Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus of

B. Tech.

(Electronics Engineering)

Pattern 'B-19'

Academic Year 2019-20

Prepared by: - Board of Studies in Electronics Engineering

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Signed by

Chairman – BOS

Chairman – Academic Board

Title: Course Structure **FF No.: 653**

Branch: Electronics Engineering Year: S. Y. Academic Year: 2019-20 Semester: I Module: NA Pattern: B-19

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)		Examination scheme					Total	Credits
			Theory	Lab	CA		MSE	ESA			
					HA	LAB		ESE	VIVA		
S1	ET2101	Electronic Circuits	3	2	10	30	10	30	20	100	4
S2	ET2003	Network Theory	3	2	10	30	10	30	20	100	4
S3	ET2005	Signals & Systems	3	2	10	30	10	30	20	100	4
S4	ET2002	Data Structures and Algorithms	3	2	10	30	10	30	20	100	4
S5	ET2111	Probability & Random Variables	2	-	20	-	30	30	20	100	2
S6	ET2016	Engineering Design & Innovation 1	2	4	-	-	50	50	-	100	4
Total											22

Abbreviations Used	
CA	Continuous Assessment
HA	Home Assignment
MSE	Mid Semester Examination
ESE	End Semester Examination
ESA	End Semester Assessment
GD / PPT	Group Discussion / Power Point Presentation

Title: Course Structure **FF No.: 653**

Branch: Electronics Engineering **Year: S. Y.** **Academic Year: 2019-20** **Semester: II** **Module: NA** **Pattern: B-19**

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)		Examination scheme					Total	Credits
			Theory	Lab	CA		MSE	ESA			
					HA	LAB		ESE	VIVA		
S1	ET2007	Control Systems	3	2	10	30	10	30	20	100	4
S2	ET2004	Communication Engineering	3	2	10	30	10	30	20	100	4
S3	ET2006	Electromagnetic Engineering	3	2	10	30	10	30	20	100	4
S4	ET2015	Digital Systems	3	2	10	30	10	30	20	100	4
S5	ET2012	Multivariate Data Analysis	2	-	20	-	30	30	20	100	2
S6	ET2017	Engineering Design & Innovation 2	2	4	-	-	50	50	-	100	4
	ET2014	**General Proficiency 2									
Total											22

Abbreviations Used	
CA	Continuous Assessment
HA	Home Assignment
MSE	Mid Semester Examination
ESE	End Semester Examination
ESA	End Semester Assessment

(**) Audit Course evaluated in second semester

Vishwakarma Institute of Technology													Issue 1: Rev No. 1: Dt. 01/07/18
Title: Course Structure													FF No. 653
Branch: Electronics Engineering		TY B.Tech			Academic Year: 2019-20			Semester	Module:V				Pattern: C-19
Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination Scheme							Credits
			Theory	Lab	Tut	CA			MSE	ESA		Total	
						HA	LAB	GD/PPT		ESE	VIVA		
		Elective-1											
1	EL3001	Microcontroller Applications	3	2		10	30	10	15	15	20	100	4
2	EL3025	Sensors & Actuators											
3	EL3003	Data Compression											
		Elective-2											
4	EL3004	Power Electronics	3	2		10	30	10	15	15	20	100	4
5	EL3026	Computer Architecture and Operating Systems											
6	EL3006	Computer Vision											
		Elective-3											
7	EL3007	Digital Integrated Circuit Design	3	2		10	30	10	15	15	20	100	4
8	EL3009	RF Circuit Design											
9	EL3027	OOPS											
		Elective-4											
10	EL3010	Wireless Technologies	3	2		10	30	10	15	15	20	100	4
11	EL3011	Artificial Intelligence											
12	EL3008	Data Base Management System											
5	EL3177	Engineering Design & Innovation-1	1	2	2								4

6	EL3075	Seminar											1
Total													21

Vishwakarma Institute of Technology													Issue 1: Rev No. 1: Dt. 01/07/18
Title: Course Structure													FF No. 653
Branch: Electronics Engineering		TY B.Tech		Academic Year: 2019-20			Semester		Module: VI			Pattern: C-19	
Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme							Credits
			Theory	Lab	Tut	CA			MSE	ESA		Total	
						HA	LAB	GD/PPT		ESE	VIVA		
		Elective-1											
1	EL3012	Electronics Product Design	3	2		10	30	10	15	15	20	100	4
2	EL3014	Data Communication & Networking											
3	EL3002	Robotics											
		Elective-2											
4	EL3016	Digital System Design	3	2		10	30	10	15	15	20	100	4
5	EL3017	Embedded System Design											
6	EL3018	Digital Signal Processing											
		Elective-3											
7	EL3019	Machine Learning	3	2		10	30	10	15	15	20	100	4
8	EL3020	AdHoc Networks											
9	EL3021	Microwave Engineering											
		Elective-4											
10	EL3022	Internet of Things	3	2		10	30	10	15	15	20	100	4
11	EL3023	Industrial Automation											
12	EL3024	VLSI Technologies											
13	EL3178	Engineering Design & Innovation-2	1	2	2								4

14	EL3080	General Proficiency-3											1
Total													21

Vishwakarma Institute of Technology													Issue 1: Rev No. 1: Dt. 01/07/18
Title: Course Structure													FF No. 653
Branch: Electronics Engineering		Final Year B. Tech		Academic Year: 2020-21			Semester		Module: VII				Pattern: C-19
Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme							Credits
			Theory	Lab	Tut		CA		MSE	ESA		Total	
						HA	LAB	GD/PPT		ESE	VIVA		
		Elective-1											
1	EL4003	Engineering Ethics	3			10	30	10	15	15	20	100	3
2	EL4004	Renewable Energy											
		Elective-2											
3	EL4006	CMOS Mixed Signal Design	3	2		10	30	10	15	15	20	100	4
4	EL4013	Advanced Power Electronics											
5	EL4012	Design of Experiments											
		Elective-3											
6	EL4014	Artificial Neural Networks	3	2		10	30	10	15	15	20	100	4
7	EL4015	Antenna Theory											
8	EL4016	Advanced Digital Signal Processing											
9	EL4018	RF Integrated Circuit Design											
10	EL4019	Real Time Operating Systems											
11	EL4021	Pattern Recognition											
12	EL4071	Major Project 1		8									4

13	EL4078	Professional Development 3 (Audit Course)											
Total													15

Vishwakarma Institute of Technology												Issue 1: Rev No. 1: Dt. 01/07/18
Title: Course Structure												FF No. 653
Branch: Electronics Engineering		Final Year B. Tech		Academic Year: 2020-21		Semester		Module:VIII		Pattern: C-19		
Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme						Credits
			Theory	Lab	Tutorial	CA		MSE	ESA		Total	
						HA	LAB		ESE	VIVA		
		Elective-1										
1	EL4080	Research Internship										15
	EL4081	Project Internship										
	EL4082	Industry Internship										
	EL4083	International Internship										
	EL4282	Industry Internship										
Total												15

Vishwakarma Institute of Technology													Issue 1: Rev No. 1: Dt. 01/07/18
Title: Course Structure													FF No. 653
Branch: Electronics Engineering		Final Year B. Tech	Academic Year: 2020-21			Semester			Module: VIII			Pattern: C-19	
Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme							Credits
			Theory	Lab	Tut		CA		MSE	ESA		Total	
						HA	LAB	GD/PPT		ESE	VIVA		
		Elective-1											
1	EL4003	Engineering Ethics	3			10	30	10	15	15	20	100	3
2	EL4004	Renewable Energy											
		Elective-2											
3	EL4006	CMOS Mixed Signal Design	3	2		10	30	10	15	15	20	100	4
4	EL4013	Advanced Power Electronics											
		Elective-3											
5	EL4014	Artificial Neural Networks	3	2		10	30	10	15	15	20	100	4
6	EL4015	Antenna Theory											
7	EL4016	Advanced Digital Signal Processing											
8	EL4018	RF Integrated Circuit Design											
9	EL4019	Real Time Operating Systems											
10	EL4072	Major Project 2		8									4
Total													15

FF No.: 654

ET2001: Electronic Circuits

Credits: 4

Teaching Scheme: 5 Hours / Week
Theory: 3 Hours / Week
Lab/ Project: 2 Hours / Week

Section I

Drift, diffusion, Conductivity, Mobility, Mass action law, ,Potential across Graded semiconductor, Open circuited step graded junction, PN junction diode, Forward and reverse biased diode operation, V-I characteristic equation of diode, Temperature dependence of V-I characteristics, Forward and reverse dynamic resistance, Small signal diode models, junction capacitance, analysis of diode circuits like clippers clampers, rectifiers, voltage regulators.

BJT as a device, Construction, typical junction voltages for cutoff, active and saturation regions, concept of amplification, BJT configurations(CE, CB, CC), Input and output characteristics, applications of CE, CB, CC and comparison, their suitability in cascaded stages, small signal-low frequency h-parameter model, Variation of h-parameters with operating point

DC analysis of BJT circuits, Concept of load line, BJT biasing: Fixed bias, voltage divider bias, collector to base bias Determination of Q point

Section II

AC Analysis of CE, CC, CB configuration for performance parameters in terms of h parameters, Comparison of performance parameters in CE, CC and CB configurations

Introduction to JFET, I-V Characteristics, MOS capacitor,), Cut-off & Pinch-off voltages, Transconductance, Input resistance & Capacitance, MOS capacitor, concept of accumulation, depletion and inversion, Types of MOSFET, I-V characteristics, drain current equation, Channel length modulation, Non ideal characteristics

JFET/ MOSFET biasing, DC analysis of FET circuits, FET small signal AC equivalent model, AC Analysis of CS, CD , CG amplifiers for performance parameters

List of Practicals:

1. Clipper circuits
2. Clamper circuits
3. Diode rectifiers

4. JFET characteristics
5. JFET biasing
6. MOSFET as a switch
7. BJT Characteristics
8. BJT as a switch
9. BJT CE Amplifier
10. BJT CC amplifier

List of Project areas:

1. BJT as a switch
2. Cascaded amplifier
3. Unregulated power supply
4. Regulated power supply
5. MOSFET applications

Text Books

1. Integrated Electronics, Millman Halkias, Tata McGraw Hill
2. Electronic Devices, Thomas L. Floyd, Pearson Education

Reference Books

1. Solid State Electronic Devices, B.G. Streetman, PHI, New Delhi.
2. Electronic Devices & Circuit Theory, R. L. Boylestad, L. Nashelsky, PHI, New Delhi.

Course Outcomes:

Students will be able to

1. Elaborate operation and characteristics of semiconductor diodes
2. Analyze diode circuits
3. Compare BJT configurations
4. Elaborate operation and characteristics of FET
5. Analyze BJT/ FET circuits to find Q point
6. Analyze BJT/ FET amplifiers to find amplifier parameters

FF No.: 654

ET2003: Network Theory

Credits: 4 **Teaching Scheme: 5 Hours / Week**
Theory: 3 Hours / Week
Lab/ Project: 2 Hours / Week

Section 1

Network Theorems: Superposition, Thevenin's Norton's and Maximum Power transfer Theorems. (DC and AC)

Concept of Network Topology, Terms used in Topology, Relation between Twigs and Links Properties of a Tree in a Graph, Formation of Incidence Matrix [Ai], number of tree in Graph. Cut –Set Matrix, Network Equilibrium Equation.

Terminal characteristics of network: Z, Y, h, ABCD Parameters; Reciprocity & Symmetry conditions, Interrelation of Parameters, interconnection of parameters. Network functions for one port and two port networks. Pole-zeros of network functions and network stability

Section 2:

Classifications: Symmetrical and Asymmetrical networks. Properties of two port Network: Symmetrical Networks (T and Π only). Z0 and γ in terms of circuit components, open and short circuit parameters, Filter fundamentals, Constant K -LPF, HPF, BPF and BSF, m derived LPF and HPF, introduction to Neper and Decibel, Relation between Neper and Decibel, Symmetrical T and Π type attenuators, Lattice attenuator, Bridge T-attenuator. Asymmetrical Networks: Image Impedance and Iterative Impedance (L-Section only).Terminating half sections, Asymmetrical L- type.

Transient response of passive circuits, transient response of series RL, RC and RLC circuits with DC and sinusoidal excitation

Significance of Quality factor, Series Resonance: Impedance, Phase angle variations with frequency, Voltage and current variation with frequency, Bandwidth, Selectivity Resonant frequency and admittance variation with frequency, Bandwidth and selectivity. Magnification factor, Parallel resonance: General case: Resistance present in both branches

List of Practicals (Any Six):

1. To study and verify the Thevenin's Theorem and Norton's Theorem,
2. To study the Superposition Theorem and Maximum Power Transfer Theorem
3. To Measure and Verify of Z, Y, Parameters of a Two-port Network
4. To determine equivalent parameters of parallel connection of two-port network.
5. To find critical frequencies (poles and zeros) of LC impedance driving point function.
6. To study the operation of low pass and high pass prototype filters.
7. To study the operation of band pass and band stop prototype filters
8. To study of T –type and π- type attenuator.
9. To study the transient response of a RL and RC circuit
10. To study the frequency response of a RLC series circuit

List of Projects (Any One):

1. Design Passive Prototype Low pass filter having cut-off frequency 2 KHz with design impedance 600 Ω in T and π section. Select frequency range up to 1 MHz with input voltage 5V
2. Design Passive Prototype High pass filter having cut-off frequency 10 KHz with design impedance 600 Ω in T and π section. Select frequency range up to 1 MHz with input voltage 5V
3. Design Passive Prototype Band pass filter having cut-off frequencies 3000 Hz and 6000Hz with design impedance 600 Ω in T and π section. Select frequency range up to 1 MHz with input voltage 5V
4. Design Passive Prototype Band pass filter having cut-off frequencies 2000 Hz and 5000Hz with design impedance 600 Ω in T and π section. Select frequency range up to 1 MHz with input voltage 5V
5. Design a π-type attenuator to give attenuation of 20 dB and characteristic resistance of 500 Ω.
6. Design a T-type attenuator to give attenuation of 20 dB and characteristic resistance of 500 Ω

Text Books:

1. "Circuit Theory (Analysis and Synthesis)",Chakrabarti, Dhanpat Rai and Co.
2. "Electrical Networks", Ravish R Singh, Tata Mc-Graw Hill

Reference Books:

1. "Network Analysis", Van Valkenberg, PHI
2. "Kuo F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India.
3. "Engineering Circuit Analysis, Hayt W. H., Kemmerly J. E. and Durbin S. M., 6th Ed., Tata McGraw-Hill Publishing Company Ltd

Course Outcomes:

The students will be able to

1. Simplify networks and circuits using network theorems and graph theory. (CO Attainment level : 4)
2. Simplify networks and circuits using graph theory and Network Topology. (CO Attainment level : 3)
3. Find network parameters and network function. (CO Attainment level : 4)
4. Design Attenuators and filters. (CO Attainment level : 4)
5. Analyze RL, RC and RLC Circuits using steady state and transient response. (CO Attainment level : 4)
6. Analyze Resonance Circuits. (CO Attainment level : 3)

FF No.: 654

ET2005: Signals and Systems

Credits: 4 **Teaching Scheme: 5 Hours / Week**
Theory: 3 Hours / Week
Lab/ Project: 2 Hours / Week

Section 1:
Introduction to signals and systems, signal classification, elementary signals, signal operations on dependent and independent variables, sampling theorem. Classification of systems, time domain analysis of LTI systems: convolution integral, convolution sum, correlation. Continuous time Fourier series: Trigonometric, exponential form of Fourier series, Frequency spectrum of CT periodic signals, Gibbs phenomenon.

Section2:
Continuous time Fourier transform, existence of Fourier transform, properties, system analysis using Fourier transform. Introduction to energy spectral density (ESD) and power spectral density (PSD). Discrete time Fourier transform, discrete frequency spectrum, analysis of discrete-time LTI systems using DFT. Laplace transform, region of convergence, properties, Pole-zero plots, inverse Laplace transform, circuit analysis using Laplace transform.

List of Practicals (Any Six):

1. To generate different continuous time and discrete time signals like sinusoidal signal, ramp signal, step signals, exponential signal etc.
2. To perform different operations on the signals.
3. To find the response of a given discrete time system to any arbitrary discrete time input signal
4. To perform Fourier analysis of the given signal to find the spectral components.
5. To find autocorrelation and cross correlation of given sequences.
6. Generate a discrete time sequence by sampling the given continuous time signal by varying the sampling frequency and to observe the aliasing.
7. To obtain the step response and impulse response of the given system.
8. To analyze the given discrete time signal in frequency domain using DFT.
9. To obtain ESD and/or PSD of a given signal.
10. To perform the pole-zero analysis of the given system using Laplace Transform

List of Projects (Any One):

1. To separate voiced/unvoiced/silence part of the speech signal.
2. Design a MATLAB app to generate different continuous and discrete time signals and to plot their spectra.
3. Design a MATLAB app for Fourier series synthesis of different signals.
4. ECG signal Analysis
5. Isolated word recognition using correlation
6. Generation of different audio effects like echo, reverberation flanger etc.
7. Analysis of given CT-LTI system using Laplace transform
8. Analysis of different musical instruments (air instruments like harmonium, flute)
9. Analysis of different musical instruments (string instruments like guitar, sitar)

Text Books:

1. Alan V. Oppenheim, Alan S. Wiisky and S. Hamid Nawab, "Signals and systems," Pearson Education, 2004.
2. Ramesh Babu and Anandnatarajan, "Signals and Systems," Scitech Publication, Fourth Edition.

Reference Books:

1. Haykin Simon and Veen Barry Van, "Signals and Systems," New York. John Wiley & Sons.
2. Roberts Michael J, "Signals and Systems," Tata McGraw Hill Publishing Company Limited, 2003.
3. A. Nagoor Kani, "Signals and Systems," McGraw Hill, 2013.

Course Outcomes:

The student will be able to –

1. Perform operations on dependent and independent variable of one dimensional signals (CO Attainment level : 3)
2. Synthesize the signal using elementary signals (CO Attainment level : 4)
3. Classify the systems and determine response of given CT/DT LTI system to any arbitrary input using convolution integral/sum (CO Attainment level : 4)
4. Analyze the given CT deterministic signal in spectral domain using Fourier series/transform. (CO Attainment level : 5)
5. Apply sampling theorem to obtain a discrete time signal from a continuous signal and to find the spectral components of the discrete-time signal using discrete Fourier transform (DFT). (CO Attainment level : 4)
6. Analyze the given LTI systems using Laplace transform. (CO Attainment level : 3)

FF No.: 654

ET2002: Data Structures & Algorithms

Credits: 4 **Teaching Scheme: 5 Hours / Week**
Theory: 3 Hours / Week
Lab/ Project: 2 Hours / Week

Section 1:
Analysis of algorithms. Asymptotic analysis, asymptotic notations, Searching and sorting algorithms. Linear Data Structures: Stack, Queue, Linked list, Expression conversion and evaluation, Generalized liked list

Section 2:
Tree, Binary search tree, Tree traversal, threaded binary tree, implementation of tree using linked list, Expression tree, application of trees, Graphs, representation of graphs, Graph traversal, minimum spanning tree and algorithms, shortest path algorithms.

List of Practicals (Any Six):

1. Implement sorting algorithms
2. Implement searching algorithms
3. Create and manipulate Database using Array
4. Create and manipulate Database using Linked List
5. Addition of two single variable polynomials using Linked List.
6. Implementation of Stacks
7. Conversion of infix expression to postfix expression and evaluation of postfix expression
8. Implementation of Queue
9. Operations on Binary Search Tree.
10. Create a graph using adjacency list

List of Projects (Any One):
Project based on

1. Dijkstra's algorithm
2. Prim's algorithm
3. Kruskal algorithm
4. Binary Trees
5. Expression trees
6. Binary heap
7. Stack and it application
8. Queue and its application
9. Linked list based project.
10. Hash tables.

Text Books:

1. Tenenbaum A M &Langsam Y: Data Structure Using C. Prentice Hall Of India, New Delhi.

2. Horowits E &Sahni S: Fundamentals of Data Structures. Gurgaon. Galgotia Book Source New Delhi.

Reference Books:

1. Kruse R L, Leung B P &Tondo C L: Data Structure And Programming Design In C. Prentice Hall Of India Pvt.ltd.
2. Data Structures : Schaum Outline Series, TMH

Course Outcomes:

The student will be able to –

1. Find time complexity using Big-O notation. (CO Attainment level : 4)
2. Explain the concept of sequential organization, ordered list and dynamic memory management. (CO Attainment level :3)
3. Solve Engineering problems by employing Stack, Queue and Linked list data structure. (CO Attainment level : 4)
4. Explain and analyze major Tree algorithms. (CO Attainment level : 4)
5. Explain and analyze major Graph algorithms. (CO Attainment level : 4)
6. Solve Engineering problems by employing trees and graph data structure. (CO Attainment level : 4)

FF No.: 654

ET2111: Probability and Radom Variables

Credits: 2 **Teaching Scheme: 2 Hours / Week**

Section 1:

Data basics – numerical and categorical variables, Observational studies and experiments, sampling and sources of bias - exploratory analysis and inference, sampling methods – simple, stratified, cluster and multistage sampling, experimental design – principles of experimental design, Experimental terminology – placebo, blinding etc., Measures of center and spread, data transformation

Probability basics; Independence; Conditional probability; Probability trees; Bayesian inference; Probability distributions such as Normal distribution, Binomial distribution etc.

Section 2:

Sampling variability and central limit theorem, Confidence interval for mean, hypothesis testing for mean, Inference, Inference for comparing means, ANOVA, Bootstrapping, Proportions, Hypothesis testing for proportions, Chi-square GOF test, Chi-square independence test

Cumulative distribution function, probability density function, Random Processes such as Laplace, Erlang, Gamma, Chi-square etc.; conditional distributions and density functions; Expected value, moments, central moments; Joint Cumulative distribution function, joint probability density function, Probability mass function

Text Books:

1. Probability and Statistics for Engineers – Johnson, Gupta, Pearson Prentice Hall, 3rd edition
2. Applied statistics and probability for Engineers – Montgomery, Runger, Wiley India, 3rd Edition

Reference Books:

1. Probability and random processes – Miller, Childers, Elsevier, 2nd Edition.

Course Outcomes:

The Student will be able to-

1. Distinguish between various types of variables (CO Attainment level : 1)
2. Apply concepts of probability such as independence, conditional probability (CO Attainment level : 4)
3. Apply Normal distribution and Binomial distribution concepts in case studies (CO Attainment level : 5)
4. 4.Apply variance analysis tests for data analysis (CO Attainment level : 4)
5. Apply Central limit theorem and carry out hypothesis testing (CO Attainment level : 5)
6. Use and apply concepts of various Random Processes in modeling data (CO Attainment level : 4)

ET2016: Engineering Design & Innovation 1

Course Prerequisites:

Basic Electronics, Physics, Engineering Mathematics, Statistics, Programming Languages

Course Objectives:

1. To develop critical thinking and problem-solving ability by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group to develop team skills and learn professionalism.

Credits: 4 **Teaching Scheme:** Lab 2 Hours/Week

Course Relevance:

Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. Students can be evaluated for higher order skills of Blooms taxonomy like ‘analyze, design and apply’. This course is capable of imparting hands on experience and self-learning to the students which will help them throughout their career. This is a step ahead in line with national policy of Atmanirbhar Bharat.

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. This course is designed to encourage and ensure application of technology for solving real world problems using an interdisciplinary approach.

Students need to plan their work in following steps:

1. Formation of project group comprising of 4-5 students. Multidisciplinary groups are allowed
2. A supervisor/mentor teacher assigned to individual groups.
3. Carrying out literature survey
4. Finalization of problem statement
5. Planning the project execution
6. Execution of project and testing
7. Writing a report
8. Publication in the form of research paper/patent/copyright as found suitable by supervisor/mentor

Teacher's Role in PCL:

1. Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
2. To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
3. To aware the group about time management.
4. Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

Student's Role in PCL:

1. Students must have ability to initiate the task/idea they should not be mere imitators.
2. They must learn to think.
3. Students working in PCL must be responsible for their own learning.
4. Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
5. Students in PCL are actively constructing their knowledge and understanding of the situation in groups.
6. Students in PCL are expected to work in groups.
7. They must develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Core Technology domains identified for E&TC Engg are as below. However, this list can be extended as per the need of project and multidisciplinary approach

1) VLSI Design
2) Embedded Systems
3) Signal Processing
4) Communication
5) Machine learning

Assessment Scheme:

Mid Semester Examination - 30 Marks
End Semester Examination - 70 Marks

MOOCs Links and additional reading material:

www.nptelvideos.in
https://worldwide.espacenet.com/

Course Outcomes:

On completion of the course, learner will be able to–

1. Review the literature to formulate problem statement to solve real world problems (PO2,PO4) : LEVEL 3
2. Apply knowledge of technology and modern tools to design solution considering sustainability and
   nvironmental issues (PO1, PO3, PO4,PO5, PO6, PO7, PO12) LEVEL 4
3. Manage project ethically as team member/ lead. (PO4,PO8, PO9, P11, P12) LEVEL 3

4. Demonstrate effectively technical report/ research paper/ prototype/ patent (PO4,PO10, PO12) LEVEL 4

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	3	1	0	0	3	1	3	0	2	2	2
2	3	3	3	3	3	3	3	2	1	2	0	2	3	3
3	0	1	1	1	0	2	0	3	3	3	3	2	0	0
4	3	1	1	1	0	0	0	3	1	3	3	2	1	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:

CO1: - Level 3
CO2: - Level 4
CO3: - Level 3
CO4: - Level 4

FF No.: 654

ET2007: Control Systems

Credits: 4

Teaching Scheme: 5 Hours / Week
Theory: 3 Hours / Week
Lab/ Project: 2 Hours / Week

Section 1:

Introduction, Terminology, Mathematical modeling of electrical, mechanical and electro mechanical systems, Transfer function, State space modeling of dynamical system. Block Diagram, Signal flow graph. Time domain analysis, response to step, ramp and parabolic input, steady state error, transient and steady state analysis. Introduction to PI, PD and PID Controller. Stability, Stability criterion, Root Locus Analysis, Construction of root loci.

Section2:

Frequency Domain Analysis:- correlation between time and frequency responses, Frequency domain specifications. Bode plots, Gain and Phase margin, Polar plot, Nyquist criterion and plot.
Design of Compensators

List of Practicals (Any Six):

1. Using Matlab
    a. find the transfer function from Poles and Zeros
    b. find zero's and pole's from transfer function.
2. Using Matlab
    a. Step response of transfer function.
    b. Impulse response of transfer function.
    c. Ramp response of transfer function.
3. Using Matlab find the time response of second order system.
4. Using Matlab
    a. Transfer function from state model.
    b. State model from transfer function.
    c. Step and impulse response of a state model.
5. To perform stability analysis of the system and plot root locus from the transfer function.
6. To plot Bode plot from transfer function.
7. To plot Nyquist plot from transfer function.
8. To find the transfer function of DC motor.
9. To study and simulate PID Controller.
10. To study using Matlab
    a. Lag Compensator
    b. Lead Compensator
    c. Lead lag compensator
11. System identification of DC motor using Matlab.
12. Simulation of any closed loop system.

List of Projects (Any One):

1. Model a given electrical / Mechanical system.
2. Closed loop control of D C Motor.
3. Design and implementation of filter.
4. Compensator design for a low pass filter ad realize using op amp.
5. **Eyeball Controlled Automatic Wheelchair.**
6. **Health Condition Monitoring System.**
7. Hardware realization and implementation of closed loop system using Matlab and microcontroller.
8. Implementation of Accelerometer Based Wireless Gesture Controlled Rover.

Text Books:

1. Ogata Katsuhiko, "Modern Control Engineering", 5th Edition, PHI
2. Nagrath I. J. and M. Gopal, "Control Systems Engineering", 6th edition, New Age International

Reference Books:

1. 1 Norman S. Nise, "Control System Engineering", 6th Edition, Wiley.
2. F. Golnaraghi, B.C. Kuo, "Automatic Control Systems", 10th Edition, McGraw-Hill.

Course Outcomes:

The student will be able to –

1. Model a given system using transfer function approach (CO Attainment level : 4)
2. Find steady state and transient response of control systems and understand the behavior of LTI systems qualitatively and quantitatively, both in the transient and steady-state region. (CO Attainment level : 4)
3. Analyze given system for stability using root locus. (CO Attainment level : 4)
4. Demonstrate various techniques of frequency domain analysis. (CO Attainment level : 3)
5. Analyze given system for stability in frequency domain. (CO Attainment level : 4)

Design proportional, proportional-integral, proportional-derivative, and proportional-integral-derivative feedback control systems meeting specific system performance requirements. (CO Attainment level : 4)

FF No.: 654

ET2004: Communication Engineering

Credits: 4 **Teaching Scheme: 5 Hours / Week**
Theory: 3 Hours / Week
Lab/ Project: 2 Hours / Week

Section 1:

1.1 Introduction To Communication System : Analog & Digital Communication System Overview, The Electromagnetic & Optical Spectrum and its usage, Types of Electronic Communication, Need of modulation, Communication Channels, Classification of noise, Noise in Cascaded Stages.

1.2 Analog Modulation Techniques: Mathematical treatment for an AM and FM signal, Spectral Analysis, Modulation Index, Efficiency, Power calculations, DSB-SC and SSB-SC ,FM generators, pre-emphasis and de-emphasis in FM signal.

1.3 Analog Receivers: TRF Receiver, Super Heterodyne Receiver, Intermediate Frequency and Image Frequency, Diode detector, DSB-SC and SSB-SC, FM Detector

Section 2:

2.1 Sampling and Waveform Coding: Sampling, ideal sampling, Flat top & Natural Sampling, Aliasing, Pulse amplitude modulation, Quantization, Pulse code modulation & reconstruction, Delta modulation, Line Coding, Companded PCM, ISI and eye diagram, Time division multiplexing.

2.2 Digital Modulation Techniques: Digital modulation techniques - Binary Phase Shift Keying, Quadrature Phase Shift Keying, Binary Frequency Shift Keying, Quadrature amplitude modulation, Minimum shift keying.

2.3 Detection and Performance analysis of digital signal: Base Band signal receiver ,Derivation for Error prob of integrate& dump Filter, Optimum Filter, white noise matched filter, probability error of match filter, correlation.

List of Practicals (Any Six):

1. Observe spectral components of time-domain signal using Digital Storage Oscilloscope (DSO).
2. Experiment with Double side band suppressed carrier (DSBSC) modulator and demodulator.
3. Experiment with Single side band suppressed carrier (SSBSC) modulator an demodulator.
4. Experiment with Frequency modulator (FM).
5. Simulation of Analog communication system.
6. Experiment with Pulse Amplitude modulation.
7. Experiment with Pulse Code modulation and demodulation.
8. Experiment with Delta modulation and demodulation.
9. Experiment with Quadrature phase shift keying modulation and demodulation.
10. Experiment with frequency shift keying modulation and demodulation

List of Projects (Any One):

1. Simulation of Analog Communication System

2. Double Side Band –Suppressed Carrier

3. Implementation of Pre-emphasis and De-emphasis for FM
4. Implementation of Antialiasing filter
5. Implementation of Adaptive Delta modulator to avoid slope overload distortion
6. Generation of discrete PAM signal

Text Books:

1. "Principles of Electronic Communication Systems", Louis E Frenzel, Tata McGraw Hill Publications, Third Edition.
2. "Electronic Communication", Kennedy &Devis, Tata McGraw Hill Publications.
3. "Principles of Communication Systems", Taub Schilling, Tata McGraw Hill Fourth Edition.

Reference Books:

1. "Electronic Communication", Dennis Roddy & Coolen, Tata McGraw Hill Publications.
2. "Electronic Communication Systems", Wayne Tomasi, Fourth Edition.
3. "Digital Communications", Simon Haykin, Wiley Publications, Fourth Edition.
4. "Communication Systems", Carlson, McGrawHill, Fourth Edition.
5. "Analog& Digital Communications", Simon Haykin, Wiley Publications.
6. "Digital Communication",B. Sklar, Pearson, Second Edition.

Course Outcomes:

The student will be able to –

1. Classify communication channels and noise. (CO Attainment level : 4)
2. Analyze amplitude and frequency modulated signal and their spectrum. (CO Attainment level : 3)
3. Explain working of analog receivers. (CO Attainment level : 3)
4. Discuss encoding of analog signals in digital formats. (CO Attainment level : 3)
5. Analyze modulation techniques with respect to bandwidth, Euclidian distance. (CO Attainment level : 2)
6. Evaluate performance of optimum filter. (CO Attainment level : 1)

FF No.: 654

ET2006: Electromagnetic Engineering

Credits: 4 **Teaching Scheme: 5 Hours / Week**
Theory: 3 Hours / Week
Lab/ Project: 2 Hours / Week

Section 1:
Vector Calculus basics; Gradient, Curl and Divergence; Co-ordinate systems; Coulomb's Law, Electric Field Intensity, Electric flux density, Gauss' law, Electrostatic potential, Boundary conditions, Laplace and Poisson's equations, Capacitance; Biot Savart law, Magnetic flux density, Magnetic field intensity, scalar and vector magnetic potential, Ampere's circuital law, boundary conditions, self inductance, continuity equation.

Section2:
Maxwell equation in differential form, point form, integral form; Phasor concept; time periodic fields; Poynting vector and concept of power flow; Helmholtz equations, Transverse Electromagnetic (TEM) wave, properties of Uniform Plane Wave, Intrinsic impedance; wave propagation ; Behavior of Uniform Plane wave at an interface between ideal medium and ideal conductor, concept of standing wave; Behavior at an interface between two dielectrics; Uniform Plane wave in a good dielectric, Uniform plane wave in a good conductor

Text Books:
1. Engineering Electromagnetics – William Hayt, J.A. Buck, 6th Edition, McGraw Hill publications
2. Elements of Electromagnetics – Matthew Sadiku, 3rd Edition, Oxford University Press

Reference Books:
1. Electromagnetic Waves and Radiating Systems – Pearson Education
2. Electromagnetic Field Theory Fundamentals – Guru, Hiziroglu, Cambridge University Press

List of Tutorials (Any Six):
1. Co-ordinate systems and their conversions, Gradient & Divergence
2. Coulomb's Law, Electric Flux Density, Electric field intensity, Gauss' law
3. Electrostatic potential, Boundary conditions, Laplace and Poisson's equations
4. Magnetic flux density, Magnetic field intensity, scalar and vector magnetic potential
5. Ampere's circuital law, boundary conditions
6. Maxwell equation in differential form, point form, integral form
7. Phasor concept; time periodic fields; Poynting vector and concept of power flow
8. Helmholtz equations, Transverse Electromagnetic (TEM) wave, properties of Uniform Plane Wave
9. Intrinsic impedance; wave propagation
10. Behavior of Uniform Plane Wave at various interfaces; Behavior of Uniform Plane wave in a good dielectric & Uniform plane wave in a good conductor

Course Outcomes:

The Student will be able to-

1. Apply knowledge of Vector Calculus (CO Attainment level : 2)
2. Use Boundary conditions and Laplace equations for realization of capacitance (CO Attainment level : 4)
3. Use Boundary conditions and Laplace equations for realization of Inductance (CO Attainment level : 4)
4. Implement Maxwell's Equations in various forms (CO Attainment level : 3)
5. Apply Phasors and Power flow concept (CO Attainment level : 5)
6. Understand the concept of Uniform Plane wave propagation and behavior at interfaces. (CO Attainment level : 4)

FF No.: 654

ET2015: Digital Systems

Credits: 4

Teaching Scheme: 5 Hours / Week
Theory: 3 Hours / Week
Lab/ Project: 2 Hours / Week

Section 1

Binary arithmetic & logic simplification: Binary, Hexadecimal number systems, Inter conversions, 1's complement, 2's complement arithmetic, Binary Coded Decimal codes, Excess-3 Code, Gray code, Standard logic gates, Universal logic gates, Derived gates, Simplification of logic function using Boolean algebra, De Morgan's Theorem, Sum-of-Products and Product-of-Sums forms of Boolean function, NAND and NOR implementation, Canonical and Standard forms, Karnaugh map up to 4 variables.

Combinational circuits: Design procedure for combinational logic circuits, Code conversion, Half Adder, Full Adder, 4- bit binary adder, BCD Adder, BCD Subtractor, Parity generator, Parity checker, Digital Comparator, Multiplexer and Demultiplexer, their use in combinational logic designs, multiplexer and Demultiplexer trees, Encoder and Decoder.

Latches and Flip-flops: Latches and flipflops: SR, D, JK, Master-Slave JK, and T, use of preset and clear terminals, schematic symbol, truth table and excitation table, conversion of flip flops.

Section 2

Sequential Circuits: Shift registers: SISO, SIPO, PISO, PIPO, bi-directional shift registers, Johnson and Ring counters, design and analysis of asynchronous and synchronous counters, up/down counters, modulo counters, Pseudo Random Binary Sequence (PRBS) generator.

Finite State Machines: Introduction to state machine, Basic Design steps for these sequential circuits using state diagram, State Table, State assignment, finite state machine, Mealy machine and Moore machine representation and implementation, sequence detector, designing vending machine based on state machine. Design problems based on finite state machine.

Logic Families: Classification of Logic Families: TTL, CMOS, ECL, RTL, I2L and DCTL, Characteristics of Digital ICs: Speed of Operation, Power Dissipation, Figure of Merit, Fan in, Fan out, Current and Voltage Parameters, Noise Immunity, Operation of TTL NAND gate, Tri- State logic, Comparison of logic families.

List of Practicals:

1. Design & implement code converters / comparators
2. Design & implement BCD Adder
3. Design & implement combinational logic circuit using multiplexer & de-multiplexer
4. Design & implement 3 bit bidirectional shift register using D flip-flop
5. Decade counter output to be displayed on 7 segment display
6. Design & implement pulse train generator
7. Design & implement 3 bit up-down ripple counter using flip-flop

8. Verification of mod-n counters
9. Design & implement sequence generator.
10. Simulation of combinational circuit like Half adder, Full adder, Multiplexer, De multiplexer etc.

List of Project areas:

1. Applications of Combinational Circuits
2. Applications of Digital Counters
3. Applications of Shift registers
4. Applications of Finite state machines

Text Books:

1. M. Morris Mano , "Digital Design", Pearson Education, Third Edition
2. Jan M. Rabaey, Anantha P. Chandrakasan, Borivoje Nikolić, "Digital Integrated Circuits", Pearson Education, Second Edition 20032.

Reference Books:

1. Thomas L Floyd, "Digital Fundamentals", Pearson Education, 11th Edition
2. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 3rd Edition

Course Outcomes:

The student will be able to –

1. Interpret Binary arithmetic/ logic simplification
2. Design combinational digital circuits
3. Compare flipflops and latches
4. Design sequential digital circuits
5. Design finite state machine
6. Compare different parameters of logic families

FF No.: 654

ET2012: Multivariate Data Analysis

Credits: 2 **Teaching Scheme: 2 Hours / Week**

Section 1:

An introduction to multivariate statistical models, Multivariate normal distributions-Multivariate Normal Density Function, Properties of Multivariate Normal Random Processes, Estimation in the Multivariate Normal. Discriminant analysis: The Discriminant Function for Two Groups, Discriminant Analysis for Several Groups, Standardized Discriminant Functions, Interpretation of Discriminant Functions. Classification analysis: Classification into Two Groups, Classification into Several Groups, Estimating Misclassification Rates, Improved Estimates of Error Rates, Subset Selection.

Section2:

Multivariate regression: Multiple Regression: Fixed *x*'s, Multiple Regression: Random *x*'s, Multivariate Multiple Regression: Estimation. Principal component analysis: Geometric and Algebraic Bases of Principal Components, Principal Components and Perpendicular Regression, Principal Components from the Correlation Matrix, Deciding How Many Components to Retain, Information in the Last Few Principal Components, Interpretation of Principal Components. Cluster Analysis: Measures of Similarity or Dissimilarity, Hierarchical Clustering, Nonhierarchical Methods, Choosing the Number of Clusters, Cluster Validity, Clustering Variables. Dimension reduction.

Text Books:

1. R.A. Jonhson, D.W. Wichern, "Applied multivariate statistical analysis", Pearson prentice Hall 6th Edition.
2. W.K. Hardle, L. Simer, ""Applied multivariate statistical analysis" Springer

Reference Books:

1. T. Hastie, R. Tibsirani, J. Friedman, "Element of statistical learning: Data mining, inference and prediction", Springer.

Course Outcomes:

The student will be able to –

1. Demonstrate knowledge and understanding of the basic ideas behind several common statistical techniques for analyzing multivariate data (Discriminant analysis, classification analysis, linear regression analysis, principal component analysis, cluster analysis) (CO Attainment level : 5)
2. Identify the most appropriate statistical techniques for analyzing multivariate dataset. (CO Attainment level : 3)
3. Apply commonly used multivariate data analysis techniques for real data and interpret results. (CO Attainment level :5)
4. Describe the relationship between two or more independent variables and the dependent variable

using a multiple regression equation. (CO Attainment level : 3)

5. Compare and contrast the methods for a given data analysis situation considering the benefits and the pitfalls of the methods. (CO Attainment level : 4)
6. Select and apply an appropriate technique to achieve dimensionality reduction (CO Attainment level : 5)

ET2017: Engineering Design & Innovation 2

Course Prerequisites:

Basic Electronics, Physics, Engineering Mathematics, Statistics, Programming Languages

Course Objectives:

6. To develop critical thinking and problem-solving ability by exploring and proposing solutions to realistic/social problems.
7. To Evaluate alternative approaches, and justify the use of selected tools and methods,
8. To emphasize learning activities those are long-term, inter-disciplinary and student centric.
9. To engage students in rich and authentic learning experiences.
10. To provide every student the opportunity to get involved either individually or as a group to develop team skills and learn professionalism.

Credits: 4 **Teaching Scheme:** Lab 2 Hours/Week

Course Relevance:

Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. Students can be evaluated for higher order skills of Blooms taxonomy like ‘analyze, design and apply’. This course is capable of imparting hands on experience and self-learning to the students which will help them throughout their career. This is a step ahead in line with national policy of Atmanirbhar Bharat.

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. This course is designed to encourage and ensure application of technology for solving real world problems using an interdisciplinary approach.

Students need to plan their work in following steps:

9. Formation of project group comprising of 4-5 students. Multidisciplinary groups are allowed
10. A supervisor/mentor teacher assigned to individual groups.
11. Carrying out literature survey
12. Finalization of problem statement
13. Planning the project execution
14. Execution of project and testing
15. Writing a report
16. Publication in the form of research paper/patent/copyright as found suitable by supervisor/mentor

Teacher's Role in PCL:

5. Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
6. To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
7. To aware the group about time management.
8. Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

Student's Role in PCL:

8. Students must have ability to initiate the task/idea they should not be mere imitators.
9. They must learn to think.
10. Students working in PCL must be responsible for their own learning.
11. Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
12. Students in PCL are actively constructing their knowledge and understanding of the situation in groups.
13. Students in PCL are expected to work in groups.
14. They must develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Core Technology domains identified for E&TC Engg are as below. However, this list can be extended as per the need of project and multidisciplinary approach

6) VLSI Design
7) Embedded Systems
8) Signal Processing
9) Communication
10) Machine learning

Assessment Scheme:

Mid Semester Examination - 30 Marks
End Semester Examination - 70 Marks

MOOCs Links and additional reading material:

www.nptelvideos.in
https://worldwide.espacenet.com/

Course Outcomes:

On completion of the course, learner will be able to–

4. Review the literature to formulate problem statement to solve real world problems (PO2,PO4) : LEVEL 3
5. Apply knowledge of technology and modern tools to design solution considering sustainability and
   nvironmental issues (PO1, PO3, PO4,PO5, PO6, PO7, PO12) LEVEL 4
6. Manage project ethically as team member/ lead. (PO4,PO8, PO9, P11, P12) LEVEL 3

4. Demonstrate effectively technical report/ research paper/ prototype/ patent (PO4,PO10, PO12) LEVEL 4

CO PO Map

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	3	3	2	3	1	0	0	3	1	3	0	2	2	2
2	3	3	3	3	3	3	3	2	1	2	0	2	3	3
3	0	1	1	1	0	2	0	3	3	3	3	2	0	0
4	3	1	1	1	0	0	0	3	1	3	3	2	1	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:

CO1: - Level 3
CO2: - Level 4
CO3: - Level 3
CO4: - Level 4

FF No: 654

Course Code: EL3001 **Course Name-Microcontroller Applications**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

AVR Atmega32 Architecture, Instruction Set, Assembly Language Programming, Embedded C Programming, Simple I/O Interfacings

Section 2:

AVR Atmega-32 On-chip Peripherals, Communication Protocols, Interfacing Sensors & Actuators

List of Practicals:

1. Write an ALP code to flash LEDs connected to PORT
2. Write an ALP to display 0 to 9 numbers on 7-Segment Display using Timer
3. Write a C program to display message on 16 X 2 LCD
4. Write a C program to interface 4 X 4 matrix keypad
5. Write a C program to use on chip ADC
6. Write a C program to read/write on chip EEPROM.
7. Write a C program to control DC motor using PWM
8. Write a C program for serial communication using on chip UART
9. Write a C program to implement I2C protocol for RTC
10. Write a C program to read switch and control AC Lamp load using relay.

List of Project areas:

1. Industrial Automation
2. Home automation
3. Robotics
4. Medical Electronics
5. Communication
6. Automotive Electronics

Examples: - Design of Electronic Lock, Design of Temperature Controller

Text Books:-

1. Mohammad AliMazidi, Sarmad Naimi&SepehrNaimi; The AVR Microcontroller and Embedded Systems using Assembly and C; 1stEdition; Pearson Education India.

2. Dhananjay Gadre; Programming and Customizing the AVR Microcontroller; 1 st

Edition; McGraw Hill.

Reference Books:

1. Atmel 8-Bit AVR Microcontroller& ATmega32A Datasheet complete

Course Outcomes:

The student will be able to –

1. Explain AVR Microcontroller Architecture.
2. Develop an Assembly Language Program&Embedded C Program for AVR Microcontroller.
3. Make use of internal peripherals of AVR Microcontroller.
4. Develop an interface for Sensors and Actuators

FF No : 654

Course Code : EL3025 **Course Name: Sensors and Actuators**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

Sensor static and dynamic characteristics, Sensor selection criteria, Sensor operating principle: Temperature, linear and rotary displacement, optical, pressure and strain gauge. Smart sensors. Classification of actuators, Relays and solenoids, Relay circuits, Pneumatic and Hydraulic linear and rotary actuators, Control circuits for actuators.

Section2:

Analog signal processing circuits: Preamplifier, gain amplifier, Power amplifier. LNA, Op amp based signal conditioning circuits. Digital signal processing circuits: ADC and DAC, Types, selection criteria, designing with analog and digital signal processing circuits.

List of Practical:

1. Rotary and linear encoder for displacement measurement.
2. Comparative study of temperature sensors.
3. Strain gauge with Wheatstone's' Bridge configurations.
4. Design and development of signal conditioning circuits.
5. Design and development of R-2R ladder 4 bit DAC.
6. Evaluation of ADC performance parameters.
7. Implementation of relay circuits.
8. Design and testing of fluid power circuits.
9. Co-ordinated motion of multiple actuators.
10. Simulation of P and H circuits.

List of Projects:

1. Automatic door opening closing system.
2. Designing of Automatic Weighing scale.
3. Designing Pneumatic circuit for sorting of jobs running on conveyor belt.
4. Data Acquisition System.

Text Books:

1. Ramon Pallas-Areny, John G. Webster; Sensors and Signal Conditioning; Second Edition; Wiley India.

2. Anthony Esposito; Fluid Power with Applications.

3. Walt Jung; Op Amp Application Handbook; Newnes.

Reference Books:

1. Analog Devices; Practical Design Techniques for Sensor Signal Conditioning.
2. FESTO Didactic; Basic Principles of Pneumatics and Electro pneumatics.
3. C. D. Johnson; Process Control Instrumentation Technology; Eighth Edition; Pearson.

Course Outcomes:

The student will be able to –

1. Understand sensors in terms of behavior or response to external physical variables.
2. Design application based on electro-pneumatic/electro-hydraulic circuits.
3. Experiment with analog signal conditioning circuits.
4. Demonstrate to interface between analog and digital domain.

FF No. : 654

Course Code: EL3003 **Course Name: Data Compression**

Credits: 4 Teaching Scheme: 3 Hours / Week Lab: 2 Hours / Week

Section 1: Lossless Compression Techniques

Introduction to Information Theory, Entropy, Uniquely Decodable Codes, Prefix Codes, Shannon Fano Coding, Huffman Coding, Extended Huffman Codes, Adaptive Huffman Codes, Golomb and Rice Codes, Linear block codes, Arithmetic Coding, Dictionary Techniques: Static and Adaptive Dictionary; Lempel Ziv Approaches: LZ77, LZ78, LZW; File Formats

Section 2:Lossy Compression Techniques

Uniform Quantizer, Adaptive Quantizer; Forward and Backward, Jayant Quantizer, Non-Uniform Quantizer, Vector Quantization, Linde-Buzo-Grey LBG Algorithm, Necessity of Transforms, Discrete Cosine, Hadamard Transform, Haar Transform, Wavelet Transform**,** Quantization and Coding of Transform Coefficients, Baseline JPEG Image Compression

List of Practicals:

1. Implement Unique Decodability Test
2. Implement Huffman Coding
3. Implement Arithmetic encoding and Decoding
4. Implement Golomb encoding Table
5. Implement LZ77 Dictionary Technique
6. Implement Discrete Cosine Transform(DCT)
7. Implement Walsh and Hadamard Transform
8. Implement Uniform Quantization
9. Implement vector quantization
10. Multiresolution analysis using Wavelet Transform

List of Project areas:

1. A photograph of large size required huge amount of memory to store and transmit. Hence compress the image using JPEG standard. Calculate compression ratio and MSQE. Also observe quantization effects on quality of decompressed image.

2. A text or bio-medical data needs to be stored and transmitted. To reduce the storage requirement, compress data using lossless methods like Huffman coding, Golomb, runlength, dictionary techniques. Compare results in terms of compression ratio, execution time, time

complexity, suitability for the chosen data.

3. A photograph of crowd or natural scene requires huge amount of memory. Apply Transform based Lossy compression techniques for 1D or 2D images. Compare performance of Lossless and Lossy compression techniques.

4. Project based on Lossless Compression Methods

5. Project based on Lossy Compression Methods

6. Project based on Quantization effects on Signal/Image

Text Books:

1. Khalid Sayood; Introduction to Data Compression; 3rd Edition; Elsvier publication

2. Graham Wade; Coding Techniques – Introduction to compression and Error control; Palgrave Publications

3. Simon Hyakins; Communication systems; 4th Edition; Wiley Publications

Reference Books:

1. Ranjan Bose; Information Theory and cryptography; Tata McGraw Hill, 2002/2006

2. Saloman; Data compression – Complete reference; Springer Verlag; 3rd Edition

3. Levis W.J; Data compression; Springer; 2nd Edition

4. Nelson Mark, Gaily. Jean, Loup; Data Compression book; 2nd Edition; BPB Publication

Course Outcomes:

The student will be able to –

1. Explain encoding and decoding of lossless compression methods.
2. Calculate effect and efficiency of compression algorithms.
3. Explain encoding and decoding of lossy compression methods
4. Implement suitable Compression algorithms on Text/ Signal /Image.

FF No: 654

Course Code : EL3004 **Course Name: Power Electronics**

Credits: 4 Teaching Scheme: 3 Hours / Week Lab: 2 Hours / Week

Section 1:

Power Devices- power diode, SCR, GTO, power BJT and MOSFET, IGBT- Structure, Characteristics, Selection criterion, Driver Circuits, Comparison.

Single phase-controlled converters (line commutated), Performance analysis for resistive and inductive load, Evaluation of average and rms load voltage, supply current harmonics, power factor, current distortion factor, device ratings

Single phase inverters-bridge and push-pull type, Performance analysis for resistive and inductive load, harmonic analysis of voltage for square-wave and PWM inverters.

Section 2:

Step down/ up DC-DC converters (Choppers), Analysis for resistive and inductive load, Load voltage calculations, Single, two and four quadrant operational analysis.

AC to AC controllers, Half and full cycle control, Analysis for resistive and inductive load, Load voltage estimation, Gating signal requirement for inductive load.

Fly back and Forward SMPS, Concept of resonant converter, ZVS and ZCS switches, On – line and Off-line UPS, Battery selection, HVDC transmission, Industrial applications of different converters.

List of Practicals:

1. Study of Triggering/ Driver Circuit for SCR
2. Study of Triggering/ Driver Circuit for MOSFET
3. Study of Single Phase Controlled Converter (Half controlled) with Load
4. Study of Single Phase Controlled Converter (Fully Controlled) with Load
5. Study of DC-DC Converter (Step down with MOSFET/ IGBT) with Load
6. Study of DC-DC Converter (Step up with MOSFET/ IGBT) with Load
7. Study of DC-AC Converter (Single Phase Bridge) with Load
8. Study of Single Phase AC-AC Controllerwith Load
9. Simulation of Single Phase Converter (AC-DC/ DC-DC) with R, RL Load
10. Simulation of Single Phase Converter (AC-AC/ DC-AC) with R, RL Load

List of Projects:

1. Develop a switching/triggering circuit for a power device (SCR / power BJT / power MOSFET / IGBT)
2. PWM generation for device switching

Develop a single-phase power converter for utility application as listed below (Any one). Source available is AC Mains/ DC battery.

3. Battery charger
4. Fan regulator
5. Intensity control of lighting
6. Inverter
7. SMPS
8. Power control by Integral Cycle Switching
9. Verify, through simulation, the performance of AC-DC/ DC-DC power conversion systems for suitable load. Comment on the results.
10. Verify, through simulation, the performance of DC-AC/ AC-AC power conversion systems for suitable load. Comment on the results.

Text Books:

1. M D Singh, K B Khanchandani; Power Electronics; 2 nd Edition; TMH.
2. M. H. Rashid; Power Electronics Circuits, Devices and Applications; 3 rd Edition; PHI.

Reference Books:

1. N. Mohan, T. M. Undeland and W.P. Robbins; Power Electronics: Converters, Applications, and Design; 3rd edition; John Willey and Sons, Singapore.
2. P. C. Sen; Modern Power Electronics; S. Chand and Co, New Delhi.

Course Outcomes:

The student will be able to –

1. Describe the operation, characteristics and applications of power devices like power diode, SCR, power BJT, power MOSFET, and IGBT.
2. Analyze controlled converter and inverter circuits in terms of performance parameters.
3. Analyze dc-dc converter and ac controller circuits in terms of performance parameters.
4. Illustrate the role of Power Electronics in utility-related applications.

FF No: 654

Course Code: EL3026 Course Name: Computer Architecture & Operating System

Credits: 4 **Teaching Scheme: 3 Hours / Week**
Lab: 2 Hours / Week

Section 1:

Functional Units of a Computer: ALU, Control Unit, Memory, IO Units; Software Hardware Interaction/Interface; Basic Structure of a CPU: Overview of X 86 Family, Multicore, Mics and GPGPU; CPU Bus Architecture; Advancement in Computer Architectures

ALU: Block Diagram, Data Representation: Computer Arithmetic with Signed/Unsigned Numbers, Multiplication with Signed Numbers: Booths Algorithm, Control Unit, *I*/O Module Functions and I/O Block Diagram, Accessing I/O Devices, Direct Memory Access

Section 2:

Memory System: Characteristics, CPU Memory Interaction, Hierarchical Memory System, Types and Characteristics of Memories: Cache Memories, Memory Management Techniques: Virtual Memory, Paging, Segmentation, Associative Memories.

OS: Architecture, Goals and Structures of OS., Hardware Abstraction Layer, Types of OS: Process Management, Resource Management, Deadlock, Uniprocessor Scheduling; Types of Scheduling: Scheduling Algorithms

List of Practical:

1. Designing of 4-bit adder with look ahead carry generator
2. Designing and implementing Boots multiplier
3. Designing of Combinational Multiplier
4. Designing of ALU
5. Designing of Memory Unit
6. Designing of Directly Mapped Cache.
7. Design of Control Unit
8. Simulation of CPU Scheduling Algorithm
9. Implementation of Semaphore

List of Projects:

1. Design an instruction set for a limited functionality machine having all instructions of 8-bits fixed length only, including opcode and operands.
2. Simulate a word multiplier.
3. Simulate a word divider
4. Design a minimal CPU architecture for controlling the washing machine.
5. Design a 2 bit CPU which can execute minimum five instructions

Text Books:

1. *Carl Hamacher and Zaky; Computer Organization; 5th Edition; Mcgraw Hill publication.*
2. *William Stallings; Computer organization and architecture; 9th Edition; Pearson Publication.*
3. *William Stalling; Operating Systems; 5th Edition; Pearson Education.*

Reference Books:

1. *A. Tanenbaum; Structured Computer Organization; 4th Edition; Prentice Hall of India.*
2. *Abraham Silberschatz, Peter Baer Galvin; Operating system concepts; John Wiley and Sons, 6th Edition.*

Course Outcomes:

The student will be able to –

- Elaborate basic concepts of computer architecture.
- Describe functional units of the CPU including the ALU and control unit.
- Explain the organization of memory and memory management techniques.
- Understand the role of the operating system in interfacing with the computer hardware

FF No: 654

Course Code: EL3006 **Course Name: Computer Vision**

Credits: 4 Teaching Scheme: 3 Hours /
WeekLab: 2 Hours/ Week

Section 1:

Human Vision System; Computer Vision System; Camera Geometry Fundamentals, Probability Distribution Models. Geometric Primitives and Transformations; Photometric Image Formation; Digital Camera; Point Operators; Neighborhood Operators; Pyramids and Wavelets. Feature Detection and matching; Hough Transform; Edge Linking.

Section 2:

Object Recognition, Segmentation and Classification, Global Methods; Active Contours; Normalized Cuts; Support Vector Machine; Histogram of Oriented Gradients; Adaboost Classifiers. Triangulation; Two-Frame Structure from Motion; Factorization; Bundle Adjustment; Translational Alignment; Motion estimation techniques; Tracking, Stereo Vision. Real-world Computer Vision Systems applications.

List of Practicals:

1. Develop an algorithm for pre-processing of an input image for geometric transformation of image.
2. Develop an algorithm for pre-processing of an input image for enhancement of image.
3. Develop an algorithm for feature extraction of an input image using point detector
4. Develop an algorithm for segmentation of an input image
5. Develop an algorithm for recognition of an object from input image
6. Develop an algorithm for motion estimation from given video sequence.
7. Design an algorithm for SVM classifier
8. Design an algorithm for adaboost classifier
9. Line detection using Hough transform
10. To design and develop optical flow algorithm for motion estimation

List of Project areas:

Select any one project from the list below and execute it.

1. Develop an application for vision-based security system during day/night time. The system should trigger an audio- visual alarm upon unauthorized entry.
2. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Automobile tracking/ face tracking/ human tracking)

3. Develop motion estimation/ tracking system to recognize object of interest related to one of the following applications. (Space vehicle tracking/ solar energy tracking/ crowd pattern tracking)

Text Books:

1. *RichardSzeliski; Computer Vision: Algorithms and Applications; Springer.*
2. *Forsyth, Ponce; Computer Vision-A Modern Approach; Low Price Edition, Pearson Education.*
3. *Bernd Jahne and Host HauBecker; Computer Vision and applications-A Guide for Students and Practitioners; Elsevier.*

Reference Books:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle; Image Processing, Analysis, and Machine Vision; Thomson Learning
2. Robert Haralick and Linda Shapiro; Computer and Robot Vision; Vol I, II, Addison Wesley, 1993.
3. Dana H Ballard and Christopher M. Brown; Computer Vision; Prentice Hall

Course Outcomes:

The student will be able to –

1. Explain camera geometry fundamentals and image formation.
2. Apply pre-processing algorithms to acquired images
3. Develop feature descriptor for object detection purpose.
4. Make use of Computer Vision algorithms to solve real-world problems

FF No: 654

Course Code: EL3007 **Course Name: Digital Integrated Circuit Design**

Credits: 4 Teaching Scheme: 3 Hours /
WeekLab: 2 Hours/ Week

Section 1:

Introduction to MOSFET, I-V, CLM, Body bias and sub-micron effects, CMOS Inverter - DC Analysis, VTC, Propagation Delay, Components of Power, Transistor Sizing, Inverter Layout; Impact of Technology ScalingCombinational Circuits - static CMOS, Ratioed Logic, Pass Transistor, Transmission Gate Logic, DCVSL, Introduction to Dynamic Logic – DOMINO and NORA, Cascading Dynamic Logic Gates, Sequential Circuits - Sequential Logic, Bi-stability, Latches vs Registers, MUX based Latch, Setup/Hold Timing, clocked MOS logic - C^2MOS, TSPC, Issues of Clock Overlapping, Pipelining.

Section 2:

Arithmetic Structures - Adders, Multipliers, Shifters Semiconductor Memories - MOS NOR and NAND ROM, EEPROM, 6-T SRAM Cell, DRAM Cell, Sense AmplifierHardware Description Language - Introduction to HDL, Hardware Concurrency, Notion of Delta Delay, Combinational Logic Design, VHDL for Sequential Circuit, Introduction to Verilog, Sample Coding in Verilog

Fabrication and Layout - Basic CMOS Fabrication Flow, N well, Twin tub, Design of process flow, Stick diagram, Standard Cell, Design rules, Layout of Combinational/Sequential Circuits

List of Practicals:

All laboratory exercises must be completed; these are intended to prepare the students for the term project. In doing these exercises, each student works individually first and then in a group. It is strongly recommended that each student must use his/her own machine, install thefree VLSI TCAD tools which will be discussed in class or laboratory session. Typicalassignments as follows:

1. Simulation of I-V characteristics of MOSFET to see the effect of CLM and body bias on the performance of the device
2. Design of symmetrical VTC CMOS inverter, Pre-layout simulation, Parasitic extraction, Post layout simulation.
3. Simulation of static and dynamic logic gates
4. Simulation of latch and flip-flop
5. Simulation of arithmetic structures – adders, shifters
6. Simulation of combinational and sequential circuits in VHDL/Verilog

7. Layout of CMOS inverter
8. Layout of combinational circuit
9. Layout of sequential circuit
10. Post layout (back annotation) simulation of combinational and/or sequential circuit

List of Projects:

The most important assignment is the Term Project, about which more detailed instructions will be issued in class. In doing this assignment, students will work in group(s). They should begin finding their partner(s) early in the term. The term project requirements must be completed in accordance with the schedule given in the instructions. Students must make a presentation of their part of the project to the rest of the class. They must demonstrate/present their work in the term project even if it does not fully function. Typical projects as follows:

1. Multi Precision Arithmetic Adders
2. Efficient Floating-Point Multiplier

Text Books:

1. *Rabaey Jan, AnanthaChandrakasan, and Bora Nikolic; Digital Integrated Circuits: A Design Perspective; Prentice Hall*
2. *Jayram Bhasker; VHDL Primer*

Reference Books:

1. *Sung-Mo Kang and Yusuf Leblebici; CMOS Digital Integrated Circuits*
2. *N. Weste and K.Eshraghian; Principles of CMOS VLSI Design*
3. *ZainalabedinNavabi; VHDL*
4. *Charles H. Roth; Fundamentals of Logic Design*

Course Outcomes:

The students will be able to

1. Calculate the output voltage of pass transistor
2. Identify combinational function implemented in CMOS logic
3. Differentiate between latch and flip-flop
4. Implement logic function in MOS ROM
5. Draw logic gate circuit from VHDL code
6. Draw stick diagram from Euler's path

FF No: 654

Course Code: EL3009 **Course Name: RF Circuit Design**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

High Frequency behavior of components, HF device models, Transmission Line Analysis, Filter Design, Use of Smith Chart

Section 2:

Impedance transformation, Impedance matching, Y and S parameters, RF amplifier design, RF Transformer.

List of Practicals:

1. To study the behavior of R, L, C components at high frequency.
2. Study Smith chart.
3. Design a LC high pass filter.
4. Design a band pass filter with given specifications
5. Design of T-Matching network.
6. RF Amplifier design.

List of Projects:

1. Design of RF Filter for given specifications
2. Design of Impedance matching circuits under given conditions
3. To develop RF Amplifier for given specifications.

Text Books:

1. *Reinhold Ludwig, Pavel Bretchko; RF Circuit Design: Theory and Applications; Pearson.*
2. *Chris Bowick; RF Circuit Design; Newnes, Butterworth-Heinemann*

Reference Books:

1. Fred Lefrak, How RF Transformers Work and How They are Measured, an-20-001 rev: b m150261 04/15/15) file: an20001.w61. This document and its contents are the property of mini-circuits

2. Jens Vidkjær, RF-CIRCUITS, Class Notes, 31415 RF-Communication Circuits

Course Outcomes:

The student will be able to –

1. Understand high frequency behavior of components
2. Demonstrate transmission line analysis.
3. Design RF filter.
4. Develop impedance matching circuits.
5. Design RF amplifier.
6. Explain RF transformer.

FF No: 654

Course Code: EL3027 Course Name: Object Oriented Programming Systems

Credits: 4 Teaching Scheme: 3 Hours / Week

Lab: 2 Hours / week

Section 1:

Introduction to Object Oriented Programming, Basic Concepts of Object-Oriented Programming – Classes, objects, data abstraction and encapsulation, inheritance, polymorphism, dynamic binding and message passing, Benefits of OOP, Applications of OOP.Java Fundamentals:Features of Java, Comparison of Java with other programming languages, Java Environnent, Simple Java Program, Java Tokens, Java Statements, Constants, variables, data types. Control statements- Decision making & branching, Decision making & looping. Classes, Methods & Objects in Java,Constructors, Destructors.

Section 2:

Inheritance:Types of Inheritance: Single, Multilevel, Hierarchical, Method Overloading and Method Overriding, Interface and Package, Multithreading, Life Cycle of Thread, Priority in Multithreading, Concept of Exception handling: Introduction, Types of errors, Exception handling syntax, Multiple catch statements.

List of Practicals:

1. Write some simple programs in C++ such as
   a) Find first N even numbers and its sum.
   b) Find first 10 prime numbers
2. Write a C++ program to define a class to represent a bank account.
3. Write a program in C++ to implement a Calculator with simple arithmetic operations
4. WAP to implement following constructors.
   a) Default constructor
   b) Parameterized constructor
5. Write a C++ program based on concept of Inheritance.
6. Write a C++ program which use try and catch for exception handling.
7. Create a class named 'Rectangle' with two data members 'length' and 'breadth' and two methods to print the area and perimeter of the rectangle respectively. Its constructor having parameters for length and breadth is used to initialize length and breadth of the rectangle. Let class 'Square' inherit the 'Rectangle' class with its constructor having a parameter for its side (suppose s) calling the constructor of its parent class as 'super(s,s)'. Print the area andperimeter of a rectangle and a square.
8. Create a class to print the area of a square and a rectangle. The class has two methods with the same name but different number of parameters. The method for printing area of rectangle

has two parameters which are length and breadth respectively while the other method for printing area of square has one parameter which is side of square.

9. Write a program to create multiple threads and demonstrate how two threads communicate with each other.
10. Write a C++ program which use try and catch for exception handling.

Project areas:

1. Design an application such as calculator, notepad, using OOP concepts.

Text Books:

1. Herbert Schildt; Java: The complete reference; 7th Edition; Tata McGraw Hill.
2. Yashwant Kanitkar; Let Us Java; 2nd Edition; BPB Publications.

Reference Books:

1. T. Budd; Understanding OOP with Java; Pearson Education.
2. E Balagurusamy; Programming with Java A Primer;3rd. Edition; Tata McGraw Hill.

Course Outcomes:

The student will be able to –

1. Identify potential benefits of object-oriented programming.
2. Code a program using C++ constructs.
3. Apply the concepts of classes, methods to write programs C++.
4. Develop programming application using inheritance, exception handling.

FF No: 654

Course Code: EL3010 **Course Name: Wireless Technologies**

Credits: 4 Teaching Scheme: 3 Hours / Week

Lab: 2 Hours / week

Section 1:

Modern Wireless Communication Technologies: 2G, 2.5G, 3G, 4G, LTE, 5G, Cellular Technology ; Multiple Access Technologies for Wireless Communication: TDMA, FDMA, CDMA, CSMA, SDMA

Section 2:

Wireless Systems and Standards: GSM, DECT, PACS; Wireless Application Protocol, IEEE 802.x based wireless Technologies: Bluetooth, Wireless LANs; Planning and designing of Wireless Systems

List of Practicals

1. Installation of Linux and ns-2
2. Simulation of wired networks
3. Simulation of multi-node network-Link break.
4. Study of X-Graph
5. Simulation of 2-node wireless network
6. Simulation of multi node wireless network

List of Projects:

1. Measure the energy consumption and the residual energy of wireless nodes in a network.
2. Measure the packet loss, packet delivery ratio and throughput in a wireless network.
3. Predict link failure in a wired / wireless network.
4. Compare the throughput, PDR, packet loss, energy consumption of 802.11 and 802.15.4
5. Compare the total network energy consumption in 802.11 and 802.15.4 protocols
6. Compare the latency of 802.11 and 802.15.4 protocols
7. Study the effect of mobility on energy consumption, packet delivery ratio, throughput in a wireless network.

Text Books:

1. T.S. Rappaport; Wireless Communications; 2nd Edition; Pearson.

Reference Books:

1. Dr. Sunil Kumar.S. manvi; Wireless and Mobile Networks; 2nd edition; Wiley.

Course Outcomes:

The student will be able to –

1. Design Cellular Networks
2. Analyze the Wireless Channel Access Protocols
3. Compare the 802.11x and 802.15.x wireless technologies
4. Plan and design wireless systems.

FF No: 654

Course Code: EL3011 **Course Name: Artificial Intelligence**

Credits: 4 Teaching Scheme: 3 Hours / Week

Lab: 2 Hours/Week

Section 1:

Introduction to Artificial Intelligence :- AI task domain, problem representation in AI, Problem characteristics. Game playing using AI.

Searching Techniques: - A.I. search process, non-heuristic and heuristic search techniques, constrain satisfaction and their applications.

Knowledge Representation: - Hierarchy of knowledge, types of knowledge, knowledge representation, methods for knowledge representation, predicate logic, Problems on predicate logic.

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Section 2:

Planning :- Components of planning system, goal stack planning technique. Nonlinear Planning using Constraint Posting.

AI Tools:- Expert System Shells, Explanation, and Knowledge Acquisition. Human expert behaviors, Expert system components, structure of expert system, the production system, Expert system development for application.

Natural language processing: - Introduction, Syntactic Processing, Semantic Analysis, . Architectures and functions in ANN, various learning rules. Building an ANN.

List of Practicals:

1. Develop a medical system using expert system.
2. Develop crypto-arithmetic puzzles.
3. Develop a system for Robotics planning.
4. Develop a knowledge representation system.
5. Implement the Breadth first search.
6. Implement the Depth first search.
7. Implement the Best first search.
8. Implement the A* first search.
9. Implement the AO* breadth first search.
10. Implement the search.

List of Projects:

1. Develop a project for the expert system.
2. Design a robotic arm using A I Technique.

Text Books:

1. Elain Rich and Kevin Knight; Artificial Intelligence; Third edition; Tata McGraw- Hill Publishing Company Limited.

2. Kishan Mehrotra, Chilukurik Mohan, Sanjay Rankia; Elements of Artificial Neural Networks; Second edition; Penram International Publishing (India) Pvt. Ltd.

Reference Books:

1. Kishan Mehrotra, Sanjay Rawika, K. Mohan; Artificial Neural Network; Second Edition; Pearson Publication.

2. Rajendra Akerkar; Introduction to Artificial Intelligence; Second Edition; Prentice Hall Publication.

3. Relevant IEEE papers.

Course Outcomes:

The student will be able to –

1. Identify real world problems of AI domain.
2. Write algorithms for searching techniques.
3. Develop an AI tool for practical application.
4. Develop an expert system

FF No: 654

Course Code: EL3008 **Course Name: Database Management Systems**

Credits: 4 Teaching Scheme: 3 Hours / Week Lab: 2 Hours / Week

Section 1:

Introductory concepts of DBMS: Introduction, purpose and applications of DBMS, Database System architecture- levels

Entity-Relationship model: Entity, Relationship and Attribute types, Design issues, E-R diagrams, extended E-R features

Relational Model and Design Theory: Structure of relational databases, Relational algebra, and Mapping of ER diagram to Relational Schemas, Codd's Twelve Rules, Normalization

Section 2:

SQL Concepts: Basics of SQL, DDL,DML, Primary key, foreign key, functions, Built-in functions, sub-queries, , transaction control commands

Storage and Query Processing: Storage and file structures, indexed files, single level and multi level indices, B+ trees, Query processing

Transaction Management and emerging trends: Transaction concepts, state diagram, deadlock, NoSQL, RDBMS vs NoSQL, NewSQL, Distributed database, Parallel database, Data warehouse and data mining.

Listof practicals:

1. Implementation of DDL commands of SQL: Create function, Alter function, Drop function, Insert function
2. Implementation of DML commands: Insert function, Update function, Delete function
3. Implementation of functions in SQL: Number function , Aggregate function , Character function, Convergence function, Date function
4. Implementation of operators in SQL: Arithmetic operator, Logical operator, Set operator (IN and NOT IN), Comparison operator
5. Study and implementation of different types of JOINS like Inner join, Outer join, Nature join
6. Study and implementation of different types clause: GROUP BY clause, HAVING clause, ORDER BY clause, Indexing clause
7. Study and implementation of sub queries and views
8. Study and implementation of SQL queries (creating database/table and managing users)
9. Study and implementation of PL/SQL
10. Study of standard database models

List of project areas:

1. Student information system
2. Library management
3. Courier service
4. Hospital management
5. Employee database management
6. MSRTC database management
7. Inventory database management
8. Exam database management

Text Books:

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

2. RamezElmasri, Shamkant B. Navathe; Fundamentals of Database Systems; 6th Edition; Pearson

Reference Books:

1. Thomas M. Connolly, Carolyn E. Begg; Database Systems: A Practical Approach to Design, Implementation, and Management; 6th Edition; Pearson

2. Raghu Ramakrishnan, Johannes Gehrke; Database Management Systems; 3rd Edition; McGraw Hill Education

3. Kristina Chodorow, Mongo; DB The definitive guide; O'Reilly Publications, ISBN: 978-93-5110-269-4, 2nd Edition.

4. Dr. P. S. Deshpande; SQL and PL/SQL for Oracle 10g Black Book;DreamTech.

Course Outcomes:

The student will be able to –

1. Differentiate database systems from file systems by enumerating the features provided by database systems and describe each in both function and benefit.
2. Transform an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS
3. Design ER diagrams for new databases and read (understand) ER diagrams.
4. Read/write - Extended Relational Algebra, Simple SQL, Embedded SQL, SQL Queries Using Embedding Operators, SQL Queries With GROUP BY, HAVING

FF No: 654

Course Code: EL3012 **Course Name: Electronics Product Design**

Credits: 4 **Teaching Scheme: 4 Hours / Week**
Lab 2 Hours / Week

Section 1:
Product specifications, feasibility analysis, Hardware Design, Software Design

Section 2:
System Reliability, Aesthetics and Ergonomics of product, EMI & EMC Consideration in Product design.

List of Practicals:

1. Define the specifications for the given product.
2. Carryout market feasibility analysis of giving product.
3. Draw and explain ERD of the given product.
4. Draw and explain the CFD / DFD of the given product.
5. Build and test the circuit of the given product.
6. Design the enclosure for the product. Ensure aesthetic and ergonomic design.
7. Draw and explain the component layout plan of the product.
8. Draw the power supply –grounding plan of the product.
9. Develop marketing plan of the product
10. Carryout profit loss analysis of developed product.

List of Projects:
Design and model a Prototype for

1. Coffee making machine
2. Cruise control
3. Ticket dispensing system
4. Power Supply
5. Attendance Monitoring System etc.

Text Books:

1. *Kevin Otto, Kristin Wood; Product Design – Techniques in Reverse Engineering and New Product Design; Pearson.*
2. *Roger Pressman; Software Engineering – A Practitioner's Approach; McGraw Hill.*

Reference Books:

1. *Karl Ulrich, Steven Eppinger; Product Design and Development; McGraw Hill.*

Course Outcomes:

The student will be able to –

1. Understand hardware design methodology.
2. Understand software design techniques.
3. Model a prototype of product.
4. Develop reliable products ergonomically and aesthetically under Emi / EMC constraints.

FF No: 654

Course Code: EL3014 **Course Name: Data Communication and Networking**

Credits: 4 Teaching Scheme: 3 Hours / WeekLab: 2 Hours / Week

Section 1:

Introduction to Data Communication and Networking: Uses of Computer Networks, Network Hardware, Network Software Internet Reference Models (OSI and TCP/IP)

Physical Layer: Basis for Data Communication, Guided Transmission Media , Wireless Transmission Medium, Circuit Switching and Telephone Network,

Data Link Layer and Medium Access Layer: Data Link Layer Design Issues, Error and Flow Control, Example Data Link Protocol, Channel Allocation Problem, Multiple Access, CSMA, CSMA/CD, CSMA/CA

Local Area Network: Connecting devices:-Repeaters, Hub, Bridges, Switch, Router, Gateways, Ethernet, Fast Ethernet, Wireless LAN, Blue tooth

Section 2:

Network Layer: Network Layer Design Issues, Routing Algorithms, Congestion control Algorithms, Quality of Service; Network Layer Protocols

Transport layer: Transport Layer Service, Elements of Transport protocols, Internet protocols (UDP and TCP)

Application Layer: DNS- Domain Name System, Electronic Mail, World Wide Web, Multimedia **Network Security:** Cryptography, Symmetric key Algorithms (DES, AES),Public key Algorithms-RSA, Digital Signatures, Firewall

List of Practicals (Any Six):

1. Preparation and testing of UTP Cat6 straight through and crossover cable.
2. Implementation of any LAN topology for file/printer sharing
3. Implementation of Stop and wait or Sliding window protocol
4. Implementation of Error correction and checking method
5. Implementation of Shortest Path Finding Algorithm
6. Design a client server environment to implement a web application.
7. Design a client server environment to implement a File transfer application.
8. Implementation of Private Key algorithms
9. Implementation of Public Key - RSA algorithm
10. Simulation of Network to study addressing mechanism and routing

Text Books:

1. *Computer Networks by Andrew S. Tanenbaum (Fifth Edition), Pearson Education*
2. *Data Communication and Networking by Behrouz A. Forouzan (Fourth Edition), Tata McGraw Hill*

Reference Books:

1. *William Stallings; Data and Computer Communication*
2. *James Kurose and Keith Ross; Computer Networking; Low Price Edition.*

Course Outcomes:

The student will be able to –

1. Describe OSI reference Model and the components and infrastructure that form the basis for most computer networks
2. Depict physical and data link layer functions and implement data link layer protocols and medium access control protocols
3. Design Local Area Network
4. Analyze the TCP/IP Protocol
5. Implement application layer protocols
6. Illustrate network management functions and security algorithms

FF No.: 654

Course Code: EL3002 **Course Name: Robotics**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

Introduction to robotics, Safety and economics of robots, Specifications, Robot Anatomy, Degrees of freedom, Robot Coordinate systems, Joints, workspace, Singularity, Representation of position and orientation by Homogeneous Transformation, Forward and inverse kinematics of robot, D-H convention, Jacobeans and dynamics of robot. End effectors-Grippers and tools. Gripper force analysis.

Section2:

Path planning, Trajectory Planning, Joint space and Cartesian space trajectories. Linearfunction with parabolic blends, Higher order polynomials, Robot sensing and vision system. Machine vision, Robot programming: Lead through, offline; Hardware and software of robot controller, Introduction to Robot operating system.

List of Practical:

1. Understanding GUI of Robo Analyzer
2. Understanding coordinate frames and transformations
3. Virtual Models of Industrial Robots
4. Virtual Models of Industrial Robots with teach pendant and Blue Tooth
5. Forward kinematics of robots
6. Creating robot joint trajectories
7. Control a virtual robot using a joystick
8. Pre-processing of image- implementation of histogram, filters, Thresholding.
9. Morphological processing
10. Image segmentation

List of Projects:

1. Designing of gripper for cylindrical objects
2. Design of pick and place robot for a given pay load capacity
3. Integration of machine vision with robot for industrial application.
4. Rubik Cube solving by Lego.
5. Writing a welding profile using virtual robot.
6. Performing “YOGA” by Humanoid robot.

Textbooks:

1. Saeed Niku; Introduction to Robotics analysis, Systems, Applications; Prentice-Hall.

2. Mikell P. Groover; Industrial Robotics Technology Programming and Applications; McGraw Hill.

3. S. K. Saha; Introduction to Robotics; Tata Mcgraw Hill.

Reference Books:

1. Klafter R.D, Chmielewski T.A. and Noggins; Robot Engineering: An Integrated Approach; Prentice Hall.

2. Fu K.S., Gonzalez R.C., & Lee, C.S.G; Robotics control, sensing, vision and intelligence; McGraw Hill.

3. Craig J. J; Introduction to Robotics mechanics and control; Addison-Wesley, London.

Course Outcomes:

The student will be able to –

1. Evaluate forward and inverse kinematics of robot.
2. Describe various types of robot end effectors.
3. Compute trajectories in joint and Cartesian space.
4. Familiar with robot sensing and vision system for industrial applications.

FF No: 654

Course Code: EL3016 **Course Name: Digital System Design**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

Interconnects - signal interconnect models: lumped, distributed, transmission-line, delay, crosstalk, power, clock distribution; Decomposition of a system into data and control paths - Mealy/Moore state machines, RTL descriptions, Implementation; Decomposition of the control path - Additive decomposition, Multiplicative decomposition, control synchronization, deadlocks

Section 2:

Parallelism and system decomposition - pipelines: control-flow and data-flow; Communication between sub-systems; Queuing models of systems, performance estimation; Resource contention; Memory sub-systems - Memory architecture, Shared memory, Data hazards, Consistency, Mutual Exclusion; Test and verification.

List of Practical:

All laboratory exercises must be completed; these are intended to prepare the students for the term project. In doing these exercises, each student works individually first and then in a group. It is strongly recommended that each student must use his/her own machine, install thefree VLSI TCAD tools which will be discussed in class or laboratory session. Typical assignments as follows:

1. Design and simulation of an inverter chain for optimized performance.
2. Simulation of Differential and Single Ended Signal

For a given design(s) discussed in class -

Sketch proto-RTL for the given Design, Code the design using VHDL/Verilog, write a testbench to test the code, verify that the design works as expected, Synthesize the design.

Typical circuits/systems to be implemented are as follows:

1. Sequence detector Moore/Mealy Machine
2. Priority Encoder
3. Booth's Multiplier
4. Barrel Shifter
5. Queues
6. Pipelines
7. Memory – CAM, Dual port, Shared, LIFO, FIFO, etc.
8. Logic decoder

List of Projects:

The most important assignment is the Term Project, about which more detailed instructions

will be issued in class. In doing this assignment, students will work in group(s). They should begin finding their partner(s) early in the term. The term project requirements must be completed in accordance with the schedule given in the instructions. Students must make a presentation of their part of the project to the rest of the class. They must demonstrate/present their work in the term project even if it does not fully function. Typical projects as follows:

1. Design a 16-entry queue with data width as 32 bits.
2. Design a system with one 32-bit data input and four 32-bit data outputs. The system is expected to broadcast the input 32-bit data to all outputs.

Text / Reference Books:

1. *J. M. Rabaey; Digital Integrated Circuits, A Design Perspective; Prentice Hall India.*
2. *W. J. Dally, J. W. Poulton; Digital Systems Engineering; Cambridge University Press, 1998.*
3. *S. H. Hall, G. W. Hall, J. A. McCall; High-Speed Digital System Design; John Wiley and Sons, 2000.*
4. *H. G. Cragon; Memory Systems and Pipelined Processors;Narosa, 1996.*

Course Outcomes:

The students will be able to

1. Identify the type of state machine
2. Calculate delay of transmission line
3. Write rtl description for a circuit/system
4. Estimate performance of queue
5. Analyze data hazards

FF No: 654

Course Code: EL3017 **Course Name: Embedded System Design**

Credits: 4 Teaching Scheme: 3 Hours / Week

Lab: 2 Hours / Week

Section 1:

Types, Hardware architecture,Processor, memory, IO devices, ADC,DMA controller, Debug port, Interrupt Service Mechanism,Context switching, Software architecture, development tools. ARM architecture,nomenclature, operating modes, Exception Handling,ARM and thumb instruction set and assembly language programs, LPC 2148 feature, PLL, watch dog timer, Timer/ counter,Serial Communication, ADC, DAC

Section 2:

Communication protocols: CAN, Bluetooth, MODBUS, OS: Architecture, objectives and functions, ,Types of OS ,RTOS: Characteristics, Critical section of code, race condition , Shared resource, multitasking, Task scheduling, Context switching , Intertask Communication, Mutual Exclusion, Semaphores , preemptive and non-preemptive kernel, Priority Inversion, Deadlock, memory management, ISR, Timer. µCOS IIOS: Kernel structure, services

List of Practical:

1. Interfacing and programming LED with LPC 2148 using on chip timer
2. LCD interfacing
3. Keypad interfacing
4. Serial communication programming
5. ADC programming
6. DAC programming
7. PLL programming
8. external interrupt programming
9. Multitasking using RTOS
10. Resource sharing with semaphore

List of projects

1. Digital counter using proximity sensor
2. Wireless electronic notice board
3. Lab attendance monitoring system
4. System for communication availability/ non-availability of authority to visitor
5. Water quality measurement system

Text Books:

1. *Raj Kamal; Embedded Systems; TMH*
2. *Andrew Sloss; ARM system Developers Guide; Elsevier publication*
3. *SantanuChatopadhyay; Embedded system design; Second edition,*

Reference Books:

1. *Dr. K.V.K.K. Prasad; Embedded / Real Time Systems;Dreamtech Publication*
2. *Iyer, Gupta; Embedded Real systems programming; Tata Mcgraw Hill Publication*
3. *Steve Heath; Embedded System Design;Neuwans.*
4. *Frank Vahid; Embedded System Design.*

Course Outcomes:

The student will be able to –

1. Elaborate architecture of Embedded Systems &ARM
2. Experiment with ARM7
3. Compare various communication protocols used in embedded application
4. Relate RTOS kernel functions with general purpose OS functions

FF No: 654

Course Code: EL3018 Course Name: Digital Signal Processing

Credits: 4 Teaching Scheme: 3 Hours / Week

Lab: 2 Hours / Week

Section 1:

Z-Transform, analysis of LTI systems in Z domain, Discrete Fourier Transform (DFT) and its computation, Linear filtering using DFT, FFT Algorithms

Section 2:

FIR filter Design and Realization,IIR filter Design and Realization

List of Practical:

1. Verification of sampling theorem. Plot Magnitude and Phase Response of Discrete Time Signal
2. Verification of Properties of DFT
3. Implement Decimation in Time FFT Algorithm.
4. Design of FIR Filter
5. Design of IIR Filter
6. Study the effects of up sampling and down sampling in time and frequency domain
7. Verification of properties of Z Transform
8. Check stability of System using pole zero plot
9. Implement Convolution and correlation of two signals
10. Decimation and Interpolation of signal

List of Project areas:

1. A signal (ECG/Speech) is contaminated with power line interference noise. Design a Notch filter to remove 50Hz Notch frequency from noisy signal. Observe frequency response of designed filter and analyze the filtered signal.

2. Design of Multirate system for the given sampling rate and specifications of filter required for sound recording system to compose and mix high and low frequency signals generated from different instruments in a Recording studio.

3. A signal (ECG/Speech) is contaminated with noise. Design FIR and IIR filters for given specifications to remove noise from signal. Compare results of FIR and IIR filters. Implement using DSP Processor.

4. Project based on Multirate signal processing

5. Project based on Filter Design for noise removal

6. Project based on Transform properties

Text Books:

1. *Sanjit Mitra; Digital Signal Processing; TMH, 3rd edition*
2. *John Proakis, Dimitri Manolakis; Digital Signal Processing – Principles, Algorithms and Applications; PHI*

Reference Books:

1. *Ramesh Babu; Digital Signal Processing; Scitech publications 2001.*
2. *Shalivahanan, Vallavraj, Gnanapriya C; Digital Signal Processing; TMH 2001.*

Course Outcomes:

The student will be able to –

1. Demonstrate use of Z Transform in analyzing LTI systems.
2. Determine DFT coefficients using FFT algorithms to minimize hardware complexity.
3. Analyze FIR filters for the given Specifications.
4. Analyze IIR filters for the given Specifications.
5. Design practical sampling rate converters.

FF No: 654

Course Code: EL3019 **Course Name-Machine Learning**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

Data preprocessing; Regression – simple linear, multiple linear, polynomial, decision tree, random forest; Classification – logistic regression, K-nearest neighbors, support vector machine, kernel SVM, naïve bays;evaluating regression model performance

Section2:

Clustering – k-means, hierarchical, Reinforcement learning; Natural language processing; Artificial neural network; Dimensionality reduction – Principal Component Analysis, Model Selection

List of Practical:

1. Build linear regression model.
2. Build a classifier model using logistic regression / K-NN / SVM
3. Studyofrandomforest Regression Model
4. Developdecisiontreetosolvetheproblem
5. Develop naïve Bayesclassifiermodel
6. Studyofhierarchicalclusteringapproach
7. Develop K-means clustering technique
8. Design and develop a model for natural language processing
9. Construct model using Artificial neural network
10. Build model using Principal Component Analysis

List of Project areas:

1. Plant disease classification
2. Prediction for commercial success
3. Restaurant recommendation system
4. Improve healthcare
5. Natural language processing

Text Books:-

1. *Tom Mitchell; Machine Learning; TMH, 2018*
2. *StefenMarsland; Machine Learning; CRC Press, 2011*
3. *Peter Flach; Machine Learning: The Art and Science of Algorithms that make sense of Data; Cambridge University Press, 2012*

4. *T. Hastie, R. Tibshirani, J. Friedman; Introduction to Statistical Machine Learning with applications in R Springer; 2nd edition.*

Reference Books:

1. *EthemAlpaydin; Introduction to Machine Learning; PHI 2nd edition, 2013*
2. *Lorenza Saitta, Attilio Giordana; Phase Transitions in ML; Cambridge Press.*
3. *C. M. Bishop;Pattern Recognition and Machine Learning; Springer 1st Edition-2013*
4. *T. Hastie, R. Tibshirani, J. Friedman;the Elements of Statistical Learning; 2nd 2008.*

Course Outcomes:

The student will be able to –

1. Select regression model to solve business problems
2. Choose a classifier model for building applications
3. Apply clustering techniques to solve real world problems
4. Design and implement various machine learning algorithms in a range of real-world applications

FF No: 654

Course Code: EL3020 **Course Name: AdHoc Networks**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1: Ad Hoc Wireless Networks

Cellular and Ad Hoc Wireless Networks, MAC Protocols, Routing Protocols Applications, Issues,

Section 2:Implementation and performance of Ad Hoc Networks

Quality of service, Performance parameters, route discovery time, end to end delay, throughput, packet loss, repair time, power life issues.

List of Practical:

1. Installation of Linux and NS-2 network simulator.
2. Simulation of wired topology.
3. Simulation of wireless topology.
4. Generation of trace file and X-Graph
5. Measure the energy consumption and the residual energy of wireless nodes in network.
6. Measure the packet loss and packet delivery ratio in a wireless network
7. Predict link failure in a wired / wireless network.

List of Projects:

8. Study the effect of mobility on throughput in a wireless network with DSR & AODV
9. Study the effect of mobility on energy consumption of a wireless network with DSR & AODV
10. Study the effect of network topology on throughput in a wireless network with DSR & AODV
11. Compare the packet loss in unicast and multicast protocols. Comment on your results
12. Queue Monitoring - Drop-Tail
13. Study the effect of data rate on energy consumption in 802.15.4 protocol

Text Books:

1. *C.K. Toh; Ad Hoc Mobile Wireless Networks Protocols and Systems; Pearson.*
2. *C. Siva Ram Murthy, B.S. Manoj; Ad Hoc Wireless Networks Architecture and*

Protocols; Pearson Education.

3. *Sudip Misra, IsacWoungang, Subhas Chandra Misra; Guide to Wireless Adhoc Network; Springer.*

Reference Books:

1. *Jagannathan Sarangpani; Wireless Ad Hoc and Sensor networks: Protocols, performance and Control; CRC Press.*
2. *Carlos De Morais Cordeiro, Dharma Prakash Agrawal; Ad Hoc and Sensor Networks: Theory and applications.*
3. *Relevant IEEE Papers.*

Course Outcomes:

The student will be able to –

1. Understand MAC protocols.
2. Describe routing protocols
3. Explain performance issues in Ad-hoc networks.
4. Select QoS solutions for performance improvement

FF No: 654

Course Code: EL3021 Course Name: Microwave Engineering

Credits: 4 Teaching Scheme: 3 Hours / Week Lab: 2 Hours / Week

Section 1:

Microwave transmission lines; Overview of Microwave communication: Microwave communication system , Advantages and applications of Microwaves. Rectangular Waveguides – TE/TM mode analysis, Waveguide components and applications. Ferrite Components, Scattering matrix of microwave devices.

Microwave tubes: O type and M type classifications.

Section 2 :

Microwavesolid state devices: Gunn Diode , Tunnel Diode, PIN diode, Varactor diode, MASER. IMPATT and TRAPATT. Real world applications of microwave engineering in Radars, Communication, Industrial applications

Microwave Measurement – Bolometer Method. Measurement of Attenuation, Frequency, VSWR, Q of a Cavity Resonator. Impedance Measurements

List of Practicals:

1. Study of different Microwave components.
2. Derive the expressions for Waveguide parameters.
3. Mathematical analysis of Reflex klystron.
4. Study the characteristics of Reflex klystron.
5. Study the domain formation in Gunn diode.
6. Study V-I characteristics of Gunn diode.
7. Calculate Scattering matrix for Magic Tee.
8. Study port parameters of Magic Tee.
9. Study construction details of Circulator.
10. Calculate port parameters of Circulator. .

List of Projects:

1. Plot radiation pattern of different antennas.

Text Books:

1. Microwave Devices and Circuits – Samuel Y. Liao, PHI, 3rd Edition

2. Micro Wave and Radar Engineering – M. Kulkarni, UmeshPublications

Reference Books:

1.R. Chatterjee; Elements of Microwave Engineering; Affiliated East-West Press Pvt. Ltd; New Delhi, 1988.

2. *Peter A. Rizzi; Microwave Engineering Passive Circuits; PHI, 1999.*

Course Outcomes:

The student will be able to-

1. Analyze microwave channel mathematically.
2. Analyze microwave components mathematically.
3. Interpret microwave sources mathematically.
4. Describe microwave solid state devices.
5. Describe real time applications of microwave engineering.
6. Explain different microwave measurements.

FF No: 654

Course Code: EL3022 Course Name: Internet of Things

Credits: 4 Teaching Scheme: 3 Hours / Week

Lab: 2 Hours / Week

Section 1: IoT Overview

Introduction, IoT Architecture: a. Node Structure B. Networking, Communication Technologies, **Industrial Network Evolution** IT-OT Manufacturing Convergence Industrial IoT TCP/IP & OSI Networking Models Fundamentals of LAN & WAN, Fundamentals of IP Addressing, **Switching-** Ethernet LAN Switching Ethernet Switch Configuration, Practical Example discussion, **Routing-** Routing Protocols-RIP, EIGRP,OSPF

Section 2:Case studies and Implementation

Case Study.Routing Between VLANs, Smartness,IoT Fabricator, Study of IoT Projects based on some Hardware (Raspberry pi, Arduino, Intel, IITH Mote, Smartphones),

List of Practical:

1. Install Packet Tracer
2. Building the LAN Network
3. Smart Lamp
4. Configure routing information protocol (RIP)
5. Port Security
6. Configure the basic parameters of a CISCO router

List of Projects:

1. Implementation Routing Information protocol RIP on IP Network
2. Smart home
3. Smart office
4. Smart campus
5. Temperature Monitoring & Control
6. Smart garden
7. Smart industry

Text Books:

1. *Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann; Interconnecting Smart Objects with IP: The Next Internet.*
2. *Adrian McEwen, Hakim Cassimally; Designing the Internet of Things.*

3. *Dr. Ovidiu Vermesan, Dr. Peter Friess; Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems; River Publishers*
4. *Vijay Madisetti,ArshdeepBahga; Internet of Things (A Hands-on-Approach); 1st Edition, VPT, 2014*
5. *Zach Shelby, Carsten Bormann; 6LoWPAN: The Wireless Embedded Internet; Wiley*
6. *Daniel Minoli John; Building the internet of things with ipv6 and mipv6, The Evolving World of M2M Communications; Wiley & Sons*

Reference Books:

1. *Francis da Costa; Rethinking the Internet of Things: A Scalable Approach to Connecting Everything; 1st Edition;Apress Publications, 2013*
2. *Cuno Pfister; Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-44939357-1*

Course Outcomes:

The student will be able to –

1. Understand the vision of IoT from a global context.
2. Use of Devices, Gateways and Data Management in IoT.
3. Building state of the art architecture in IoT.
4. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

FF No: 654

Course Code: EL 3023 **Course Name: Industrial Automation**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

Automation overview, types of Automation, Hierarchical levels of automation, Plant wide control systems and Automation Strategy. PLC: Architecture, I/O module, Scan cycle, Set, Reset, Timer and counter instructions. Advanced PLC programming: Logical, math, Branching etc. Standalone and Distributed PLCs.

Section 2:

SCADA, HMI: Concepts, functionality and programming techniques. Introduction to DCS, Communication and networking protocols: Devise Net, Control Net, HART, Profibus PA, Field Bus H1, IEEE 1394, Introduction to EtherCAT, Condition monitoring, Intelligentcontrol. Case Studies .

List of Practicals:

1. Ladder program realizing Boolean logic.
2. Sequencing operation using bit logic.
3. Performing delayed operation of lamp using PLC timers
4. Performing UP/DOWN counters with RESET instruction.
5. Program control- Jump and subroutine.
6. Sensor interfacing to PLC
7. PLC interfacing with SCADA and status read/command transfer operation.
8. Alarm annunciation using SCADA.
9. GUI development for industrial application.
10. RTU / MTU communications.

List of Projects:

1. Simulation of conveyor belt industrial application using PLC.
2. PLC controlled robotic arm.
3. Automatic car parking system.
4. PLC, SCADA and HMI for waste water treatment and distribution plant.
5. PLC, SCADA and HMI for Building automation systems
6. Wireless SCADA application for remote Industrial plant.

Text Books:

1. Frank D Petruzella; Programmable logic controller; McGraw-Hill Education.

2. Poppovik and Bhatkar; Distributed Computer Control for Industrial Automation;Dekkar Publication.

3. SCADA by Stuart a Boyer: ISA 1999

Reference Books:

1. Krishna Kant; Computer Based Process Control; Prentice Hall of India.

2. A. D. Rodić; Automation and Control- Theory and Practice; In Tech.

3. *Srinivas Medida; Pocket Guide on IndustrialAutomation- For Engineers and Technicians.*

Course Outcomes:

The student will be able to –

1. Develop PLC programs for industrial applications.
2. Apply advanced instruction of PLC to solve complex automation applications.
3. Understand the functionality of SCDA, HMI and DCS systems.
4. Describe and apply protocols needed for industrial communication and networking.

FF No: 654

Course Code: EL3024 **Course Name: VLSI Technology**

Credits: 4 Teaching Scheme: 3 Hours / Week

Lab: 2 Hours / Week

Section 1:

Introduction, MOSFET Fabrication for IC, Silicon Crystal Structure, Defects in Crystal, Crystal growth, Oxidation, Kinetics of Oxidation, Oxidation rate constants, Dopant Redistribution, Oxide Charges, Epitaxy, Molecular Beam Epitaxy, Diffusion, theory of Diffusion, Infinite Source, Actual Doping Profiles, typical diffusion systems, Ion Implantation Process, Annealing, Masking, Lithography.

Section 2:

Etching - Wet Chemical and Dry Etching, Plasma Etching, Etching of Si, SiO_2, SiN and other materials, Deposition, Plasma Deposition, Metallization, Issues in Aluminum Metal contacts, Isolation, LOCOS, Issues in LOCOS, Trench isolation, BJT Fabrication and Realization of Circuits, MOSFET – Metal gate vs Self-aligned, Poly-gate, Tailoring of Device Parameters, CMOS Technology, latch up in CMOS, BICMOS Technology.

List of Practicals:

All laboratory exercises must be completed; these are intended to prepare the students for the term project. In doing these exercises, each student works individually first and then in a group. It is strongly recommended that each student must use his/her own machine, install thefree VLSI TCAD tools which will be discussed in class or laboratory session.

Typical Lab experiments as follows:

Design and simulate process flow for

1. NMOSFET
2. PMOSFET
3. Resistive NMOS Inverter
4. CMOS Inverter
5. RC Filter
6. LOCOS
7. STI
8. SOI MOSFET
9. P-N Junction
10. BJT

List of Projects

The most important assignment is the Term Project, about which more detailed instructions

will be issued in class. In doing this assignment, students will work in group(s). They should begin finding their partner(s) early in the term. The term project requirements must be completed in accordance with the schedule given in the instructions. Students must make a presentation of their part of the project to the rest of the class. They must demonstrate/present their work in the term project even if it does not fully function. Typical projects as follows:

1. Design, Simulate and Optimize the performance of a FINFET
2. Design, Simulate and Optimize the performance of a FDSOI/PDSOI

Text Books:

1. *S. K. Gandhi ; VLSI Fabrication Principles*
2. *S. M. Sze; VLSI Technology*
3. *J. D. Plummer, M. Deal and P. D. Griffin; Silicon VLSI Technology*

Material is also referred from the relevant International Journals and Conference proceedings.

Course Outcomes:

The students will be able to

1. Locate the defect in Silicon crystal
2. Differentiate between deposition and ion implantation
3. Calculate thickness of oxide in oxidation process
4. Design process flow for the given structure
5. Identify the profile of etching
6. Draw the structure from process flow

FF No: 654

Course Code: EL4003 **Course Name: Engineering Ethics**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

Introduction to Ethical Reasoning and Engineer Ethics, Professional Practice in Engineering, Ethics as Design - Doing Justice to Moral Problems, Central Professional Responsibilities of Engineers**.**

Section 2:

Computers, Software, and Digital Information, Rights and Responsibilities Regarding Intellectual Property, Workplace Rights and Responsibilities, Responsibility for the Environment

List of Projects:

1. Case Study: Based on Theory of GroupThink
2. Case Study: Halting a Dangerous Project
3. Case Study: Related to Innocent comments, Late Confessions etc.
4. Case study: Related to assessment schemes, teaching methodology, EDD, lab conduction

Text Books:

1. *Ethics in Engineering practice and Research (2nd Edition) by Caroline Whitbeck Cambridge.*
2. *Ethics in Engineering MW Martin and R Schinzinger MC Graw Hill Engineering Ethics and Environment P a Vesilind and AS Gunn Cambridge.*

Reference Books:

1. *Engineering Ethics, Concepts and Cases; Charles e. Harris, michael s. Pritchard, Michael J. Rabins, wadsworthCengage Learning*

Course Outcomes:

The student will be able to –

1. Perform their professional responsibilities as Engineers.
2. Recognize through ethically significant problem situations that are common in Engineering

3. Think through ethically significant problem situations
4. Evaluate the existing ethical standards for ENGINEERING Practice.

FF No: 654

Course Code: EL4004 **Course Name: Renewable Energy**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1: Creating Energy

Conventional and Non-Conventional EnergylikeWind Power, Solar Power, Geothermal energy, Tidal/Hydro Power, Biomass, Challenges, Production, Transmission and use of energy.

Section 2: Sustainable Energy

Technologies to generate Energy from Wind, Solar, Hydro, Biomass. Integration of Renewable energy in the electrical Power System, Energy Storage.

List of Practical:

1. Collect the information about Energy Conservation Building Code.2007
2. Prepare a write up on role of Energy Manager and Energy Auditor.
3. Collect information from by market survey and prepare report on rating, luminous output, cost, list of manufacturers of various types of energy efficient luminaries (FTL, CFL, LED, Sodium Vapor, HPMV etc.)
4. Make a comparative study of energy efficient control gears and ballasts used in lighting system based on energy efficiency, cost, life, energy saving and saving in energy bill
5. Visit to any organization where energy conservation program is implemented (Hospitals, workshops, institutes, commercial building, residential building etc.
6. Using various energy audit instruments used for measurement of electrical, mechanical and thermal energy parameters, carryout energy audit and prepare a report as a case study for Residence, Small workshop, Public Library, Hospital etc.(Inclusive of Data Collection processes)
7. Visit a dealer in Electric Home Appliances to know and understand STAR Rating
8. Testing of solar cells for I-V characteristics
9. Design of Off Grid Solar System
10. Design of grid connected rooftop system

List of Project areas:

1. Case study of the biggest planned renewable energy projects in the world.
2. Testing of solar cell

Text Books:

1. Solanki C. S; Solar Photovoltaics - Fundamentals, Technologies and Applications;

3rd edition; PHI.

2. *S. Sukhatme, J Nayak;Solar Energy: Principles of Thermal Collection and Storage; 3rd edition; Mc Graw Hill.*

Reference Books:

1. *Michael Boxwell;The Solar Electricity Handbook: A Simple, Practical Guide to Solar Energy: How to Design and Install Photovoltaic Solar Electric Systems 2017; internet linked.*
2. *Solanki;Renewable Energy Technologies: A Practical Guide for Beginners; PHI*

Course Outcomes:

The student will be able to –

1. Obtain the overview of the global energy scenario, understand need on non-conventional energy resources.
2. Global Challenges and their limited resources.
3. Calculate the potential attribution of different sources of renewable energy like wind, solar and biomass and how to integrate them in an energy system
4. Design a plan for a 100% sustainable energy system technique.

FF No: 654

Course Code: EL4006 **Course Name: CMOS Mixed Signal Design**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

Two stage amplifiers, Cascade – Folded and Telescopic, DC and AC behavior, Current and Voltage references, Current mirrors, Bandgap references, Analog and discrete-time signal processing, sampling circuits, different types of sampling switches, Sample and Hold Architectures, Open loop & closed loop architectures, switched capacitor filter, Interconnects.

Section 2:

Basics of data converters, Analog to digital converters (ADC), Digital to analog converters (DAC), Successive approximation ADCs, Dual slope ADCs, High-speed ADCs - flash ADC, pipeline ADC and related architectures, High-resolution ADCs - delta-sigma converters,DACs – Resistor Ladder architectures, Current steering architectures, CMOS comparator, Analog Multiplier, Phase Locked Loops (PLL), Charge Pump PLL, Delay Locked Loops.

List of Practicals:

All laboratory exercises must be completed; these are intended to prepare the students for the term project. In doing these exercises, each student works individually first and then in a group. It is strongly recommended that each student must use his/her own machine, install thefree VLSI TCAD tools which will be discussed in class or laboratory session. Typical assignments as follows:

1. Simulation of two-stage amplifier
2. Simulation of Sample and Hold circuit
3. Measuring the performance parameters of cascade amplifier
4. Measuring the performance parameters of folded cascode amplifier
5. Simulation of OTA
6. Simulation of PLL signal generators
7. Simulation of Switch Capacitor Filter
8. Simulation of Resistor Ladder DAC
9. Simulation of basic charge pump circuit
10. Simulation of an analog multiplier

List of Projects:

The most important assignment is the Term Project, about which more detailed instructions will be issued in class. In doing this assignment, students will work in group(s). They should

begin finding their partner(s) early in the term. The term project requirements must be completed in accordance with the schedule given in the instructions. Students must make a presentation of their part of the project to the rest of the class. They must demonstrate/present their work in the term project even if it does not fully function. Typical projects as follows:

1. Design of high speed CMOS comparator
2. Design of higher order Sigma Delta modulator

Text Books:

1.R. Jacob Baker; CMOS mixed-signal circuit design; Wiley India, IEEE press, reprint 2008.
2.Behad Razavi; Design of analog CMOS integrated circuits; McGraw-Hill; 2003.

Reference Books:

1. *Baker, Li, Boyce; CMOS: Circuit Design, layout and Simulation; PHI, 2000.*
2. *R. Gregorian and G. Temes; Analog MOS Integrated Circuit for signal processing; John Wiley & Sons.*

Material is also referred from the relevant International Journals and Conference proceedings.

Course Outcomes:

The students will be able to

1. Draw small signal model of an amplifier stage
2. Calculate current in current mirror circuit
3. Identify feedback loop in sample and hold circuit
4. Find quantization noise in data converter
5. Draw basic architecture of PLL
6. Differentiate various architectures of ADCs

FF No: 654

Course Code: EL4008Course Name: Mobile Communication

Credits: 4 Teaching Scheme: 3 Hours / Week

Lab: 2 Hours / Week

Section 1: Infrastructure to develop Mobile Communication Systems

Cellular Technology, Capacity improvement, Mobile Traffic calculation, Attributes of CDMA and GSM in cellular systems

Section 2: Wireless Communication System and standards

Broadcast Networks, Infrastructure based/ cellular Networks, Ad-Hoc Network, WLAN

List ofPracticals:

1. Study of DSSS Modulation/Demodulation using an analog signal as an input.
2. Study of BPSK Modulation/Demodulation process.
3. Study of PSTN
4. Study of Mobile trainer
5. To configure servers using packet tracer.
6. Antenna Design using Simulation Software(MATLAB/HFSS)

List of Projects:

1. Performance analysis of wireless networks.
2. Implement a home automation system using packet tracer.
3. Antenna Design

Textbooks:

1. *Wireless Communication- Principle and Practice, Theodore S. Rappaport, PHI*
2. *Mobile Communication- Jochen Schiller, Pearson Education*

Reference Books:

1. *Radio Frequency Principles and Applications, Albert A. Smith, Universities Press*

Course Outcomes:

The student will be able to –

1. Understand latest trends in wireless technologies, a path towards 5G.
2. Correlate how the handsets in their hand works, what is happening on the air interfacesand how call shifts from/to 4G to 3G and then to 2G .
3. Understanding the different standards in Mobile Technology.
4. Understand Real time application of knowledge using projects with simulation software for call flow and negative events.

FF No: 654

Course Code: EL4013 **Course Name: Advanced Power Electronics**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

Three phase-controlled converters, Analysis for resistive and inductive load.
Effect of Source Impedance (Ls) on single phase converter operation, Single and Three Phase Dual Converter: Control Schemes and analysis.
Three phase transistorized voltage source inverter (VSI), Analysis of operational modes.
PWM Inverters: Techniques, Comparison, Harmonic Analysis, Voltage Control and Harmonic Reduction in Inverters, Power Factor Improvement techniques: PAC, SAC, EAC and PWM

Section 2:

Series and parallel operation of power devices, String efficiency and Derating factor, Equalizing networks, Protection circuits, Sensing & measurement of sinusoidal/ non-sinusoidal voltage & current signals.
DC motor drives: - Performance parameters, speed control and braking techniques,
AC motor drives: - Performance parameters, Speed control (Stator voltage, Frequency, V/F), Effect of non-sinusoidal supply on motor performance, Selection of drive, Protection circuits for AC/DC Motor Drives.
Power Quality: -Types, Sources, measurement and preventive techniques of power line disturbances

List of Practical:

1. Study of 3 Phase Inverter with Load
2. Study of Stator Voltage Control of 3 Phase IM
3. Speed Control of DC Drive (Controlled Converter/ Chopper Based)
4. Study of Protection Circuits for Drives (OV/ OC)
5. Study of Protection Circuits for Drives (Soft start/ Soft stop)
6. Study of Voltage/ Frequency Control of 3 Phase IM
7. Study of Power Factor Improvement Technique (SAC/ PAC)
8. Simulation of three Phase Controlled Converter with R, RL Load
9. Simulation of three Phase Inverter with R, RL Load
10. Simulation of dual converter with suitable Load

List of Projects:

1. Switching circuit for a power device for 3 phase power conversion systems (SCR /

power BJT / power MOSFET / IGBT)

2. PWM generation for device switching

Develop a 3-phase power converter for utility applications as listed below (Any one). Source available is AC Mains/ DC battery.

3. UPS
4. Speed control of DC Motor
5. Speed control of AC Motor
6. Develop sensing and protection circuit for converter/ AC or DC drive (over voltage/ over current/ soft start and soft stop)
7. Dual converter (switching circuit)
8. Solid state relay/ Programmable Ac power control
9. Verify, through simulation, the performance of 3 phase AC-DC power conversion systems for suitable load. Comment on the results.
10. Verify, through simulation, the performance of 3 phase DC-AC power conversion systems for suitable load. Comment on the results.

Text Books:

1. M D Singh, K B Khanchandani; Power Electronics; 2 nd Edition, TMH.
2. M. H. Rashid; Power Electronics Circuits, Devices and Applications; 3 rd Edition, PHI.

Reference Books:

1. N. Mohan, T. M. Undeland and W P Robbins; Power Electronics: Converters, Applications, and Design; 3 rd edition, John Willey and Sons, Singapore.
2. Dubey, Doralda, Joshi and Sinha; Thyristorised Power Controllers; New Age International.
3. P. C. Sen; Thyristor DC Drives; John Wiley.
4. B. K. Bose; Modern Power Electronics and AC Drives; Pearson Education, 2002.

Course Outcomes:

The student will be able to –

1. Analyze three phase AC-DC/ DC-AC power converters in terms of performance parameters.
2. Analyze power factor in AC/DC converters.
3. Describe series and parallel connection of power devices.
4. Describe the role of converters in speed control DC & AC motors.

FF No: 654

Course Code: EL4012 **Course Name: Design of Experiments**

Credits: 4 **Teaching Scheme: 3 Hours / Week Lab: 2 Hours / Week**

Section 1:

Statistical Concepts Performance Evaluation, Selection of techniques and metrics, Strategy of experimentation, applications of experimental design, characterizing a process, optimizing a process variable, principles of experimental design replication, randomization, blocking, design guidelines, statistical techniques in experimentation

Simple Comparative Experiments

Probability distributions, Mean, variance, expected values, sampling and sampling distributions, properties of sample, mean, variance, degrees of freedom, normal distribution, standard normal distribution, Chi square distribution, t distribution, f distribution, hypothesis testing, confidence intervals

Section 2:

Experiments with Single Factor

Analysis of Variance (ANOVA), fixed effect and random effect model, analysis of fixed effect model, decomposition of total sum of squares, Cochrans theorem, model adequacy checking, normal probability plot, plot of residuals versus fitted values

Factorial Design

Basic definitions and principles, advantages of factorials, two factor factorial design, statistical analysis of fixed effect model, analysis of variance table for two factor factorial design fixed effect model, degrees of freedom

List of Practicals:

1. Study and install minitab. Practice all functionalities available.
2. Acquire a full understanding of the inputs and outputs being investigated. A process flow diagram or process map can be helpful. Utilize subject matter experts as necessary.
3. Create a design matrix for the factors being investigated. The design matrix will show all possible combinations of high and low levels for each input factor.
4. Measure and identify the factors that affect the performance of an experimental garbage collection algorithm.
5. What type of chart (line or bar) would you use to plot
    a. CPU usage for 12 months of the year
    b. CPU usage as a function of time in months
    c. Number of I/O's to three disk drives: A, B, and C
    d. Number of I/O's as a function of number of disk drives in a system 3.
6. Analyze the 23 design
7. Quantify main effects ,
8. Quantify all interactions
9. Find percentages of variation.

10. Sort the variables in the order of decreasing importance.

List of Project areas:

1. Case study- Implement DOE on identified live problem.

Text Books:

1. *Art of Computer Systems Performance Analysis Techniques For Experimental Design Measurements Simulation And Modeling, Raj Jain, Wiley Computer Publishing, John Wiley & Sons, Inc. ISBN: 0471503363 Pub Date: 05/01/91*
2. *Design and analysis of experiments, Douglas Montgomery, Wiley India, (2007)*
3. *Design and Analysis of Experiments, Das, M.N. and Giri, N, Wiley Eastern, New Delhi.*

Reference Books:

1. *Applied statistics and probability for engineers, Douglas Montgomery, Wiley India, (2007)*

Course Outcomes:

The student will be able to –

1. Identify relationships between cause and effect.
2. Providing an understanding of interactions among causative factors.
3. Design the experiment and apply on systems.
4. Understand the common mistakes done in performance Evaluation, Experimentation , Regression.

FF No: 654

Course Code: EL4014 **Course Name: Artificial Neural Networks**

Credits: 4 Teaching Scheme: 3 Hours / Week

Lab: 2 Hours / Week

Section 1:

Introduction to ANN: History of Neural networks, Neural net architecture, Neural learning, Evaluation of networks, Implementation. Supervised Learning: Perceptions, Linear separability, perceptron training algorithms, modifications, Support vector machines, multilevel discrimination, back propagation algorithm. Adaptive multilayer networks, predication networks, Polynomial Networks.

Section 2:

Unsupervised & Associative Learning: Winner-Takes All network, learning vector quantization, counter propagation networks, Adaptive Resonance theory, Topological Organized networks , Distance based learning, Max Net, Competitive Net, Principal Component Analysis, Associative Learning: Associative non-iterative procedures for association, hop field networks, Optimization, Learning using Hopfield networks, Introduction to Fuzzy logic.

List of Practical:

1. To study the neural network tool box.
2. To study how to train the database.
3. Design the support vector machine.
4. Design the support probabilistic networks.
5. Write down the algorithms and implement back propagation algorithm.
6. Write down the algorithms and implement predication network algorithm.
7. Design and simulate the probabilistic network.
8. Design and simulate the Max Net.
9. Design and simulate the Competitive Net.
10 Design and simulate the Hopfield networks.

List of Projects:

1. Study the relevant IEEE papers based on the Principal Component Analysis and implement it for any of the application.
2. Study the relevant IEEE papers based on the Support Vector Machine and implement it for any of the application.

Text Books:

1 Kishan Malhotra, Chilukurik. Mohan, Sanjay Ranka; Elements of Artificial Neural Networks; Second edition; Penram International Publishing (India) Pvt. Ltd.

2 John Yen, Reza Langari; Fuzzy Logic; First edition; Pearson Educations.

Reference Books:

1. Bart Kosko, John c. Burgess; Neural Network and Fuzzy system.

2. M.H. Hassoun; Fundamental of Artificial Neural Networks.

3. M Zurada; Introduction to Artificial Neural Network system.

4. Relevant IEEE Papers

Course Objectives:

The student will be able to –

1. Study architecture of different Neural algorithms
2. Solve problems using unsupervised, associative learning techniques.
3. Solve problems using associative learning techniques.
4. Provide an understanding of the basics of fuzzy logic

FF No: 654

Course Code: EL4015 **Course Name: Antenna Theory**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

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

Radiation from Wires and Loops: Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop. Aperture Antennas: Huygens Principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts.

Section 2:

Broadband Antennas: Broadband concept, Log-periodic antennas, frequency independent antennas. Microstrip Antennas: Basic characteristics of microstrip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas, .Antenna Arrays: Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays. And basic concepts of Smart antennas.

List of Practical:

1. Study the Friss transmission formula.
2. Design and simulate the circular loop antenna.
3. Design and simulate the dipole for mobile.
4. Design and simulate the antenna for the specific microwave frequency.
5. Study and design the reflector and director for the Yagi Uda antenna.
6. Study and design the patch antenna.
7. Study and design the circular patch antenna.
8. Study and design the Log Periodic antenna.
9. Simulate Microstrip antenna
10. Study antenna radiation pattern.

List of Projects:

1 Project based on the loop Antenna

2. Project based on the Rectangular Patch antenna

Text Books:

*Constantine A. Balanis; Antenna Theory: Analysis and Design, 3rd Edition; John Wiley, 2005 (or 2nd Ed.).*Reference Books:

1. W. L. Stutzman, and G.A. Thiele; Antenna Theory and Design; 2nd Edition; John Wiley & Sons., 1998.

2. R.S. Elliot; Antenna Theory and Design; Revised edition; Wiley-IEEE Press., 2003.

Course Outcomes:

Students will be able to

1. Understand standard antenna characterization parameters.
2 Explore electromagnetic radiation mechanisms for common antenna structures.
3. Design simple antennas for specified performance.
4. Design antenna arrays with required radiation pattern characteristics.

FF No: 654

Course Code: EL4016 **Course Name: Advanced DSP**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

Random Signals, Time Averages for DT Random Process, Multirate DSP- Decimation, Interpolation, Design of Practical Sampling Rate Conversion, Adaptive Filters LMS, RLS.

Section 2:

Linear Prediction and Optimum Linear Filters, Wiener Filter for Filtering and Prediction, Power Spectrum Estimation, Wavelet Transform and Applications- Multiresolution Analysis, Denoising Using DWT, Signal Compression, Signal Filtering, Sampling Rate Conversion.

List of Practical:

1. Record an audio signal with and without noise. Display time and frequency domain representation
2. Study the effects of up sampling and down sampling in time and frequency domain
3. write a program to design Adaptive filter for Noise cancellation
4. Implement Linear prediction algorithm
5. Power spectrum estimation of Vowels of a speech signal
6. Sub band filtering of signal using Wavelet Transform
7. Design and implement Sampling rate converters
8. Implement Weiner Filter
9. Study random signal and study its power spectrum estimation
10. Implement signal compression using Wavelet Transform.

List of Project areas:

1. Design of Multirate system for the given sampling rate and specifications of filter required for sound recording system to compose and mix high and low frequency signals generated from different instruments in a Recording studio.
2. Design and implement Adaptive filter for reverberation/echo cancellation /speech signal and audio signal processing / image processing
3. Collect Speech/ECG signal which is contaminated with noise. Apply Wavelet transform for denoising, compression, feature extraction and Analysis of signal.
4. Project based on Adaptive filters
5. Project based on Multirate signal processing
6. Project based on prediction algorithm

Text Books:

1. E C Ifleachor and B W Jervis; Digital Signal Processing – A practical approach; 2ndEdition, Pearson Education John G Proakis, Monolakis; Digital Signal Processing – Principles, Algorithms andApplications; Pearson education

Reference Books:

1. P Vaidyanathan; Multirate Systems and Filter Banks; PHI

2. B Venkatramani, M Bhaskar; Digital Signal Processors, Architecture, Programming and Applications; TMH

3. Simon Haykin; Adaptive Filter Theory; 4th Edition Pearson Education

Course Outcomes:

The student will be able to –

1. Explain random signals and random processes.
2. Demonstrate decimation and interpolation of signals
3. Apply the concept of adaptive filtering.
4. Implement the principles of linear prediction
5. Estimate spectral density
6. Use wavelet transform for signal processing

FF No: 654

Course Code: EL4018 **Course Name: RF Integrated Circuit Design**

Credits: 4 **Teaching Scheme: 3 Hours / Week**

Lab: 2 Hours / Week

Section 1:

Basic concepts in RF Engineering: Architecture, noise, nonlinear effects, sensitivity and dynamic range; Transmission media reflections, Maximum Power Transfer, Matching, Passive Components, Transmission lines, High Frequency Amplifier, MOSFET device review, MOS Capacitances.

Section 2:

Noise – Various sources, Noise in MOSFET; Low Noise Amplifier – Design, Various topologies; Mixers; Oscillators; RF Power Amplifiers.

List of Practicals:

All laboratory exercises must be completed; these are intended to prepare the students for the term project. In doing these exercises, each student works individually first and then in a group. It is strongly recommended that each student must use his/her own machine, install thefree VLSI TCAD tools which will be discussed in class or laboratory session.

Typical Lab experiments as follows:

1. Semiconductor Devices at High/Radio Frequencies.
2. RF-gain enhancement by inductor or by LC tank.
3. Design of CE and CS tuned amplifiers.
4. Design of CB and CD tuned amplifiers.
5. Stability problems in tuned amplifiers and Neutralization.
6. RF Power Amplifiers in Class A, B and C
7. First and second order Filters.
8. Basic topology of CG LNA
9. CS emitter degenerated LNA
10. Reflection coefficients of transmission line.

List of Projects:

The most important assignment is the Term Project, about which more detailed instructions will be issued in class. In doing this assignment, students will work in group(s). They should begin finding their partner(s) early in the term. The term project requirements must be completed in accordance with the schedule given in the instructions. Students must make a presentation of their part of the project to the rest of the class. They must demonstrate/present their work in the term project even if it does not fully function. Typical projects as follows:

1. Design of 2 - 5 GHz LNA with variable gain
2. Design of Double Cross-Coupled VCO with AGC

Text Books:

1. *Behzad Razavi; RF Microelectronics; 2nd Ed; Pearson, 2012.*
2. *Thomas H. Lee; The design of CMOS radio-frequency integrated circuits; 2nd Ed; Cambridge University Press, 2004.*

Course Outcomes:

1. Understand the basic concepts of RF engineering.
2. Describe the behavior of components at RF.
3. Design low noise devices
4. Design low noise circuits.

FF No: 654

Course Code: EL4019 **Course Name: Real Time Operating Systems**

Credits: 4 Teaching Scheme: 3 Hours / Week

Lab: 2 Hours / Week

Section 1:

OS: Architecture, Objectives and functions, types of OS, Real-Time kernel concepts uC/OS blocks, Task Management

Section 2:

µC/OS-II'S Services, Inter task Communication and Synchronization, semaphores, message mailboxes and message queues, Memory Management

List of Practical:

1. Programming to interface LEDs, 7 Segment Display
2. Programming to interface Text LCD
3. Programming to demonstrate Task Scheduling using Task Management
4. Programming to demonstrate Task Scheduling using Time Management
5. Programming to demonstrate multitasking using Task management.
6. Programming for demonstrating resource sharing using Semaphores
7. Programming for demonstrating resource sharing using Mutex
8. Programming for demonstrating Inter-process communication using Mailbox.
9. Programming for demonstrating Inter-process communication using Message Queues
10. Porting UCOS-II based applications on Embedded targets (ARM)

List of Project areas:

1. Design RTOS based Embedded System for Bar Code Scanner

Text Books:

1. Jean J. Labrosse; µC/OS, The Real-Time Kernel; Paul Temme2002

2. Linux Device Drivers (Nutshell Handbook); O'Reilly Publishers 2000

3. Craig Hollabaugh; Embedded Linux: Hardware, Software, and Interfacing; Addison Wesley 2002

Reference Books:

1. SreekrishnanVenkateswaran; Essential Linux Device Drivers; Prentice Hall 2008

2. Christopher Hallinan; Embedded Linux Primer: A Practical, Real-World Approach; Prentice Hall, 20063. µC/OS-II User Manual

Course Outcomes:

The student will be able to –

1. Explain RTOS Architecture.
2. Understand task management
3. Develop Multitasking Embedded System using RTOS services.
4. Understand synchronization and communication in RTOS

FF No: 654

Course Code: EL4021 **Course Name: Pattern Recognition**

Credits: 4 Teaching Scheme: 3 Hours / Week
Lab: 2 Hours / Week

Section 1:

Pattern recognition systems, design cycle, learning and adaptation. Classification problem, classification error, Bayes minimum error classifier, Bayes minimum risk classifier, discriminant functions and decision surfaces, discriminant functions and decision surfaces, multidimensional case for distributions, Parametric estimation of probability density functions, non-parametric estimation of probability density functions, Parzen windows, k-nearest neighbor classifier

Section 2:

Properties of linear classifiers, linearly separable training samples, perceptron criterion and algorithm, minimum squared error criterion, Support vector machines, Fisher's linear discriminant, Unsupervised learning & Clustering, Stages in clustering, hierarchical clustering, partitional clustering, Expectation-maximization(EM) algorithm, Applications of Pattern recognition real world problems.

List of Practicals:

1. Develop an algorithm for Bayes minimum risk classifier/ Bayes minimum errorclassifier.
2. Develop an algorithm for classification using Parzen windows.
3. Develop an algorithm for classification using k-nearest neighbor classifier.
4. Develop an algorithm for classification using Support vector machines
5. Develop an algorithm for classification using Fisher's linear discriminant analysis.
6. Develop an algorithm for classification using k mean classifier.

List of Projects:

1. Develop an automated Supervised classification of foreground and background objectsseparately in a scene.
2. Develop an Application of pattern recognition for Automated Inspection System.
3. Develop an Application of pattern recognition for handwritten character recognitionsystem

Text Books:

1. "Introduction to Pattern Recognition" – Theodoridis, Koutrombas, Academic Press,3rd Edition.
2. "Pattern Classification" – R.O.Duda, P.E. Hart, G.G.Stork , John Wiley and sons, 2004.

Reference Books:

1."Pattern Recognition & Machine Learning" – C.M.Bishop, Springer, 2006.

Course Outcomes:

The student will be able to –

1. Explain the process of Pattern Recognition.
2. Apply probability theory to estimate classifier performance.
3. Describe the principles of parametric and non-parametric classification methods.
4. Compare pattern classifications and pattern recognition techniques.
5. Apply Pattern Recognition techniques to real world problems such as image analysis,character recognition, etc.