Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(*An Autonomous Institute affiliated to Savitribai Phule Pune University*)

Structure & Syllabus of

Final Year B. Tech.
(Electronics Engineering)

Pattern D_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 – Board Of Studies **Chairman – Academic Board**

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: 2019-20			Semester		Module: VII				Pattern: D-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	EL4019	Real Time Operating Systems	3	2		10	30	10	15	15	20	100	4
2	EL4023	Control Systems											
3	EL4003	Engineering Ethics											
4	EL4004	Renewable Energy											
		Elective-2											
5	EL4006	CMOS Mixed Signal Design	3	2		10	30	10	15	15	20	100	4
6	EL4021	Pattern Recognition											
		Elective-3											
7	EL4016	Advanced Digital Signal Processing	3	2		10	30	10	15	15	20	100	4
8	EL4013	Advanced Power Electronics											
9	EL4008	Mobile Communication											
10	EL4002	Design of Experiments											
11	EL4018	RF Integrated Circuit Design											
12	EL4017	Optimization Techniques											
13	EL4071	Major Project 1		8									4
	EL4078	Professional Development 3 (Evaluated in Semester 2)											
Total													16

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: 2019-20		Semester		Module: VII / VIII		Pattern: D-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										16
	EL4081	Project Internship										
	EL4082	Industry Internship										
	EL4083	International Internship										
	EL4282	Industry Internship										
Total												16

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: 2019-20			Semester		Module: VIII				Pattern: D-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	EL4019	Real Time Operating Systems	3	2		10	30	10	15	15	20	100	4
2	EL4023	Control Systems											
3	EL4003	Engineering Ethics											
4	EL4004	Renewable Energy											
		Elective-2											
5	EL4006	CMOS Mixed Signal Design	3	2		10	30	10	15	15	20	100	4
6	EL4021	Pattern Recognition											
		Elective-3											
7	EL4016	Advanced Digital Signal Processing	3	2		10	30	10	15	15	20	100	4
8	EL4013	Advanced Power Electronics											
9	EL4008	Mobile Communication											
10	EL4002	Design of Experiments											
11	EL4018	RF Integrated Circuit Design											
12	EL4017	Optimization Techniques											
13	EL4071	Major Project 1		8									4
	EL4078	*Professional Development 3 Evaluated in Semester 2											
Total													16

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 Energy like Wind 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: EL4023 **Course Name: Control Systems**

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

Section 2:

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:

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:

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
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.
3. Analyze given system for stability using root locus.
4. Demonstrate various techniques of frequency domain analysis.
5. Analyze given system for stability in frequency domain.
6. Design proportional, proportional-integral, proportional-derivative, and proportional-integral-derivative feedback control systems meeting specific system performance requirements.

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 the free 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: EL4008 **Course 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 of Practicals:
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 interfaces and 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: 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, preceptron training algorithms, modifications, Support vector machines, multilevel discrimination, back propagation algorithm. Adaptive multilayer networks, predication networks, Polynomial Networks, Radial basis functions, probabilistic 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, Hopfield networks, Brain state in a box network, Boltzman machines, Hetero-associators, Introduction to Fuzzy logic.

List of Practicals:

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. *Elements of Artificial Neural Networks - by Kishan Malhotra, Chilukurik. Mohan, Sanjay Ranka Penram International Publishing (India) Pvt. Ltd. Second edition,*
2. Fuzzy Logic by John Yen, Reza Langari, Pearson Educations, First edition

Reference Books:

1. *Neural Network and Fuzzy system by Bart Kosko, John c. Burgess.*
2. Fundamental of Artificial Neural Networks. By M.H. Hassoun.
3. Introduction to Artificial Neural Network system by M.Zurada.
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 Practicals:

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:

1. *Constantine A. Balanis; Antenna Theory: Analysis and Design; John Wiley, 2005, 2nd Edition.*

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:

The 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: 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 error classifier.
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 objects separately in a scene.
2. Develop an Application of pattern recognition for Automated Inspection System.
3. Develop an Application of pattern recognition for handwritten character recognition system

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.

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: 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; 2nd Edition, Pearson Education*

2. John G Proakis, Monolakis; Digital Signal Processing – Principles, Algorithms and Applications; 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 the free 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 Temme 2002*
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. *Sreekrishnan Venkateswaran; 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