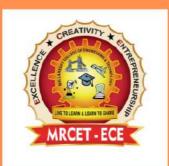# MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS INSTITUTION-UGC, GOVT.OF INDIA)

Affiliated to JNTU, Hyderabad, Approved by AICTE - NBA(Tier1) & NAAC – 'A' Grade - ISO 9001:2015 Certified

Maisammaguda, Dhulapally ,Secunderabad – 500100, Telangana State, India.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

B.TECH

R22-SYLLABUS

MRCET CAMPUS

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

ELECTRONICS & COMMUNICATION ENGINEERING

B.TECH
R22- COURSE STRUCTURE

I YEAR – I SEMESTER

S.No	Subject Code	SUBJECT	L	T	P	C	MAX.MARKS	
							INT	EXT
1	R22A0001	English	2	0	0	2	40	60
2	R22A0023	Mathematics–I	3	1	0	4	40	60
3	R22A0021	Applied Physics	3	1	0	4	40	60
4	R22A0022	Engineering Chemistry	3	0	0	3	40	60
5	R22A0501	Programming for Problem Solving	3	0	0	3	40	60
6	R22A0082	Applied Physics/Engineering Chemistry Lab	-	0	3	1.5	40	60
7	R22A0083	Engineering and Computing Hardware Workshop	-	0	2	1	40	60
8	R22A0581	Programming for Problem Solving Lab	-	0	3	1.5	40	60
9	R22A0003	Human Values and Professional Ethics	2	0	0	0	40	60
		Total	**16**	**2**	**8**	**20**	**360**	**540**

I YEAR – II SEMESTER

S.No	Subject Code	SUBJECT	L	T	P	C	MAX.MARKS	
							INT	EXT
1	R22A0002	Professional English	2	0	0	2	40	60
2	R22A0024	Mathematics–II	3	1	0	4	40	60
3	R22A0201	Principles of Electrical and Electronics Engineering	3	0	0	3	40	60
4	R22A0301	Computer Aided Engineering Graphics	2	0	3	4	40	60
5	R22A0502	Problem Solving using Python Programming	3	0	0	3	40	60
6	R22A0081	English Language and Communication Skills Lab	-	0	2	1	40	60
7	R22A0281	Principles of Electrical and Electronics Engineering Lab	-	0	3	1.5	40	60
8	R22A0582	Problem Solving using Python Programming Lab	-	0	3	1.5	40	60
9	R22A0004	Environmental Science	2	0	0	0	40	60
		Total	**15**	**1**	**11**	**20**	**360**	**540**

II YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0401	Analog Circuits	3	1	0	4	40	60
2	R22A0261	Network analysis and Synthesis	3	0	0	3	40	60
3	R22A0402	Digital Logic Design	3	0	0	3	40	60
4	R22A0403	Signals and Systems	3	1	0	4	40	60
5	R22A0404	Probability Theory and Stochastic Processes	3	0	0	3	40	60
6	R22A0481	Analog Circuits Laboratory	0	0	2	1	40	60
7	R22A0482	Digital logic Design Laboratory	0	0	2	1	40	60
8	R22A0483	Basic Simulation Laboratory	0	0	2	1	40	60
9	R22A0008 R22A0005	Constitution of India/ Foreign Language: French	3	0	0	0	100	-
		Total	**18**	**2**	**6**	**20**	**420**	**480**

II YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0025	Numerical Methods and Complex Variables	3	0	0	3	40	60
2	R22A0405	Electromagnetic Fields and Transmission Lines	3	0	0	3	40	60
3	R22A0406	Analog and Digital Communications	3	0	0	3	40	60
4	R22A0407	Linear and Digital IC Applications	3	0	0	3	40	60
5	R22A0408	Electronic Circuit Analysis	3	0	0	3	40	60
6	R22A0484	Analog and Digital Communications Laboratory	0	0	2	1	40	60
7	R22A0485	Linear and Digital IC Applications Laboratory	0	0	2	1	40	60
8	R22A0486	Electronic Circuit Analysis Laboratory	0	0	2	1	40	60
9	R22A0487	Real Time Project/Field Based Project	0	0	4	2	40	60
10	R22A0061	Public policy & e Governance	0	0	2	0	**100**	-
		Total	**15**	**0**	**12**	**20**	**460**	**540**

III YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0409	Microprocessors & Microcontrollers	3	0	0	3	40	60
2	R22A6661	Artificial Intelligence & Machine Learning	3	0	0	3	40	60
3	R22A0210	Control Systems	3	0	0	3	40	60
4	OE-I	Open Elective –I	3	0	0	3	40	60
5		**Professional Elective–I**	3	0	0	3	40	60
	R22A0561	Computer Organization & Operating Systems						
	R22A0410	Data Communications and Computer Networks						
	R22A0411	Digital Design through Verilog HDL						
6	R22A0488	Microprocessors & Microcontrollers Laboratory	0	0	2	1	40	60
7	R22A6684	Artificial Intelligence & Machine Learning Laboratory	0	0	2	1	40	60
8	R22A0489	Application Development-I	0	0	4	2	40	60
9	R22A0084	Professional Development Skills-1	2	0	0	1	40	60
		Total	**17**	**0**	**8**	**20**	**360**	**540**

III YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0412	Antennas and Wave Propagation	3	0	0	3	40	60
2	R22A0413	Digital Signal Processing	3	0	0	3	40	60
3	R22A0414	VLSI Design	3	0	0	3	40	60
4	OE-II	Open Elective –II	3	0	0	3	40	60
5		**Professional Elective-II**	3	0	0	3	40	60
	R22A0415	Electronic Measurements & Instruments						
	R22A0416	Mobile Communications and Networks						
	R22A6215	Fundamentals of Cyber Security						
6	R22A0490	Digital Signal Processing Laboratory	0	0	2	1	40	60
7	R22A0491	VLSI Design Laboratory	0	0	2	1	40	60
8	R22A0492	Application Development-II	0	0	4	2	40	60
9	R22A0085	Professional Development Skills-2	2	0	0	1	40	60
		Total	**17**	**0**	**8**	**20**	**360**	**540**

IV YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0417	Microwave Engineering	3	1	0	4	40	60
2	R22A0418 R22A0419 R22A6666	**Professional Elective–III** Radar Systems CMOS Analog IC Design Artificial Neural Networks	3	0	0	3	40	60
3	R22A0420 R22A0421 R22A0422	**Professional Elective–IV** Network Security and Cryptography Satellite Communications Biomedical Signal Processing	3	0	0	3	40	60
4	**OE-II**	**Open Elective–II**	3	0	0	3	40	60
5	R22A0XXX	Professional Practice, Law& Ethics	3	0	0	2	40	60
6	R22A0493	Electro Magnetics and Microwave Laboratory	0	0	4	2	40	60
7	R22A0494	**Project Stage–I**	0	0	6	3	40	60
		Total	**15**	**1**	**10**	**20**	**280**	**420**

IV YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	MAX. MARKS	
							INT	EXT
1	R22A0335	Innovation, Start-Up & Entrepreneurship	4	0	0	4	40	60
2	R22A0423 R22A0424 R22A0425	**Professional Elective– V** Digital Image Processing 5G and beyond Communication System on Chip Architecture	3	0	0	3	40	60
3	R22A0572 R22A0426 R22A0427	**Professional Elective–VI** Multimedia Database Management Embedded System Design Wireless sensor Networks	3	0	0	3	40	60
4	R22A0495	Project Stage–II including Seminar	0	0	20	10	80	120
		Total	**10**	**0**	**20**	**20**	**200**	**300**

OPEN ELECTIVES

		OPEN ELECTIVE-I
1	R22A0551	JAVA PROGRAMMING
2	R22A1251	WEB DEVELOPMENT
3	R22A2151	INTELLECTUAL PROPERTY RIGHTS
4	R22A0351	ROBOTICS & AUTOMATION
5	R22A0451	ELECTRONICS FOR HEALTH CARE
6	R22A0251	RENEWABLE ENERGY SOURCES
7	R22A06751	PRINCIPLES OF DATA SCIENCE
8	R22A06752	BUSINESS ANALYTICS

		OPEN ELECTIVE-II
1	R22A0553	DATABASE SYSTEMS
2	R22A6753	BIG DATA ARCHITECTURE
3	R22A0352	DESIGN THINKING
4	R22A0552	PRINCIPLES OF CLOUD COMPUTING
5	R22A6951	INTERNET OF THINGS & ITS APPLICATIONS
6	R22A2152	NANO TECHNOLOGY
7	R22A0252	ELECTRICAL AND HYBRID VEHICLES
8	R22A6251	CYBER GOVERNANCE

B. TECH SYLLABUS
II YEAR- I SEMESTER

R22-REGULATION

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

II Year B.Tech. ECE- I Sem   L/T/P/C
                                                                                                  3/1/-/4

(R22A0401) ANALOG CIRCUITS

Course Objectives:
1. Learn the concepts of, load line analysis and biasing techniques
2. Learn the concepts of high frequency analysis of transistors.
3. To give understanding of various types of amplifier circuits
4. Learn the concepts of small signal analysis of BJT and FET
5. To familiarize the Concept of feedback in amplifiers so as to differentiate betweennegative and positive feedback.

UNIT – I

BJT Biasing: Transistor Biasing and Stabilization - Operating point, Need for biasing, DC Load line, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diode.
Analysis and Design of Small Signal Low Frequency BJT Amplifiers: Transistor Hybrid model, Analysis of single stage transistor amplifier using h-parameters: voltage gain, current gain, Input impedance and Output impedance. Comparison of transistor configurations in terms of A_i, R_i, A_v,and R_o.

UNIT –II

BJT Amplifiers-Frequency Response: Frequency response of an amplifier, Analysis at low and High Frequencies, Hybrid-pi (π) common emitter transistor model, Calculation of hybrid- π model parameters, Millers theorem and its dual.
Multistage Amplifiers: Distortion in amplifiers, Analysis of cascaded BJT amplifier, Darlington pair, coupling schemes-RC coupled amplifier, Transformer coupled amplifier, and Direct coupled Amplifier.

UNIT – III

FET-Biasing and FET Amplifiers: FET biasing: fixed bias and self bias. FET Amplifiers: Analysis of Common source (C.S), Common Drain (C.D) JFET Amplifiers, comparison of performance with BJT Amplifiers, Basic Concepts of MOSFET Amplifiers.

UNIT –IV

FEEDBACK AMPLIFIERS: Concept of Feedback and types, Effects of negative feedback on amplifiers characteristics, voltage series, current series, current shunt, and voltage shunt feedback amplifiers**.**

UNIT –V

OSCILLATORS: Classification of oscillators, Barkhausen criterion, RC phase Shift oscillator, Wien-bridge oscillator, LC oscillators- Hartley and Colpitts oscillator.

TEXT BOOKS:
1. Jacob Millman, Christos C Halkias -Integrated Electronics, McGraw Hill Education.
2. Robert L. Boylestead, Louis Nashelsky -Electronic Devices and Circuits theory, 11th Edition,2009, Pearson

REFERENCE BOOKS:
1. David A. Bell – Electronic Devices and Circuits, 5th Edition, Oxford.
2. Adel S. Sedra, Kenneth C. Smith- Microelectronic Circuits- Theory and Applications, Oxford.
3. Chinmoy Saha, Arindam Halder, Debaati Ganguly -Basic Electronics-Principles andApplications, 2018, Cambridge.

Course Outcomes:
Upon completing this course, the students will be able to
1. Design the amplifiers with various biasing techniques.
2. Design single stage amplifiers using BJT and FET
3. Design multistage amplifiers and understand the concepts of High Frequency Analysis of BJT.
4. Utilize the Concepts of negative feedback to improve the stability of amplifiers and positivefeedback to sustained oscillations.

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(R22A0261) NETWORK ANALYSIS AND SYNTHESIS

COURSEOBJECTIVES:
1. To solve the two port network parameters.
2. To recognize the behavior of R, L, C with DC excitation.
3. Concept of Series , parallel resonance and current locus diagrams
4. To know the pole zero location for driving point and transfer functions
5. To describe Foster and Cauer forms and the properties of immittance functions.

UNIT–I: TWO PORT NETWORKS:

Impedance Parameters, Admittance Parameters, Hybrid Parameters, Transmission (ABCD) Parameters, Conversion of one parameter to another parameter, Conditions for Reciprocity and symmetry, Illustrative problems.

UNIT–II: D.C.TRANSIENT ANALYSIS (FIRST & SECOND ORDER CIRCUITS):
Introduction to transient response and steady state response, Transient response of series – RL,RC, RLC Circuits for D.C excitation with Initial Conditions, Solutions using Differential Equations approach and Laplace Transform approach ,Illustrative problems.

UNIT-III: LOCUS DIAGRAMS & RESONANCE:
Locus diagrams: Locus diagrams of Series RL, RC circuits with variation of various parameters, parallel RL, RC circuits with variation of various parameters.
Resonance: Resonance-Series and Parallel circuits, Concept of Bandwidth and Quality factor.

UNIT–IV: NETWORK FUNCTIONS: Review of Network functions for one port and two port
networks: – pole zero location for driving point and transfer functions-Impulse response of Network functions from pole-zero plots.

UNIT-V: SYNTHESIS OF ONE PORT NETWORKS

 Synthesis of reactive one-ports by Foster's and Cauer methods (forms I and II) -Synthesis of LC, RC

and RL driving-point functions.

Text Books:
1. K. S. Suresh Kumar, —Electric Circuit Analysis‖, Pearson Publications, 2013.
2. 2. Ravish R. Singh, "Network Analysis and Synthesis", McGraw-Hill Education, 2013

References:

1. Franklin Kuo, ―Network Analysis and Synthesis‖, 2nd Ed.,Wiley India.
2. Van Valkenburg M.E., ―Introduction to Modern Network Synthesis,‖ Wiley Eastern, 1960 (reprint 1986).
3. Van Valkenburg M.E, ―Network Analysis,‖ Prentice Hall India, 2014.
4. Charles A. Desoer and Ernest S. Kuh, ―Basic Circuit Theory,‖ Tata McGraw Hill Edition.
5. Chakrabarti, A., "Circuit Theory Analysis and Synthesis", Dhanpat Rai& Co., Seventh - Revised edition, 2018
6. S. K. Bhattacharya, ―Network Analysis and Synthesis,‖ Pearson Education India.

COURSE OUTCOMES:
- Able to solve two port network parameters
- Able to analyze the transient and steady state analysis of RLC Circuits.
- Accomplish the computation of Quality factor, band width and current locus diagram for a given electrical circuit.
- Identify the properties and characteristics of network functions.
- Synthesize passive one-port networks using standard Foster and Cauer forms.

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II Year B.Tech. ECE- I Sem   **L/T/P/C**
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(R22A0402) DIGITAL LOGIC DESIGN

COURSE OBJECTIVES:

1. To understand common forms of number representation in digital electronic circuits andto be able to convert between different representations.
2. To implement simple logical operations using combinational logic circuits
3. To design combinational logic circuits, sequential logic circuits.
4. To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems.
5. Understanding of the different technologies related to HDLs, construct, compile and execute Verilog HDL programs using provided.
6. Designing digital circuits, behavior and RTL modeling of digital circuits using Verilog HDL.

UNIT –I:

Number Systems, Boolean Algebra and Switching Functions:
Number Systems, Base Conversion Methods, Complements of Numbers, Codes- Binary Codes, Binary Coded Decimal Code, Unit Distance Codes, Error Detecting and Error Correcting Codes, Hamming Code.

Boolean Algebra:
Basic Theorems and Properties, Switching Functions, Canonical and Standard Forms, Algebraic Simplification of Digital Logic Gates, Properties of XOR Gates, Universal Logic Gates.

UNIT –II

Minimization and Design of Combinational Circuits:
K- Map Method, up to Five variable K- Maps, Don't Care Map Entries, Combinational Design, Arithmetic Circuits, Comparator, decoder, Encoder, Multiplexers, De-Multiplexers, Code Converters.

UNIT –III:

Sequential Machines Fundamentals:
Introduction, Basic Architectural Distinctions between Combinational and Sequential circuits, classification of sequential circuits, The binary cell, The S-R-Latch Flip-Flop The D-Latch Flip-Flop,The "Clocked T" Flip-Flop, The " Clocked J-K" Flip-Flop, Conversion from one type of Flip-Flop to another.

UNIT –IV:

INTRODUCTION TO VERILOG HDL: Verilog as HDL, Levels of Design Description, Concurrency,Simulation and Synthesis, Programming Language Interface, Module.
Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Data Types, Operators.

UNIT –V:

GATE LEVEL MODELING: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Design of Flip- Flops with Gate Primitives, Delay.
MODELING AT DATAFLOW LEVEL: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments.
BEHAVIORAL MODELING: Introduction, Operations and Assignments, 'Initial' Construct, 'always' construct, , Design at Behavioral Level, The 'Case' Statement, 'If' and 'if-Else' Constructs

TEXT BOOKS:

1. Digital Design- Morris Mano, PHI, 3rd Edition.
2. Switching Theory and Logic Design-A. Anand Kumar, PHI, 2nd Edition.
3. T.R. Padmanabhan, B Bala Tripura Sundari, Design through Verilog HDL, Wiley 2009.
4. Verilog HDL - Samir Palnitkar, 2nd Edition, Pearson Education, 2009.
5.

REFERENCE BOOKS:

1. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rdEd,John Wiley & Sons Inc.
2. Digital Fundamentals – A Systems Approach – Thomas L. Floyd, Pearson, 2013.
3. Switching Theory and Logic Design – Bhanu Bhaskara –Tata McGraw Hill Publication, 2012
4. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.
5. Fundamentals of Digital Logic with Verilog Design - Stephen Brown,Zvonkoc Vranesic, TMH, 2nd Edition.
6. Advanced Digital Design with Verilog HDL - Michel D. Ciletti, PHI, 2009.

COURSE OUTCOMES:

Upon completion of the course, student should possess the following skills:

1. Be able to manipulate numeric information in different forms
2. Be able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
3. Be able to design and analyze small combinational circuits and to use standard combinational functions to build larger more complex circuits.
4. Be able to design and analyze Digital circuits
5. Verify behavior and Implement RTL models on FPGAs.

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(R22A0403) SIGNALS AND SYSTEMS

COURSE OBJECTIVES:
The main objectives of the course are:
1) Knowledge of time-domain representation and analysis concepts of basic elementary signals
2) Knowledge of Fourier Series for Continuous Time Signals
3) Knowledge of frequency-domain representation and analysis concepts F.T., L.T. & Z.T and Concepts of the sampling process.
4) Mathematical and computational skills needed to understand the principal of Linear System and Filter Characteristics of a System.
5) Mathematical and computational skills needed to understand the concepts of auto correlation and cross correlation and power Density Spectrum.

UNIT I:
INTRODUCTION TO SIGNALS: Elementary Signals- Continuous Time (CT) signals, Discrete Time (DT) signals, Classification of Signals, Basic Operations on signals.
FOURIER SERIES: Representation of Fourier series, Continuous time periodic signals, Dirichlet's conditions, Trigonometric Fourier Series, Exponential Fourier Series, Properties of Fourier series, Complex Fourier spectrum.

UNIT II:
FOURIER TRANSFORMS: Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Properties of Fourier transforms.
SAMPLING: Sampling theorem – Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing.

UNIT III:
SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS: Introduction to Systems, Classification of Systems, Linear Time Invariant (LTI) systems, impulse response, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics.

UNIT IV:
CONVOLUTION AND CORRELATION OF SIGNALS: Concept of convolution in time domain, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between convolution and correlation.

UNIT V:
LAPLACE TRANSFORMS: Review of Laplace transforms, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, Properties of L.T's relation between L.T's, and F.T. of a signal.
Z–TRANSFORMS: Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms, Region of convergence in Z-Transform, Inverse Z- Transform,

Properties of Z-transforms.

TEXT BOOKS:
1) "Signals & Systems", Special Edition – MRCET, McGraw Hill Publications, 2017
2) Signals, Systems & Communications – B.P. Lathi, BS Publications, 2003.
3) Signals and Systems – A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.
4) Signals and Systems – A. Anand Kumar, PHI Publications, 3rd edition.

REFERENCE BOOKS:
1) Signals & Systems – Simon Haykin and Van Veen, Wiley, 2nd Edition.
2) Network Analysis – M.E. Van Valkenburg, PHI Publications, 3rd Edn.,2000.
3) Fundamentals of Signals and Systems Michel J. Robert, MGH International Edition,2008.
4) Signals, Systems and Transforms – C. L. Philips, J. M. Parr and Eve A. Riskin, Pearson education.3rd Edition, 2004.

COURSE OUTCOMES:
After completion of the course, the student will be able to:
1) Understand the basic elementary signals
2) Determine the Fourier Series for Continuous Time Signals
3) Analyze the signals using F.T, L.T & Z.T and study the properties of F.T., L.T. & Z.T.
4) Understand the principal of Linear System and Filter Characteristics of a System.
5) Understand the concepts of auto correlation and cross correlation and power Density Spectrum.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

II Year B.Tech. ECE- I Sem   **L/T/P/C**
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(R22A0404) PROBABILITY THEORY AND STOCHASTIC PROCESSES

COURSE OBJECTIVES:
1) To expose the students to the basics of probability theory and random processes essential for their subsequent study of analog and digital communication.
2) To understand the basic concepts of probability, single and multiple random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon
3) To understand the basic concepts of random processes.
4) To understand the concept of correlation and spectral densities.
5) To understand the significance of linear systems with random inputs.

UNIT I:
PROBABILITY AND RANDOM VARIABLE
Probability: Set theory, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, and Independent Events, Bernoulli's trials.
The Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete and Continuous.

UNIT II:
DISTRIBUTION AND DENSITY FUNCTIONS AND OPERATIONS ON ONE RANDOM VARIABLE
Distribution and density functions: Distribution and Density functions, Properties, Binomial, Uniform, Exponential, Gaussian and Conditional Distribution and Conditional Density function and its properties, problems.
Operation on One Random Variable: Expected value of a random variable, function of a random variable, moments about the origin, central moments, variance, characteristic function, moment generating function.

UNIT III:
MULTIPLE RANDOM VARIABLES AND OPERATIONS ON MULTIPLE RANDOM VARIABLES
Multiple Random Variables: Joint Distribution Function and Properties, Joint density Function and Properties, Marginal Distribution and density Functions, conditional Distribution and density Functions, Statistical Independence.
Operations on Multiple Random Variables: Expected Value of a Function of Random Variables, Joint Moments about the Origin, Joint Central Moments.

UNIT IV:
Random Processes-Temporal Characteristics: The Random process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Statistical Independence and concept of Stationarity: First-Order Stationary Processes, Second-Order and Wide-Sense Stationarity, Nth-Order and Strict-Sense Stationarity, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions and its properties.

Linear system Response: Mean and Mean-squared value, Autocorrelation, Cross-Correlation

Functions.

UNIT V:
Random Processes-Spectral Characteristics: The Power Spectrum and its Properties, Relationship between Power Spectrum and Autocorrelation Function, the Cross-Power Density Spectrum and Properties, Relationship between Cross-Power Spectrum and Cross- Correlation Function.
Spectral characteristics of system response: Power Density Spectrum of response of linear system, Cross Power Spectral Density of input and output of a Linear System.

TEXT BOOKS:
1) Probability, Random Variables & Random Signal Principles -Peyton Z. Peebles, TMH, 4th Edition, 2001.
2) Probability and Random Processes-Scott Miller, Donald Childers,2Ed,Elsevier,2012

REFERENCE BOOKS:
1) Theory of probability and Stochastic Processes-Pradip Kumar Gosh, University Press
2) Probability and Random Processes with Application to Signal Processing - Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
3) Probability Methods of Signal and System Analysis- George R. Cooper, Clave D. MC Gillem, Oxford, 3rd Edition, 1999.
4) Statistical Theory of Communication -S.P. Eugene Xavier, New Age Publications 2003
5) Probability, Random Variables and Stochastic Processes Athanasios Papoulis and S.Unnikrishna Pillai, PHI, 4th Edition, 2002.

COURSE OUTCOMES
1) Exposed to the basics of probability theory and random processes essential for their subsequent study of analog and digital communication.
2) Understand the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.
3) Characterize probability models and function of random variables based on single & multiples random variables.
4) Evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits.
5) Understand the concept of random processes and determine covariance and spectral density of stationary random processes.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

II Year B.Tech. ECE- I Sem   **L/T/P/C**
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(R22A0481) ANALOG CIRCUITS LAB

COURSE OBJECTIVES:

1) To design Multistage, Power amplifiers and multivibrators according to given specifications.

2) To analyze various amplifiers such as Common Emitter, Common Source, Cascade and Cascode amplifiers.

3) To build circuit construction skills using circuit simulation software tool.

4) To simulate different amplifier circuits.

5) To design Feedback amplifiers

CYCLE-I: Design and Simulation in Simulation Laboratory using any Simulation Software. (Minimum eight experiments)

1. Common Emitter Amplifier
2. Common Source Amplifier
3. Two stage RC-Coupled amplifier
4. Current Shunt Voltage Feedback amplifier
5. Cascade Amplifier
6. Class A Power Amplifier
7. Switching Characteristics of a Transistor
8. Design a Bistable Multivibrator and draw its waveforms
9. Design a Astable Multivibrator and draw its waveforms
10. Design a Monostable Multivibrator and draw its waveforms

CYCLE-II: Components Testing in the Hardware Laboratory (Minimum 8 Experiments):

1. P-N Junction Diode and Zener Diode V-I Characteristics
2. Half -Wave Rectifier and Full Wave Rectifier With And Without Filter
3. Input And Output Characteristics Of Transistor C.E Configuration
4. FET Characteristics
5. Common Emitter Amplifier.
6. Two Stage RC Coupled Amplifier
7. Class A Power Amplifier
8. Class C Power Amplifier
9. Design a Bistable Multivibrator and draw its waveforms
10. Design a Astable Multivibrator and draw its waveforms
11. Design of Schmitt Trigger
12. Logic Gates

COURSE OUTCOMES

1) Design Multistage, Power amplifiers and multivibrators according to given specifications.

2) Analyze various amplifiers such as Common Emitter, Common Source, Cascade and Cascode amplifiers.

3) Build circuit construction skills using circuit simulation software tool.

4) Simulate different amplifier circuits.

5) Design Feedback amplifiers

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(R22A0482) DIGITAL LOGIC DESIGN LAB

COURSE OBJECTIVES:
1) To design basic combinational logic and sequential circuits using HDL.
2) To develop familiarity and confidence with designing, building and testing digital circuits, including the use of CAD tools.

HDL Simulation programs:

Programming can be done using any compiler. Download the programs on FPGA / CPLD boards and performance testing may be done using pattern generator / logic analyzer apart from verification by simulation using Cadence / Mentor Graphics / Synopsys / Equivalent front end CAD tools.

1. HDL code to realize all the logic gates
2. Design of 2-to-4 Decoder
3. Design of 8-to-3 Encoder
4. Design of Priority Encoder
5. Design of 8-to-1 Multiplexer
6. Design of 1 x 8 De-Multiplexer.
7. Design of 4-bit Binary to Gray Code Converter
8. Design of 2-bit Comparator
9. Design of Full Adder using 3 modeling styles
10. Design of Full Subtractor
11. Design of SR, JK, T & D Flip Flops

COURSE OUTCOMES:

1. Design and simulate the combinational and sequential logic circuits using hardware description languages.
2. Analyze the results of logic and timing simulations and to use these simulation results to debug digital systems.

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(R22A0483) BASIC SIMULATION LAB

COURSE OBJECTIVES:

1) To learn basic Operations on Matrices.

2) To simulate generation of basic waveforms and general operations on signals.

3) To Understand the Concept of auto correlation, cross correlation and Convolution of given Signal/ sequence and simulate it accordingly.

4) To learn various transforms like Fourier and Z-transform of various signals.

NOTE:

1) All the experiments are to be simulated using MATLAB or equivalent software

2) Minimum of 10 experiments are to be completed

List of experiments:

1) Basic operations on matrices.

2) Generation of various signals and Sequences (periodic and aperiodic) such as unit impulse, unit step, square, saw tooth, triangular, sinusoidal, ramp, sine.

3) Operations on signals and sequences such as addition, multiplication, scaling, shifting, folding, computation of energy and average power.

4) Finding the even and odd parts of signal/sequence and real and imaginary part of signal.

5) Convolution between signals and sequences.

6) Auto correlation and cross correlation between signals and sequences.

7) Verification of linearity properties of a given continuous /discrete system.

8) Verification of time invariance properties of a given continuous discrete system.

9) Computation of unit sample, unit step and sinusoidal response of the given LTI system and verifying stability properties.

10) Finding the Fourier transform of a given signal and plotting its magnitude and phase spectrum.

11) Locating the zeros and poles and plotting the pole zero maps in s-plane and z-plane for the given transfer function.

12) Sampling theorem verification.

COURSE OUTCOMES

After going through this course the student will be able to

1) Do the various operations on matrices.

2) Perform various operations on the signals including Time shifting, Scaling, Reversal, Amplitude Scaling.

3) Determine the correlation & Convolution between Signals and sequences.

4) Understand the various transforms of signals and sequences.

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(R22A0008) CONSTITUTION OF INDIA

Course Objectives:
Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- role and entitlement to civil and economic rights as well as the emergence of nationhood in
- the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution
- in 1917 and its impact on the initial drafting of the Indian Constitution.
- Course Outcomes: Students will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the
- arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the
- conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP]
- under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct
elections through adult suffrage in the Indian Constitution
- Discuss the passage of the Hindu Code Bill of 1956.

Unit - 1 History of Making of the Indian Constitution- History of Drafting Committee.
Unit - 2 Philosophy of the Indian Constitution- Preamble Salient Features
Unit - 3 Contours of Constitutional Rights & Duties - Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit - 4 Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions
Unit - 5 Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj:Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit - 6 Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Reading:
1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015

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MANDATORY COURSE – IV
(R22A0005) FOREIGN LANGUAGE-FRENCH

INTRODUCTION

In view of the growing importance of foreign languages as a communication tool in some countries of the world, French has been identified as one of the most popular languages after English. As a result, French program is introduced to develop the linguistic and communicative skills of engineering students and to familiarize them to the French communication skills. This course focuses on basic oral skills.

COURSE OBJECTIVES:

1) To inculcate the basic knowledge of the French language
2) To hone the basic sentence constructions in day to day expressions for communication in their vocation
3) To form simple sentences that aids in day-to-day communication
4) To prepare the students towards DELF A1
5) To develop in the student an interest towards learning languages.

UNIT - I:

Speaking: Introduction to the French language and culture –Salutations - French alphabet -Introducing people

Writing: Understand and fill out a form

Grammar: The verbs "to be ' and "to have '' in the present tense of the indicative

Vocabulary: The numbers from 1 to 20 - Professions- Nationalities

UNIT - II:

Speaking: Talk about one's family – description of a person - express his tastes and preferences - express possession - express negation

Writing: Write and understand a short message

Grammar: Nouns (gender and number) - Articles - The–erverbs in the present- Possessive adjectives - Qualifying adjectives

Vocabulary: The family – Clothes-Colors- The numbers from 1 to 100-The classroom

UNIT - III

Speaking: Talk about your daily activities - be in time - ask and indicate the date and time - talk about sports and recreation - express the frequency

Writing: A letter to a friend

Grammar: The expression of time– The –ir verbs in the present- The verbs do, go, take, come,-Adverbs-Reflexive verbs

Vocabulary: The days and months of the year-The sports-Hobbies

UNIT - IV
Speaking: Express the quantity - ask and give the price - express the need, the will and the capacity - compare (adjective) - speak at the restaurant / in the shops
Writing: A dialogue between a vendor and a customer at the market
Grammar: Verbs "to want", "to can"- Express capacity / possibility- Express will / desire
                 – the future tense
Vocabulary: The food – Meals-Fruits and vegetables– The parts of the body

UNIT - V
Speaking: Express the prohibition and the obligation - describe an apartment - talk about the weather / ask the weather - ask the opinion - give your opinion - express your agreement or disagreement
Writing: Descriptions
Grammar: Demonstrative adjectives-Prepositions-The verb 'must 'to indicate obligation and necessity in the present
Vocabulary: Seasons – Holidays-The city– Furniture

NOTE: The students are exposed to simple listening and reading activities.

REFERENCE BOOKS
 1) Apprenons le Français 1& 2, New Saraswati House, 2015
 2) A propos, A1, Langers International, 2010
 3) Easy French Step-by-step by Myrna Bell Rochester
 4) Ultimate French Beginner-Intermediate (Coursebook) By Livid Language
 5) Ã L'Aventure: An Introduction to French Language and Francophone Cultures by Evelyne Charvier-Berman, Anne C. Cummings.

COURSE OUTCOMES
 1) The students will be able to communicate in French at A1 level.
 2) The student will have an advantage in the competitive job market.
 3) This course benefits the graduates when pursuing study *opportunities* in the countries where French is the official language.

B.TECH II YEAR
II SEMESTER SYLLABUS

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(R22A0025) NUMERICAL METHODS AND COMPLEX VARIABLES

COURSE OBJECTIVES:
1) The expansion of a given function by Fourier series.
2) The Fourier sine and cosine transforms, properties, inverse transforms, and finite Fourier transforms.
3) Differentiation and integration of complex valued functions. Evaluation of integrals using Cauchy's integral formula.
4) Taylor's series, and Laurent's series expansions of complex functions, evaluation of integrals using residue theorem.
5) Transform a given function from z - plane to w – plane. Identify the transformations like translation, magnification-rotation, reflection-inversion, and Properties of bilinear transformations.

UNIT – I:
Fourier series: Definition of periodic function, Fourier expansion of periodic functions in a given interval of length 2. Determination of Fourier coefficients – Fourier series of even and odd functions – Half-range Fourier sine and cosine Expansions-Fourier series in an arbitrary interval.

UNIT – II:
Fourier Transforms: Fourier integral theorem - Fourier sine and cosine integrals, Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT – III:
Analytic functions: Complex functions and its representation on Argand plane, Concepts of limit, continuity, differentiability, Analyticity, and Cauchy-Riemann conditions, Harmonic functions – Milne – Thompson method. Line integral – Evaluation along a path and by indefinite integration – Cauchy's integral theorem (singly and multiply connected regions) – Cauchy's integral formula – Generalized integral formula.

UNIT – IV:
Singularities and Residues: Radius of convergence – Expansion in Taylor's series, Laurent's series. Singular point – Isolated singular point – pole of order m – essential singularity. Residue – Evaluation of residue by formula and by Laurent series – Residue theorem. Evaluation of integrals of the type

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{c} f(cos\Theta, sin\Theta)d\Theta$

UNIT – V:
Conformal mapping: Transformation of z-plane to w-plane by a function, Conformal transformation. Standard transformations- Translation; Magnification and rotation; Inversion and

reflection, Transformations like e^z, log z, z^2, and Bilinear transformation. Properties of Bilinear transformation, determination of bilinear transformation when mappings of 3 points are given (cross ratio).

TEXT BOOKS:
1) Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers.
2) Higher Engineering Mathematics by Ramana B.V, Tata McGraw Hill.
3) Complex Variables : Theory and Applications by H.S Kasana.

REFERENCES:
1) Complex Variables by Murray Spiegel, Seymour Lipschutz, et al. by Schaum's outlines series.
2) Advanced Engineering Mathematics by Kreyszig, John Wiley & Sons.
3) Advanced Engineering Mathematics by Michael Greenberg –Pearson publishers.

COURSE OUTCOMES:
After learning the concepts of this paper the student will be able to
1) Find the expansion of a given function by Fourier series in the given interval and hence this concept can be used in the analysis of signals.
2) Find Fourier sine, cosine transforms and inverse transformations; hence this concept can be used in designing electrical circuits, signal processing and image processing etc.
3) Analyze the complex functions with reference to their analyticity and integration using Cauchy's integral theorem.
4) Find the Taylor's and Laurent series expansion of complex functions and solution of improper integrals can be obtained by Cauchy's-Residue theorem.
5) Understand the conformal transformations of complex functions can be dealt with ease and which can be used in different physical situations.

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(R22A0405) ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

OBJECTIVES

The course objectives are:
1. To introduce the student to the coordinate system and its implementation to electromagnetics.
2. To elaborate the concept of electromagnetic waves and transmission lines, and their practical applications.
3. To study the propagation, reflection, and transmission of plane waves in bounded unbounded media.
4. To present the concepts of transmission lines, and this is a prerequisite course for "Antennas"

UNIT - I:

Electrostatics: Review of coordinate system, Coulomb's Law, Electric Field Intensity - Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Equations for Electrostatic Fields, , Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations Illustrative Problems.

UNIT - II:

Magnetostatics: Biot - Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law,

Maxwell's Equations (Time Varying Fields): Faraday's Law, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms, Conditions at a Boundary Surface: Dielectric - Dielectric, Illustrative Problems.

UNIT - III:

EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves - Definition, All Relations Between E & H , Reflection and Refraction of Plane Waves - Normal for both perfect Conductor and perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Poynting Vector and Poynting Theorem , Illustrative Problems.

UNIT - IV:

Transmission Lines - I: Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristics Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, , Distortion - Condition for Distortionless Transmisssion and Minimum Attenuation, Illustrative Problems.

UNIT - V:

Transmission Lines - II: SC and OC Lines, Input Impedance Relations, Reflection Coefficient, VSWR, Smith Chart - Configuration and Applications, Illustrative Problems.

TEXT BOOKS:

1. Elements of Electromagnetics - Matthew N. O. Sadiku, 4th., Oxford Univ. Press.
2. Electromagnetic Waves and Radiating Systems - E.C. Jordan and K. G. Balmain, 2nd Ed., 2000, PHI.
3. Transmission Lines and Networks - Umesh Sinha, Satya prakashan, 2001, (Tech. India Publications), New Delhi.

REFERENCES BOOKS:

1. Engineering Electromagnetics - Nathan Ida, 2ndEd., 2005, Springer (India) Pvt. Ltd., New Delhi.
2. Engineering Electromagnetics - William H. Hay Jr. and John A. Buck, 7thEd., 2006, TMH.
3. Electromagnetics Fields Theory and Transmission Lines - G. Dashibhushana Rao, Wiley India, 2013.
4. Networks, Lines and Fields - John D. Ryder, 2nd Ed., 1999, PHI.

OUTCOMES
Upon the successful completion of the course, students will be able to;
1. Study time varying Maxwell equations and their applications in electromagnetic problems
2. Determine the relationship between time varying electric and magnetic field and electromotive force
3. Analyze basic transmission line parameters in phasor domain
4. Use Maxwell equation to describe the propagation of electromagnetic waves in vaccum
5. Show how waves propagate in dielectrics and lossy media
6. Demonstrate the reflection and refraction of waves at boundaries
7. Explain the basic wave guide operation and parameters

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(R22A0406) ANALOG & DIGITAL COMMUNICATIONS

COURSE OBJECTIVES:

1) To analyze and design various continuous wave Amplitude modulation and demodulation techniques.
2) To understand the concept of Angle modulation and demodulation, and the effect of noise on it.
3) To attain the knowledge about the functioning of different AM, FM Transmitters and Receivers.
4)   To analyze and design the various Pulse Modulation Techniques (Analog and Digital Pulsemodulation)
5) To understand the concepts of Digital Modulation Technique, Baseband transmission and Optimum Receiver.

UNIT – I
Amplitude Modulation: Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves -Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, COSTAS Loop, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, Vestigial side band modulation.

UNIT - II
Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single tone Frequency modulation, Narrow band FM, Wide band FM, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Signal- Armstrong Method, Direct method- Reactance Modulator, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM., Concept of Pre-emphasis and de-emphasis.

UNIT - III
Transmitters: Classification of Transmitters, AM Transmitters, FM Transmitters
Receivers: Radio Receiver - Receiver Types - Tuned radio frequency receiver, Superhetrodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, AGC, Amplitude limiting, FM Receiver, Comparison of AM and FM Receivers.

UNIT - IV
Pulse Modulation: Types of Pulse modulation- PAM, PWM and PPM. Comparison of FDM and TDM.
Pulse Code Modulation: PCM Generation and Reconstruction, Quantization Noise, Non- Uniform Quantization and Companding, DPCM, DM and Adaptive DM, Noise in PCM and DM.

UNIT - V

Digital Modulation Techniques: ASK- Modulator, Coherent ASK Detector, FSK- Modulator and Non-Coherent FSK Detector, FSK detection using PLL BPSK- Modulator, Coherent BPSK Detection, Principles of QPSK, Differential PSK and QAM.

Baseband Transmission and Optimal Reception of Digital Signal: A Baseband Signal Receiver, Probability of Error, Optimum Receiver, ISI, Eye Diagrams.

TEXTBOOKS:
1) Analog and Digital Communications – Simon Haykin, John Wiley, 2005.
2) Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5th Edition, 2009, PHI.
3) Communication Systems-Simon Haykin, 2nd Edition.

REFERENCE BOOKS:
1) Principles of Communication Systems - Herbert Taub, Donald L Schilling, Goutam Saha, 3rd Edition, McGraw-Hill, 2008.
2) Analog and Digital Communication – K. Sam Shanmugam, Willey, 2005.

COURSE OUTCOMES:
Upon completing this course, the student will be able to
1) Analyze and Design various continuous wave Amplitude modulation and demodulation techniques.
2) Understand the concept of Angle modulation and demodulation, and the effect of noise on it.
3) Attain the knowledge about the functioning of different AM, FM Transmitters and Receivers.
4)   Analyze and design the various Pulse Modulation Techniques (Analog and Digital Pulsemodulation)
5) Understand the concepts of Digital Modulation Technique, Baseband transmission and Optimum Receiver.

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(R22A0407) LINEAR AND DIGITAL IC APPLICATIONS

COURSE OBJECTIVES:
1) To introduce the basic building blocks of linear integrated circuits.
2) To teach the linear and non-linear applications of operational amplifiers.
3) To introduce the theory and applications of analog multipliers and PLL.
4) To teach the theory of ADC and DAC.
5) To introduce the concepts of wave form generation and introduce some special function ICs.

UNIT – I:
Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation – Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators.

UNIT – II:
Op-Amp, IC-555 & IC 565 Applications: Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, waveform Generators – Triangular, Saw tooth, Square wave, IC555 Timer – Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL – Block Schematic, Description of Individual Blocks, Applications.

UNIT – III:
Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted Resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs – Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT – IV:
Digital Integrated Circuits: Classification of Integrated Circuits, Comparison of Various Logic Families, CMOS Transmission Gate.
Combinational Logic ICs – Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs – Code Converters, Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Parity Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT – V:
Sequential Logic IC's and Memories: Familiarity with commonly available 74XX & CMOS 40XX Series ICs – All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.
Memories – ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

TEXT BOOKS:
1) Linear Integrated Circuits – D. Roy Chowdhury, New Age International (p) Ltd, 2nd Edition,2003.
2) Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 2003.
3) Digital fundamentals – Floyd and Jain, Pearson Education,8th Edition ,2005

REFERENCES BOOKS:

1) Op Amps & Linear Integrated circuits-Concepts and Applications James M.Fiore, Cengage Learning/Jaico,2009.
2) Operational Amplifiers with linear integrated circuits by K.Lal kishore-Pearson,2009.
3) Linear integrated circuits and applications-Salivahana,TMH.
4) Modern digital electronics-RP Jain-4/e-TMH,2010.
5) Digital design principles and practices-John.F.Wakerly 3/e,2005.
6) Operational amplifiers with linear integrated cuircuits,4/e William D.Stanley, Pearson education India,2009.

COURSE OUTCOMES:

1) A thorough understanding of operational amplifiers with linear integrated circuits.
2) Also students will be able to design circuits using operational amplifiers for various applications.
3) Understanding of the different families of digital integrated circuits and their characteristics.
4) Understanding of D/A and A/D Converters.
5) Design of combinational and sequential circuits using the TTL & CMOS ICs.

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(R22A0408) ELECTRONIC CIRCUIT ANALYSIS

Course Objectives:

Upon completing this course, the student twill be able to

1. Learn the concepts of Power Amplifiers.
2. To give understanding of tuned amplifier circuits
3. Understand various multivibrators using transistors and sweep circuits.

UNIT – I

Large Signal Amplifiers: Class A Power Amplifier- Series fed and Transformer coupled, Conversion Efficiency, Class B Power Amplifier- Push Pull and Complimentary Symmetry configurations, Conversion Efficiency, Principle of operation of Class AB and Class –C and D Amplifiers.

UNIT- II

Tuned Amplifiers: Introduction, single Tuned Amplifiers – Q-factor, frequency response, Double Tuned Amplifiers – Q-factor, frequency response, Concept of stagger tuning and synchronous tuning

UNIT - III

Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

UNIT - IV

Time Base Generators: General features of a Time base Signal, Methods of Generating Time Base Waveform, concepts of Transistor Miller and Bootstrap Time Base Generator, Methods of Linearity improvement.

UNIT - V

Synchronization and Frequency Division: Pulse Synchronization of Relaxation Devices, Frequency division in Sweep Circuits, Stability of Relaxation Devices, Astable Relaxation Circuits, Monostable Relaxation Circuits, Synchronization of a Sweep Circuit with Symmetrical Signals.

Sampling Gates: Basic operating principles of Sampling Gates, Unidirectional and Bi-directional Sampling Gates, Four Diode Sampling Gate, Reduction of pedestal in Gate Circuits

TEXT BOOKS:

1. Jacob Millman, Christos C Halkias - Integrated Electronics, , McGraw Hill Education.

2. J. Millman, H. Taub and Mothiki S. PrakashRao - Pulse, Digital and Switching Waveforms –2nd Ed., TMH, 2008,

REFERENCE BOOKS:

1. David A. Bell - Electronic Devices and Circuits, 5th Ed., Oxford.

2. Robert L. Boylestead, Louis Nashelsky - Electronic Devices and Circuits theory, 11th Ed.,Pearson, 2009

3. Ronald J. Tocci - Fundamentals of Pulse and Digital Circuits, 3rd Ed., 2008.

4. David A. Bell - Pulse, Switching and Digital Circuits, 5th Ed., Oxford, 2015.

Course Outcomes:

Upon completing this course, the student will be able to

1. Design the power amplifiers

2. Design the tuned amplifiers and analyze is frequency response

3. Design Multivibrators and sweep circuits for various applications.

4. Utilize the concepts of synchronization, frequency division and sampling gates

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(R22A0484) ANALOG AND DIGITAL COMMUNICATIONS LABORATORY

COURSE OBJECTIVES:
1) Familiarize the students with basic analog and digital communication systems.
2) Integrate the concepts of analog modulation techniques studied in theory with experiments.
3) Integrate the concepts of pulse modulation techniques studied in theory with experiments.
4) Integrate the concepts of Time and Frequency division multiplexing techniques studied in theory with experiments.
5) Integrate the concepts of digital modulation techniques studied in theory with experiments so that the students appreciate the knowledge gained from the theory course.

Note: Minimum 12 Experiments should be conducted: All these experiments are to be simulated first using MATLAB, COMSIM or any other simulation package and then to be realized in hardware.

LIST OF EXPERIMENTS
Analog Communication Experiments:
1) (i) Amplitude modulation and demodulation (ii) Spectrum analysis of AM
2) (i) Frequency modulation and demodulation (ii) Spectrum analysis of FM
3) DSB-SC Modulator & Detector
4) SSB-SC Modulator & Detector (Phase Shift Method)
5) Frequency Division Multiplexing & De multiplexing
6) Pulse Amplitude Modulation & Demodulation
7) Pulse Width Modulation & Demodulation
8) Pulse Position Modulation & Demodulation

Digital Communication Experiments:
1) PCM Generation and Detection
2) Time Division Multiplexing & Demultiplexing
3) Differential Pulse Code Modulation & Demodulation
4) Delta Modulation
5) Amplitude Shift Keying: Generation & Detection
6) Frequency Shift Keying: Generation & Detection
7) Binary Phase Shift Keying: Generation & Detection
8) Generation & Detection of DPSK

COURSE OUTCOMES
1. Analyze and understand the operation of a basic communication system.
2. Design the different analog modulation, demodulation circuits such as amplitude and frequency modulation, and also analyze their Spectrum.
3. Design various analog and digital pulse modulation techniques such as PAM, PPM, PWM, PCM, DPCM and DM.
4. Design and Analyze the TDM & FDM circuits.
5. Design the different digital modulation and demodulation circuits such as ASK, FSK, BPSK, and Differential PSK.

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II Year B.Tech. ECE- II Sem   **L/T/P/C**
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(R22A0485) LINEAR AND DIGITAL IC APPLICATIONS LABORATORY

COURSE OBJECTIVES:

1)   To study the hands-on experience on 741 Op-Amp applications.
2)   To apply the perceptions of IC 555 Timer and PLL applications.
3)   To Design and verify the IC 723 Voltage Regulator and Three terminal voltage regulators.
4)   To apply the concepts of basic combinational logic and sequential circuit elements using HDL program.
5)   To develop familiarity and confidence with designing, building and testing digital circuits, including the use of CAD tools.

Note: To perform any twelve experiments (choosing at least five from each part).

Part – I: Linear IC Experiments

1.   OP AMP Applications – Adder, Subtractor, Comparators.
2.   Integrator and Differentiator Circuits using IC 741.
3.   Active Filter Applications – LPF, HPF (first order)
4.   IC 741 Waveform Generators – Sine, Square wave and Triangular waves.
5.   IC 555 Timer – Monostable and Astable Multivibrator Circuits.
6.   Schmitt Trigger Circuits – Using IC 741
7.   IC 565 – PLL Applications.
8.   Voltage Regulator using IC 723, Three Terminal Voltage Regulators – 7805, 7809, 7912.

EQUIPMENT REQUIRED:
1)   20 MHz / 40 MHz / 60 MHz Oscilloscope.
2)   1 MHz Function Generator (Sine, Square, Triangular and TTL).
3)   Regulated Power Supply.
4)   Multimeter / Volt Meter.

Part – II: HDL Simulation programs:

Programming can be done using any compiler. Download the programs on FPGA / CPLD boards and performance testing may be done using pattern generator / logic analyzer apart from verification by simulation using Cadence / Mentor Graphics / Synopsys / Equivalent front end CAD tools.
1.   HDL code to realize all the logic gates
2.   Design of 2-to-4 decoder
3.   Design of 8-to-3 encoder (without and with Priority)
4.   Design of 8-to-1 multiplexer and 1 x 8 Demultiplexer.
5.   Design of 4-bit binary to gray code converter
6.   Design of 4-bit comparator
7.   Design of Full adder using 3 modeling styles
8.   Design of flip flops: SR, JK, T
9.   Design of 4-bit binary, BCD counters (synchronous/ asynchronous reset)

COURSE OUTCOMES

1.   Understand the various applications of linear IC's like 741 Op-amp applications.

2.   Design the Multivibrator circuits using IC 555 and determine the frequency of oscillation and time delay.

3.   Understand the functionality of IC 723 voltage regulator and determine the load and line regulations.

4.   Design and simulate the combinational and sequential logic circuits using hardware description languages.

5.   Analyze the results of logic and timing simulations and to use these simulation result to debug digital systems.

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(R22A0486) ELECTRONIC CIRCUIT ANALYSIS LABARATORY

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Course Outcomes:
Upon completing this course, the students will be able to
1. Design power amplifiers and find its efficiency
2. Design tuned amplifiers and find its Q-factor
3. Design various multivibrators and sweep circuits. Understand the necessity of linearity
4. Design sampling gates and understanding the concepts of frequency division

List of Experiments:
Minimum of 9 experiments to be performed.

1. Design transformer coupled class A power amplifier and draw the input and output waveforms find its efficiency
2. Design class B power amplifier and draw the input and output waveforms, find 2nd order and above harmonics.
3. Prove that the complementary symmetry push pull amplifier eliminates cross over distortion.
4. Design class C power amplifier and draw the input and output waveforms
5. Design a single tuned amplifier and determine the Q of its tuned circuit practically.
6. Design a Bistable Multivibrator and analyze the effect of commutating capacitors and draw the wave forms at base and collector of transistors.
7. Design an Astable Multivibrator and draw the wave forms at base and collector of transistors.
8. Design a Monostable Multivibrator and draw the input and output waveforms
9. Draw the response of Schmitt trigger for gain of greater than and less than one.
10. Design a Bootstrap sweep circuit using BJT and draw its output time base waveform
11. Design a Miller sweep circuit using BJT and draw its output time base waveform.
12. Design a constant current sweep generator and draw input and output waveforms
13. Design unidirectional and bidirectional sampling gates
14. Prove practically Schmitt Trigger generates square wave
15. Frequency division with sweep circuit

Major Equipment required for Laboratories:
1. Computer System with latest specifications connected
2. Window XP or equivalent
3. Simulation software-Multisim or any equivalent simulation software
4. Regulated Power Suppliers, 0-30V 5. 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
6. Functions Generators-Sine and Square wave signals
7. Multimeters
8. Electronic Components

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(R22A0487) REAL TIME PROJECT/ FIELD BASED PROJECT

Project Requirements:

A project will typically involve the analysis, improvement, optimization or design of a process, operation, complex system or a component thereof. The student can select the project based on his/her areas of interest and to allow the course coordinator to make a judgment on the suitability of the project.

Project Definition:

•Brief background on the project
•Rationale for the project in terms of expected benefit and building on previous work
•Project scope, defining the area or department within which the project will be executed and solution developed.
Key policies or constraints that might apply to the project solution development, expected key deliverables of the project.
•Industrial engineering tools and techniques that can be used (if possible).
•A suggested high level outline of the approach that can be followed (if possible).
•A mentor/sponsor to guide the student from an industry perspective.
•Project application process and contact details.

Project Phases

The project consists of the following sequential phases:

Phase	Description

1	**Project planning**
	    a. Background
	    b. Problem Statement
	    c. Project Aim & Project Approach

2	**Problem Investigation and Literature Review**
	    a. Critical analysis of literature and the problem environment
	    b. Identification of solution requirements and solution evaluation measures
	    c. Data gathering
	    d. Suggestion of an appropriate solution development approach

3	**Detailed design and/or problem solving**
4	**Completion and presentation of results**
5	Submission of Preliminary Project Report for assessment
6	Viva-Voce Examination

Important criteria for the evaluation of a project are:

1. Clarity on the expected benefit or value add of the project
2. The application of industrial engineering principles, tools and techniques
3. Clear evidence of engineering analysis and design, that is an improved or new approach, model, process, facility or system needs to be developed or formulated. In exceptional cases the project might be purely investigative in nature, but the complexity and value add need to be clear.

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(R22A0061) PUBLIC POLICY AND GOVERNANCE

Course objectives:

1. To make the students understand in-depth analysis of public policy and to solve its ills prevailing in the society.

2. To provide an opportunity for the students to learn the basic areas of public policy analysis, implementation and evaluation.

3. To make understand the process and various approaches in public policy making

4. To understand the theories and issues of social coordination and the nature of all patterns of rule.

5. To make the students understand the techniques of governance and emerging trends in public and private governance its policy-making and implementation.

Unit-I

Introduction of Public Policy: Definition, Nature, Scope and Importance of Public Policy, Evolution of Public Policy and Policy Sciences, Public Policy and Public Administration. **Approaches to Public Policy Analysis:** The Process Approach, The Logical Positivist Approach, The Phenomenological Approach, The Participatory Approach and Normative Approach

Unit-II

Theories and Process of Public Policy Making: Theories and Models of Policy Making, Perspectives of Policy Making Process, Institutions of Policy Making.

Unit-III

Policy Implementation and Evaluation: Concept of Policy Implementation, Techniques of Policy Implementation, Concept of Policy Evaluation, Constraints of Public Policy Evaluation

Unit-IV

Introduction of Governance: Definitions, Issues and Controversies, Reinventing Government, Reforming Institutions: The State, Market and Public domain. **State and Governance:** Origin and types of State, Democratic State and Democratic Administration, Neo-Liberalism and Rolling Back State and Governance as Government.

Unit-V

Citizen and Techniques of Governance: Rule of Law and Human Rights, Accountability, Participation, Representation. **Techniques of Governance**: Openness and Transparency, Citizen Charter, Social Audit.

Emerging Trends in Public and Private Governance: An Overview, Market, Civil Society, Information and Communication Technology.

Text and Reference books

1. Introduction to Public Policy- Charles Wheelan, Naked Economics 2010.
2. Birkland Thomas A., (2005), An Introduction to The Policy Process: Theories, Concepts, And Models of Public Policy Making, Armonk; M.E. Sharpe.
3. Anderson J.E., (2006) Public Policy-Making: An Introduction, Boston, Houghton
4. Bardach, Eugene (1977), The Implementation Game: What Happens After a Bill Becomes a Law, Cambridge, MA: MIT.
5. Bell, S., and Hind moor, A. (2009) Rethinking Governance: The Centrality of the State in Modern Society, Cambridge: Cambridge University Bell, Stephen and Andrew Hind moor.
6. Joyee M. Mitchell & William C. Mitchell, Political Analysis & Public Policy: An Introduction to Political Science, Thomson Press Limited, New Delhi, 1972.
7. R.K. Sapru, Public Policy, Art and Craft of policy Analysis, PHI learning private limited, New Delhi, 2011.
8. Brian W. Hogwood & Lewis A. Gunn, Policy Analysis for the Real world, Oxford University, Press, 1986.

Course Outcomes:

1. Understand public policy analysis and they will be able to understand policy evaluation and implementation.

2. Understand the public policy and governance on the largest gamut of its canvas.

3. Students will understand the what are emerging trends in public and private governance and various theories in public policy making

4. Understands various concepts, and techniques of governance and its policy-making decisions

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(R22A0409) MICROPROCESSORS & MICROCONTROLLERS

COURSE OBJECTIVES:

1. To understand the basics of microprocessors and microcontrollers architectures and its functionalities.
2. To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques.
3. To design and develop Microprocessor/ microcontroller-based systems for real-time applications using low level language like ALP.
4. To create an exposure to basic peripherals, its programming and interfacing techniques.
5. To understand the concepts of ARM processor.

UNIT –I

8086 ARCHITECTURE:

Architecture of 8086, Register Organization, Physical Memory Organization, Signal descriptions of 8086- Common Function Signals, Minimum and Maximum mode signals, Timing diagrams.

UNIT –II

INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING OF 8086:

Addressing modes, Instruction Set, Assembler Directives, Procedures, Macros, Simple Programs involving Logical, Branch and Call Instructions, Sorting, Evaluating Arithmetic Expressions, String Manipulations.

UNIT –III

I/O INTERFACE: 8255 PPI, Various Modes of Operation and Interfacing to 8086, D/A and A/D Converter, Stepper motor, Interfacing of DMA controller 8257.Memory Interfacing to 8086, Interrupt Structure of 8086, Interrupt Vector Table.

COMMUNICATION INTERFACE: Serial Communication Standards, Serial Data Transfer Schemes, 8251 USART Architecture and Interfacing.

UNIT –IV

INTRODUCTION TO MICROCONTROLLERS: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051, Simple Programs.

UNIT –V

8051 REAL TIME CONTROL: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters.

ARM PROCESSOR: Fundamentals, Registers, Current program status register, Pipeline

TEXT BOOKS:
1. D. V. Hall, Microprocessors and Interfacing, TMGH, 2nd Edition2006.
2. Kenneth. J. Ayala, The 8051 Microcontroller, 3rd Ed., Cengage Learning.
3. ARM System Developer's Guide: Designing and Optimizing System Software- Andrew N. Sloss, Dominic Symes, Chris Wright, Elsevier Inc.,2007

REFERENCE BOOKS:
1. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, TMH, 2nd Edition2006.
2. The 8051Microcontrollers, Architecture and Programming and Applications - K.Uma Rao, Andhe Pallavi, Pearson, 2009.
3. Micro Computer System 8086/8088 Family Architecture, Programming and Design – Liu and GA Gibson, PHI, 2ndEd.
4. Microcontrollers and Application – Ajay. V. Deshmukh, TMGH, 2005.

COURSE OUTCOMES:
1. After going through this course, the student will
2. Learn the internal organization of popular 8086/8051 microprocessors / microcontrollers.
3. Learn hardware and software interaction and integration.
4. Learn the Assembly level language programming.
5. Learn the Memory and Interfacing of different external peripheral devices with microprocessors and micro controllers.
6. Learn the developing an assembly language program for specified application.

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(R22A6661) ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

COURSE OBJECTIVES:
1. To train the students to understand different types of AI agents.
2. To understand various AI search algorithms.
3. Fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation.
4. To introduce the basic concepts and techniques of machine learning and the need for Machine learning techniques for real world problem.
5. To provide understanding of various Machine learning algorithms and the way to evaluate the performance of ML algorithms.

UNIT - I:
Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

UNIT - II:
Advanced Search: Constructing Search Trees, Stochastic Search, AO* Search Implementation, Minimax Search, Alpha-Beta Pruning Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

UNIT - III:
Machine-Learning: Introduction. Machine Learning Systems, Forms of Learning: Supervised and Unsupervised Learning, reinforcement – theory of learning – feasibility of learning – Data Preparation– training versus testing and split.

UNIT - IV:
Supervised Learning:
Regression: Linear Regression, multi linear regression, Polynomial Regression, logistic regression, Non-linear Regression, Model evaluation methods. **Classification:** – support vector machines (SVM), Naïve Bayes classification
UNIT - V:
Unsupervised learning
Nearest neighbor models – K-means – clustering around medoids – silhouettes – hierarchical clustering – k-d trees, Clustering trees – learning ordered rule lists – learning unordered rule.
Reinforcement learning- Example: Getting Lost -State and Action Spaces

TEXT BOOKS:
1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice Hall, 2010.
2. MACHINE LEARNING An Algorithmic Perspective 2nd Edition, Stephen Marsland,2015, by Taylor & Francis Group, LLC
3. Introduction to Machine Learning, The Wikipedia Guide

REFERENCES:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shiva sankar B. Nair, The McGraw Hill publications, Third Edition, 2009. 2. George F. Luger,
2. Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.
3. Introduction to Machine Learning, Second Edition, Ethem Alpaydın, the MIT Press, Cambridge, Massachusetts, London, England.
4. Machine Learning, Tom M. Mitchell, McGraw-Hill Science, ISBN: 0070428077
5. Understanding Machine Learning: From Theory to Algorithms, c 2014 by Shai Shalev-Shwartz and Shai Ben-David, Published 2014 by Cambridge University Press.

COURSE OUTCOMES:
1. Understand the informed and uninformed problem types and apply search strategies to solve them.
2. Apply difficult real-life problems in a state space representation so as to solve those using AI techniques like searching and game playing.
3. Apply machine learning techniques in the design of computer systems
4. To differentiate between various categories of ML algorithms
5. Design and make modifications to existing machine learning algorithms to suit an

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(R22A0210) CONTROL SYSTEMS

COURSE OBJECTIVES:

1. To learn the basic principles of control system, transfer function representation using block diagram and signal flow graph.
2. To analyze the time response and the effect of different controllers.
3. To study and analyze the different methods of stability in time domain.
4. To understand the frequency domain specifications and different methods of stability in frequency domain.
5. To learn the basic concepts of state space analysis and solutions to time invariant state equations.

UNIT - I:

INTRODUCTION: Concept of control system, Classification of control systems - Open loop and closed loop control systems, Differences, Examples of control systems- Effects of feedback, Feed Back Characteristics.

TRANSFER FUNCTION REPRESENTATION: Block diagram algebra, determining the Transfer function from block diagrams, Representation by Signal flow graphs - Reduction using Mason's gain formula – Transfer function of SFG's.

UNIT - II:

TIME RESPONSE ANALYSIS: Standard test signals, Time response of first order systems, Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications, Steady state response, Steady state errors and error constants. PID controllers, Effects of proportional derivative, Proportional integral systems on steady state error.

UNIT - III:

STABILITY ANALYSIS IN S-DOMAIN: The concept of stability – Routh-Hurwitz's stability criterion - Qualitative stability and conditional stability – Limitations of Routh-Hurwitz's stability.

ROOT LOCUS TECHNIQUE: Concept of root locus - Construction of root locus.

UNIT - IV:

FREQUENCY RESPONSE ANALYSIS: Introduction, Frequency domain specifications, Bode plot diagrams-Determination of Phase margin and Gain margin, Stability analysis from Bode plots.

UNIT - V:

STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS: Concepts of state, state variables and state model, Derivation of state models from block diagrams, Diagonalization, Solving the time invariant state equations, State Transition Matrix and its properties, Concepts of Controllability and Observability.

TEXT BOOKS:

1. Control Systems Engineering by I. J Nagrathan and M.Gopal, new age international (P) Limited, Publishers.
2. Control Systems by Anand Kumar, PHI.
3. Control Systems Engineering by A. NagoorKani, RBA Publications.

REFERRENCE BOOKS:

1. Control Systems Theory and Applications by S. K. Bhattacharya, Pearson.
2. Control Systems Engineering by Palani, TMH.
3. Control Systems by N. K. Sinha, New Age International (P) Limited Publishers.
4. Control Systems by S.Hasan Saeed, KATSON BOOKS
5. Solutions and Problems of Control Systems by A.K. Jairath, CBS Publishers.

COURSE OUTCOMES:

1. At the end of this course, students would be able to:
2. Explain the basic principles of control system, transfer function representation using block diagram and signal flow graph.
3. Analyze the time response and effect of different controllers.
4. Study the different methods of stability in time domain.
5. Analyze the frequency domain specifications and stability methods in frequency domain.
6. Explain the basic concepts of state space analysis and solutions to time invariant state equations.

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PROFESSIONAL ELECTIVE–I
(R22A0561) COMPUTER ORGANIZATION & OPERATING SYSTEMS

COURSE OBJECTIVES:
1. Ability to understand the basic structure of machine instructions and programs
2. Ability to understand - Memory system basic Concepts, Semiconductor RAM Memories, Static memories, Asynchronous DRAMS, Read Only Memories, Cache Memories and Virtual Memories.
3. Ability to understand - How I/O devices are accessed and its principles
4. Introduce basic concepts of operating system and process management
5. Discuss various CPU scheduling algorithms and problems of process synchronization & demonstrate different methods for handling deadlock

UNIT - I:

Basic Structure of Computers: Computer Types, Functional UNIT, Basic Operational Concepts, Bus, Structures, Software, Performance, Multiprocessors and Multi Computers, Data Representation, Fixed Point Representation, Floating - Point Representation. Register Transfer Language and Micro Operations: Register Transfer Language, Register Transfer Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers Computer Instructions - Instruction Cycle. Memory - Reference Instructions, Input - Output and Interrupt, STACK Organization, Instruction Formats, Addressing Modes, DATA Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

UNIT - II:

Micro Programmed Control: Control Memory, Address Sequencing, Micro program Examples, Design of Control Unit, Hard Wired Control, Micro programmed Control. The Memory System: Basic Concepts of Semiconductor RAM Memories, Read-Only Memories, Cache Memories Performance Considerations, Virtual Memories secondary Storage, Introduction to RAID.

UNIT - III:

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input-Output Processor (IOP), Serial Communication; Introduction to Peripheral Components, Interconnect (PCI) Bus, Introduction to Standard Serial Communication Protocols like RS232, USB, IEEE1394.

UNIT - IV:

Operating Systems Overview: Overview of Computer Operating Systems Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating

Systems Structures, Operating System Services and Systems Calls, System Programs, Operating System Generation.

Memory Management: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Virtual Memory, Demand Paging, Page-Replacement Algorithms, Allocation of Frames, Thrashing Case Studies - UNIX, Linux, Windows Principles of Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

UNIT - V:

File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection. File System Implementation: File System Structure, File system Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

TEXT BOOKS:

1. Computer Organization - Carl Hamacher, Zvonks Vranesic, Safea Zaky, 5th Edition, McGraw Hill.
2. Computer System Architecture - M. Moris mano, 3rd edition, Pearson
3. Operating System Concepts - Abreham Silberchatz, Peter B. Galvin, Greg Gagne, 8th Edition, John Wiley.

REFERENCE BOOKS:

1. Computer Organization and Architecture - William Stallings 6th Edition, Pearson
2. Structured Computer Organization - Andrew S. Tanenbaum, 4th Edition, PHI
3. D.M. Dharmdhere, Operating Systems – A Concept based Approach, 2nd Edition. TMH, 2007.

COURSE OUTCOMES:

1. Student will develop the ability and confidence to use the fundamentals of Computer Organization as a tool in the engineering of digital systems.
2. An ability to identify, formulate, and solve hardware and software computer engineering problems.
3. Apply the knowledge gained in the design of Computer.
4. Summarize operating system and process management concepts.
5. Apply process scheduling and synchronization related issues.
6. Outline Deadlock Prevention, Avoidance, detection, and recovery mechanisms.

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(R22A0410) DATA COMMUNICATIONS AND COMPUTER NETWORKS

Course Objectives

1. To introduce the Fundamentals of data communication networks
2. To demonstrate the Functions of various protocols of Data link layer
3. To demonstrate Functioning of various Routing protocols
4. To introduce the Functions of various Transport layer protocols
5. To understand the significance of application layer protocols

UNIT - I
Introduction to Data Communications: Components, Data Representation, Data Flow, Network, Uses of Networks, Network Topologies, Categories of Networks, Multiplexing: FDM, TDM. Reference Models: TCP/IP Model, The OSI Model, Comparison of the OSI and TCP/IP reference model. Physical Layer: Guided Media, Unguided Media (wireless).

UNIT- II
Data Link Layer: Design issues, Error Detection & Correction, Elementary Data Link Layer Protocols, Sliding window protocols
Multiple Access Protocols - ALOHA, CSMA, CSMA/CD, CSMA/CA, Collision free protocols, Ethernet- Physical Layer, Ethernet Mac Sub layer.

UNIT- III
The Network Layer: Network Layer Design issues, Routing algorithms: optimality principle, shortest path, flooding, Distance Vector Routing, Count to Infinity Problem, Link State Routing, Hierarchical Routing; Congestion control algorithms, IP addresses, CIDR, Sub netting, Super Netting, IPv4, Packet Fragmentation, IPv6 Protocol, Transition from IPv4 to IPv6.

UNIT-IV
Transport Layer: Services provided to the upper layer's elements of transport protocol, addressing, connection establishment, Connection release, Error Control & Flow Control.
UDP, Introduction to TCP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Sliding Window, The TCP Congestion Control Algorithm.

UNIT-V
Application Layer:
Introduction, services, Applications layer paradigms: Client-server model, HTTP, E-mail, WWW, TELNET, DNS.

TEXT BOOKS:

1. Kurose James F, Keith W- Computer Networking A Top-Down Approach, 6th Edition, Pearson.
2. Behrouz A. Forouzan - Data Communications and Networking, 4th Edition, McGraw-Hill Education

REFERENCE BOOKS:

1. Bhusan Trivedi - Data communication and Networks, Oxford university press, 2016
2. Andrew S Tanenbaum - Computer Networks, 4th Edition, Pearson Education
3. W. A. Shay - Understanding Communications and Networks, 3rd Edition, Cengage Learning.

COURSE OUTCOMES:
Upon completing this course, the student will be able to
1. Know the Categories and functions of various Data communication Networks
2. Design and analyze various error detection techniques.
3. Demonstrate the mechanism of routing the data in network layer
4. Know the significance of various Flow control and Congestion control Mechanisms
5. Know the Functioning of various Application layer Protocols.

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(R22A0411) DIGITAL DESIGN THROUGH VERILOG HDL

Course Objective:

1. This course teaches designing digital circuits, behavior and RTL modeling of digital circuits using Verilog HDL, verifying these Models and synthesizing RTL models to standard cell libraries and FPGAs.
2. Students aim practical experience by designing, modeling, implementing and verifying several digital circuits.
3. This course aims to provide students with the understanding of the different technologies related to HDLs, construct, compile and execute Verilog HDL programs using provided

Software Tools: Design digital components and circuits that is testable, reusable, and synthesizable.

UNIT - I: Introduction to Verilog HDL: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Programming Language Interface, Module.
Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Data Types, Scalars and Vectors, Operators.

UNIT - II: Gate Level Modeling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Gate Delay.
Modeling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vector, Operators.

UNIT - III: Behavioral Modeling: Introduction, Operations and Assignments, 'Initial' Construct, always construct, Assignments with Delays, 'Wait 'Construct, Design at Behavioral Level, Blocking and Non-Blocking Assignments, The 'Case' Statement, 'If' and 'if-Else' Constructs, 'Assign- De-Assign' Constructs, 'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop, sequential and Parallel Blocks.

UNIT - IV: Switch Level Modeling: Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, instantiation with strengths and delays, Switch level modeling for NAND, NOR and XOR.
UNIT - V: System Tasks, Functions and Compiler Directives: Parameters, Path Delays, Module Parameters, System Tasks, User Defined Primitives, Compiler directives.

Sequential Circuit Description: Sequential Models - Feedback Model, Capacitive Model, Implicit Model.

TEXT BOOKS:

1. T.R. Padmanabhan, B Bala Tripura Sundari, Design Through Verilog HDL, Wiley 2009.
2. Verilog HDL - Samir Palnitkar, 2nd Edition, Pearson Education, 2009.

REFERENCE BOOKS:

1. Fundamentals of Digital Logic with Verilog Design - Stephen Brown, Zvonkoc Vranesic, TMH, 2nd Edition.
2. Zainalabdien Navabi, Verliog Digital System Design, TMH, 2nd Edition.
3. Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA - Sunggu Lee, Cengage Learning, 2012.
4. Advanced Digital Design with Verilog HDL - Michel D. Ciletti, PHI, 2009.

COURSE OUTCOMES:

By the end of the course student should be able to:

1. Describe Verilog HDL
2. Design Digital circuits
3. Write behavior model of digital circuits
4. Write RTL models of digital circuits
5. Verify behavior and RTL models
6. Describe standard Cell Libraries and FPGAs
7. Synthesize RTL models to standard cell libraries and FPGAs
8. Implement RTL models on FPGAs and testing and verification

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(R22A0488) MICROPROCESSORS & MICROCONTROLLERS LABORATORY

COURSE OBJECTIVES

1. To study programming based on 8086 microprocessor and 8051 microcontrollers.
2. To study 8086 microprocessor-based ALP using arithmetic, logical and shift operations.
3. To study to interface 8086 with I/O and other devices. To study parallel and serial communication using 8051 microcontrollers.
4. Understand the operations of various study cards like 8257/37, stepper motor etc.

Note: - Minimum of 12 experiments has to be conducted

The Following programs/experiments are to be written for assembler and execute the same with 8086 and 8051 kits.

1. Programs for 16-bit arithmetic operations using 8086 (using Various Addressing Modes).
2. Program for sorting an array using 8086.
3. Program for searching a number or character in a string using 8086.
4. Program for string manipulations using 8086.
5. Program for digital clock design using 8086.
6. Interfacing ADC and DAC to 8086.
7. Parallel communication between two microprocessors using 8255.
8. Serial communication between two microprocessor kits using 8251.
9. Interfacing to 8086 and programming to control stepper motor.
10. Programming using arithmetic, logical and bit manipulation instructions of 8051.
11. Program and verify Timer/ Counter in 8051.
12. Program and verify Interrupt handling in 8051
13. UART Operation in 8051.
14. Communication between 8051 kit and PC.
15. Interfacing LCD to 8051.
16. Data Transfer from Peripheral to Memory through DMA controller 8237/8257.

COURSE OUTCOMES

1. Demonstrate ability to handle arithmetic operations using assembly language programming in MASM and training boards.
2. Work with standard microprocessor real time interfaces including serial ports, digital-to-analog converters and analog-to-digital converters.

3. Troubleshoot interactions between software and hardware.
4. Demonstrate ability to handle string instructions using assembly language programming in MASM.
5. Various applications of microcontrollers like LCD, Key Board are learned.

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(R22A6684) ARTIFICIAL INTELLIGENCE & MACHINE LEARNING LABORATORY

LAB OBJECTIVES:
1. Familiarity with the PYTHON programming environment.
2. To introduce students to the basic concepts and techniques of Machine Learning.
3. To implement classification and clustering methods.
4. To become familiar with various supervised and unsupervised learning Algorithms.
5. Learning basic concepts of PYTHON through illustrative examples and small exercises understanding list data structures.

STUDY OF PROLOG; WRITE THE FOLLOWING PROGRAMS USING PYTHON

Week-1. Implementation of BFS algorithm

Week-2. Implementation of DFS algorithm

Week-3. Implementation of Best First Search

Week-4. Write a program to solve 8 Queens problem

Week-5. Implementation of Hill-climbing algorithm

MACHINE LEARNING

WEEK-1
Data Extraction, Wrangling
1. Loading different types of datasets in Python
2. Arranging the data

WEEK-2
Data Visualization
1. Handling missing values
2. Plotting the graphs

WEEK-3
Supervised Learning
Implementation of Linear Regression

WEEK-4
Implementation of K-nearest Neighbor

WEEK-5
Unsupervised Learning
Implementing K-means Clustering

WEEK-6
Unsupervised Learning

Implementing Hierarchical Clustering

LAB OUTCOMES:

1. Apply various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction,)
2. Understand the fundamentals of knowledge representation, inference using AI tools.
3. Solve the problems using various machine learning techniques
4. Design application using machine learning techniques

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(R22A0489) APPLICATION DEVELOPMENT-I

The topic should be selected / chosen to ensure a direct connectivity between theoretical fundamentals and applications and, thus reduce the gap between the world of work and the world of study.

The application should meet the following criteria

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Research and development in various domain

The student should complete the following

- Literature survey related to Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

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(R22A0084) PROFESSIONAL DEVELOPMENT SKILLS -I
(COMMON FOR ALL BRANCHES)

OBJECTIVES:

1. To strengthen the students with the professional skill set.
2. To make the students recognize the role of technical English in their academic and professional fields.
3. To improve language proficiency and to develop the required professional ethics.
4. To equip students, organize, comprehend, write, and present, short and long forms of any technical work within the broad framework of the Scientific Method.
5. To facilitate communication about projects and ideas throughout the industry and also to the non-technical people.

SYLLABUS

UNIT- I:

Communication Skills:

- Verbal & Non-verbal communication
- Body Language: Facial expressions, Gestures, Eye Contact, Shrugging, and Standing Postures
- Writing: Letter Writing: requisition, complaint, Enquiry and response
- Exploring Career Opportunities

UNIT-2:

- Self-Introduction
- Ice-Breaking
- Writing: E-Mail Writing, Email Etiquette
- Social and Cultural Etiquette

UNIT-3:

- Oral Presentation Skills: PPTs, Paper Presentation, Poster Presentation etc.,
- JAM Session
- Writing: Paragraph writing and Types of Paragraph Writing (descriptive, narrative, expository, and persuasive)
- Ethics and Integrity

UNIT-4:

- Describing People, Places, things etc.
- Telephonic Conversation: Telephonic Expressions, and Etiquette
- Writing: Essay writing and Types of Essay Writing
- Digital Literacy and Social Media

UNIT-5:

- Extempore
- Role play and Situational dialogues
- Writing: Memo Writing
- Digital Ethics and Cyber Security

COURSE OUTCOMES:

Students will be able to

1. Understand information which assists in completion of the assigned job tasks more successfully
2. Market them with the rich professional skills that they acquire.
3. Adhere to ethical norms of scientific communication
4. Strengthen their individual and collaborative work strategies
5. Successfully market them and sell themselves to the employer of their choice.

REFERENCE BOOKS:

1. Curriculum and Guide line for Life Skills, By UGC, August 2023
2. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
3. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
4. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
5. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
6. Meenakshi Raman, Prakash Singh, Business communication, Oxford Publication, New Delhi 2012.
7. Dale Jung k, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
8. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
9. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

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(R22A0412) ANTENNAS AND WAVE PROPAGATION

COURSE OBJECTIVES:

1. Understand basic terminology and concepts of Antennas.
2. To attain knowledge on the basic parameters those are considered in the antenna design process and the analysis while design that.
3. Analyze the electric and magnetic field emission from various basic antennas and mathematical formulation of the analysis.
4. To have knowledge on antenna operation and types as well as the in usage in real time.
5. Aware of the wave spectrum and respective band-based antenna usage and also to know the propagation of the waves at different frequencies through different layers in the existing layered free space environment structure.

UNITI

ANTENNA BASICS: Introduction, Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain, Illustrative Problems. Field Zones, Front–to-back Ratio, Retarded Potentials–Helmholtz Theorem.

THIN LINEAR WIRE ANTENNAS: Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Illustrative Problems.

UNIT II

VHF, UHF AND MICROWAVE ANTENNAS – I: Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas – Helical Geometry, Helix Modes, Practical Design Considerations for Helical Antenna in Axial and Normal Modes, Horn Antennas: Types, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems.

VHF, UHF AND MICROWAVE ANTENNAS – II: Micro strip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas–Geometry and Parameters, Characteristics of Microstrip Antennas. Impact of Different Parameters on Characteristics, Reflector Antennas–Introduction, Flar Sheet and Corner Reflectors, Paraboloidal Reflectors –Reflector Types–Related Features, Illustrative Problems. Lens Antennas–Introduction, Geometry of Non-metallic Dielectric Lenses, Fermat 's Principle.

UNITIII

ANTENNA ARRAYS: Point Sources–Definition, Patterns, arrays of 2 Isotropic Sources–Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, End fire Arrays, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions–General Considerations and Binomial Arrays,

Illustrative Problems.

ANTENNA MEASUREMENTS: Introduction, Pattern Measurement Arrangement, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3- Antenna Methods)

UNITIV

WAVE PROPAGATION – I: Introduction, Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ground Wave Propagation – Introduction, Space and Surface Waves, Wave Tilt. Space Wave Propagation – Introduction, Field Strength Variation with Distance and Height, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Tropospheric Propagation.

UNITV

WAVEPROPAGATION–II: Sky Wave Propagation–Introduction, Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multihop Propagation.

TEXTBOOKS:
1. Antennas and Wave Propagation– J.D.Kraus, R.J. Marhefka and Ahmad S.Khan, TMH, New Delhi, 4[th]ed.,(Special Indian Edition),2010.
2. Electromagnetic Waves and Radiating Systems–E.C. Jordan and K.G. Balmain, PHI, 2[nd]ed.,
3. A. Harish, M. Sachidanada," Antennas and Wave Propagation", Oxford University Press, 2007

REFERENCEBOOKS:
1. Antenna Theory– C.A. Balanis, John Wiley& Sons,3rd Ed.,2005.
2. Antennas and Wave Propagation–K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.
3. Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol.5, Standard Publishers Distributors, Delhi.
4. Antennas–John D.Kraus, Mc Graw-Hill (International Edition), 2[nd]Ed. 1988.
5. Electronic and Radio Engineering–F.E.Terman, McGraw-Hill, 4[th]edition,1955.

COURSEOUTCOMES:
1. Aware of antenna parameter considerations
2. Capable to analyze the designed antenna and field evaluation under various conditions and formulate the electric as well as magnetic fields equation set for far field and near field conditions
3. Understand the array system of different antennas and field analysis under application of different currents to the individual antenna elements
4. Understand the design issues, operation of fundamental antennas and their operation methodology in practice.
5. Design a lens structure and also the bench set up for antenna parameter measurement of testing or their effectiveness.

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(R22A0413) DIGITAL SIGNAL PROCESSING

COURSE OBJECTIVES:

1) To understand the basic concepts digital signal processing and discrete time signals and systems.

2) To Master the representation of discrete-time signals in the frequency domain, using z transform, discrete Fourier transforms (DFT).

3) To Understand the implementation of the DFT in terms of the FFT, as well as some of its applications.

4) To learn the basic design and structure of FIR and IIR filters with desired frequency responses and design digital filters.

5) To acquaint in FFT algorithms, Multi-rate signal processing techniques.

UNIT I:

Introduction to Digital Signal Processing: Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, Linear Shift Invariant Systems, Stability, and Causality,

Realization of Digital Filters: Solution of Difference Equations Using Z-Transform, Realization of Digital Filters - Direct, Canonic forms.

UNIT II:

Discrete Fourier Transforms: Properties of DFT. Computation of DFT, Linear Convolution of Sequences using DFT. Over-lap Add Method, Over-lap Save Method.

Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.

UNIT III:

IIR Digital Filters: Analog Filter Approximations - Butterworth and Chebyshev, Design of IIR Digital filters from Analog Filters, Bilinear Transformation Methods, Comparison of Butterworth and Chebyshev.

UNIT IV:

FIR Digital Filters: Comparison of Digital filters from Analog Filters, Characteristics of FIR Digital Filters. Design of FIR Filters: using Window Techniques, Comparison of IIR & FIR filters.

UNIT V:

Multirate Digital Signal Processing: Introduction, Down sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion, Applications of Multi Rate Signal Processing.

TEXT BOOKS:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009.
3. Fundamentals of Digital Signal Processing – Loney Ludeman, John Wiley, 2009

REFERENCE BOOKS:

1. Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier, 2008.

2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling, Sandra L. Harris, b   Thomson, 2007.
3. Digital Signal Processing – S.Salivahanan, A.Vallavaraj and C.Gnanapriya, TMH, 2009.
4. Discrete Systems and Digital Signal Processing with MATLAB – Taan S. ElAli, CRC press, 2009.
5. Digital Signal Processing - A Practical approach, Emmanuel C. Ifeachor and Barrie W.Jervis, 2nd Edition, Pearson Education, 2009.
6. Digital Signal Processing - Nagoor Khani, TMG, 2012.

Course Outcomes

1. Understand time, frequency and z-transform analysis on signals and systems.
2. Understand the inter relationship between DFT and various transforms.
3. Understand the fast computation of DFT and Appreciate the FFT processing.
4. Ability to design & analyze DSP systems like FIR and IIR Filter etc.
5. Understand the LTI system characteristics and Multi rate signal processing.

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(R22A0414) VLSI DESIGN

COURSEOBJECTIVES:
1. To understand MOS transistor fabrication processes.
2. To understand basic circuit concepts
3. To have an exposure to the design rules to be followed for drawing the layout of circuits
4. Design of building blocks using different approaches.
5. To have acknowledge of the testing processes of CMOS circuits.

UNIT I
Introduction: Brief Introduction to IC technology- Moore's Law, Microelectronic Evolution, Fabrication: NMOS, CMOS (n-well, p-well, Twin-tub)
Basic Electrical Properties of MOS Transistor: I_{DS}- V_{DS}relationships, MOS transistor Threshold Voltage-V_T, figure of merit-ω_0, Transconductance- g_m, g_{ds}; Pass transistor, NMOS Inverter, Pull-up to pull-down ratio of NMOS Inverter driven by another NMOS inverter (Z=4:1), Various pull ups, CMOS Inverter analysis and design.

UNIT II
VLSI Circuit Design Processes: VLSI Design Flow (Y-Chart), MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and Gates.
Scaling
Scaling of MOS circuits, Limitations of Scaling

UNIT III

Gate level Design: Logic gates (AOI, OAI), Switch logic (TG), Alternate gate circuits (Pseudo NMOS, Dynamic Logic Circuits, Domino logic circuits, Clocked-CMOS, NP Logic).
Concepts: Sheet Resistance R_S and its concepts to MOS, Area Capacitances calculations, Inverter Delays, driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out.

UNITIV
Subsystem Design: Adders, Multipliers
VLSI Design styles: Full-custom, Semi-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs, Parameters influencing low power design.

UNITV
CMOS Testing: Need for Testing, Test Principles- Fault models, observability, controllability, ATPG, Design for testability: Ad-hoc based testing, Scan-based Design, BIST.

TEXTBOOKS:

1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, Eshraghian Dougles A.Pucknell, 2005,PHI.
2. Modern VLSI Design–Wayne Wolf,3 Ed.,1997, Pearson Education.
3. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rdEdn, Pearson,2009.

REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective–Ming BO Lin, CRC Press, 2011.
2. Principals of CMOS VLSI Design–N.H. E Weste, K. Saraghina, 2 Ed., Addison Wesley.
3. VLSI Design-K. Lal Kishore, V.S.V. Prabhakar, I.K. International, 1997.
4. Introduction to VLSI Design-Mead &Convey, B S Publications, 2010.
5. CMOS Logic Circuit Design-John P. Uyemura, Springer, 2007.

COURSEOUTCOMES

1. Acquire quality knowledge about the fabrication process of IC using MOS Transistor
2. Draw the layout of any logic circuits which helps to understand and estimate parasitic of any logic circuit
3. Provide design concepts required to design building blocks of data path using gates.
4. Design simple logic circuits using PLA, PAL, FPGA, and CPLD
5. Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve the test ability of the system.

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PROFESSIONAL ELECTIVE–II
(R22A0415) ELECTRONIC MEASUREMENTS & INSTRUMENTS

Course Objectives:

1. It provides an understanding of various measuring system functioning and metrics for performance analysis.
2. Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
3. Understanding the concepts of various measuring bridges and their balancing conditions.
4. Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

UNIT-I

Block Schematics of Measuring Systems: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohm meters, 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, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications

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 Specifications.
Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

UNIT-IV

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hot wire Anemometers, LVDT, Thermocouples, Synchro, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers, gyroscopes, accelerometers.

UNIT-V

Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.

Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure – High Pressure, Vacuum level, Temperature -Measurements, Data Acquisition Systems.

TEXTBOOKS:
1. Modern Electronic Instrumentation and Measurement Techniques: A.D.Helbincs, W.D. Cooper: PHI 5th Edition 2003.
2. Electronic Instrumentation: H.S.Kalsi –TMH,2nd Edition2004.

REFERENCEBOOKS:
1. Electrical and Electronic Measurement and Measuring Instruments – A K Sawhney, Dhanpat Rai & Sons, 2013.
2. Electronic Instrumentation and Measurements David A.Bell, Oxford Univ.Press,1997.
3. Industrial Instrumentation: T.R.Padmanabham Springer2009.
4. Electronic Measurements and Instrumentation K.Lal Kishore, Pearson Education 2010.

Course Outcomes:

Upon completing this course, the student will be able to
1. Measure electrical parameters with different meters and understand the basic definition of measuring parameters.
2. Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.
3. Operate an Oscilloscope to measure various signals.
4. Measurevariousphysicalparametersbyappropriatelyselectingthetransducers.

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PROFESSIONAL ELECTIVE–II
(R22A0416) MOBILE COMMUNICATIONS AND NETWORKS

Course Objectives:

1. To know the evolution of cellular and mobile communication system.
2. To understand Co-Channel and Non-Co-Channel interferences.
3. To understand multipath fading.
4. To understand cell coverage for signal and traffic, frequency management, Channel assignment and types of hand off.
5. To Know the difference between cellular and Adhoc Networks and design goals of MAC Layer protocol.

UNIT-I

Introduction to Cellular Mobile Radio Systems: Limitations of Conventional Mobile Telephone Systems. Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems. Uniqueness of Mobile Radio Environment-Fading-Tie Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time.

Fundamentals of Cellular Radio System Design: Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I from a Normal Case in a Omni Directional Antenna System, System Capacity Improving Coverage and Capacity in Cellular Systems- Cell Splitting, Sectoring, Microcell Zone Concept.

UNIT-II

Co-Channel Interference: Measurement of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameters and their effects, diversity techniques-space diversity, polarization diversity, frequency diversity, time diversity.

Non-Co-Channel Interference: Adjacent Channel Interference, Near end far end interference, cross talk, effects on coverage and interference by power decrease, antenna height decrease, effects of cell site components.

UNIT-III

Cell Coverage for Signal and Traffic: Signal Reflections in flat and Hilly Terrain, effects of Human Made Structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation, path loss from a point-to-point prediction model in different conditions, merits of lee model.

Frequency Management and Channel Assignment: Numbering and Grouping, Setup Access and Paging Channels, Channel Assignments to Cell Sites and Mobile Units.

UNIT-IV

Handoffs and Dropped Calls: Handoff Initiation, types of Handoffs, Delaying Handoff, advantages of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, Intersystem handoff, Introduction to Dropped Call Rates and their Evaluation.

UNIT-V

Ad Hoc Wireless Networks: Introduction, Cellular and Ad Hoc wireless Networks, Applications and Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet, MAC Protocols for Ad Hoc Wireless, Introduction, issues in designing AMAC Protocol for Ad Hoc wireless Networks, Design Goals of AMAC protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols.

TEXT BOOKS:

1. Mobile Cellular Telecommunications-W.C.Y. Lee, Mc Graw Hill, 2nd Edn., 1989.
2. Wireless Communications-Theodore. S. Rapport, Pearson Education, 2nd Edn., 2002.

REFERENCE BOOKS:

1. Ad Hoc Wireless Networks: Architectures and Protocols-C. Siva ram Murthy and B.S. Manoj, 2004, PHI.
2. Modern Wireless Communications-Simon Haykin, Michael Moher, Pearson Education, 2005.
3. Wireless Communications and Networking, Vijay Garg, Elsevier Publications, 2007.
4. Wireless Communications-Andrea Goldsmith, Cambridge University Press, 2005.

Course Outcomes:

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

1. Known the evolution of cellular and mobile communication system.
2. The student will be able to understand Co-Channel and Non-Co-Channel interferences.
3. Understand impairments due to multipath fading channel and how to overcome the different fading effects.
4. Familiar with cell coverage for signal and traffic, diversity, techniques, frequency management, Channel assignment and types of handoffs.
5. Know the difference between cellular and Ad hoc Networks and design goals of MAC Layer protocol.

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PROFESSIONAL ELECTIVE–II
(R22A6215) FUNDAMENTALS OF CYBER SECURITY

COURSE OBJECTIVES

1. To understand the basic concepts of cyber-Security.
2. To study different attacks in cyber-crimes.
3. To understand different tools and methods used in cyber-crime.
4. To study cyber security challenges and implications.
5. To know about Cyber Security Organizational Issues, Policies.

UNIT-I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance–Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats -Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy

UNIT-II

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets: The Fuel for Cyber-crime, Attack Vector, and Cloud Computing.

UNIT-III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT-IV

Types of Attacks and Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Over flow.

UNIT-V

Cyber Security Organizational Policies, Risk and Challenges: Organizational Implications. Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

TEXTBOOKS:
1. **Cyber Security:** *Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Nina Godbole and Sunil Belapure, Wiley INDIA.

REFERENCEBOOKS:
1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john)Wu, J.David Irwin. CRC Press T&F Group

COURSEOUTCOMES:

Student will be able to

1. Understand basic concepts of Cyber Crimes.
2. Ability to identify the attacks in Cyber Crimes.
3. Able to specify the suitable methods used in Cyber Crime.
4. Ability to face cyber security challenges.
5. Understand Cyber Security.

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(R22A0490) DIGITAL SIGNAL PROCESSING LABORATORY

COURSE OBJECTIVES:
1. To implement Linear and Circular Convolution
2. To implement FIR and IIR filters
3. To Estimate power spectral densities using a variety of techniques
4. To Study the architecture of DSP processor
5. To learn programming of DSP hardware for real-time signal processing applications

Note: 1) Minimum of 12 experiments has to be conducted.
2) The programs shall be implemented in software (Using MATLAB / Lab view / C programming/ Equivalent) and hardware (Using TI / Analog devices / Motorola / Equivalent DSP processors).

List of Experiments:

1. To find DFT / IDFT of given DT signal
2. Implementation of Linear Convolution between two finite length sequences
3. Implementation of Circular Convolution between two finite length sequences.
4. To find frequency response of a given system (in Transfer Function/ Differential equation form). 5. Implementation of FFT/IFFT of given sequence
5. Determination of power spectrum of a given signal(s).
6. Implementation of LP FIR filter for given sequence
7. Implementation of HP FIR filter for given sequence
8. Implementation of LP IIR filter for given sequence
9. Implementation of HP IIR filter for given sequence
10. Generation of sinusoidal signal through filtering
11. Implementation of Decimation Process
12. Implementation of Interpolation Process
13. Implementation of I/D sampling rate converters.
14. Audio application such as to plot a time and frequency display of microphone plus a cosine using DSP. Read a .wav file and match with their respective spectrograms.
15. Impulse response of first order and second order systems.

COURSE OUTCOMES

1. Generate & perform different operations on discrete time signals and systems.
2. Analyze and implement digital systems using the Discrete Fourier Transform and Fast Fourier Transform (FFT) techniques using MATLAB and signal processing toolboxes.
3. Use Z transforms to analyze a digital system finding the region of convergence using MATLAB and signal processing toolboxes.
4. Design and Implement digital FIR and IIR filters.
5. Design Up converter, down converter & Sample rate converter.

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(R22A0491) VLSI DESIGN LABORATORY

COURSEOBJECTIVES:
1. To understand the EDA tools
2. To model the sequential and combinational circuits in Verilog HDL.
3. Perform simulation of sequential and combinational circuits using proper EDA tools.
4. To design and analyze digital and analog CMOS circuits.
5. To understand the design rules and draw the layout for various schematics.

Note: Minimum of 10 programs from Part –I and 4 programs from Part -II are to be conducted. Design and implementation of the following CMOS digital/analog circuits using Cadence / Mentor Graphics / Synopsys / Equivalent CAD tools. The design shall include Gate-level design, Transistor-level design, Hierarchical design, Verilog HDL/VHDL design, Logic synthesis, Simulation and verification.

Programming can be done using any complier. Download the programs on FPGA/CPLD boards and performance testing may be done using pattern generator(32channels) and logic analyzer apart from verification by simulation with any of the front-end tools.

1. HDL code to realize all the logic gates
2. Design of Full adder using 3modelingstyles
3. Design and Simulation of carry propagation adder.
4. Design and Simulation of2-to-4decoder
5. Design and Simulation of8-to-3 encoder (without and with parity)
6. Design and Simulation of8-to-1multiplexer
7. Design and Simulation of4bitbinarytograyconverter
8. Design and Simulation of Multiplexer/Demultiplexer
9. Design and Simulation of flipflops: SR, D, JK, T
10. Design and Simulation of 4-bit binary, BCD counters (synchronous/ asynchronous reset) or any Sequence Counter

Part–II:

VLSI Back End Design programs:

Design and implementation of the following CMOS digital/analog circuits using Cadence / Mentor Graphics / Synopsys / Equivalent CAD tools.

The design shall include Gate-level design/Transistor-level design/Hierarchical design/ Verilog HDL or VHDL design, Logic synthesis, Simulation and verification, Scaling of CMOS Inverter for different technologies, study of secondary effects (temperature, power supply and process corners),Circuit optimization with respect area, performance and/or power, Layout, Extraction of parasitics and back annotation, modifications in circuit parameters and layout consumption, DC/transient analysis, Verification of layouts

(DRC,LVS).

1. Introduction to layout design rules
2. Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis of the following:
   a. Basic logic gates
   b. CMOS inverter
   c. CMOS NOR/NAND gates
   d. CMOS XOR and MUX gates
   e. CMOS 1-bit full adder
   f. Static/Dynamic logic circuit (register cell)
   g. Latch
   h. Pass transistor
3. Introduction to SPICE simulation of NMOS/CMOS circuit
4. SPICE Simulation of basic analog circuits: Inverter/Differential Amplifier
5. Analog Circuit simulation (AC analysis) of CS & CD Amplifier

COURSE OUTCOMES
1. To gain hands-on experience on the VLSI Physical Design Tools.
2. Design entry using Verilog for Circuit Descriptions using sequential and concurrent statements.
3. Design synthesizable Verilog code.
4. Model Analog and Mixed signal blocks using Verilog.
5. Interpret and evaluate the special features of VLSI back end and front-end CAD tools

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(R22A0492) APPLICATION DEVELOPMENT-II

The topic should be selected / chosen to ensure a direct connectivity between theoretical fundamentals and applications and, thus reduce the gap between the world of work and the world of study.

The application should meet the following criteria

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Research and development in various domain

The student should complete the following

- Literature survey related to Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

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(R22A0085) PROFESSIONAL DEVELOPMENT SKILLS -2
(COMMON FOR ALL BRANCHES)

OBJECTIVES:

1. To strengthen the students with the professional skill set.
2. To make the students recognize the role of technical English in their academic and professional fields.
3. To improve language proficiency and to develop the required professional ethics.
4. To equip students, organize, comprehend, write, and present, short and long forms of any technical work within the broad framework of the Scientific Method.
5. To facilitate communication about projects and ideas throughout the industry and also to the non-technical people.

SYLLABUS

UNIT- I:

- Inter-personal & Intra-Personal Communication
- Sub Skill of Reading: Skimming
- Writing: Resume Writing: Functional, Chronological, Targeted
- Innovative Leadership and Design Thinking

UNIT-2:

- Group Discussion: Factual, Opinion-Based, Abstract
- Sub Skill of Reading: Scanning
- Writing: Cover Letter
- Trust and Collaboration

UNIT-3:

- Debate
- Sub Skill of Reading: Intensive Reading
- Writing: Report Writing: Research Report, Analytical and Projects
- Managing Personal Finance

UNIT-4:

- Interview skills
- Sub Skill of Reading: Extensive reading
- Writing: Précis Writing
- Leadership and Managerial Skills

UNIT-5:

- Mock Interviews
- Reading: Cloze-Test
- Writing: Mini Projects
- Entrepreneurial Skills

COURSE OUTCOMES:
Students will be able to

1. Understand information which assists in completion of the assigned job tasks more successfully
2. Market them with the rich professional skills that they acquire
3. Adhere to ethical norms of scientific communication
4. Strengthen their individual and collaborative work strategies
5. Successfully market them and sell themselves to the employer of their choice.

REFERENCE BOOKS:
1. Curriculum and Guide line for Life Skills, By UGC, August 2023
2. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
3. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
4. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
5. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
6. Meenakshi Raman, Prakash Singh, Business communication, Oxford Publication, New Delhi 2012.
7. Dale Jung k, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
8. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
9. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

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(R22A0417) MICROWAVE ENGINEERING

Course Objective

1. To analyze Waveguides in Rectangular Coordinate Systems.
2. To Use S-parameter terminology to describe circuits.
3. To explain how microwave devices and circuits are characterized in terms of their "S" Parameters.
4. To Use microwave components such as isolators, Couplers, Circulators, Tees, Gyrators etc.
5. To give students an understanding of basic microwave devices (both amplifiers and oscillators).
6. To expose the students to the basic methods of microwave measurements.

UNIT I
Waveguides: Introduction, Microwave spectrum and bands, applications of Microwaves, Rectangular Waveguides-Solution of Wave Equation in Rectangular Coordinates, TE/TM mode analysis, Expressions for fields, Cutoff frequencies, dominant and degenerate modes, Mode characteristics - Phase and Group velocities, wavelengths and impedance relations, Impossibility of TEM Modes, Illustrative Problems.

UNIT II
Waveguide Components: Scattering Matrix - Significance, Formulation and properties, Wave guide multiport junctions - E plane and H plane Tees, Magic Tee, 2-hole Directional coupler, S Matrix calculations for E plane and H plane Tees, Magic Tee, Directional coupler, Ferrite components - Gyrator, Isolator, Circulator, Illustrative Problems.

UNIT III
Linear beam Tubes: Limitations and losses of conventional tubes at microwave frequencies, Classification of Microwave tubes.
O type tubes - 2 cavity klystrons-structure, velocity modulation process and Applegate diagram, bunching process and small signal theory Expressions for o/p power and efficiency, Reflex Klystrons-structure, Velocity Modulation, Applegate diagram, power output, efficiency.

UNIT IV
Cross-field Tubes: Introduction, Magnetrons-different types, cylindrical travelling wave magnetron-Hull cutoff and Hartree conditions.
Microwave Semiconductor Devices: Introduction to Microwave semiconductor devices, classification, Transfer Electronic Devices, Gunn diode - principles, RWH theory, Characteristics, Basic modes of operation - Gunn oscillation modes, Introduction to Avalanche Transit time devices (brief treatment only), Illustrative Problems.

UNIT V
Microwave Measurements: Description of Microwave Bench – Different Blocks and their Features, Waveguide Attenuators – Resistive Card, Rotary Vane types; Microwave Power Measurement – Bolometer Method. Measurement of Attenuation, Frequency, VSWR,

Impedance Measurements.

TEXT BOOKS:
1) Microwave Devices and Circuits – Samuel Y. Liao, PHI, 3rd Edition,1994.
2) Microwave and Radar Engineering- M.Kulkarni, Umesh Publications,1998.

REFERENCES:
1) Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.
2) Microwave Circuits and Passive Devices – M.L. Sisodia and G.S.Raghuvanshi, Wiley Eastern Ltd., New Age International Publishers Ltd., 1995.
3) Microwave Engineering Passive Circuits – Peter A. Rizzi, PHI, 1999.
4) Electronic and Radio Engineering – F.E. Terman, McGraw-Hill, 4th ed., 1955.
5) Elements of Microwave Engineering – R. Chatterjee, Affiliated East-West Press Pvt. Ltd., New Delhi,1988.

COURSE OUTCOMES
1) Understand the significance of microwaves and microwave transmission lines
2) Analyze the characteristics of microwave tubes and compare them
3) Be able to list and explain the various microwave solid state devices
4) Can set up a microwave bench for measuring microwave parameters
5) Expose to the basic methods of microwave measurements.

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PROFESSIONAL ELECTIVE- III
(R22A0418) RADAR SYSTEMS

COURSE OBJECTIVES:

1. To learn Radar Fundamentals like Radar Equation, Operating frequencies & Applications.
2. To understand the basic concepts of different types of Radars for Surveillance & Tracking.
3. To know the various types of Tracking Techniques involved.
4. To understand Radar Receivers, MTI filters, displays and antennas.
5. To learn about electronic warfare.

UNITI

Basics of Radar: Introduction, Maximum Unambiguous Range, Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Related Problems.

Radar Equation: SNR, Envelope Detector-False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Related Problems.

UNIT-II

CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Related Problems.

FM-CW Radar: FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

UNIT-III

MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono-pulse Tracking Radar – Amplitude Comparison Mono-pulse (one and two coordinates), Angular Accuracy, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

UNIT-IV

Detection of Radar Signals in Noise: Introduction, Matched Filter Receiver – Response, Characteristics and Derivation, Correlation Function and Cross-correlation Receiver,

Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

UNIT-V
Radar Receivers: Noise Figure and Noise Temperature, displays– types, Duplexers-Branch and Balanced Types, Introduction to Phased Arrays Antennas–Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications, Advantages and Limitations.

TEXTBOOK:
1. Introduction to Radar Systems –MerrillI. Skolnik, TMH Special Indian Edition, 2nd edition, Tata McGraw-Hill, 2007.

REFERENCES:
1. Introduction to Radar Systems–MerrillI.Skolnik,3rd Edition Tata McGraw-Hill,2001.
2. Radar: Principles, Technology, Applications-Byron Edde, Pearson Education,2004.
3. Principles of Modern Radar: Basic Principles-Mark A. Richards, James A. Scheer, WilliamA. Holm, Yesdee,2013.
4. 'Radar Hand Book' Ed. By M.I Skolnik,2nd Edition, Tata McGraw Hill.
5. 'Understanding Radar Systems' by Simon Kinsley and Shaun Quegan, Scitech Publishing, McGraw-Hill.

COURSE OUTCOMES
1. Demonstrate an understanding of the factors affecting the radar performance using Radar Range Equation.
2. Analyze the principle of FM-CW radar and apply it in FM-CW Altimeter.
3. Differentiate between an MTI Radar and a Pulse Doppler Radar based on their working principle.
4. Demonstrate an understanding of the importance of Matched Filter Receivers in Radars.
5. Familiarize with the different types of Radar Displays and their application in real time scenario

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PROFESSIONAL ELECTIVE- III
(R22A0419) CMOS ANALOG IC DESIGN

Course Objectives:

1. To provide in-depth understanding of different types of MOS devices and modeling techniques
2. To understand and design the operation of current mirror circuits
3. To demonstrate the analysis and design of amplifiers using CMOS
4. To design a various stages of Operational amplifiers using CMOS devices.
5. Design and construct the open loop and discrete time comparators using op-amp.

UNIT -I

MOS Devices and Modeling:

The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT -II

Analog CMOS Sub-Circuits:

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascade current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT –III

CMOS Amplifiers

Inverters, Differential Amplifiers, Cascade Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

UNIT –IV

CMOS Operational Amplifiers

Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power-Supply Rejection Ratio of Two-Stage Op Amps, Cascade Op Amps, Measurement Techniques of OPAmp.

UNIT –V

Comparators

Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

TEXT BOOKS:

1. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
2. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.

REFERENCE BOOKS:

1. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edn, 2013.
2. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition.
3. CMOS: Circuit Design, Layout and Simulation- Baker, Li

Course Outcomes:

1. Model various components in CMOS process to estimate their performance in circuits.
2. Analyze and design of MOS and different current mirror circuits including Wilson, cascade current mirror.
3. Design of CMOS Amplifiers including Differential, Cascade and high gain amplifier architectures.
4. Design of CMOS Operational amplifiers and to measure the characteristics of cascade operational-amplifier.
5. Apply and analyze the performance of open loop and discrete time capacitor circuits

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PROFESSIONAL ELECTIVE- III
(R22A6666) ARTIFICIAL NEURAL NETWORKS

Course Objectives:
• To understand the biological neural network and to model equivalent neuron models.
• To understand the architecture, learning algorithm and issues of various feed forward and feedback neural networks

UNIT - I
Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks
Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

UNIT - II
Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment
Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

UNIT - III
Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

UNIT - IV
Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

UNIT - V
Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm Hopfield Models – Hopfield Models, Computer Experiment

TEXT BOOKS:
1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.

REFERENCE BOOKS:
1. Artificial Neural Networks - B. Vegna narayana Prentice Hall of India P Ltd 2005

2. Neural Networks in Computer Intelligence, Li Min Fu MC GRAW HILL EDUCATION 2003
3. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.
4. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

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

1. Create different neural networks of various architectures both feed forward and feed backward.
2. Perform the training of neural networks using various learning rules.
3. Perform the testing of neural networks and do the perform analysis of these networks for various pattern recognition applications.

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PROFESSIONAL ELECTIVE -IV
(R22A0420) NETWORK SECURITY AND CRYPTOGRAPHY
COURSE OBJECTIVES:

1. Explain the objectives of information security.
2. Explain the importance and application of each of confidentiality, integrity, authentication and availability.
3. Understand various cryptographic algorithms.
4. Understand the basic categories of threats to computers and networks.
5. Describe public-key crypto system.
6. Describe the enhancements made to IPv4 by IPSec.
7. Understand Intrusions and intrusion detection.
8. Discuss the fundamental ideas of public-key cryptography.
9. Generate and distribute a PGP key pair and use the PGP package to send an encrypted e- mail message.
10. Discuss Web security and Firewalls.

UNIT-I
Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security.
Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT-II
Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.
Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

UNIT-III
Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), **Message authentication codes:** Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme.

Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure.

UNIT-IV
Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH).

Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security.

UNIT-V
E-Mail Security: Pretty Good Privacy, S/MIME **IP Security:** IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, Internet Key Exchange.

Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions.

TEXTBOOKS:
1. Cryptography and Network Security-Principles and Practice: William Stallings, Pearson Education, 6th Edition.
2. Cryptography and Network Security: Atul Kahate, Mc GrawHill,3rdEdition.

REFERENCEBOOKS:
1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, WileyIndia, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, McGraw Hill,3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

COURSE OUTCOMES:

1. Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.
2. Ability to identify information system requirements for both of them such as client and server.
3. Ability to understand the current legal issues towards information security.

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PROFESSIONAL ELECTIVE -IV
(R22A0421) SATELLITE COMMUNICATIONS

COURSEOBJECTIVES:
1. To prepare the student to excel in basic knowledge of satellite communication principles.
2. To provide students with solid foundation in orbital mechanics and launches for the satellite communication
3. To train the students with the basic knowledge of link design of satellite with design examples.
4. To provide the better understanding of multiple access systems and earth station technology.
5. To prepare the students with knowledge in satellite navigation and GPS and satellite packet communication

UNIT-I:
Communication Satellite: Orbit and Description: A Brief history of satellite Communication, satellite Frequency Bands, Satellite Systems, Applications, Orbital Period and Velocity, effects of orbital Inclination, Azimuth and Elevation, Coverage angle and slant Range, Eclipse, Orbital Perturbations, Placement of a Satellite in a Geo-Stationary orbit.

UNIT-II:
Satellite Sub-Systems: Attitude and Orbit Control system, TT&C subsystem, Attitude Control subsystem, Power systems, Communication subsystems, Satellite Antenna Equipment.
Satellite Link: Basic Transmission Theory, System Noise Temperature and G/T ratio, Basic Link Analysis, Interference Analysis, Design of satellite Links for a specified C/N, (With and without frequency Re-use), Link Budget.

UNIT-III:
Propagation Effects: Introduction, Atmospheric Absorption, Cloud Attenuation, Tropospheric and Ionospheric Scintillation and Low angle fading, Rain induced attenuation, rain induced cross polarization interference. Multiple Access: Frequency Division Multiple Access (FDMA) - Intermodulation, Calculation of C/N, Time Division Multiple Access (TDMA) -Frame Structure, Burst Structure, Satellite switched TDMA, On-board Processing, Demand Assignment Multiple Access (DAMA) –Types of Demand Assignment, Characteristics, CDMA Spread Spectrum Transmission and Reception.

UNIT-IV:
Earth Station Technology: Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Power Test Methods, Lower Orbit Considerations. Satellite Navigation and Global Positioning Systems: Radio and Satellite Navigation, GPS Position

Location Principles, GPS Receivers, GPS C/A Code Accuracy, Differential GPS.

UNIT-V:
Satellite Packet Communications: Message Transmission by FDMA:M/G/1 Queue, Message Transmission by TDMA, PURE ALOHA-Satellite Packet Switching, Slotted Aloha, Packet Reservation, Tree Algorithm.

TEXTBOOKS:
1. Satellite Communications–Timothy Pratt, Charles Bostian, Jeremy Allnutt, 2nd Edition, 2003, John Wiley & Sons.
2. Satellite Communications Engineering–Wilbur, L.Pritchand, RobertA.Nelson and Heuri G.Suyderhoud, 2nd Ed., Pearson Publications.
3. Digital Satellite Communications-Tri.T.Ha, 2nd Edition, 1990, Mc.Graw Hill.

REFERENCEBOOKS:
1. Satellite Communications-Dennis Roddy, 2nd Edition, 1996, McGraw Hill.
2. Satellite Communications: Design Principles–M.Richcharia, 2nd Ed., BSP,2003.
3. Digital Satellite Communications–Tri.T.Ha,2nd Ed., MGH, 1990.
4. Fundamentals of Satellite Communications–K.N.Raja Rao, PHI, 2004.

COURSEOUTCOMES
1. Student will understand the historical background, basic concepts and frequency allocations for satellite communications
2. Students will demonstrate the orbital mechanics, launch vehicles and launchers
3. Student will demonstrate the design of satellite links for specified C/N with system design examples
4. Students will be able to visualize satellites subsystems like telemetry, tracking, command and monitoring power systems etc.,
5. Students will understand the various multiple access systems for satellite communication systems and satellite packet communications

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PROFESSIONAL ELECTIVE -IV
(R22A0422) BIOMEDICAL SIGNAL PROCESSING

Course Objectives:
The main objectives of the course are:
1. To use basic probability theory to model random signals in terms of Random Processes.
2. To understand various cardiological signal processing techniques and noise cancellation techniques.
3. To understand estimation of signals using Prony's and least square and linear prediction methods.
4. To comprehend EEG signals, modeling and sleep stages.

UNIT -I:
Random Processes: Stationary random process, Ergodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth and noise figure of systems.

UNIT -II:
Data Compression Techniques: Lossy and Lossless data reduction Algorithms, ECG data compression using Turning point, AZTEC, CORTES, Huffman coding, vector quantization.

UNIT -III:
Cardiological Signal Processing: Pre-processing, QRS Detection Methods, Rhythm analysis, Arrhythmia Detection Algorithms, Automated ECG Analysis, ECG Pattern Recognition. Adaptive Noise Cancelling: Principles of Adaptive Noise Cancelling, Adaptive Noise Cancelling with the LMS Adaptation Algorithm, Noise Cancelling Method to Enhance ECG Monitoring, Fetal ECG Monitoring.

UNIT -IV:
Signal Averaging, Polishing: Mean and trend removal, Prony's method, Prony's Method based on the Least Squares Estimate, Linear prediction, Yule – Walker (Y –W) equations, Analysis of Evoked Potentials.

UNIT -V:
Neurological Signal Processing: Modelling of EEG Signals, Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves, Auto Regressive (A.R.) modelling of seizure EEG, Sleep Stage analysis, Inverse Filtering, least squares and polynomial modelling.

TEXT BOOKS:
1. Probability, Random Variables & Random Signal Principles – Peyton Z. Peebles, 4th Ed., 2009, TMH.
2. Biomedical Signal Processing- Principles and Techniques - D. C. Reddy, 2005, TMH.

REFERENCE BOOKS:

1. Digital Bio signal Processing - Weitkunat R, 1991, Elsevier.
2. Biomedical Signal Processing - Akay M, IEEE Press.
3. Biomedical Signal Processing -Vol. I Time & Frequency Analysis - Cohen.A, 1986, CRC Press.
4. Biomedical Digital Signal Processing: C-Language Experiments and Laboratory Experiments, Willis J. Tompkins, PHI.

Course Outcomes:

After studying the course, each student is expected to be able to:

1. Use probability theory to model random processes.
2. Compare various lossless and lossy data compression techniques.
3. Compare various ECG processing and noise cancellation techniques.
4. Model and estimate EEG signals and various sleep stages.

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IV Year B.Tech. ECE- I Sem   **L/T/P/C**
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(R22A0XXX) PROFESSIONAL PRACTICE, LAW& ETHICS

COURSE OBJECTIVES
1. To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
2. To develop some ideas of the legal and practical aspects of their profession.

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

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

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

UNIT- IV
Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other - Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

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

TEXT BOOKS:
1. R. Subramanian - Professional Ethics, Oxford University Press, 2015.
2. Ravinder Kaur - Legal Aspects of Business, 4th edition, Cengage Learning, 2016.

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

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

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IV Year B.Tech. ECE- I Sem   **L/T/P/C**
                                                                              -/-/4/2

(R22A0493) ELECTRO MAGNETICS AND MICROWAVE LAB

COURSE OBJECTIVES:
1) To analyze wave characteristics and antenna parameters
2) To understand array antenna significance
3) To define the range of frequencies for operation in microwave engineering
4) To discover the functioning of microwave components
5) To analyze the characteristics and parameters of various microwave components

Part – A: Electromagnetics Lab (Any Five experiments using any simulation software)
1) Generation of EM-Wave
2) Propagation of wave in Rectangular Waveguide
3) Impedance Matching using Smith Chart
4) Calculation of phase and group velocity calculation at 9GHz
5) Plot of Radiation pattern of dipole antenna
6) Plot of Radiation pattern of monopole antenna
7) Plot of Radiation pattern of Uniform Linear Array

Part – B: Microwave Lab (Any six experiments)
1. Characteristics of Gunn diode
2. Characteristics of the reflex klystron tube
3. Attenuation measurement
4. Impedance measurement
5. Frequency measurement
6. Characteristics of Multi hole directional coupler
7. Determination of standing wave ratio and reflection coefficient
8. Study of magic tee

Equipment required for Microwave Laboratory:
1) Regulated Klystron Power Supply
2) VSWR Meter
3) Micro Ammeter - 0 – 500 μA
4) Multimeter
5) CRO
6) GUNN Power Supply, Pin Modulator
7) Reflex Klystron Tube
8) Crystal Diodes
9) Microwave components (Attenuation)
10) Frequency Meter
11) Slotted line carriage
12) Probe detector

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IV Year B.Tech. ECE- I Sem   **L/T/P/C**
                                                                                                    -/-/6/3

(R22A0494) PROJECT STAGE–I

The dissertation / Project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study.

The dissertation should have the following:

• Relevance to social needs of society
• Relevance to value addition to existing facilities in the institute
• Relevance to industry need • Problems of national importance
• Research and development in various domain

The student should complete the following:

: • Literature survey Problem Definition
• Motivation for study and Objectives
• Preliminary design / feasibility / modular approaches
• Implementation and Verification
• Report and presentation

NOTE: The viva-voce examination will be based on the above report and work

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

IV Year B.Tech. ECE- II Sem   L/T/P/C
                                                                          4/-/-/4

(R22A0335) INNOVATION, START-UP & ENTREPRENEURSHIP

COURSE OBJECTIVES:
1. To understand the concept of innovation, new product development
2. To know the startup opportunities and startup equation
3. To understand new venture creation opportunities, its resources, and Requirements
4. To understand the Entrepreneurial Mindset and new trends in entrepreneurship
5. To understand the strategic perspectives in entrepreneurship

UNIT-I
Innovation Management: Concept of Innovation- Levels of Innovation- Incremental Vs Radical Innovation-Inbound and Outbound Ideation- Open and Other Innovative Ideation Methods-Theories of outsourcing New Product Development: Transaction Cost, Resource Based, Resource Dependence, Knowledge Based Theories.

UNIT-II
Startup opportunities: The New Industrial Revolution – The Big Idea- Generate Ideas with Brainstorming Business Startup - Ideation- Venture Choices - The Rise of The startup Economy -The Six Forces of Change- The Startup Equation

UNIT-III
Startup Capital Requirements and Legal Environment: Identifying Startup capital Resource Requirements - estimating Startup cash requirements - Develop financial assumptions- Constructing a Process Map - Positioning the venture in the value chain - Launch strategy to reduce risks- Startup financing metrics – Business plan-The Legal Environment- Approval for New Ventures- Taxes or duties payable for new ventures.

UNIT-IV
Understanding Entrepreneurial Mindset- The revolution impact of entrepreneurship- The evolution of entrepreneurship - Functions of Entrepreneurs – types of entrepreneurs - Approaches to entrepreneurship- Process approach- Role of entrepreneurship in economic development- Twenty first century trends in entrepreneurship.

UNIT-V
Strategic perspectives in entrepreneurship - Strategic planning - Strategic actions strategic positioning- Business stabilization - Building the adaptive firms - Understanding the growth stage – Internal growth strategies and external growth strategies, Unique managerial concern of growing ventures. Initiatives by the Government of India to promote entrepreneurship, Social and women entrepreneurship.

TEXT BOOKS:
REFERENCE BOOKS
1. Kathleen R Allen, Launching New Ventures, An Entrepreneurial Approach, Cengage Learning, 2016
2. Anjan Rai chaudhuri, Managing New Ventures Concepts and Cases, Prentice Hall

International, 2010.
3. Innovation Management, C.S.G. Krishnama charyulu, R. Lalitha, Himalaya Publishing House, 2010.
4. S. R. Bhowmik & M. Bhowmik, Entrepreneurship, New Age International, 2007.
5. Stuart Read, Effectual Entrepreneurship, Routledge, 2013.
6. Rajeev Roy, Entrepreneurship, 2e, Oxford publications, 2012.
7. Nandan .H, Fundamentals of Entrepreneurship, PHI, 2013

COURSE OUTCOMES:
Students will be able to
- Understand the concept of innovation and new product development startup opportunities and startup equation.
- New venture creation opportunities, its resources, and Requirements
- The Entrepreneurial Mindset and new trends in entrepreneurship strategic perspectives in entrepreneurship**.**

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PROFESSIONAL ELECTIVE-V
(R22A0423) DIGITAL IMAGE PROCESSING

COURSE OBJECTIVES:
The course objectives are:
1. Provide the student with the fundamentals of digital image processing
2. Give the students a taste of the applications of the theories taught in the subject. This will be achieved through the project and some selected lab sessions.
3. Introduce the students to some advanced topics in digital image processing.
4. Give the students a useful skill base that would allow them to carry out further study should they be interested and to work in the field.

UNIT I
Digital image fundamentals & Image Transforms: -Digital Image fundamentals, Sampling and quantization, Relationship between pixels.
Image Transforms: 2-D FFT, Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform.

UNIT II
Image enhancement (spatial domain): Introduction, Image Enhancement in Spatial Domain, Enhancement Through Point Operation, Types of Point Operation, Histogram Manipulation, Linear and nonlinear gray level Transformation, local or neighborhood operation, median filter, spatial domain high-pass filtering.
Image enhancement (Frequency domain): Filtering in Frequency Domain, Obtaining Frequency Domain Filters from Spatial Filters, Generating Filters Directly in the Frequency Domain, Low Pass (smoothing) and High Pass (sharpening) filters in Frequency Domain

UNIT III
Image Restoration: Degradation Mode, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration.

UNIT IV
Image segmentation: Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation
Morphological Image Processing: Dilation and Erosion, Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, The Hit or Miss Transformation.

UNIT V

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

TEXT BOOKS:

1. Digital Image Processing- Rafeal C.Gonzalez, Richard E.Woods, 3rd Edition, Pearson, 2008
2. Digital Image Processing- S Jayaraman, S. Essakki rajan, T. Veerakumar-TMH,2010

REFERENCE BOOKS:

1. Digital Image Processing and analysis-human and computer vision application with using CVIP Tools – Scotte Umbaugh,2nd Ed, CRC Press,2011
2. Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology
3. Fundamentals of Digital Image Processing-A.K. Jain, PHI, 1989.
4. Digital Image Processing and computer Vision-Somka, Halavac,Boyle-Cengage learning (Indian edition)2008,
5. Digital Image Processing using Matlab, Rafeal C.Gonzalez, Richard E.Woods, Steven L. Eddins, Pearson Education.
6. Introduction to Image Processing & Analysis-John C.Russ, J. Christian Russ, CRC Press, 2010
7. Digital Image Processing with MATLAB &Labview-Vipula Singh Elsevier

COURSE OUTCOMES:

Upon Successfully completing the course, the student should:

1. Have an appreciation of the fundamentals of Digital Image Processing including the topics of filtering, transforms and morphology, and image analysis and compression
2. Be able to implement basic image processing algorithms in MATLAB.
3. Have the skill base necessary to further explore advance d topics of Digital Image Processing.
4. Be in a position to make a positive professional contribution in the field of Digital Image Processing.
5. At the end of the course the student should have a clear impression of the breadth and practical scope of Digital Image Processing and have arrived at a level of understanding that is the foundation for most of the work currently underway in this field.

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PROFESSIONAL ELECTIVE-V
(R22A0424) 5G AND BEYOND COMMUNICATION

Course Objectives:

1.   To understand the principles of MIMO Communications
2.   To provide exposure to advanced research topics beyond 5G/6G wireless systems
3.   To know the various requirements beyond 2020 communications

UNIT-I
Multiple Input Multiple Output (MIMO) Communications: Spatial Multiplexing, Spatial Diversity, Beam forming in MIMO systems, Hybrid Precoding, 5G Communication Landscape, Related work on 5G.

UNIT-II
Introduction to Mobile Wireless Technology Generations: 5G, WISDOM, GIMVC, Requirements of 5G, standardization of WISDOM, Vision of 5G, WISDOM Concept and Challenges, Cellular D2D Communication, D2D Using Physical Layer Network Coding, Using FFR and Using Cognitive Radio.
SMNAT: Introduction, Network Architecture and the Process, Implementation of SMNAT for In-Band- D2D and Interoperability with WISDOM, Description of Network elements of SMNAT and Call Flow for Session Establishment.

UNIT-III
Radio Wave Propagation for Mm Wave: Introduction, Large-scale Propagation Channel Effects, Small-Scale Channel Effects, Spatial Characterization of Multipath and Beam Combing, Outdoor Channel Models, Indoor Channel Models.

UNIT-IV
Higher layer Design Considerations for Mm Wave: Challenges when Networking Mm Wave Devices, Beam Adaptation Protocols, Relaying for Coverage Extension, Support for Multimedia Transmission, Multiband considerations, Performance of Cellular networks, Mm Wave Standardization: ECMA-387, IEEE 802.11ad.

UNIT-V
BEYOND2020: Major Challenges Surrounding Future Cyber Security, Users Awareness, Spectrum Related Security Issues in CRNs. Challenges for 2020 and beyond, Future Mobile Technologies, High Altitude Stratospheric Platform Station Systems, Human Bond Communications, CONASENSE.

TEXTBOOKS:

1. Ramjee Prasad, 5G: 2020 and Beyond, River Publishers
2. T. S. Rappaport, R.W.HeathJr., R.C.Daniels, and J.M. Murdock, Millimeter Wave Wireless Communication, Pearson Education, 2015.

REFERENCE BOOKS:

1. M. Manish, G. Devendra, P.Pattanayak, and N.Ha, 5G and Beyond Wireless Systems PHY Layer Perspective, Springer Series in Wireless Technology
2. M. Vaezi, Z. Ding, and H. V. Poor, Multiple Access techniques for 5G Wireless Networks and Beyond, Springer Nature, Switzerland, 2019

Course Outcomes:
Students will be able to:
1. Design MIMO Communication system
2. Utilize the Mobile Wireless Technology Generations
3. Know the propagation of mm waves
4. Face the challenges of beyond 2020 wireless communication

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PROFESSIONAL ELECTIVE –V
(R22A0425) SYSTEM ON CHIP ARCHITECTURE

UNIT –I:
Introduction to the System Approach:
System Architecture, Components of the system, Hardware & Software, Processor

UNIT –II:
Processors:
Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.
Simple Processor – memory interaction.

UNIT –III:
Memory Design for SOC:
Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

UNIT -IV:
Interconnect Customization and Configuration:
Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration -overhead analysis and trade-off analysis on reconfigurable Parallelism.

UNIT –V:
Application Studies / Case Studies:
SOC Design approach, AES algorithms, Design and evaluation, Image compression – JPEG compression.

TEXT BOOKS:
1. Computer System Design System-on-Chip - Michael J. Flynn and Wayne Luk, Wiely India Pvt. Ltd.
2. ARM System on Chip Architecture – Steve Furber –2 nd Ed., 2000, Addison Wesley

Professional.

REFERENCE BOOKS:

1. Design of System on a Chip: Devices and Components – Ricardo Reis, 1 st Ed., 2004, Springer
2. Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) – Jason Andrews – Newnes, BK and CDROM.
3. System on Chip Verification – Methodologies and Techniques –Prakash Rashinkar, Peter Paterson and Leena Singh L,2001, Kluwer Academic Publishers.

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IV Year B.Tech. ECE- II Sem   **L/T/P/C**
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PROFESSIONAL ELECTIVE –VI
(R22A0572) MULTIMEDIA DATABASE MANAGEMENT

COURSE OBJECTIVES:
1. To understand the concepts of Data Base systems and evolving Multimedia Techniques
2. To gain knowledge in virtualization of Multimedia Techniques
3. To introduce the multimedia concepts with Data Base.
4. To understand advantages of Multimedia effect on Data Base Systems.

UNIT-I
BASICS OF DATABASE MANAGEMENT SYSTEMS
Database Management Systems - Relational Model – SQL, Functional Dependencies - Normal Forms – Multivalued Dependencies, Join Dependencies – Examples - An introduction to Object-oriented Databases.

UNIT II - MULTIDIMENSIONAL DATA STRUCTURES
Multidimensional Data Structures: k-d Trees - Point Quad trees - The MX-Quad tree - R-Trees – comparison of Different Data Structures.

UNIT III - TEXT/DOCUMENT DATABASES
Text/Document Databases - Precision and Recall - Stop Lists - Word Stems and Frequency Tables - Latent Semantic Indexing - TV-Trees - Other Retrieval Techniques Image Databases - Raw Images - Compressed Image Representations - Similarity-Based Retrieval - Alternative Image DB Paradigms - Representing Image DBs with Relations - Representing Image DBs with R-Trees - Retrieving Images By Spatial Layout - Implementations.

UNIT IV - AUDIO AND VIDEO DATABASES
Audio Databases - A General Model of Audio Data - Capturing Audio Content through Discrete Transformation - Indexing Audio Data. Video Databases - Organizing Content of a Single Video - Querying Content of Video Libraries - Video Segmentation

UNIT V - MULTIMEDIA DATABASE ARCHITECTURE
Design and Architecture of a Multimedia Database - Organizing Multimedia Data Based on The Principle of Uniformity - Media Abstractions - Query Languages for Retrieving Multimedia Data.

TEXT BOOKS:
1. Multimedia Database Management Systems by B. Prabhakaran
2. Multimedia Database Management Systems by Guojun Lu

REFERENCE BOOKS:
1. Communication and Computing for Distributed Multimedia Systems by Guojun Lu

COURSE OUTCOMES:

1. Ability to analyze various Data base concepts.
2. Understanding the Database concept on Multimedia techniques.
3. Understand the Multimedia Techniques and design concepts
4. Analyze principles of Database with Multimedia.

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IV Year B.Tech. ECE- II Sem   **L/T/P/C**
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PROFESSIONAL ELECTIVE –VI
(R22A0426) EMBEDDED SYSTEM DESIGN

COURSE OBJECTIVES:

1. Understand the basics of an embedded system.
2. Program an embedded system.
3. To learn the design process of embedded system applications.
4. To understands the RTOS and inter-process communication.
5. To understand different communication interfaces.

UNIT–I
INTRODUCTION TO EMBEDDED SYSTEMS:

Definition of Embedded System, Embedded Systems Vs General Computing Systems, Classification, Major Application Areas, Purpose of Embedded Systems. Characteristics of embedded computing applications, challenges in embedded computing system design. The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration.

UNIT–II

TYPICAL EMBEDDED SYSTEM:
Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory selection for embedded systems; Sensors, actuators and other components, seven segment LED, relay, piezo buzzer, push button switch, reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer.

UNIT–III

EMBEDDED FIRMWARE DESIGN AND DEVELOPMENT:
Embedded firmware design approaches-super loop-based approach, operating system-based approach; Embedded firmware development languages-assembly language-based development, high level language-based development; Programming in embedded C.

UNIT–IV
RTOS BASED EMBEDDED SYSTEM DESIGN:
Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-preemptive and pre-emptive scheduling; task communication-shared memory, message passing.

UNIT –V

COMMUNICATION INTERFACE:
On board communication interfaces -I2C, SPI, UART,1-wire interface, parallel interface; External communication interfaces-RS232 and RS485, USB, infrared, Bluetooth, Wi-Fi, Zigbee, GPRS;

TEXTBOOKS:
1. Computers as Components–Wayne Wolf, Morgan Kaufmann (second edition).
2. Introduction to Embedded Systems-shibukv, McGraw Hill Education.

REFERENCEBOOKS:
1. Embedded System Design-frank Vahid, Tony Grivargis, John Wiley.
2. Embedded Systems-An integrated approach -Lylabdas, Pearson education2012.
3. Embedded Systems–Rajkamal, TMH
4. An embedded Software Primer, Davide Simon, Pearson education

COURSEOUTCOMES
1. Understand and design the embedded systems
2. Learn the basics of OS and RTOS
3. Understand types of memory and interfacing to external world
4. Understand embedded firm ware design approaches
5. Understand different communication interfaces.

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IV Year B.Tech. ECE- II Sem   L/T/P/C
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PROFESSIONAL ELECTIVE –VI
(R22A0427) WIRELESS SENSOR NETWORKS

COURSE OBJECTIVES:
1. To understand the characteristics, basic concepts in Wireless sensor networks
2. To understand the architecture framework and goals of WSN.
3. To understand the Medium Access control and its protocols.
4. To understand the routing metrics and network layer protocols.
5. To understand the QoS based routing protocols.

UNITI
Introduction: Components of a wireless sensor node, Motivation for a Network of Wireless Sensor Nodes, Classification of sensor networks, Characteristics of wireless sensor networks, Challenges of wireless sensor networks, Comparison between wireless sensor networks and wireless mesh networks, Limitations in wireless sensor networks, Design challenges, Hardware architecture.

UNIT II
Basic Architectural Framework: Physical Layer, Basic Components, Source Encoding, Channel Encoding, Modulation.
Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III
Medium Access Control: Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, S-MAC, IEEE 802.15.4.

UNIT IV
Network Layer: Routing Metrics, Flooding and Gossiping, Data-Centric Routing, Proactive Routing, On-Demand Routing, Hierarchical Routing, Location-Based Routing.

UNIT V
QoS-Based Routing Protocols: Node and Network Management: Power Management, Local Power Management aspects, Dynamic Power Management, Conceptual Architecture

TEXT BOOKS:
1. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley 2010
2. Mohammad S. Obaidat, Sudip Misra, "Principles of Wireless Sensor Networks", Cambridge, 2014
3. LoWPAN: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley
4. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers

REFERENCEBOOKS:
1. IanF. Akyildiz, Mehmet Can Vuran, "Wireless Sensor Networks", Wiley2010
2. C S Raghavendra, KM Sivalingam, Taieb Znati, "Wireless Sensor Networks",

Springer,2010
3. C. Sivarmmurthy & B.S. Manoj,"AdhocWirelessNetworks",PHI-2004
4. FEIHU., XIAOJUNCAO, "Wireless Sensor Networks", CRC Press,2013
5. Feng ZHAO, Leonidas GUIBAS, "Wireless Sensor Networks", ELSEVIER,2004
6. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan
7. Internet of Things (A Hands-on-Approach), Vijay Madisetti, Arshdeep Bahga

COURSEOUTCOMES:

The student will have the ability to:
1. Understand the challenges, design goals and architecture of Wireless sensor networks
2. Understand the channel encoding and modulation mechanism.
3. Understand the contention free and contention-based MAC protocols.
4. Understand the routing metrics and protocols of Network layer
5. Understand the QoS based routing protocols

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IV Year B.Tech. ECE- II Sem   **L/T/P/C**
                                                                          -/-/20/10

(R22A0495) PROJECT STAGE–II INCLUDING SEMINAR

The dissertation / Project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study.

The dissertation should have the following:

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need • Problems of national importance
- Research and development in various domain

The student should complete the following:

- Literature survey Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

NOTE: The viva-voce examination will be based on the above report and work

OPEN ELECTIVE-I

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

III Year B.Tech. ECE- I Sem   **L/T/P/C**
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OPEN ELECTIVE -I
(R22A0551) JAVA PROGRAMMING

COURSE OBJECTIVES:
1. To create Java programs that leverage the object-oriented features of the Java language, such as encapsulation, inheritance and polymorphism; Use data types, arrays and strings.
2. Implement error-handling techniques using exception handling,
3. To know about Applets and Event Handling
4. Create and event-driven GUI using AWT components.
5. To learn Multithreading concepts.

UNIT I
Java Programming-OOP Concepts, History of Java, Java buzzwords, Data types, Variables, Constants, Scope and Life time of variables, Operators, Type conversion and casting, Control Flow Statements, simple java programs, concepts of classes, objects, arrays, strings, constructors, methods, access control, this keyword, overloading methods and constructors, garbage collection, recursion.

UNIT II
Inheritance – Types of Inheritance, super keyword, and preventing inheritance: final classes and methods.
Polymorphism – Dynamic binding, method overriding, abstract classes and methods.
Interfaces-Interfaces Vs Abstract classes, defining an interface, implement interfaces, extending interface.
Packages- Defining, creating and accessing a package, importing packages.

UNIT III
Exception handling - Benefits of exception handling, exception hierarchy, Classification of exceptions - checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, built in exceptions.
Multi-threading- Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads.

UNIT IV
Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.
Event Handling: Events, Handling mouse and keyboard events.
Files- Streams, Byte streams, Character streams, Text input/output.
UNIT V
GUI Programming with Java – AWT class hierarchy, AWT controls - Labels, button, text field, check box, and graphics. Layout Manager – Layout manager types: border, grid and flow. Swing – Introduction, limitations of AWT, Swing vs AWT.

TEXT BOOKS:
1. Java- The Complete Reference, 7th edition, Herbert schildt, TMH.
2. Understanding OOP with Java, updated edition, T. Budd, Pearsoneducation.
3. Core Java an integrated approach, dreamtech publication, Dr. R.NageswaraRao.

REFERENCE BOOKS:
1. Java for Programmers, P.J.Deitel and H.M.Deitel, PEA (or) Java: How to Program, P.J.Deitel and H.M.Deitel, PHI
2. Object Oriented Programming through Java, P. Radha Krishna, Universities Press.

COURSE OUTCOMES:
1. An understanding of the principles and practice of object-oriented programming and design in the construction of robust, maintainable programs which satisfy their requirements;
2. A competence to design, write, compile, test and execute straightforward programs using a high-level language;
3. An awareness of the need for a professional approach to design and the importance of good documentation to the finished programs.
4. Be able to make use of members of classes found in the Java API.
5. Demonstrate the ability to employ various types of constructs and a hierarchy of Java classes to provide solution to a given set of requirements.

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OPEN ELECTIVE -I
(R22A1251) WEB DEVELOPMENT

COURSE OBJECTIVES:
1. To learn the basics of web & html programming
2. To understand CSS and its style
3. To know about Java Scripting & Dynamic Html
4. To understand the concepts of XML
5. To gain knowledge about web server software PHP.

UNIT I
Web Basics- Introduction, Concept of Internet- History of Internet, Protocols of Internet, World Wide Web, URL, Web Server, Web Browser, HTML-Introduction HTML-Basic Formatting Tags, HTML- Grouping Using Div Span, HTML-Lists, HTML-Images, HTML Hyperlink, HTML-Table, HTML- Frames, HTML – Forms, Form Elements, HTML – Meta Tags, HTML-Miscellaneous using tool Dreamweaver/ Visual studio.

UNIT II
CSS –Introduction, Syntax, CSS and page layout, CSS-Selectors, CSS-Attribute selectors, CSS-Color Background Cursor, CSS-Text Fonts, CSS-Lists Tables, CSS -Box Model, CSS-Display Positioning, CSS Floats. Using tool Visual studio, Net Beans.

UNIT III
Java Script: JavaScript characteristics, Objects in Java Script, Events-Handlers, Event objects, DOM, Advanced Java script and HTML Forms, Form Validation, Dynamic HTML with Java Script, DHTM-Events, CSS with JavaScript in DHTML.

UNIT IV
XML: Introduction to XML, Benefits, Holding Data, XML-DOM, Document Type Definition - DTD, XML Schema, Separates Structure from Formatting, Data Sharing XM, XML, HTTP Request, Accessing, Creating and Modifying XML Nodes, Loading XML Data into an HTML Page, Receiving XML Responses, Handling Response XML.

UNIT V
PHP: PHP Introduction, Structure of PHP, PHP Namespace, PHP Functions, PHP-File Handling, PHP Form-handling, PHP Form-validation, Connecting to database, Simple AJAX application.

TEXT BOOKS:
1. Web Programming, Building Internet Applications, CHRIS BATES II Edition, Wiley Dream tech.
2. Programming World Wide Web, SEBESTA, PEARSON.

REFERENCE BOOKS:
1. Internet and World Wide Web – How to program, Dietel and Nieto PHI/Pearson
2. PHP: The Complete reference-steven Holzner Tata McGraw-Hill.
3. An Introduction to web Design and Programming –Wang-Thomson
4. Web Warrior Guide to Web Programming -Bai/Ekedaw-Thomas
5. Beginning Web Programming-Jon Duckett WROX.

COURSE OUTCOMES:

1. Ability to design a web application.
2. Ability to develop a specific style sheet.
3. Ability to build a java scripting web application.
4. Ability to create a web design using XML.
5. Ability to develop web pages using PHP.

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OPEN ELECTIVE -I
(R22A2151) INTELLECTUAL PROPERTY RIGHTS

Course Objectives:

- Significance of intellectual property and its protection
- Introduce various forms of intellectual property

UNIT – I

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copyrights: Fundamental of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, international copyright law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV

Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation.
Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law; copyright law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copyright law, international patent law, and international development in trade secrets law.

TEXT BOOK:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

REFERENCE BOOK:

1. Intellectual property right – Unleashing the knowledge economy, Prabuddha Ganguli, Tata McGraw Hill Publishing company ltd.

COURSE OUTCOMES:

1. Distinguish and explain various forms of IPRs.
2. Identify criteria to fit one's own intellectual work in particular form of IPRs.
3. Apply statutory provisions to protect particular form of IPRs.
4. Appraise new developments in IPR laws at national and international level

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OPEN ELECTIVE -I
(R22A0351) ROBOTICS & AUTOMATION

COURSEOBJECTIVES:
1. To study overview of Embedded Systems, Robots, Microprocessors & Microcontrollers.
2. To study in detail about Robotics and sensors.
3. To study about AVR RISC Microcontroller architecture in detail.
4. To study about ARM Processor in detail.
5. To study about Artificial Intelligence in Robotics.

UNIT-I
Introduction to Embedded System Design, Categories of ES, Overview of Embedded System Architecture, Recent Trends in Embedded Systems, Hardware Architecture of Embedded System, Real-time Embedded Systems, Robots and Robotics, Microprocessors and Microcontrollers, Microcontroller or Embedded Controller

UNIT- II
Robotics: Classification of Robots, Links and Joint, Degree of freedom, Motors-DC motors, Stepper Motors, Servo Motors; Power Transmission-Type of Gears, Robotic Sensors, Applications of Robot, S/w used for Robot programming.

UNIT- III
The AVR RISC microcontroller architecture: Introduction, AVR family architecture, register file, Pin diagram of AVR, memory organization, I/O ports, timers, USART, Interrupt structure.

UNIT-IV
ARM Processor: Fundamentals, Registers, current program status register, pipeline concept, Interrupt and the vector table.

UNIT-V
AI IN ROBOTICS: Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics.

TEXTBOOKS:
1) Subrata Ghoshal, "Embedded Systems & Robots", Cengage Learning
2) Stuart Russell, Peter Norvig, "Artificial Intelligence: A modern approach", Pearson Education, India 2003.
3) ARM System Developer's Guide: Designing and Optimizing System Software- Andrew N.Sloss, Dominic Symes, Chris Wright,ElsevierInc.,2007

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OPEN ELECTIVE -I
(R22A0451) ELECTRONICS FOR HEALTH CARE

COURSEOBJECTIVES:
1. To understand x-ray generation and biological effects.
2. To study different x-ray diagnostic methods.
3. To study CT imaging concepts, fundamental of Magnetic resonance imaging.
4. To study Generation and detection of ultrasound and its techniques.
5. To study the principles of Radio nuclide imaging

UNIT-I

X-RAY IMAGING: Generation and Detection of X-rays – X-ray generation, X-ray generators, Filters, Beam restrictors and grids, Intensifying screens, fluorescent screens, and image intensifiers, X-ray detectors, X-ray image characteristics – Spatial resolution, Image noise, Image contrast, biological effects of ionizing radiation.

UNIT-II

X-RAY DIAGNOSTIC METHODS: Conventional X-ray radiography, Fluoroscopy, Angiography, Mammography and Xeroradiography, Image subtraction.

COMPUTED TOMOGRAPHY: Conventional tomography, Computed tomography, Algorithms for image reconstruction: parallel and Fan beam data, Spiral CT. Recent developments – Digital radiography.

UNIT-III

ULTRASOUND IMAGING: Generation and detection of Ultrasound- Piezoelectric effect, Ultrasonic transducers,

ULTRASONIC DIAGNOSTIC METHODS: Pulse echo systems- Amplitude mode(A-mode), Brightness mode(B-mode), Motion mode (M- mode), Constant depth mode (C-mode), Doppler methods, Duplex imaging, Tissue characterization, Colour Doppler flow imaging, Image characteristics – Ultrasonic texture or speckle, Speckle reduction, Compensation of phase aberration, biological effects of ultrasound

UNIT-IV

RADIONUCLIDE IMAGING: Generation & Detection of Nuclear Emission – Radionuclide generators, nuclear radiation detectors, Collimators, Radionuclide imaging systems-Gamma Camera, SPECT, PET.

BASICS OF MAGNETIC RESONANCE IMAGING: fundamentals of nuclear magnetic resonance- Angular momentum, magnetic dipole moment, magnetization, Larmor frequency, Rotating frame of reference and RF magnetic field, Free induction decay (FID), Fourier spectrum of the NMR signal, Spin density, Relaxation times, Pulse sequences.

UNIT-V

MRI SYSTEM & IMAGING METHODS: Magnetic field gradients, NMR Coil/Probe, Transmitter, Receiver, Data acquisition. Imaging Methods- Introduction, slice selection, frequency encoding, phase encoding, Spin-Echo imaging- Characteristics of MRI images-spatial resolution, image contrast. Functional MRI.

COURSE OUTCOMES:
On the completion of the course, the students will be able to
1. Understand the X-ray fundamentals and its characteristics.
2. Understand the X-ray diagnostic methods and CT imaging.
3. Understand the Ultra sound imaging and diagnostics methods.
4. Understand the properties of radio nuclides and its applications.
5. Understand the MRI system and imaging methods.

TEXTBOOKS:
1. **Principles of Medical Imaging**, Kirk Shung, Michael B. Smith and Banjamin Tsui, Academic Press, 1992.
2. **Handbook of Biomedical Instrumentation**, R.S. Khandpur, Tata McGraw Hill, 2nd Edition,2003.

REFERENCE BOOK:
1. **Fundamentals of Medical Imaging**, Paul Suetens, Cambridge University Press, 2002

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OPEN ELECTIVE -I
(R22A0251) RENEWABLE ENERGY SOURCES

Course Objectives:

1. To recognize the awareness of energy conservation in students
2. To identify the use of renewable energy sources for electrical power generation
3. To collect different energy storage methods and detect about environmental effects of energy conversion

UNIT-I:

Introduction

Renewable Sources of Energy- Grid- Supplied Electricity- Distributed Generation-Renewable Energy Economics- Calculation of Electricity Generation

Wind Power Plants:

Appropriate Location -Evaluation of Wind Intensity -Topography -Purpose of the Energy Generated – General Classification of Wind Turbines- Rotor Turbines- Multiple-Blade Turbines Drag Turbines- Lifting Turbines- Generators and Speed Control used in Wind Power Energy Analysis of Small Generating Systems.

UNIT-II:

Photo voltaic Power Plants

Solar Energy- Generation of Electricity by Photo voltaic Effect- Dependence of a PV Cell Characteristic on Temperature- Solar cell Output Characteristics-Equivalent Models and Parameters for Photo voltaic Panels- Photo voltaic Systems-Applications of Photo voltaic Solar Energy- Economical Analysis of Solar Energy.

Fuel Cells: The Fuel Cell- Low and High Temperature Fuel Cells- Commercial and Manufacturing Issues Constructional Features of Proton Exchange- Membrane Fuel Cells– Reformers- Electrolyzer Systems and Related Precautions- Advantages and Disadvantages of Fuel Cells-Fuel Cell Equivalent Circuit- Practical Determination of the Equivalent Model Parameters -Aspects of Hydrogen as Fuel.

UNIT-III:

Induction Generators

Principles of Operation-Representation of Steady- State Operation-Power and Losses Generated-Self-Excited Induction Generator-Magnetizing Curves and Self-Excitation Mathematical Description of the Self-Excitation Process-Interconnected and Stand-alone Operation-Speed and Voltage Contro- Economical Aspects.

UNIT-IV:

Storage Systems

Energy Storage Parameters-Lead-Acid Batteries-Ultra Capacitors-Flywheels–Super conducting Magnetic Storage System-Pumped Hydroelectric Energy Storage- Compressed Air Energy Storage-Storage Heat-Energy Storage as an Economic Resource.

UNIT-V:

Integration of Alternative Sources of Energy

Principles of Power Injection-Instantaneous Active and Reactive Power Control Approach Integration of Multiple Renewable Energy Sources-Islanding and Interconnection Control-DG Control and Power Injection.

Inter connection Of Alternative Energy Sources with the Grid:
Inter connection Technologies-Standards and Codes for Inter Connection-Inter connection, Considerations-Inter connection Examples for Alternative Energy Sources.

TEXTBOOKS:
1. Felix A. Farret, M. Godoy Simoes, "Integration of Alternative Sources of Energy", John Wiley& Sons, 2006.
2. Solanki: Renewable Energy Technologies: Practical Guide for Beginners, PHI Learning Pvt. Ltd., 2008.

REFERENCE BOOKS:
1. Mukherjee: Fundamentals of Renewable Energy Systems, New Age International publishers, 2007.
2. Remus Teodorescu, Marco Liserre, Pedro Rodríguez: Grid Converters for Photo voltaic and Wind Power Systems, John Wiley & Sons, 2011.
3. Gilbert M.Masters: Renewable and Efficient Electric Power Systems, John Wiley& Sons, 2004.

Course Out comes:
Costs- Demand side Management Options –Supply side Management Options-Modern Electronic Controls of Power Systems. At the end of the course the student will be able to:
1. Understand the principles of wind power and solar photo voltaic power generation, fuel cells.
2. Assess the cost of generation for conventional and renewable energy plants
3. Design suitable power controller for wind and solar applications and analyze the issues involved in the integration of renewable energy sources to the grid

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OPEN ELECTIVE -I
(R22A06751) PRINCIPLES OF DATA SCIENCE

Course Objectives:
   • To gain knowledge in the basic concepts of Data Analysis
   • To acquire skills in data preparatory and preprocessing steps.
   • To understand the mathematical skills in statistics.
   • To understand the concepts of Artificial Intelligence Roles and Skills in Data Science.
   • To understand the role of Data Science in Real-time applications

UNIT I INTRODUCTION Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – building the models – presenting and building applications.

UNIT II DESCRIBING DATA - I Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions – frequency distributions for nominal data – interpreting distributions – graphs – averages – mode – median – mean – averages for qualitative and ranked data – describing variability – range – variance – standard deviation – degrees of freedom – interquartile range – variability for qualitative and ranked data.

UNIT III DESCRIBING DATA - II Normal distributions – z scores – normal curve problems – finding proportions – finding scores – more about z scores – correlation – scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of r2 – multiple regression equations – regression toward the mean.

UNIT IV AI: ROLES AND SKILLS AI: Cognitive Computing: Learning Perceptions – Terminologies - Machine Learning – Neural Networks – Deep Learning - NLP – Speech Processing – Big Data and AI – Ethics in AI Research - Advanced Applications – AI Myths – Data Science Roles Data Scientist, Data Architect, Data Analyst – Machine Learning Engineer – Skills.

UNIT V DATA SCIENCE USE CASES Data Science Use Cases Specifications and Discussion – Data Sources Identification – Data Types –Data Classification – Data Characteristics of Big V"s – Data Science P"s – Applications of AI: Domains: Customer Insights – Behavioral Analysis –- Marketing – Retails – Insurance – Risk and Security – Health care – Supply Chain Logistics.

Text Books:
   1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (first two chapters for Unit I)
   2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Chapters 1–7 for Units II and III)
   3. Joel Grus, "Data Science from Scratch", 2nd Edition, O'Reilly Publisher, ISBN: 9781492041139, May 2019 (for Unit IV and V)

Reference Books:
1. Lillian Pierson, Jake Porway, "Data Science for Dummies", Second Edition, John Wiley & Sons, Publishers, ISBN: 9781119327639, 2017 (EBook)
2. Sinan Ozdemir, Sunil Kakade, "Principles of Data Science", Second Edition (EBook)
3. E- Learning Resources: Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

Course Outcomes:
On successful completion of this course, students would be able to
• Understand the foundational concepts of Data Science.
• Understand the nature of Data.
• Determine the relationship between data dependencies using statistics.
• Understand the concepts of Artificial Intelligence Roles and Skills in Data Science.

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OPEN ELECTIVE -I
(R22A06752) BUSINESS ANALYTICS

Course Objective
1. To help students in understanding how the managers use business analytics for managerial decision making.

Learning Outcome:
1. The students will be familiar with the practices of analyzing and reporting the business data useful for the insights of business growth and development.

UNIT-1: Understanding Business Analytics
Introduction: Meaning of Analytics - Evolution of Analytics - Need of Analytics - Business Analysis vs. Business Analytics - Categorization of Analytical Models - Data Scientist vs. Data Engineer vs. Business Analyst - Business Analytics in Practice - Types of Data – Role of Business Analyst.

UNIT-II Dealing with Data and Data Science
Data: Data Collection –Data Management – Big Data Management - Organization/Sources of Data - Importance of Data Quality - Dealing with Missing or Incomplete Data - Data Visualization - Data Classification.
Data Science Project Life Cycle: Business Requirement-Data Acquisition-Data Preparation
- Hypothesis and Modeling - Evaluation and Interpretation - Deployment - Operations - Optimization - Applications for Data Science

Unit-III: Data Mining and Machine Learning
Data Mining: The Origins of Data Mining - Data Mining Tasks - OLAP and Multidimensional Data Analysis - Basic Concept of Association Analysis and Cluster Analysis.
Machine Learning: History and Evolution - AI Evolution - Statistics vs. Data Mining vs. Data Analytics vs. Data Science - Supervised Learning - Unsupervised Learning - Reinforcement Learning - Frameworks for Building Machine Learning Systems.

Unit-IV: Applications of Business Analytics
Overview of Business Analytics Applications: Financial Analytics - Marketing Analytics - HR Analytics - Supply Chain Analytics - Retail Industry - Sales Analytics - Web & Social Media Analytics - Healthcare Analytics - Energy Analytics - Transportation Analytics - Lending Analytics - Sports Analytics - Future of Business Analytics.

Unit-V: Ethical, Legal and Organizational Issues
Issues & Challenges: Business Analytics Implementation Challenges - Privacy and Anonymization - Hacking and Insider Threats - Making Customer Comfortable.

REFERENCES
1. James R Evans, Business Analytics, Global Edition, Pearson Education U Dinesh Kumar, Business Analytics, Wiley India Pvt. Ltd., New Delhi
2. Ger Koole, An Introduction to Business Analytics, Lulu.com,2019

3. J.D.Camm, J.J.Cochran, M.J.Fry, J.W.Ohlmann, D.R.Anderson, D.J.Sweeney, T. A.Williams - *Essentials of Business Analytics*, 2e; Cengage Learning.
4. Vipin Kumar, Introduction to Data Mining, Pang-NingTan, Michael Steinbach, Pearson Education India
5. Bhima sankaram Pochiraju, Sridhar Seshadri, Essentials of Business Analytics: An Introduction to the Methodology and its Application, Springer

OPEN ELECTIVE-II

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OPEN ELECTIVE–II
(R22A0553) DATABASE SYSTEMS

COURSE OBJECTIVES:

1. To understand the basic concepts and the applications of database systems
2. To Master the basics of SQL and construct queries using SQL
3. To understand the relational database design principles
4. To become familiar with the basic issues of transaction processing and concurrency control
5. To become familiar with database storage structures and access techniques

UNIT I: INTRODUCTION

Database: Purpose of Database Systems, File Processing System Vs DBMS, History, Characteristic- Three schema Architecture of a database, Functional components of a DBMS, DBMS Languages- Database users and DBA

UNIT II: DATABASE DESIGN

ER Model: Objects, Attributes and its Type. Entity set and Relationship Set-Design Issues of ER model-Constraints, Keys-primary key, Super key, candidate keys. Introduction to relational model-Tabular, Representation of Various ER Schemas. ER Diagram Notations Goals of ER Diagram- Weak Entity Set- Views

UNIT III: STRUCTURED QUERY LANGUAGE

SQL: Overview, The Form of Basic SQL Query -UNION, INTERSECT, and EXCEPT– join operations: equi join and non equi join -Nested queries - correlated and uncorrelated Aggregate Functions-Null values. Views, Triggers.

UNIT IV - DEPENDENCIES AND NORMAL FORMS

Importance of a good schema design: - Problems encountered with bad schema designs, Motivation for normal forms- functional dependencies, -Armstrong's axioms for FD's Closure of a set of FDs, - Minimal covers -Definitions of 1NF,2NF, 3NF and BCNF Decompositions and desirable properties

UNIT V:

Transactions: Transaction concept, transaction state, System log, commit point, Desirable Properties of a Transaction, concurrent executions, serializability, recoverability, implementation of isolation, transaction definition in SQL, testing for serializability, Serializability by Locks- Locking Systems with Several Lock Modes-Concurrency Control by Timestamps, validation.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, McGraw- Hill, 6th Edition, 2010.

2. Fundamental of Database Systems, by Elmasri, Navathe, Somayajulu, and Gupta, Pearson Education

REFERENCE BOOKS:

1. Raghu Ramakrishnan, Johannes Gehrke, —Database Management System, McGraw Hill., 3rd Edition 2007.

2. Elmasri & Navathe, Fundamentals of Database System, Addison-Wesley Publishing, 5thEdition, 2008.

3. Date. C.J, —An Introduction to Database, Addison-Wesley Pub Co, 8th Edition, 2006.

4. Peterrob, Carlos Coronel, —Database Systems – Design, Implementation, and Management, 9th Edition, Thomson Learning, 2009

COURSE OUTCOMES:

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

1. Understand the basic concepts and the applications of database systems

2. Master the basics of SQL and construct queries using SQL.

3. Understand the relational database design Principles.

4. Familiarize with the basic issues of transaction processing and concurrency control.

5. Familiarize with database storage structures and access techniques.

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OPEN ELECTIVE–II
(R22A06753) BIG DATA ARCHITECTURE

Prerequisite: DBMS, DWDM

Course Objectives:

1. The purpose of this course is to provide the students with the knowledge of Big dataAnalytics principles and techniques.
2. This course is also designed to give an exposure of the frontiers of Big data Analytics.
3. To Understand the knowledge of Hadoop, HDFC and MapReduce Techniques
4. To gain the acknowledge on Hadoop Architecture.
5. To learn the machine learning approaches using R

UNIT - I:

Introduction to Big Data: Big Data and its Importance – Four Vs of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications.

UNIT - II:

Big Data Technologies: Hadoop's Parallel World – Data discovery – Open-source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data

UNIT - III:

Introduction Hadoop: Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization

UNIT - IV:

Hadoop Architecture: Hadoop: RDBMS Vs Hadoop, Hadoop Overview, Hadoop distributors, HDFS, HDFS Daemons, Anatomy of File Write and Read., Name Node, Secondary Name Node, and Data Node, HDFS Architecture, Hadoop Configuration, Map Reduce Framework, Role of HBase in Big Data processing, HIVE, PIG.

UNIT - V:

Data Analytics with R Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering, Social Media Analytics, Mobile Analytics, Big Data Analytics with BigR.

TEXT BOOKS:

1. Big Data Analytics, Seema Acharya, Subhasini Chellappan, Wiley 2015.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1st Edition, Ambiga Dhiraj,

Wiely CIO Series, 2013
3. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O‟Reilly Media, 2012.

REFERENCE BOOKS:

1. Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC press (2013).
2. Professional Hadoop Solutions, Boris Lublin sky, Kevin t. Smith, Alexey Yakubovich, Wiley,ISBN: 9788126551071, 2015.
3. Understanding Big data, Chris Eaton, Dirk deroos et al. McGraw Hill, 2012.

COURSE OUTCOMES:

1. Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools
2. Ability to program using HADOOP and Map reduce, NOSQL.
3. Ability to understand the importance of Big Data in social media and Mining.

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OPEN ELECTIVE–II
(R22A0352) DESIGN THINKING

COURSE OBJECTIVES:
1. To understand the engineering design process and identification of customer need.
2. To understand innovative problem-solving concepts.
3. To understand the principles of Design for Manufacturing and FMEA.
4. To know about the design for assembly principles.
5. To know about the concepts of design for environment and design for recycling.

UNIT-I

Introduction: Innovations in Design, Engineering Design Process, Prescriptive and integrativemodels of design, Design Review and societal considerations.

Identification of Customer Need: Evaluating Customer requirements and survey on customer needs, Conversion of customer needs into technical Specifications, Information sources.

UNIT-II

Theory of Inventive Problem solving (TRIZ), Creativity and Problem solving, Functional Decomposition of the problem for innovative concept development, Introduction to Axiomatic Design, Concept evaluation and decision making.

UNIT-III

Design for Manufacturing: Technical estimating, design of experiments, design for manufacturability, statistical process control, Introduction to FMEA (failure modes and effects analysis), and Case study of design for manufacturing: Manufacturing System Design Based on Axiomatic Design: Case of Assembly Line

UNIT-IV

Design for Assembly: Assembly Principles, Process, Worksheet, Assumptions. Case study of design for Assembly: Manufacturing System Design Based on Axiomatic Design: Case of Assembly Line

UNIT-V

Design for Environment: Design for recycling; Design for disassembly, Design for energy Efficiency, Design for remanufacture, Design for disposability, Hazardous material minimization. Case study of design for Environment.

TEXT BOOKS:
1. Nigel Cross, Engineering Design Methods, John Wiley, 2009.
2. George E. Dieter, Engineering Design, McGraw-Hill, 2009.
3. Genrich Altshuller, The Innovation Algorithm, Technical Innovation Centre, 2011.

REFERENCE BOOKS
1. The Art of Innovation, by Tom Kelley.
2. Design Thinking, by Nigel Cross.
3. The Design of Business: by Roger Martin.

COURSE OUTCOMES:
1. The importance of design in innovation.
2. Design tools and processes can generate innovative new ideas.
3. Design and design thinking to innovative in areas such as engineering, software development and business operations.
4. Strengthen students' individual and collaborative capabilities to identify customer needs, create sound concept hypotheses, collect appropriate data, and develop a prototype that allows for meaningful feedback in a real-world environment.
5. To describe the various case studies for design for environment.

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OPEN ELECTIVE–II

(R22A0552) PRINCIPLES OF CLOUD COMPUTING

COURSE OBJECTIVES:
1. To understand the various distributed system models and evolving computing paradigms
2. To gain knowledge in virtualization of computer resources
3. To realize the reasons for migrating into cloud
4. To introduce the various levels of services that can be achieved by a cloud.
5. To describe the security aspects in cloud and the services offered by a cloud.

UNIT - I

Cloud Computing Fundamentals: Definition of Cloud computing, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers.

Computing Paradigms: High-Performance Computing, Parallel Computing, DistributedComputing, Cluster Computing, Grid Computing.

UNIT- II

Migrating into a Cloud: Introduction, Broad Approaches to Migrating into the Cloud, the Seven-Step Model of Migration into a Cloud.

Virtualization: Virtual Machines and Virtualization of Clusters and data centers-Implementation Levels of Virtualization -Virtualization Structures/Tools and Mechanisms- Virtualization of CPU, Memory, and I/O Devices-Virtual Clusters and Data Centers

UNIT- III

Infrastructure as a Service (IAAS) & Platform (PAAS): Virtual machines provisioning and Migration services, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action. On the Management of Virtual machines for Cloud Infrastructures- Aneka—Integration of Private and Public Clouds.

UNIT- IV

Software as a Service (SAAS) &Data Security in the Cloud: Software as a Service SAAS), Google App Engine – Centralizing Email Communications- Collaborating via Web-Based Communication Tools-An Introduction to the idea of Data Security.

UNIT- V

SLA Management in cloud computing: Traditional Approaches to SLO Management, Typesof SLA, Life Cycle of SLA, SLA Management in Cloud.

TEXT BOOKS:
1. Cloud Computing Principles and Paradigms, by Rajkumar Buyya.
2. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014.
3. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.

REFERENCE BOOKS:
1. Cloud Computing: A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill,rp2011.
2. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press,2010.
3. Cloud Computing: Implementation, Management and Security, John Rittenhouse, James F.Ransome, CRC Press,rp2012.
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O'reilly, SPD,rp2011.
5. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.

COURSE OUTCOMES:
1. Ability to analyze various service delivery models of cloud computing.
2. Ability to interpret the ways in which the cloud can be programmed and deployed.
3. Ability to comprehend the virtualization and cloud computing concepts.
4. Assess the comparative advantages and disadvantages of Virtualization technology.
5. Analyze security issues in cloud computing.

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OPEN ELECTIVE–II

(R22A6951) INTERNET OF THINGS & ITS APPLICATIONS

COURSE OBJECTIVES:
1. To study IoT Networking Core
2. To study IoT related network fundamentals
3. To study IoT Architecture.
4. To study IoT Application Development procedure
5. To study various case studies and IoT applications.

UNITI: FUNDAMENTALS OF IoT- Evolution of Internet of Things, Enabling Technologies, M2M Communication, IoT World Forum (IoTWF) standardized architecture, Simplified IoT Architecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II: IoT PROTOCOLS- IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks,6LoWPAN, Application Transport Methods: SCADA, Application Layer Protocols: CoAP and MQTT.

UNIT III: DESIGN AND DEVELOPMENT- Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details

UNIT IV: DATA ANALYTICS AND SUPPORTING SERVICES: Data Analytics: Introduction, Structured Versus Unstructured Data, Data in Motion versus Data at Rest, IoT Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M, Supporting Services: Computing Using a Cloud Platform for IoT/M2M Applications/Services, Everything as a service and Cloud ServiceModels.

UNIT V: CASE STUDIES/INDUSTRIAL APPLICATIONS: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment, Industry 4.0 concepts.

TEXT BOOKS:
1. 6LoWPAN: The Wireless Embedded Internet, Zach Shel by, Carsten Bormann, Wiley.
2. Internet of Things: Converging Technologies for Smart Environments and Integrated Eco systems, Dr.Ovidiu Vermesan, Dr.Peter Friess, River Publishers.
3. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann

REFERENCES:

1. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T.Yang, Huansheng Ning.
2. Internet of Things (A Hands-on-Approach), Vijay Madisetti, Arshdeep Bahga.
3. Designing the Internet of Things, Adrian McEwen (Author), Hakim Cassimally.
4. Asoke K Talukder and Roopa R Yavagal, "Mobile Computing," Tata Mc Graw Hill, 2010.
5. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on- Approach)", 1st Edition,VPT, 2014.
6. Computer Networks; By: Tanenbaum, AndrewS; Pearson Education Pte.Ltd., Delhi, 4thEdition.
7. Data and Computer Communications; By: Stallings, William; Pearson Education Pte.Ltd., Delhi, 6thEdition.

COURSE OUTCOMES:

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

1. Understand IoT Networking Core
2. Understand IoT related network fundamentals.
3. Understand IoT Architecture.
4. Understand IoT Application Development procedure.
5. Understand various case studies and IoT applications.

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OPEN ELECTIVE–II

(R22A2152) NANO TECHNOLOGY

Course Objectives:
1. To learn about basis of Nano Materials.
2. In this course we focus on synthetic aspects for the design of nanostructuredmaterials.
3. We describe different approaches including both the bottom-up (includes both chemical and physical methods) and the top-down methods (mainly physical methods) for the synthesis of nanostructured materials.
4. The course will then focus on different type of nanostructures with a special emphasis on carbon nanotubes (CNT), metal and metal oxide nanoparticles, core-shell nanostructures and self-assembly of these nanostructures.
5. The dependence of various properties (dielectric, magnetic and optical) with size willbe discussed.

UNIT-I
General Introduction: Basics of Quantum Mechanics, Harmonic oscillator, magnetic Phenomena, band. structure in solids, Mossbauer and Spectroscopy, optical phenomena bonding in solids, Anisotropy.
Silicon Carbide: Application of Silicon carbide, nano materials preparation, Sintering of SiC, X- ray Diffraction data, electron microscopy sintering of nano-particles, nano particles of Alumina and Zirconia: Nano materials preparation, Characterization, Wear materials and nano- composites,

UNIT-II
Mechanical properties: Strength of nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties.
Electrical properties: Switching glasses with nanoparticles, electronic conduction with nano- particles.
Optical properties: Optical properties, special properties and the coloured glasses.
Magnetic Properties: Soft magnetic Nanocrystalline alloy, Permanent magnetic Nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties, and Mechanical Properties.

UNIT–III
Synthesis Routes: Top & Bottom up approaches: Physical Vapor Deposition, Micromulsion, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Solgel method, Spray Pyrolysis, Template Based synthesis, Lithography.

UNIT–IV
Tools to Characterize Nanomaterials: X-Ray Diffraction (XRD), Small Angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron

Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nanoindentation

UNIT–V
Applications of Nanomaterials: Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nanosensors, Nanocatalysts, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, Water Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defense and Space Applications.

TEXT BOOKS:
1. Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, University Press-IIM.
2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wiley India Edition, 2012.
3. Guozhong Cao, Nanostructures and Nano-materials: Synthesis, Properties and Applications, Imperial College Press 2004.

REFERENCES BOOKS:
1. Nano: The Essentials by T. Pradeep, McGraw- Hill Education.
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L. Schodek.
3. Transport in Nano structures- David Ferry, Cambridge University press 2000
4. Nanofabrication towards biomedical application: Techniques, tools, Applicationand impact – Ed. ChallaS., S. R. Kumar, J. H. Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. Electron Transport in Mesoscopic systems – S. Dutta, Cambridge University press.
7. Nanomaterials Synthesis, Properties and Applications Edited by A S Edelstein and R CCammarata, IOP Publishing Ltd 1996.

Course Outcomes:
1. Upon completion of course, students will familiarize about Nano Technology.
2. Students should demonstrate the preparation of Nano Technology.
3. Upon course completion, students will develop knowledge in characteristic Nano
4. Technology & Nano Materials.
5. Student should able to explain about carbon nanotube metal oxide formation.
6. Student able to understand different properties along with sizes.

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OPEN ELECTIVE–II
(R22A0252) ELECTRICAL AND HYBRID VEHICLES

Course Objectives:

- To understand the fundamentals of Electric Vehicles (EVs), especially in Indian Context.
- To examine technology associated with each element of EV drive-train.
- To get in to the economics of EVs in India v is-à-v is petrol vehicles.

UNIT-I:

Introduction

Overview of Electric Vehicles in India, India's EV program, Charging and Swapping Infrastructure, brief introduction of batteries, Lithium for batteries, EV Subsystems.

UNIT-II:

Vehicle Dynamics: Forces acting when a vehicle moves, Aerodynamic drag, Rolling Resistance and Uphill Resistance, Power and Torque to accelerate.

Drive Cycle: Concept of Drive Cycle, Drive Cycles and Energy used per km.

UNIT-III:

EV Power train: Design of EV Drive Train, Introduction to Battery Parameters, Why Lithium Ion Battery? Batteries in Future, Li-Ion Battery Cells, SoH and SoC estimation and Self Discharge, Battery Pack Development, Computation of Effective cost of battery, Charging Batteries.

Fundamentals of EV Battery Pack design: Mechanical, Thermal and Electrical Design, BMS Design of Electric Vehicle.

UNIT-IV:

EV Motors and Controllers: Fundamentals and Design, Understanding Flow of Electricity, Magnetism and Heat, Power and Efficiency, Torque Production, Speed and Back EMF, the d-q Equivalent circuit, Field-oriented Control, Understanding Three phase AC and DC to AC conversion systems, Understanding the thermal design of the motors, Engineering Considerations, Future Frontiers.

UNIT-V:

EV Charging: Introduction, Slow or Fast EV Chargers, Battery Swapping, Standardization and on-board Chargers, Public Chargers, Bulk Chargers/Swap Stations, Economics of Public Chargers in context, Analytics and Tools for EV systems.

TEXT BOOKS:

1. Electric Power train- Energy Systems, Power electronics and drives for Hybrid, electric

and fuel cell vehicles by John G. Hayes and A. Goodarzi, Wiley Publication.

2. Mehrdad Ehsani, Yimi Gao, Sebastian E.Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

3. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRCPress,2003.

REFERENCE BOOKS

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley,2003

2. Chris Mi, M.Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, John Wiley & Sons Ltd., 2011

3. Fundamentals of Electric Vehicles: technology and economics https://onlinecourses.nptel.ac.in/noc20_ee99/previewhttps://archive.nptel.ac.in/courses/108/106/108106170/

COURSE OUTCOMES:

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

1. Understand the fundamentals of Electric Vehicles.

2. Design of batteries, EV motors and Power electronic controllers for EV systems.

3. Analyze the economics of EV market and E data using Analytical tools.

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OPEN ELECTIVE–II
(R22A6251) CYBER GOVERNANCE

Prerequisite: CYBER SECURITY

Course Objectives:

1. To learn Principles of Cyber Security.
2. To learn various types of attacks and the precautions.
3. To gain the knowledge of security and governance measurements
4. To learn the analytical and various security compliance in Cyber Security through governance.
5. To gain the knowledge of various countries Cyber Security Principles and Governance.

UNIT-I:

Principles of cyber-security governance, Assessment of cyber security maturity, Theories of governance – introduction, Governance – definitions and typologies, Tools, methods and processes,

UNIT-II:

Vulnerability management, Threat management, Endpoint management, Intrusion detection and prevention (IDPS), Security incident management, Security operations center (SOC) and related concepts.

UNIT-III:

Measurement of governance: Metrics – concepts, Application security metrics, Network security metrics, Security incident metrics, Vulnerability metrics, Service level objectives / agreement (SLO / SLA), NIST metrics

UNIT-IV:

Basics of security analytics, Threat intelligence and governance, Data driven security governance, Impact of cognitive security on security governance, Industry specific security compliance

UNIT-V:

Cyber security governance India and Other countries, NIST mandates for compliance,

Security reporting basics, CISO – role and organization structure

TEXTBOOKS:

1. Hayden, Lance. IT Security Metrics: A Practical Framework for Measuring Security & Protecting Data. McGraw-Hill Education Group, 2010.
2. Jacobs, Jay, and Bob Rudis. Data-driven security: analysis, visualization and dashboards. John Wiley & Sons, 2014
3. Collins, Michael. Network Security Through Data Analysis: From Data to Action. "O' Reilly Media, Inc.", 2017.
4. Jaquith, Andrew. Security metrics: replacing fear, uncertainty, and doubt. Pearson Education,2007.

REFERENCEBOOKS:

1. Cybersecurity, Critical Infrastructure. "Framework for Improving Critical Infrastructure Cybersecurity." Framework 1 (2014): 11.

COURSE OUTCOMES:

1. Students will be able to understand the basis of cyber-security.
2. Students will be able to know various governance principles.
3. Students will learn about various types of attacks and threats in Security.
4. Students will gain the knowledge of other countries standards, methods in governance.