SCHEME OF TEACHING
VI SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits				Contact Hours
				L	T	P	Total	
1	EE61	Digital Signal Processing	PCC	3	1	0	4	5
2	EE62	Power System Engineering- II	PCC	3	1	0	4	5
3	EEExxx	Department Elective – 2	Elective	3	0	0	3	3
4	EEExxx	Department Elective – 3	Elective	3	0	0	3	3
5	xxOExx	Open Elective-2	Elective	3	0	0	3	3
6	EE65	Mini project	Lab	0	0	4	4	4
7	EEL66	Digital Signal Processing Lab	Lab	0	0	1	1	2
8	EEL67	Building Automation Lab	Lab	0	0	1	1	2
9	EEL68	Control Systems Lab	Lab	0	0	1	1	2
			Total	**15**	**2**	**7**	**24**	

Elective Code	Elective Title	Elective Code	Elective Title
EEE631	Modern Control Theory	EEE641	Nanofabrication and Characteristics
EEE632	Energy Audit	EEE642	Machine Learning
EEE633	Electric Vehicle Technology	EEE643	Virtual Instrumentation

DIGITAL SIGNAL PROCESSING

Subject code: EE61 **Credits: 3:1:0**
Prerequisites: Nil **Contact Hours: 70**
Course Coordinator/s: Sri. Victor George

Course content:

Unit I

Basic elements of digital signal processing, Advantages of digital signal processing over analog signal processing.
Discrete Fourier Transform: Frequency domain sampling, DFT as a linear transformation, circular convolution, Use of DFT in linear filtering.

Unit II

Filtering of Long Data Sequence: Overlap-save method, Overlap-add method.
Fast Fourier Transform Algorithms : Radix-2 FFT Algorithm, Decimation in time, Decimation in frequency algorithms.

Unit III

Structure for FIR systems: Direct form, Linear phase and cascade form structure.
Structure of IIR systems: Direct form I, Direct form II, Cascade and parallel structure.

Unit IV

Design of FIR Filters: Introduction to filters**,** Design of linear phase FIR Filters using rectangular, hamming and hanning windows, FIR filter design by frequency sampling method.

Unit V

Design of IIR Filters from Analog Filters : IIR Filter design by impulse invariance, Bilinear transformation. Characteristics of analog filters -Butterworth and Chebyshev, frequency transformation in analog domain. Introduction to the TMS320LF2407 digital signal controller, C2xx DSP CPU architecture (block diagram level explanation).

Text Books

1. John G Prokis & Dimitris G Manolakis, '*Digital Signal Processing*', PHI, 3rd Ed,.
2. Hamid Toliyat and Steven Campbell, '*DSP- Based Electro Mechanical Motion Control*', CRC Press, 2011.

Course Outcomes (COs)

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

1. Identify different engineering problems where digital signal processing is involved (PO-1)(PSO-1)
2. Analyze the various techniques to obtain the transformation of discrete signals (PO-1)(PSO-1)
3. Apply various transform techniques in linear filtering (PO-1)(PSO-1)
4. Apply fundamental principles, methodologies and techniques of the digital signal processing to design various filter circuits (PO-1)(PSO-1)
5. Understand the basic functional blocks available in a digital signal processor (PO-1)(PSO-1)

POWER SYSTEM ENGINEERING- II

Subject code: EE62 **Credits: 3:1:0**
Prerequisites: Nil **Contact Hours: 70**
Course Coordinator/s: Dr. Sridhar. S

Course content:

UNIT -I

Modeling of transmission lines, off nominal transformer, loads and generator. Formation of Y_{BUS} by method of inspection. Basic definitions of Elementary graph theory. Formation of Incidence Matrices. Primitive network- Impedance form and admittance form. Formation of Y_{BUS} by method of singular transformation. Z_{BUS} formation by inverting Y_{BUS} and Z_{BUS} building Algorithm (Without mutual coupling). Computation of 3phase fault current using Z_{BUS} (derivation excluded).

UNIT -II

Load Flow Studies: Introduction, review of numerical solutions of algebraic equations by iterative methods, power flow equations, and classification of buses, operating constraints and data for load flow study. Load flow solution using Gauss–Seidal method, (numerical problem for not more than 2 iteration), acceleration of convergence. Load flow solution using Newton–Raphson method in polar co-ordinates (numerical problem for 1 iteration only). Fast Decoupled load flow method.

UNIT -III

Economic Operation of Power System: Introduction, economic generation scheduling neglecting losses and, iterative techniques. Derivation of transmission loss formula. Economic dispatch including transmission losses. Approximate penalty factor. Iterative technique for solution of economic dispatch with losses. Introduction to unit commitment (problem formulation).

UNIT -IV

Stability Studies: Introduction, steady state stability, power angle equation of synchronous machines, methods of improving SSSL, dynamics of a synchronous machine, Swing equations, Swing curve, Equal Area Criterion(EAC), applications of Equal Area Criterion, critical clearing angle. Transient stability, Numerical solution of swing equation by Point-by-Point method and Runge–Kutta method.

UNIT -V

Load Frequency Control: Schematic diagram of automatic load frequency control and automatic voltage control. Generator model, turbine model and governor model. Block diagram representation of single area ALFC.

Compensation in Power Systems: Introduction, load compensation, line compensation, series compensation and shunt compensators. Principle and operation of converters. Introduction to FACTS Controllers.
Power System Security: Introduction, Factors affecting power system security, Contingency Analysis, Contingency Selection and Ranking.

Text books

1. Nagrath, I. J., and Kothari, D. P., '*Modern Power System Analysis*', TMH, 2003.
2. K.Uma Rao, '*Computer Techniques and Models in Power Systems*', I.K. International, 2007.

Reference books

1. Allen J Wood et al, '*Power Generation, Operation and Control*', Wiley, 2003.
2. Stag G. W., and El Abiad, A. H. '*Computer Methods in Power System Analysis*', McGraw Hill International Student Edition, 1968.
3. Pai, M.A, '*Computer Techniques in Power System Analysis*', TMH, 2nd Edition.
4. John Grainger, Jr.,William Stevenson, '*Power System Analysis*', McGraw Hill, 1994.
5. Singh L. P., '*Advanced Power System Analysis and Dynamics*', New Age International (P) Ltd, New Delhi, 2001.
6. Haadi Sadat, '*Power System Analysis*', TMH, 2nd Edition, 12th Reprint.

Course Outcomes (COs):

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

1. Formulate the Y_{BUS} and Z_{Bus}. (PO-1) (PSO-1)
2. Obtain load flow solution by Gauss Siedel method, Newton Raphson Method and FDLF Method. (PO-1) (PSO-1)
3. Obtain economic load dispatch of a thermal power plant. (PO-1) (PSO-1)
4. Analyze the stability aspects of power system. (PO-1) (PSO-1)
5. Develop the block diagram of ALFC, evaluate load sharing. (PO-1) (PSO-1)

MINI PROJECT

Subject Code: EE65 **Credits: 0:0:4**
Prerequisites: Nil **Contact Hours: 84**
Course Coordinator/s: Sri. Gurunayk Nayak

Course content:

This course will provide an introduction to mini-project. Students will work in a group of 3/4 to solve a problem of current concern requiring an engineering solution. They are required to follow a systematic approach towards developing the solution by considering technical and non-technical factors. The working model of the solution along with the design documentation will be considered for final evaluation.

Course Outcomes (COs):
At the end of the course Students will be able to:

1. Perform sufficient literature survey on existing methods in the area of selected topic. (POs – 1, 2, 3, 4, PSO– 1)
2. Describe the proposed design method in terms of technical block diagram or flowchart. (POs – 2, 3, 10, PSO– 2, 3)
3. Implement the proposed design method using appropriate software or/and hardware tools (POs – 2, 3, 4, 5, PSO– 2, 3).
4. Analyze the complexity at various stages of building project involving multiple hardware or/and software technologies.
   (POs – 2, 3, 4, 5, PSO– 2, 3)
5. Present and prepare technical details of the project at regular intervals using oral, written and visual aids for effective communication.
   (POs – 9, 10, PSO– 2, 3)

DIGITAL SIGNAL PROCESSING LAB

Subject Code: EEL66 **Credit: 0: 0: 1**
Prerequisites: Nil **Contact Hours: 28**
Course Coordinator/s: Sri. Victor George

LIST OF EXPERIMENTS

1. Verification of sampling theorem.
2. Frequency domain analysis using FFT.
3. Convolution of given sequence.
4. Analysis of an audio file.
5. Pulse Width Modulation.
6. Noise reduction of signals.
7. DTMF generation and filtering.
8. Design of LP & HP FIR filter to meet given specifications.
9. Design of BP & BS FIR filter to meet given specifications.
10. Hardware implementation of FIR filter to meet given specifications.
11. Design of IIR filter to meet given specifications.
12. Hardware implementation of IIR filter to meet given specifications.

Text Books

1. J. G. Proakis, Ingle, "*Digital Signal Processing using MATLAB*", MGH, 2000.
2. B. Venkataramani and Bhaskar, "*Digital Signal Processors*", TMH, 2002.

Reference Books

1. Sanjit K Mitra, "*Digital Signal Processing using MATLAB*", TMH, 2001.

Course Outcomes (COs):

At the end of this course students will be able to

1. Understand the basic operations in digital signal processing. (PO – 1, 2, 6) (PSO-1, 2)
2. Understand the use of the FFT algorithm in signal analysis. (PO – 2, 6) (PSO-1, 2)
3. Design FIR/IIR filters for practical applications.

(PO – 2, 3, 4, 6) (PSO-1, 2)

4. Understand the handling of digital signals using a simulation package.
   (PO – 1, 2, 6) (PSO-1, 2)
5. Understand the handling of digital signals using hardware circuits.
   (PO – 2, 6) (PSO-1, 2)

BUILDING AUTOMATION LAB

Subject code: EEL67 **Credits: 0:0:1**
Prerequisites: Nil **Contact Hours: 28**
Course Coordinator/s: Sri. Narasimpur Tushar Suresh

List of experiments:

1. Installing and Testing KNX Bus Line, Create a project and add devices to the project.
2. Develop an application to program a switch and a switch actuator.
3. Develop an application to program a switch, a dimming control and a blind actuator.
4. Develop an application to configure touch Pro to control blind actuator, switch actuator, and dimming
5. Develop an application for Lighting control using the occupancy sensor
   Using 4 gang, create the following
   a. Rocker – 1: operate dimming at 0% - 50% - 100%
   b. Rocker – 2 : operate "All On" and "All Off"
6. Develop a mobile wiser application to control the given installation.
7. To operate and control HVAC using PID controller and BMS controller
8. To configure the field instruments in the BMS-"Ecostuxure Building Expert"
9. Configuration of DI and DO modules
   a. Switching on Heating, when humidity is high
   b. Open Damper when CO2 level is high
   c. Switch off AHU, when fire is activated
10. Configuration of AI and AO modules
    a. Configure a pressure sensor & pressure transmitter
    b. Configure a temperature sensor & temperature transmitter
11. Creating Graphics of the given HVAC system and Binding of variables to Graphical representation
12. Create logic for the AHU operation
    a. Using Humidity inputs
    b. Using CO_2 level
    c. Input from Fire alarm System
    d. Using flow switch

Course Outcomes (COs):

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

1) Develop a program to control loads of a smart home.(PO1,3)(PSO2,3)
2) Develop a program to control HVAC system.(PO1,3)(PSO2,3)

CONTROL SYSTEMS LAB

Subject Code: EEL68 **Credits: 0:0:1**
Prerequisites: Nil **Contact Hours: 28**
Course Coordinator/s: Sri. Gurunayak Nayak

List of Experiment

1. Obtain Time response of second order system (RLC circuit) and find time domain specifications of the same. And simulate the same using MATLAB.
2. Obtain frequency response of second order system (RLC circuit) and find time domain specifications of the same. And simulate the same using MATLAB.
3. Design and implementation of RC lead compensator. And verify the results using MATLAB.
4. Design and implementation of RC lag compensator. And verify the results using MATLAB.
5. Implementation of RC Lag-Lead compensator.
6. Experiment to draw speed torque characteristics of a AC servo motor.
7. Experiment to draw speed torque characteristics of a DC servo motor.
8. Simulate DC position control System for PI, PD and PID Controller.
9. To draw root loci for different transfer functions using MATLAB and verification by theoretical method, Obtain phase margin, gain margin for different transfer function by drawing Bode plot using MATLAB and verification by theoretical method
10. Introduction to SISO toolbox and analyzing of step, frequency responses for different pole, zero locations.
11. Introduction to SIMIAM package for Mobile robotics.
    i) Implementation of PID Control for GoToGoal application.
    ii) Implementation of PID Control for obstacle avoidance application.

Text Books

1. J. Nagrath and M. Gopal,' Control Systems Engineering', 4th edition

Reference Books

1. K. Ogata,' Modern Control engineering ', 4th edition.
2. Benjamin Kuo, 'Automatic Control Systems', PHI, 7th Edition.

Course Outcomes (COs):

At the end of the course Students are able to :

1. Analyze time domain response for different damping ratio. (PO-1,2,5)(PSO-1,2,4)
2. Analyze the stability of the system by various methods. (PO-1,2,5)(PSO-1,2,4)
3. Analyze the behavior of mobile robots for different PID co-efficients. (PO-1,2,5)(PSO-1,2,4)
4. Distinguish the performance of Servo motors. (PO-1,2)(PSO-1)
5. Design the appropriate compensator. (PO-1,3,5)(PSO-1,2,4)

Department Electives-2 &3

MODERN CONTROL THEORY

Subject code: EEE631 **Credits: 2:1:0**
Prerequisites: Control Systems **Contact Hours: 70**
Course Coordinator/s: Sri. Gurunayk Nayak

Course content:

UNIT -1

State Variable Analysis and Design: Introduction, Concept of State, State Variables and State Model, State Modeling of Linear systems, Linearization of state equation. State space representation using Physical variables, Phase variables and Canonical variables. Derivation of Transfer Function from State Model.

UNIT -2

Diagonalization, Eigen values, Eigen Vectors, Generalized Eigen Vectors.
Solution of State Equation, State Transition Matrix and its Properties. Computation of State transition matrix using Laplace Transformation, Power series Method, Cayley Hamilton Method,

UNIT -3

Concept of Controllability and Observability, Methods of determining the same. Derivation of CCF, OCF, DCF, JCF form, transformation to CCF , transformation to OCF,
Pole placement Techniques: Stability improvement by state feedback, Determination of value of K using Ackermann formula, direct substitution method.

UNIT -4

Necessary and sufficient conditions for arbitrary pole placement, State Regulator Design, Design of State Observer. Reduced order observer design, Dual systems, relation between K and Ke. Determination of value of Ke using Ackermann formula, direct substitution method.
Nonlinear Systems: Introduction, behavior of non-linear system, Common Physical non-linearity – saturation, friction, backlash, dead zone, relay, multi variable non-linearity.

UNIT -5

Phase plane method, singular points, stability of non-linear system, limit cycles,

construction of phase trajectories.
Liapunov stability Analysis: Liapunov function, direct method of Liapunov and the linear system. Construction of Liapunov functions for non-linear system by Krasovskii's method.

Text Books

1. M.Gopal, "*Digital Control and State Variable Methods: Conventional and Intelligent Control Systems*", Tata McGraw-Hill, 2007.
2. I.J.Nagrath, M. Gopal, "*Control Systems Engineering*", New Age International Publishers, 3rd Edition.

Reference Books

1. Katsuhiko Ogata, "*Modern Control Engineering*", PHI, 3rd Edition.

Course Outcomes (COs):
At the end of the course the student will be able to:

1. Determine the state model for electrical, mechanical and electromechanical systems. (PO-1, 2) (PSO-1)
2. Solve the state equations by different methods. (PO-1, 2) (PSO-1)
3. Analyze and predict the controllability and observability of the system. (PO-1, 2) (PSO-1)
4. Design the controller and observer for any given system. (PO-1, 2) (PSO-1)
5. Evaluate the stability of nonlinear systems. (PO-1, 2) (PSO-1)

ENERGY AUDIT

Subject code: **EEE632** **Credits: 3:0:0**
Prerequisites: Nil **Contact Hours: 42**
Course Coordinator: Dr. Sridhar. S

Course content:

Unit-I

Energy Scenarios: Energy Conservation, Energy Audit, Energy Scenarios, Energy Consumption, Energy Security, Energy Strategy, Clean Development Mechanism.
Types of Energy Audits and Energy-Audit Methodology: Definition of Energy Audit, Place of Audit, Energy – Audit Methodology, Financial Analysis, Sensitivity Analysis, Project Financing Options, Energy Monitoring and Training.

Unit-II

Survey Instrumentation: Electrical Measurement, Thermal Measurement, Light Measurement, Speed Measurement, Data Logger and Data – Acquisition System, Thermal Basis.
Energy Audit of Boilers: Classification of Boilers, Parts of Boiler, Efficiency of a Boiler, Role of excess Air in Boiler Efficiency, Energy Saving Methods.

Unit-III

Energy Audit of Furnaces: Parts of a Furnace, classification of Furnaces, Energy saving Measures in Furnaces, Furnace Efficiency.
Energy Audit of HVAC Systems: Introduction to HVAC, Components of Air – Conditioning System, Types of Air – Conditioning Systems, Human Comfort Zone and Psychrometry, Vapour – Compression Refrigeration Cycle, Energy Use Indices, Impact of Refrigerants on Environment and Global Warming, Energy – Saving Measures in HVAC, Star Rating and Labelling by BEE.

Unit-VI

Electrical-Load Management: Electrical Basics, Electrical Load Management, Variable- Frequency Drives, Harmonics and its Effects, Electricity Tariff, Power Factor, Transmission and Distribution Losses.
Energy Audit of Motors: Classification of Motors, Parameters related to Motors, Efficiency of a Motor, Energy Conservation in Motors, BEE Star Rating and Labelling.

Unit-V

Energy Audit of Lighting Systems: Fundamentals of Lighting, Different Lighting Systems, Ballasts, Fixtures (Luminaries), Reflectors, Lenses and Louvres, Lighting Control Systems, Lighting System Audit, Energy Saving Opportunities

Energy Audit Applied to Buildings: Energy – Saving Measures in New Buildings, Water Audit, Method of Audit, General Energy – Savings Tips Applicable to New as well as Existing Buildings.

Text Books

1. Sonal Desai, '*Handbook of Energy Audit*', McGraw Hill, 2015.

Reference Books

1. H.E. Jordan, '*Energy Efficient Electric Motors and Applications*', Plenum Pub. Corp

Course Outcomes (Cos):

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

1. Understand the need of energy audit and energy audit methodology. (PO-1) (PSO-1)
2. Explain audit parameters and working principles of measuring instruments used to measure the parameters. (PO-1) (PSO-1)
3. Conduct energy audit of boilers, furnaces, power plant, steam distribution system and compressed air systems. (PO-8,9,10,11) (PSO-1,3,4)
4. Conduct energy audit HVAC systems, motors, pumps, blowers and cooling towers. (PO-8,9,10,11) (PSO-1,3,4)
5. Explain load management techniques, effects of harmonics, electricity tariff, improvement of power factor and losses in transmission. Conduct energy audit of lighting systems and buildings. (PO-2,8,9,10,11) (PSO-1,3,4)

ELECTRIC VEHICLE TECHNOLOGY

Subject code: EEE633 **Credits: 3:0:0**
Prerequisites: Nil **Contact Hours: 42**
Course Coordinator: Dr. Janamejaya Channegowda

Course content:

Unit- I

Introduction: IC Engines Basics, Energy Consumption for cycles, Limitations with present Technology – Fuel Shortage, Mechanical Efficiency along with hybrid & Electric Vehicle Systems. Introduction to Electric Vehicles: History of Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Social and Environmental Importance of Electric and Hybrid Electric Vehicles.

Unit- II

Battery Technologies: Types of Batteries, Architecture, Battery Charging & Discharging Cycles, Use of Batteries in Powertrain, Battery Modeling & Management Systems (BMS).

Unit- III

Charging Technologies: Standards, Conductive Charging (AC & DC), Inductive Charging – (Static and Dynamic), Battery Swap Technology. Alternate Energy Storage Systems (Ultracapacitor, Solid-state battery), Hybrid Energy Management System.

Unit- IV

Power Electronics: Fundamentals of Wide-bandgap (WBG) semiconductors, Comparing WBG with Si Devices, Efficiency Comparison, Introduction to GaN and SiC devices – Band Gap, Critical Field, On-Resistance, Two-Dimensional Electron Gas Model. single phase and three phase DC-AC converters & AC-DC Converters.

Unit- V

Electric Drivetrain: Series Hybrid Electric Drive Train, Design Principles of a Series Hybrid Drive Train, Parallel Hybrid Electric Drive Train Design. Design of the Traction Motor and Generator for Specific Power Rating. Fundamentals of regenerative braking and dynamic braking in electric vehicles.

Text Book

1. James Larminie, John Lowry, '*Electric Vehicle Technology Explained*', John Wiley & Sons Ltd, 2nd edition, 2012.

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

Reference Books:

1. Iqbal Hussein, '*Electric and Hybrid Vehicles: Design Fundamentals*', CRC Press Taylor & Francis Group, 2003.
2. Fred Wang, Zheyu Zhang and Edward A. Jones, '*Characterization of Wide Bandgap Power Semiconductor Devices*', First Edition, Institution of Engineering and Technology Publications, 2018.
3. Alex Lidow, Johan Strydom, Michael de Rooij, David Reusch, '*GaN Transistors for Efficient Power Conversion*', Third Edition, Wiley, 2019.
4. John G Hayes and G Abas Goodarzi , '*Powertrain – Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles*', First Edition, Wiley, 2018.
5. Ali Emadi, '*Handbook of Automotive Power Electronics and Motor Drives*', CRC Press Taylor & Francis Group, 2005

Course Outcomes (COs):

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

1. Recognize the evolution of electric vehicles and explain EV and HEV configurations. (PO1)(PSO1)
2. Familiarize with Battery Modelling & Management Systems (PO1,2)(PSO1)
3. Learn the fundamentals of EV charging (PO1)(PSO1)
4. Select semiconductors that can be used in EV power converters (PO1)(PSO1)
5. Recognize different aspects of Electrical machines and power electronic devices used in EV. (PO1)(PSO1)

NANOFABRICATION AND CHARACTERIZATION

Subject code: **EEE641** **Credits: 3:0:0**
Prerequisites: Nil **Contact Hours: 42**
Course Coordinator: Smt. S. Dawnee

Course content:

Unit- I

Overview of Nanoelectronics devices and materials requirement, MOS capacitor as a building block of FET - MOSFET structure, SiO_2-Si interface quality- RCA cleaning, Oxidation, Gate electrode, Forming gas anneal.
CMOS scaling -ideal scaling theory, non-scaling factors, various definitions for channel length, Transistor Design methodology, Short channel Effect-Channel Engineering, Drain Induced barrier Lowering

Unit- II

Energy Bands In Silicon (Review only) , Ultrathin SiO2 growth, gate-oxide scaling, electric field calculation (V_{FB},V_{Si}), Analysis with different examples, Flat band voltage Computation, Energy band diagram under thermal equilibrium, V_{Si} calculation under different conditions like accumulation, depletion etc. FN Tunneling, Time Dependent Dielectric Breakdown, Direct tunneling

Unit- III

High-k dielectrics, EOT, High-k dielectric requirements.

Metal gate transistor-Issues, Replacement gate, Fully Silisided gate technology.

Electrical characterization : HFCV and LFCV, Issues on scaling, sub-threshold leakage, Non-idealities in CV Transport enhanced transistor, I-V and reliability measurements.

Unit- IV

Non classical transistor structure, Silicon On Insulator (SOI) –PDSOI and FDSOI Processing and Characterization, Energy band diagram comparisons, SOI MOSFET operation with backchannel biased into Accumulation, Depletion and Inversion.

Unit-V

Introduction to other high performance nanoscale MOSFETs, Nano materials – Making and Characterisation, Introduction to CVD, ALD techniques, core-shell structures, whiskers, SVS process. Analytical nano-characterization techniques: size, structure, composition, thickness measurement techniques.

References:

1. International Technology Roadmap for Semiconductors (ITRS)
2. Current literature from journals and conference proceedings

Course Outcomes (COs):

After the completion of the course the students will be able to:

1. Describe the different steps in the fabrication of scaled transistors. (PO-1) (PSO-1)
2. Develop a process flow for the fabrication of nano MOSFETs based on a particular specification, compute its threshold voltage. (PO-2) (PSO-1)
3. Implement the methodology for life time estimation and reliability. (PO-2) (PSO-1)
4. Analyze electrical characterization and perform parameter extraction from CV characteristics. (PO-2) (PSO-1)
5. Explain the different electrical and mechanical characterization techniques and making of nano materials. (PO-1)(PSO-1)

MACHINE LEARNING

Subject code: EEE642 **Credits: 2:1:0**
Prerequisites: Nil **Contact Hours: 56**
Course Coordinator: Smt. Kusumika Krori Dutta

Course content:

Unit- I

Introduction to Machine Learning:
What is machine learning? Examples of machine learning applications –learning associations- classification-regression-unsupervised learning-reinforcement learning.
Probability Theory:
Probability densities, expectations and covariance, Bayesian probabilities, the Gaussian distribution, curve fitting, probability distribution, Decision tree.
Linear algebra for Machine Learning:
Basic Matrix identities, traces and determinants, matrix derivatives, Eigen value ,eigen vector equation.

Unit- II

Supervised Learning:
Learning a class from examples, Noise, Learning multiple classes, Regression, Model selection and generalization.
Bayesian Decision Theory:
Classification, Losses and risks, Utility theory. Naïve Bayes Classifier.
Linear Model for Classification:
Discriminant functions, Probabilistic Generative models, Probabilistic Discriminative models, Bayesian Logistic regression

Unit- III

Dimensionality reduction:
Subset selection, Principal Component Analysis(PCA), Fisher's linear discriminant Analysis (LDA).
Parametric Methods:
Maximum likelihood Estimator (MLE), Bayes estimator, parametric classification.

Multivariate methods:
Multivariate data, Parameter Estimation, Estimation of Missing Values, Multivariate Normal Distribution, Multivariate Classification, Tuning Complexity.

Unit- IV

Clustering:
Mixture densities, k-Mean clustering, Expectation-Maximization, Mixtures of Latent