for pattern classification – Linear separability –Hebb net –Perceptron – Adaline – Madaline – Architecture – Algorithm and simple applications – Training algorithms forpattern association – Hebb rule and delta rule – Hetero associative – Auto associative and iterative auto associativenet – Bidirectional associative memory – Architecture – Algorithm – Simple applications.

Neural Netwroks based on Competition:

Kohonen self organising maps – Learning vector quantization – Counter propagation – Architecture –Algorithm and applications

Adaptive Resonance and Backpropagation Neural Networks:

ART1 and ART2 – Basic operation and algorithm – Standard back propagation architecture – Derivation of learning rules – Boltzmann machine learning – Architecture – Algorithm and simpleapplications

Fuzzy sets and Membership Functions:

Properties and operations on classical and fuzzy sets – Crisp and fuzzy relations – Cardinality – propertiesand operations – Composition – Tolerance and equivalence relations – Simple problems –Features of membership function – Standard forms and boundaries – Fuzzification – Membership value assignments

– Fuzzy to crisp conversions – Lambda cuts for fuzzy sets and relations –Defuzzification methods.

Applications of Neural networks and Fuzzy logic:

Applications of neural networks – Pattern recognition – Image compression – Communication – Controlsystems

Applications of fuzzy logic – Fuzzy pattern recognition – Fuzzy image compression – Fuzzy logiccontrollers

Books

1. Fundamentals of Neural Networks, LaureneFausett, 2004, Pearson Education.
2. Fuzzy Logic with Engineering Applications, Timothy Ross, 1998, McGraw-Hill.

PE-EC703B : Wireless Sensor Networks

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Design wireless sensor networks for a given application
CO2	Understand emerging research areas in the field of sensor networks
CO3	Understand MAC protocols used for different communication standards used in WSN
CO3	Explore new protocols for WSN

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	1	-	2	-	-	-	2	-	-
CO2	1	2	-	-	2	3	-	3	-	1	-	1
CO3	2	-	-	1	-	-	1	1	-	2	1	2
CO4	3	-	3	-	2	-	-	3	2	1	-	1

Syllabus (PE-EC703A)

Introduction to Sensor Networks, unique constraints and challenges, Advantage of SensorNetworks, Applications of Sensor Networks, Types of wireless sensor networks

Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologiesfor Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,

Dissemination protocol for large sensor network. Data dissemination, data gathering, anddata fusion; Quality of a sensor network; Real-time traffic support and security protocols.

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN toInternet Communication, and Internet to WSN Communication.

Single-node architecture, Hardware components & design constraints,

Operating systems and execution environments, introduction to TinyOS and nesC.

Books

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless SensorNetworks Theory And Practice”, By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science
5. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press2009

PE-EC703C : Wavelet Transforms

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Classify various wavelet transform and explain importance of it
CO2	Describe Continuous Wavelet Transform (CWT) and Discrete Wavelet Transform (DWT
CO3	Explain the properties and application of wavelet transform.
CO4	Develop and realize computationally efficient wavelet based algorithms for signal and image processing.
CO5	Explain brief features and strength of transform beyond wavelet.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	2	1	2	-	3	-	2
CO2	-	2	-	-	1	1	-	1	-	1	-	1
CO3	1	-	-	1	1	-	2	1	2		1	2
CO4	2	-	3	1	2	-	-	3	2	1	-	3
CO5	3	-	1	2	-	1	1	2	-	3	1	-

Syllabus (PE-EC703C)

Introduction:

- Origin of wavelets and its history
- Different communities of wavelet
- Classification: continuous and discrete wavelet transforms
- Developments in wavelet theory applications

Continuous Wavelet Transform:

- Introduction
- Continuous time wavelets
- Definition of CWT
- Constant Q factor filtering interpretation and Time Frequency Resolution
- CWT as an operator
- Inverse CWT

Introduction to the Discrete Wavelet Transform and orthogonal Wavelet decomposition:

- Approximations of vectors in nested linear vector subspaces
- Multi-resolution Analysis of $L^2(R)$
- Haar Scaling function
- Haar wavelet
- Haar wavelet decomposition.
- Haar wavelet packets and application.

MRA Ortho -normal wavelets and their relationships to filter banks:

- Construction of an ortho-normal MRA
- Wavelet basis for the MRA
- Digital filtering interpretation
- Examples of orthogonal basis generating wavelets
- Interpreting ortho-normal MRA for discrete time signals

- Generating scaling functions and wavelets from filter coefficients.

Bi-orthogonal Wavelets:

- Bi-orthogonal Wavelet bases
- Filtering relationship for Bi-orthogonal filters
- Bi-orthogonal scaling functions and wavelets
- Two dimensional wavelets
- Non separable Multi-dimensional wavelet
- Wavelet Packets

Wavelength Transform and applications:

- Transform coding
- DTWT for image compression, audio compression
- Wavelet based audio coding, video coding and multi resolution Techniques
- Wavelet de-noising, Speckle removal, Edge detection and
- object isolation
- Image fusion, Object detection, discrete wavelet multi-tone
- modulation.

Beyond Wavelet:

- Ridge lets and curve lets: Ridge let transform and Digital Curvelet transform
- Curve let construction
- Properties and applications.

Books

1. Raguveer M. Rao and AjitS. Bopardikar-Wavelet Transforms –Introduction and applications- Pearson Education, 2008
2. K.P Soman, K.I. Ramachandran – Insight into Wavelets from Theory to practice, PHI2006

OE-EC704A : Web Technology

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	design good web pages using different tags, tables, forms, frames and style sheets supportedby HTML.
CO2	implement, compile, test and run Java programs, comprising more than one class, to address aparticular software problem
CO3	demonstrate the ability to employ various types of selection statements and iterationstatements in a Java program
CO3	be able to leverage the object-oriented features of Java language using abstract class andinterface.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	1	3	2	1	2	2	-	1	2
CO2	3	2	-	-	1	2	-	1	-	1	-	2
CO3	3	-	2	1	-	-	1	1	-	-	1	1
CO4	-	-	1	1	-	-	-	3	2	1	2	3

Syllabus (OE-EC704A)

Web Development:

HTML, Structure, Tags, Lists, Table, Link and it's types ,Images, Form, Frame, Style sheets andit's type

Introduction to Java:

Java and Java applications, Java Virtual Machine(JVM), Java Runtime Environment(JRE)JavaDevelopment Kit(JDK,) Byte code, Java characteristics, Object oriented Programming, Simplejava programs, Data types, Operators, Expressions, control statements, Selection statements, Iteration statements, Jump statements

Classes, Inheritance :

Classes in java, Declaring a class, Creating instances of class, Constructors, Argument Passing,use of static keyword, Innner class. Method overloading, Inheritance, use of super keyword
,Method overriding, Abstract class, Dynamic method dispatch, use of final keyword

Interface, Package:

Package, Acesss control mechanism, Interface, Dynamic Method look up

Exception Handling:

Java Exception Handling Mechanism, try, catch, throw, throws and finally, Exception types,Built in Exceptions: checked and unchecked exceptions, User defined Exceptions

String Handling:

String and String Buffer, Constructors, String operations : character extractions, String comparisons, searching, strings, modifying a string. To String() and valueOf() methods, StringBuffer operations

Java I/O Stream:

I/O basics, Byte stream, Character stream, Reading console input, Writing console output,Reading and writing files

Java Utility package:

Collection overview, Collection interfaces, Collection classes: ArrayList, LinkedList, Accessinga collection using, iterator and for-Each statement

Applet:

Applet class, Applet architecture, Applet Skeleton, Life cycle methods, setForeground() and setBachground()methods, Using the status window,HTML Applet tag, Passing parameters to an applet, GetCodebase() and Get Documentbase() methods.

Event Handling and AWT:

Delegation Event Model, Event classes, Sources of Events, Event Listener interfaces,Event handling using adapter class, Inner and anonymous class, AWT classes: Label,Button,TextFieldetc.

Books

1. HTML- Complete Reference,Powell, 3rd Edition, TMH 2007
2. Core Java-An Integrated Approach, Dr. R.Nageswara Rao, Dreamtech 2015
3. Core Java, Dr. Tanweer Alam, Khanna Publishing House, New Delhi (AICTE Recommended-2018).

OE-EC704B : Optimization Technique

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	formulate fitness functions and cost functions for engineering optimization problems andspecify the constraints as required
CO2	implement different single variable optimization algorithms including the gradient basedmethods
CO3	analyze and implement different multi variable optimization algorithms and a multi objectiveoptimization techniques based on Parento-Fronts.
CO4	implement Bio-inspired optimization algorithms for solving complex engineering problems

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	2	1	2	-	1	-	-
CO2	2	2	-	3	1	-	-	3	-	1	-	1
CO3	3	-	-	1	-	2	-	1	-		1	-
CO4	1	-	-	1	2	-	3	3	-	1	-	3

Syllabus (PE-EC703A)

Introduction: Optimal problem formulation, Design variables constraints, Objective function,Variable bounds,, Engineering optimization problems, Optimization algorithms.
Single-variable Optimization Algorithm: Optimality Criteria, Bracketing methods: Exhaustivesearch methods, Region-Elimination methods; Interval halving method, Fibonacci search method, Point estimation method; Successive quadratic estimation method.
Gradient-based Methods: Newton-Raphson method, Bisection method, Secant method,Computer programmes.

Multivariable Optimization Algorithm: Optimality criteria, unidirectional search, Direct search methods: Evolutionary optimization method, Simplex search method, Hooke-Jeeves pattern search method, Cauchy's (Steepest descent) method, Newton's method, multi-objectiveoptimization, Pareto optimization.
Constrained Optimization Algorithm: Characteristics of a constrained problem. Direct methods: The complex method, Cutting plane method, Indirect method: Transformation Technique, Basic approach in the penalty function method, Interior penalty function method,Convex method.
Advanced Optimization Algorithms: Genetic Algorithm (GA), working principles, GAoperators, selection methods, advanced GAs, computer programmes, simulated annealing.Particle swarm optimization (PSO), differential evolution (DE) algorithm, bacterial foraging algorithm, ant colony optimization algorithm.

Books

1. Optimization for Engineering Design-Algorithms & Examples – K. Deb, PHI, 2nd Ed., 2012.
2. Multi-objective Optimization Using Evolutionary Algorithms-K. Deb, John Wiley & Sons, 1stEd., 2001

OE-EC704C : Entrepreneurship

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	know the contribution of an entrepreneur and role of SSI units in growth and development ofsocioeconomic condition of our country.
CO2	learn market survey, sales promotions and management of working capital through costingand book keeping.
CO3	know different decision making technique and benefit of personal management system as wellasmotivational methods of an enterprise.
CO4	learn how to prepare a project report and knowledge about different tax system of anenterprise

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	1	-	3	2	1	2	-	-	-	2
CO2	3	2	-	-	1	-	-	1	-	1	-	1
CO3	3	-	-	1	-	-	1	3	-		1	-
CO4	-	-	2	1	2	-	-	1	2	1	-	-

Syllabus (OE-EC704C)

UNIT-I :

New Industrial Policy of 1991,Meaning and Definition of Entrepreneurship, Incentives and benefits available to SSI Units and New Entrepreneurs. Dearth of entrepreneurial talent in India,Growth of SSI in India. Procedures to startSSIs.

UNIT-II :

Market survey and research pricing and techniques, Distribution Channel, Sales promotionactivities. Raising Finance and enterprise launching.

UNIT-III :

Financial Management, Working Capital Management, Costing,Book Keeping, Break-Even-Analysis. Taxation: Income Tax, Excise duty, Sales tax and VAT.

UNIT-IV :

Decision making – Types, Forecasting-Qualitative and Quantitative methods, Personal Management, Motivation and theories of motivation. Preliminary Project Report (PPR), DetailedProject Report (DPR) writing.

Books

1. Industrial Organisation and Engg.Economics. Sharma & Banga.Khanna Publication, 2003.
2. Entrepreneurship New Venture Creation. David H.Holt.Prentice Hall .PHI, 2013.

Code of Conducts of the Students

1. PREPARATION

All students must understand that it is their responsibility to follow this Code of Ethics and Conduct (hence referred to as the 'Code') and the rights, obligations, and limitations that it entails.

That the Institute's goal in implementing this Code is to pioneer and administer an equitable, conscientious, effective, and timely student discipline procedure, as well as to provide a system that encourages student progress through individual and communal accountability.

All students are expected to be well-versed in this Code, which may also be found on the Institute's official website.

2. JURISDICTION

2.1 The Institute shall have jurisdiction over the conduct of students associated/enrolled with the Institute, and shall be aware of all acts of misconduct, including incidents of ragging or otherwise, that occur on the Institute campus or in connection with Institute-related activities and functions.

2.2 The Institute may have jurisdiction over conduct that occurs off-campus that violates the ideal student conduct and discipline as outlined in this Policy and other regulations, as if the conduct occurred on campus, which shall include:

a) Any violations of the Sexual Harassment Policy of the Institute against other students of the Institute.

b) Physical assault, threats of violence, or conduct that threatens the health or safety of any person including other students at the Institute.

c) Possession or use of weapons, explosives, or destructive devices off campus.

d) Manufacturing, selling, or distributing illegal narcotics, alcohol, or other substances.

e) Conduct that has a negative impact on members of the off-campus community or is a nuisance to them.

The Institute shall consider the seriousness of the alleged offence, the risk of harm involved, whether the victim(s) are members of the campus community, and/or whether the off-campus conduct is part of a series of actions that occurred both on and off-campus when deciding whether to exercise such off-campus jurisdiction in the situations enumerated herein.

3. BEHAVIOR AND ETHICS

3.1 This Code applies to all types of student conduct on Institute grounds, including Institute-sponsored activities, functions hosted by other recognized student organizations, and any off-campus conduct that has or may have serious consequences or a negative impact on the Institute's interests or reputation.

3.2 Each student must sign a declaration recognizing this Code and promising to follow it at the time of admission:

a) He/she must be regular and complete his/her studies at the Institute.

b) If a student is obliged to abandon studies for any justifiable reason, he/she may be removed from the Institute with the Principal's written agreement.

c) As a result of such relief, the student will be required to pay any outstanding hostel/mess dues, and if the student was admitted on a scholarship, the grant will be cancelled.

3.3. The Institute believes that implementing behavioral norms would help to create a safe and efficient environment. All students must maintain academic integrity, respect all individuals and their rights and property, and ensure the safety of others, among other things.

3.4 All students shall refrain from engaging in all forms of wrongdoing, including engaging in any off-campus activities that could jeopardize the Institute's interests and reputation.

3.5 Discrimination (physical or verbal) based on a person's gender, caste, race, religion, or religious beliefs, color, region, language, disability, or sexual orientation, marriage, or family status, physical or mental disability, gender identity, or other factors.

3.6 Deliberately causing damage to Institute property or the property of other students and/or faculty members.

3.7 Any disruptive behavior in a classroom or at an Institute-sponsored event.

3.8 Inability to produce the Institute's identity card or refusal to produce it when asked by campus security officers.

3.9 Participating in activities without the Institute's consent, such as:

3.9.1 Organizing gatherings and processions.

3.9.2 Accepting membership in religious or terrorist organizations that the Institute/Government of India has outlawed.

3.9.3 Contrary to law or policy, illegal possession, carrying, or use of any weapon, ammunition, explosives, or potential weapons, fireworks.

3.9.4 Illegal possession or use of hazardous chemicals and controlled substances.

3.9.5 Smoking on the Institute's premises.

3.9.6 Possessing, consuming, distributing, selling, and/or tossing empty bottles on the Institute's campus are all prohibited.

3.9.7 Parking a vehicle in an area designated for parking other types of vehicles or in a no parking zone.

3.9.8 Improper driving on campus that may cause others to be inconvenienced.

3.9.9 Not informing the Chief Medical Officer about a pre-existing health problem, whether physical or psychological, that could impede academic development.

3.9.10 Unauthorized access to others' resources or theft.

3.9.11 Misconduct during student body elections or any Institute-sponsored activity.

3.9.12 Behaving in a disorderly, lewd, or indecent manner at the Institute, including, but not limited to, making excessive noise, pushing, and shoving, inciting or participating in a riot, or causing a group disruption.

3.10 Students are not permitted to communicate with media representatives on behalf of the Institute or to invite media persons to the campus without the authorization of the Institute management.

3.11 Without prior authorization, students are not permitted to capture audio or video lectures in classes or the behaviors of other students, instructors, or staff.

3.12 Students are not permitted to supply media with audio or video clips of any campus activity without prior approval.

3.13 Students are required to use social media properly and with caution.They are prohibited from making negative comments about other Institute employees on social media or engaging in any other activity that could harm the Institute's reputation.

3.14 Unauthorized entry, use, tampering, etc. of Institute property or facilities, private residences of staff/professors, offices, classrooms, computers networks, and other restricted facilities, as well as interference with others' work, is punishable.

3.15 Any damage to or destruction of Institute property or the property of others on Institute grounds.

3.16 Without the person's knowledge and explicit agreement, making a video/audio recording, taking pictures, or streaming audio/video of any person in a location where the person has a reasonable expectation of privacy.

3.17 Harassment, which is defined as harsh and objective behavior motivated by a person's race, color, national or ethnic origin, citizenship, sex, religion, age, sexual orientation, gender, gender identity, marital status, ancestry, physical or mental disability, or medical condition.

4 If there is a case against a student for a probable breach of code of conduct, then a committee will be constituted to recommend a suitable disciplinary action who shall enquire into the alleged violation and consequently indicate the action to be taken against the said student.

The committee may meet with the student to determine the extent of the misbehavior and recommend one or more of the disciplinary actions listed below, depending on the severity of the misconduct.

4.1 WARNING- Indicating that the delinquent student's actions were in breach of the Code, and that any future acts of misbehaviour will result in serious disciplinary punishment.

4.2 RESTRICTIONS - Reprimanding and restricting access to certain campus facilities for a period.

4.3 COMMUNITY SERVICE - For a set amount of time, which may be extended if necessary. Any future wrongdoing, as well as failure to comply with any imposed limitations, may result in severe disciplinary action, such as suspension or expulsion.

4.4 EXPULSION - Permanent expulsion of a student from the Institute, indicating that attending the Institute or participating in any student-related activities or living on campus is prohibited.

4.5 FINANCIAL PENALTY- This could include the suspension or forfeiture of a scholarship or fellowship for a set period.

4.6 SUSPENSION- A student may be suspended for a length of time, preventing them from engaging in student-related activities, classes, or programmes. Furthermore, unless permission is acquired from the Competent Authority, the student will be prohibited from using various Institute facilities. Suspension may be followed by dismissal, as well as the other punishments listed below.

4.7 For a period of three years, you will be ineligible to reapply for admission to the Institute, and

4.8 Withholding the grade card or certificate for the courses studied or work \scarred out.

5 APPEALS:

If a delinquent student feels he or she has been wronged by the application of any of the above punishments, he or she may file an appeal with the Principal. The Principal may decide on one of the following:

5.1 Accept the committee's proposal and impose the punishment recommended by the Committee or amend and impose any of the punishments stated in this Code that are appropriate with the degree of the proven wrongdoing. Or

5.2 Recommend the case to the committee for further consideration.

In all circumstances where there is a potential for student misconduct, the Director's decision is final and binding.

6 ACADEMIC INTEGRITY

The Institute values academic integrity and is devoted to building an intellectual and ethical environment based on academic integrity principles as a top institution for advanced scientific and technology research and education.

Academic integrity includes honesty, accountability, and awareness of ethical standards for study and scholarship. The Institute believes that the ideas and contributions of others should be appropriately acknowledged in all academic work. Academic integrity is critical to the Institute's and its research missions' success, and so academic integrity infractions are a significant offence.

6.1 Purpose and Scope

A. The academic integrity policy, which is an integral aspect of the Code, applies to all students at the Institute, and they are obligated to follow it.

The Policy serves a dual purpose:

- To make the ideals of academic honesty clearer, and
- To give examples of dishonest behavior and academic integrity infractions.

NOTE: These examples are intended to be illuminating rather than exhaustive.

B. Failure to follow these academic integrity principles jeopardizes the Institute's reputation as well as the worth of the degrees issued to its students.

As a result, every member of the Institute community takes responsibility for upholding the highest standards of academic integrity.

C. Academic integrity dictates that a student appropriately acknowledges and references the use of others' ideas, results, materials, or language.

Ensures that all work submitted as his or her own in a course or other academic activity is produced without the use of impermissible materials or impermissible collaboration; properly acknowledges all contributors to a given piece of work; and ensures that all work submitted as his or her own in a course or other academic activity is produced without the use of impermissible materials or impermissible collaboration.

Obtains all data or results ethically and accurately reports them, with no results suppressed that contradict his or her interpretation or conclusions.

Demonstrates ethical behavior toward all other students, respecting their integrity and right to pursue their educational goals without hindrance. This means that a student must not assist others in academic dishonesty or hamper their own academic advancement.

6.2 Examples of policy violations include, but are not limited to:

(i)Plagiarism Violation:

Plagiarism is defined as the use of someone else's content, ideas, figures, code, or data without properly recognizing the original source. This could include submitting material written by another person or previously published by oneself, directly or paraphrased.

Plagiarism can be defined as:

(a) reproducing text/sentences from a report, book, thesis, publication, or the internet in whole or in part.

(b) Reproducing previously published data, illustrations, figures, or images, whether one's own or someone else's.

(c) Incorporating non-textual material from other sources into one's class reports, presentations, manuscripts, research papers, or thesis without proper attribution, such as graphs, drawings, photographs, diagrams, tables, spreadsheets, computer programmes, or other non-textual material from other sources.

(d) Self plagiarism which comprises copying verbatim from one's own earlier \spublished work in a journal or conference proceedings without necessary citations.

e) Completing a course requirement by submitting a purchased or downloaded term paper or other resources.

f) Without citation, paraphrasing or modifying an author's words or style.

(ii) Cheating:

Cheating can take many forms, including, but not limited to:

(a) Exam copying, as well as copying of homework assignments, term papers, theses, or manuscripts.

(b) Permitting or enabling copying, making a report, or taking an examination on behalf of another person.

(c) Using unlawful materials, copying, collaborating without permission, and purchasing or borrowing papers or materials from a variety of sources.

(d) fabricating (falsifying) data and reporting it in theses and publications.

(e)Inventing new sources or citations when none exist

(f) Making changes to previously evaluated work and submitting it for re-evaluation

(g) Signing an assignment, report, research paper, thesis, or attendance sheet in the name of another student.

(iii) Conflict of Interest:

In a variety of activities such as teaching, research, publication, serving on committees, research funding, and consultancy, a clash of personal or private interests with professional actions can lead to a potential conflict of interest. Actual professional independence, integrity, and commitment must be protected, as well as the appearance of any impropriety resulting from conflicts of interest.

Conflict of interest is not restricted to personal financial gain; it extends to a vast range of professional academic activities including peer reviewing, serving on numerous committees, which may, for example, monitor financing or grant recognition, as well as influencing public policy.

Potential conflicts of interest must be notified in writing to competent authorities for a thoughtful decision to be made on a case-by-case basis, to promote transparency and boost credibility. In the part below dealing with resources, there is also some more information.

4.3 Academic behavior guidelines are presented here to protect against both negligence and purposeful dishonesty:

(a) For experiments and computational tasks, use suitable procedures. Data should be accurately described and compiled.

b) Save primary and secondary data such as original photographs, equipment data readouts, laboratory notebooks, and computer folders with care. Digital alteration of images/photos should be kept to a minimum; the original version should be maintained for subsequent inspection if necessary, and the changes done should be clearly indicated.

c) Ensure that experiments and simulations are robustly reproducible and statistically analyzed. It's critical to be honest about the facts and avoid "cherry picking" (omitting some data pieces to produce an outstanding statistic).

d) Laboratory notes should be kept in bound notebooks with printed page numbers so that they can be checked later for publication or patenting purposes. Each page should have a date on it.

e) Use your own language to write clearly. It is vital to resist the temptation to “copy and paste” from the Internet or other sources for class tasks, manuscripts, and thesis.

f) Cite prior reports, methodologies, computer programmes, and other sources appropriately. It's also a good idea to cite material from your own published work; otherwise, it'll be regarded self-plagiarism.

6.3. Individual and Collective Responsibilities: Responsibilities differ depending on the role played.

a) Student responsibilities:

Before submitting a thesis to the department (B.Tech, M Tech), the student is responsible for reviewing the thesis for plagiarism using proper tools. Furthermore, the student must guarantee that he or she is aware of the Institute's academic norms, that the paper has been examined for plagiarism, and that the thesis is original work. Plagiarism cannot always be detected with a web search. If a student notices or learns of any violations of the academic integrity policy, he or she should report the wrongdoing as soon as possible.

b) Faculty responsibilities:

Faculty members should guarantee that suitable methods for experiments, computations, and theoretical developments are followed, and that data is properly recorded and stored for future reference. They should also thoroughly analyze manuscripts and theses. Faculty members must also ensure personal compliance with the broad principles of academic integrity. Faculty members are expected to inform students in their respective courses about the Institute's academic integrity policy, to ensure minimum academic dishonesty, and to respond appropriately and promptly to academic integrity violations.

c) Institutional responsibilities:

A breach of academic integrity is a serious offence that can result in a variety of sanctions for both the individual and the institute. In the event of a student, the first academic infringement will result in a warning and/or a "F" mark in the course. If a repeat offence is deemed serious enough, it may result in expulsion. Faculty should bring any academic infractions to the attention of the department chairperson. When the Director receives reports of scientific misconduct, he or she may create a committee to review the situation and make recommendations for appropriate action on a case-by-case basis.

8th Semester

PE-EC801A: Antennas and Propagation

Course Outcome (CO)

At the end of the course, students will demonstrate the ability to:

CO1	Understand the properties and various types of antennas.
CO2	Analyze the properties of different types of antennas and their design.
CO3	Operate antenna design software tools and come up with the design of the antenna ofrequired specifications

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	-	3	2	1	2	-	-	2	2
CO2	-	2	1	1	2	2	-	3	1	1	-	-
CO3	2	-	1	1	1	-	2	3	-	3	1	-

Syllabus (PE-EC801A)

Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-andfar-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linearelements near conductors, dipoles for mobile communication, small circular loop.

Aperture and Reflector Antennas-Huygens' principle, radiation from rectangularand circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequencyindependent antennas, broadcast antennas.

Micro strip Antennas- Basic characteristics of micro strip antennas, feedingmethods, methodsof analysis, design of rectangular and circular patch antennas.

Antenna Arrays-Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

Basic Concepts of Smart Antennas-Concept and benefits of smart antennas, fixedweight beam forming basics, Adaptive beam forming.

Different modes of Radio Wave propagation used in current practice.

Books

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw ill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

PE-EC801B: Fiber Optic Communication

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Understand the principles fiber-optic communication, the components and the bandwidth advantages
CO2	Understand operation of lasers, LEDs, and detectors
CO3	Analyze system performance of optical communication systems .
CO4	Design optical networks and understand non-linear effects in optical fibers

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	-	3	2	1	2	-	-	2	2
CO2	-	3	-	-	2	2	-	3	1	1	-	-
CO3	2	-	2	1	2	-	2	-	-	2	1	-
CO4	2	-	-	-	2	-	-	2	-	1	1	2

Syllabus (PE-EC801B)

Introduction to vector nature of light, propagation of light, propagation of light inacylindrical dielectric rod, Ray model, wave model.

Different types of optical fibers, Modal analysis of a step index fiber.
Signaldegradation on optical fiber due to dispersion and attenuation. Fabrication of fibersand measurement techniques like OTDR.

Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detectorresponsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

Optical switches - coupled mode analysis of directional couplers, electro-opticswitches.

Optical amplifiers - EDFA, Raman amplifier.

WDM and DWDM systems. Principles of WDM networks.

Nonlinear effects in fiber optic links. Concept of self-phase modulation, groupvelocitydispersion and solition based communication.

Books

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, AcademicPress, 1979.
5. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997
7. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

PE-EC801C: Error Correcting Codes

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Visualize the architecture of satellite systems as a means of high speed, highrange communication system
CO2	State various aspects related to satellite systems such as orbital equations, sub-systemsin a satellite, link budget, modulation and multiple access schemes
CO3	Solve numerical problems related to orbital motion and design of link budget for thegiven parameters and conditions

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	-	-	1	2	-	1	1	-	2
CO2	3	1	3	2	1	2	3	-	1	1	-	-
CO3	3	2	3	-	1	-	2	1	2	1	-	2

Syllabus (PE-EC801C)

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

Typical Phenomena in Satellite Communication:Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena

and expression for Doppler shift.
Satellite link budget

Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

Modulation and Multiple Access Schemes:Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

Books

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

PE-EC802A: Mixed Signal Design

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Understand the practical situations where mixed signal analysis is required.
CO2	Analyze and handle the inter-conversions between signals.
CO3	Design systems involving mixed signals

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	3	2	1	2	-	-	2	2
CO2	-	3	-	-	2	2	-	3	1	1	-	-
CO3	2	-	2	1	2	-	2	3	-		1	-

Syllabus (PE-EC802A)

Analog and discrete-time signal processing, introduction to sampling theory;Analog continuous-time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

Switched-capacitor filters- Nonidealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

Basics of data converters; Successive approximation ADCs, Dual slope ADCs,Flash ADCs,Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signalinganddata transmission; Current-mode signaling and data transmission.

Introduction to frequency synthesizers and synchronization; Basics of PLL,Analog PLLs;Digital PLLs; DLLs.

Books

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition,IEEE press, 2008.
4. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
6. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
7. M. Burns et al., An introduction to mixed-signal IC test and measurement by,Oxford university press, first Indian edition, 2008.

PE-EC802B : Industrial Automation and Control

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	select suitable sensor to measure industrial parameters and the different types of actuators andits working. They will be able to design proper signal conditioning circuit to the transducer..
CO2	determine the effect of proportional gain, integral time, derivative gain constant on the systemperformance and will be able to tune the controller using tuning methods, implement PID using electronic , digital, pneumatic and hydraulic methods.
CO3	design the ladder logic to implement any process with given problem statement.
CO4	analyze DCS hardware and its merits/demerits in an industrial automation
CO5	analyze SCADA hardware and software and its merits/demerits in industrial automation.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	3	2	1	2	-	-	-	2
CO2	-	2	-	-	3	2	-	1	1	1	-	-
CO3	3	-	2	1	2	-	1	3	-		1	-
CO4	3	1	3	2	1	2	3	-	1	1	-	-
CO6	3	2	3	-	1	-	2	1	2	1	-	2

Syllabus (PE-EC802B)

Sensors: Displacement sensors, Force sensors, Ultrasonic sensors, Temperature sensors, Pressuresensors etc
Actuators: Dc motors, Servo motors, Stepper motors, Piezo electric actuators, Pneumatic actuators etc.
Signal Conditioning: Filtering, Amplifying, Isolation, ADC, DAC, Sensor protection circuits,Signal transmission and noise suppression, Estimation of errors and calibration.

Controller tuning:

PI controller, PD controller, PID controller and tuning methods: *Ziegler-Nichols tuning method, Cohen coon tuning method,* Implementation of PID controllers (digital and analog).

Automation:

PLC (Programmable logic controllers): Overview, operation and architecture, PLC programming, Application examples.
DCS (Distributed control systems): Overview, Advantages, Functional requirements of Distributed control systems, Communication for distributed control, Application examples. SCADA (supervisory control and data acquisition): Introduction to SCADA, SCADA systemcomponents, architecture and communication, SCADA applications.
Advanced control techniques: Feed forward control, Ratio control, Cascade control, Adaptivecontrol, Duplex or split range control, Override control, internal mode control.

Books

1. Computer-Based Industrial Control, Krishna Kant,2nd edition Prentice Hall of India Ltd.
2. Chemical Process Control – Theory and Practice, Stephanopoulous, Prentice Hall of India Ltd, 1984.
3. Fundamentals of Industrial Instrumentation and Process Control, William C. Dunn, TataMcGrawHill, 2009.
4. Chemical Process Technology, O.P. Gupta, Khanna Publishing House, New Delhi.

PE-EC802C : VLSI Design Automation

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Understand need for VLSI physical design automation.
CO2	Analyze VLSI automation algorithms for partitioning.
CO3	Formulate placement , floor planning and pin assignment problems and simulate.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	-	3	1		2	2	1	3
CO2	3	2	2	2	-	3	2	3	2	2	-	3
CO3	3	2	2	-	1	-	-	3	2	1	1	3

Syllabus (PE-EC802C)

Unit-I: Introduction to VLSI Design methodologies

Review of Data structures and algorithms - Review of VLSI Design automation tools - Algorithmic Graph Theory and Computational Complexity - Tractable and Intractable problems - general purpose methodsfor combinatorial optimization.

Unit-II: Layout Compaction, Placement & Partitioning

Layout Compaction: Design rules - problem formulation - algorithms for constraint graph compaction –*Placement & Partitioning:* Circuit representation - Placement algorithms - partitioning

Unit-III: Floorplanning & Routing

Floor planning concepts: Terminologies, floorplan representation, shape functions and floorplan

sizing *Routing:* Types of local routing problems - Area routing - channel routing - global routing - algorithms for global routing.

Unit-IV: VLSI Simulation

Gate-level modeling and simulation - Switch-level modeling and simulation - Combinational Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis- High level Synthesis.**Unit-V: High Level Synthesis**

Hardware models - Internal representation - Allocation assignment and scheduling - Simple scheduling algorithm - Assignment problem – High level transformations.

Books

1. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwar Academic Publishers, 2002

OE-EC803A : Internet of Things(IoT)

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	understand the application areas of IOT
CO2	realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
CO3	understand building blocks of Internet of Things and characteristics.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	3	-	-	-	2	-	-	-	1
CO2	3	1	2	-	1	-	1	-	2	2	3	-
CO3	3	1	2	-	-	-	1	-	2	2	3	-

Syllabus (OE-EC803A)

Introduction:

The Internet of Things: an Overview:

The flavour of the Internet of Things, The "Internet" of "Things", The Technology of the Internetof Things,Enchanted Objects, Who is Making the Internet of Things?

Design Principles for Connected Devices:

Calm and Ambient Technology, Magic as Metaphor, Privacy, Web Thinking for ConnectedDevices, Affordances.

Internet Principles:

Internet Communications: An Overview (IP, TCP, The IP Protocol Suite (TCP/IP), UDP), IP Addresses (DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6), MAC Addresses, TCP and UDP Ports, Application Layer Protocols.

Prototyping:

Thinking About Prototyping: Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Open Source versus Closed Source, Tapping into the Community.**Prototyping Embedded Devices:**

Electronics, Embedded Computing Basics, Developing on the Arduino, Raspberry Pi, Beaglebone Black, Electric Imp, Mobile Phone and Tablets, Plug Computing: Always-on Internet of Things.

Prototyping the Physical Design:

Preparation, Sketch, Iterate, and Explore, Non-digital Methods, Laser Cutting, 3D Printing, CNCMilling, Repurposing/Recycling.

Prototyping Online Components:

Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols.

Techniques for Writing Embedded Code:

Memory Management, Performance and Battery Life, Libraries, Debugging.

Prototype to Reality:

Business Models: A Short History of Business Models, The Business Model Canvas, Who IsThe Business Model
For Models, Funding an Internet of Things Startup, Lean Startups.

Moving to Manufacture:

What Are You Producing?, Designing Kits, Designing Printed Circuit Boards, Manufacturing Printed Circuit Boards, Mass-Producing the Case and Other Fixtures, Certification, Costs, Scaling Up Software,

Ethics:

Characterizing the Internet of Things, Privacy, Control, Environment, Solutions.

Books

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley publication, 1st Edition, November 2013.
2. Jeeva Jose, Internet of Things, Khanna Publishing House, New Delhi (AICTE Recommended – 2018)

OE-EC803B : Big Data Analysis

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	Master the concepts of HDFS and MapReduce framework.
CO2	Investigate Hadoop related tools for big data analytics and perform basic Hadoop administration.
CO3	Recognize the role of business intelligence, data warehousing and visualization in decision making.
CO4	Infer the importance of core data mining techniques for data analytics
CO5	Compare and contrast different text mining techniques.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**1**	**3**	**2**	-	-	**2**	**2**	**2**	-	**3**
CO2	**2**	**2**	-	**2**	**2**	-	-	-	**2**	**2**	-	**2**
CO3	**2**	**2**	-	**2**	**1**	**2**	**2**	-	**2**	**2**	-	**2**
CO4	**3**	**2**	**3**	**2**	**1**	**2**	-	**2**	-	-	**2**	**1**
CO5	**2**	**2**	**2**	**2**	**1**	-	-	-	**2**	**2**	-	**2**

Syllabus (OE-EC803B)

UNIT I : INTRODUCTION TO BIG DATA AND HADOOP Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

UNIT II : HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

UNIT III : Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

Unit IV : Hadoop Eco System Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction

UNIT V : Data Analytics with R Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

Books

- Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
- Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

OE-EC804A : Artificial Intelligence

Course Outcome (CO)

At the end of this course students will demonstrate the ability to

CO1	understand the modern view of AI as the study of agents that receive percepts from the environment and perform actions.
CO2	demonstrate awareness of the major challenges facing AI and the complex of typical problems within the field.
CO3	exhibit strong familiarity with a number of important AI techniques, including in particular search, knowledge representation, planning and constraint management.
CO4	asses critically the techniques presented and to apply them to real world problems.
CO5	Design applications for NLP that use Artificial Intelligence

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	2	1	1	2	1	2	1
CO2	2	3	2	3	3	2	2	2	2	1	1	2
CO3	2	-	1	1	-	-	1	1	-	2	1	2
CO4	3	-	3	-	2	-	1	3	2	1	-	1
CO5	3	-	2	-	1	3	2	1	-	1	3	1

Syllabus (OE-EC804A)

Introduction:
Overview; Foundation; History; The State of Art.

Intelligent Agents: Agents and environment; Rationality; The nature of environment; The structure of agents.

Solving Problems by Searching: Problem-solving agents; Well defined problems & solutions; Formulating problems; Searching for solution; Uninformed search strategies: (BFS, DFS, DLS, IDDFS, Bidirectional Search)

Informed Search and Exploration: Informed search strategies; Heuristic functions; On-line search agents and unknown environment.

Constraint Satisfaction Problems: Constraint satisfaction problems; Backtracking search for CSPs; Local search for CSPs.

Adversial search: Games; Optimal decisions in games; Alpha-Beta pruning.

Logical Agents: Knowledge-based agents; The wumpus world as an example world; Logic: Propositional logic Reasoning patterns in propositional logic.

First-order Logic: Syntax and semantics of first-order logic; Use of first-order logic.

Books

1. Artificial Intelligence: A Modern Approach – Stuart Russel, Peter Norvig, 3rd Edition, Pearson Education
2. Artificial Intelligence - Elaine Rich, Kevin Knight and Shivashankar B Nair, 3rd Edition, Tata McGraw Hill, 2008.
3. Artificial Intelligence: A new Synthesis – Nils J. Nilsson, 1st Edition, Elsevier, 1997.
4. Introduction to Artificial Intelligence and Expert Systems- Dan W. Patterson 2nd Edition, PHI, 2009.

OE-EC804B : Microwave Integrated Circuits

Course Outcome (CO)

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

CO1	analyze the fabrication techniques of MIC and MMIC , use of active devices with MIC and MMIC, differentiate between MIC and MMIC.
CO2	analyze and design strip lines and micro strip lines, and model the discontinuities in those lines
CO3	analyze and design slot lines, fin lines, coplanar lines and coplanar wave-guides.
CO4	design parallel coupled lines for couplers and power divider circuits.
CO5	differentiate between various measurement techniques associated with planar transmission lines.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	2	-	1	3	2	1	-	1
CO2	3	-	2	-	1	3	2	1	-	1	3	1
CO3	2	3	1	1	3	2	1	1	-	2	1	2
CO4	3	2	3	-	2	-	1	3	2	1	-	1
CO5	3	1	2	-	1	-	2	1	-	1	3	1

Syllabus (OE-EC804B)

Introduction: Introduction to Microwave Integrated Circuits (MIC) and Monolithic Microwave Integrated Circuits (MMICs), their advantages over discrete circuits, MMIC fabrication techniques, Thick and Thin film technologies and materials, encapsulation and mounting of active devices in MIC and MMIC.

Planar Transmission Lines-I: Strip line & microstrip line, field configurations, quasi-TEM mode in microstrip line, analysis of microstrip transmission line, concept of effective dielectric constant, impedance of Strip line & microstrip line, dispersion and losses in microstrip line, discontinuities in microstrip.

Planar Transmission Lines-II: Slot Line, approximate analysis and field distribution of slot line, transverse resonance method and evaluation of slot line impedance, comparison with microstrip line. Fin lines & Coplanar Lines, analysis of Fin lines by transverse resonance method, conductor loss in Fin lines, coplanar wave guide (CPW).

Parallel-coupled Microstrip Lines and Power Dividers: Coupled microstrip lines, even mode and odd mode characteristic impedances, semi-empirical formulae for coupled line parameters, coupled-region length, coupler directivity, crosstalk between microstrip lines, design of microstrip branch-line power divider and rat-race ring power divider.

MIC Measurement, Testing and Applications: MIC measurement system, microwave test fixtures and probes, measurement techniques of S- parameters, noise measurement.

Books

1. Microstrip Lines and Slot Lines - K.C. Gupta, R. Garg. , I. Bahl, P. Bhartia, Artech House, 2nd Ed., 1996.

2. Foundation for Microstrip Circuit Design-T. C. Edwards, John Wiley & Sons Ltd, 2nd Ed., 1992.