SEMESTER-VII						
Subject Area	Course Code	Course Name	L	T	P	Credits
PC-18	EE-401-L	Computer Methods in Power System	3	1	-	3.5
PC-19	EE-403-L	Discrete Data Non Linear Control System	3	1	-	3.5
PC-20	EE-405-L	Transducer & Their Applications	3	1	-	3.5
PE-2	PE-2	PE-2	3	1	-	3.5
OE -3	OE -3	OE -3	4	-		4
PC-20	EE-405-P	Transducer & Their Applications Lab	-	-	2	1
PC-21	EE-407-P	Circuit Simulation Lab	-	-	2	1
PC-22	EE-409-P	Power System Lab	-	-	2	1
PW-3*	EE-411-P	Minor Project	-	-	2	1
PW-4**	EE-413-P	Practical Training-II Report	-	-	2	1
ES-8***	EE-415-P	General Proficiency	-	-	-	1
	Total					24

Open Electives 1, 2 & 3 are to be offered by other Departments.

* The project should be initiated by the student in the beginning of 7th semester and will be evaluated at the end of the semester on the basis of a presentation delivered, viva-voce and report.

** Assement of Practical Training-II will be based on presentation/seminar delivered, viva-voce, report and certificate for the practical training taken at the end of 6th semester.

*** A viva of the students ll be taken by external examiner (Principal/Director/Professor/or any senior Person with e: ience more than 10 years) at the end of the semester.

Note1: Project load will be treated as 2 hours for project coordinator and 1 hour for each participating teacher.

Note 2: Students will be allowed to use the scientific calculator only, however sharing of calculator will not be permitted.

Lists of Program Electives

of PE-1:

1. EE-312-L Microcontroller and applications
2. EE-314-L Information Theory & Coding
3. EE-316-L Principles of Communication Engineering
4. EE-318-L System Theory

of PE-2:

1. EE-417-L Non-conventional sources of energy and management
2. EE-419-L Soft Computing Techniques
3. EE-421-L Computer Networks and Data Communication
4. EE-423-L Nano Dielectrics

of PE-3:

1. EE-406-L Electrical Machine Design
2. EE-408-L SCADA System and Applications Management
3. EE-410-L Digital Image Processing
4. EE-412-L Antenna and Wave Propagation

f PE-4:

1. EE-414-L Special Electrical Machines
2. EE-416-L Power System Planning
3. EE-418-L Computer Architecture and Organization
4. EE-420-L Flexible AC Transmission Systems (FACTS)

f PE-5:

1. EE - 422-L High Voltage Direct Current Transmission
2. EE - 424-L Restructured Power System
3. ET - 426-L Microwave & Radar Engg.
4. EE - 428-L Internet Fundamentals
5. Any one MOOC Subject not studied earlier

f PE-6:

1. EE - 430-L High Voltage Engg.
2. EE - 432-L Operation Research
3. EE - 434-L Data Structures and Algorithms
4. EE - 436-L Energy Management and Auditing
5. Any one MOOC Subject not studied earlier

Computer Methods in Power System

Course Code: EE-401-L Course Credits: 3.5 Mode: Lecture (L) and Tutorial (T) Type: Compulsory Contact Hours: 3 hours (L) + 1 hour (T) per week. Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 30; External: 70)** Two minor test each of 20marks, class performance measured through percentage of lecture attended (4 marks), assignments, quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus; it will contain seven short answer type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Prerequisite: Power System Analysis and Protection (EE-302-L)

Objectives:

- To emphasize the use of computer methods in power system planning and detection of operating conditions of the power system.
- To impart the basic knowledge of power system modeling
- Skill development to apply numerical techniques for power flow analysis, short circuit analysis and stability analysis.
- Introduce sparsity technique to optimize computer memory and decrease computation time.

Course outcomes:

CO1. Formulate the incidence, network matrices and model the power system components.
CO2. Perform steady state power flow analysis of power system networks using Gauss-Seidel, Newton-Raphson and Fast decoupled iterative methods.
CO3. Analyze short circuit faults in power system networks using Z_{Bus} method.
CO4. Perform stability and contingency analysis for power system networks
CO5. Ability to develop computer programs using various numerical techniques for power system planning and operations

Unit I

Impact of computers: Orientation of power system engineering problems to computers, review of matrices and matrix operations.
Incidence and Network Matrices: Network graph, various incidence matrices, generalized element representation, primitive network and primitive network matrices, formation of various network matrices by singular transformations, inter-relations between various incidence matrices and network matrices.

Unit II

Bus Impedance and admittance matrices: Building algorithm for bus impedance matrix, modification of bus impedance matrix for change of reference bus and for network changes, formation of bus admittance matrix and modification, calculation of Z_{bus} elements for Y_{bus}

Three-phase Elements: Representation of three-phase network elements, treatment under balanced and unbalanced excitation, transformation matrices, unbalanced elements.

Unit III

Short-Circuit Studies: Introduction, network short-circuit studies using Z_{bus}, short-circuit calculations using symmetrical components for various types of faults.

Load-Flow Studies : Introduction, importance of load flow studies, classification of buses, load-flow equations, iterative methods, computer algorithm and load flow solutions using Gauss Seidel and Newton-Raphson methods, decoupled and fast decoupled load-flow solutions, representation of regulating and off-nominal ratio transformers, comparison of load-flow solution methods.

Unit IV

Sparsity: Introduction, optimally ordered triangular factorization, schemes of optimal ordering.
Stability Studies: Algorithmic flow chart and transient stability solution using modified Euler method.
Power System Security: Introduction, contingency analysis using Z_{bus} and various distribution factors.

REFERENCE BOOKS:

1. Glenn W. Stagg and Ahmed EI-Abiad, "Computer Methods in Power System Analysis", McGraw-Hill.
2. George L. Kusic, "Computer-Aided Power Systems Analysis", PHI
3. Singh. L.P, "Advanced Power System Analysis and Dynamics", New Age International Publishers, New Delhi
4. John J Grainger and William D. Stevenson, "Power System Analysis", Jr. McGraw-Hill.
5. LJ. Nagrath and D.P. Kothari, "Power System Engineering", Tata McGraw-Hill.

Discrete Data Non-Linear Control System

Course Code: EE-403-L Course Credits: 3.5 Mode: Lecture(L) and Tutorial(T) Type: Compulsory Contact Hours: 3 hours (L) + 01 hour (T) per week. Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 30; External: 70)** Two minor test each of 20marks, class performance measured through percentage of lecture attended (4 marks), assignments, quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus; it will contain seven short answer type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Prerequisite: Control System, Signals & Systems

Objectives:

- To make the student learn basics of Computer controlled system.
- To learn the methods for analysing the behavior of nonlinear control systems and the designing of control systems.
- To impart knowledge on the basic contents in state space analysis, describing function,

Course outcomes:

CO-1 Understand about discrete-time mathematical models in both time domain (difference equations, state equations) and z-domain (transfer function using z-transform)

CO-2 Understand and analyze transient and steady-state responses and stability and sensitivity ofboth open-loop and closed-loop linear, time-invariant, discrete-time control systems.

CO-3 Understand about non-linear system model and different non-linearities

CO-4 Understand about non-linear system behavior by phase plane and describing function methods.

Course Content:

Unit-I

Sampling & Reconstruction: Time invariant vs. time variant systems. Introduction to discrete time system, Computer controlled system: Mathematical treatment of sampling process, Sampling theorem. Reconstruction from sampled signal, Transfer function of discrete data system: transfer function of discrete data system with cascade elements, transfer function of Z.O.H, Transfer function of closed loop discrete data system.

Unit-II

Discrete Z-Transform: Z- Transform of discrete time functions:- One-sided Z-Transform, Two sided Z-Transform, Properties of Z-Transform, Inverse Z- Transform by partial fraction method, power series method, Residue method. Pulse transfer function.

Stability Analysis: BIBO stability, Zero- Input stability. Concept of stability in Z- plane, Z and S domain relationship.Bilinear transformation, Stability test of discrete data system: Jury's stability criterion, modified Rout's criterion, Schur Cohn criterion.

Unit-III

Non-linear systems: Linear & non-linear systems classification & comparison, special features of non-linear systems, properties of nonlinear system. Linear verses Non-linear control system, different types of non-linearities Limit cycle, jump resonance, sub harmonics.

Unit-IV

Non-linear control: Describing functions, Determination of describing function and stability analysis, Lyapunov's stability analysis, stability definitions, Popov's stability criterion, Phase Plane Method.

REFERENCE BOOKS:

1. Control system by Ogata PHI Education.
2. Digital control system by M. Gopal TMH education.
3. Non Linear Control by Slotin& Li.
4. Digital control and state variable by M. Gopal TMH education.
5. Modern Automatic control system by B.C. Kuo.

Transducer and their Applications

General Course Information:

Course Code: EE-405-L Course Credits: 3.5 Mode: Lecture(L) and Tutorial(T) Type: Compulsory Contact Hours: 3 hours (L) + 01 hour (T) per week. Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 30; External: 70)** Two minor test each of 20marks, class performance measured through percentage of lecture attended (4 marks), assignments, quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus; it will contain seven short answer type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Prerequisite: Basics of Electrical Engineering

Objectives:

- To give an overview of the working and characteristics of conventional transducers.
- To provide a detailed knowledge on error and determination of uncertainties in measurement.
- To give a comprehensive knowledge on smart sensor design, development and interface details.

Course outcomes:

CO1. Understand about conventional transducers and select the suitable one for the given application.
CO2. Analyze and quantify the uncertainties in measurement data.
CO3. Design and develop customized smart sensors for different applications
CO4. Acquire a comprehensive knowledge of manufacturing techniques and design aspects of micro sensors and actuators.

Course Content:

Unit-I

Definition of transducer, Advantages of an electrical signal as out-put, Basic requirements of transducers, Primary and Secondary Transducer, Analog or digital types of transducers.Resistive, inductive, capacitive, piezoelectric, photoelectric and Hall effect transducers.

Unit-II

Measurement of Displacement – Potentiometric resistance type transducers, inductive type transducers, differential transformer (L.V.D.T), capacitive transducers, Hall- effect devices, strain gage transducers. Measurement of Velocity – variable reluctance pick up, electromagnetic tachometers, photoelectric tachometer, toothed rotor tachometer generator.
Measurement of Flow: Venturimeter, orifice meter, nozzle meter, Pitot-static tube, rotameter, turbine flow meter, ultrasonic flow meter, electromagnetic flow meter, hot wire anemometer.

Unit-III

Measurement of Pressure – Manometers, Force summing devices and electrical transducers
Measurement of Force – Strain-gage load cells, pneumatic load cell, LVDT type force transducer.

Measurement of Torque – Torque meter, torsion meter, absorption dynamometers, inductive torque transducer, digital methods.

Unit-IV

Measurement of Temperature – Metallic resistance thermometers, semiconductor resistance sensors (Thermistors), thermo-electric sensors, pyrometers.
Measurement of Liquid Level: Resistive Method, Inductive method, capacitive method
Sound Measurement: Microphone, Types of Microphones.
Measurement of Humidity: Resistive, capacitive, aluminium oxide & crystal hygrometers.

REFERENCE BOOKS:

1. B.C. Nakra, K.K. Chaudhry, "Instrumentation Measurement and Analysis," Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Thomas G. Beckwith etc. all, "Mechanical Measurements (International Student Edition), Addison-Wesley Longman, Inc. England.
3. A.K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation," DhanpatRai& Sons, Delhi-6.

Transducer and their Applications Lab

General Course Information:

Course Code: EE-405-P **Course** Credits: 1 **Type:** Compulsory **Contact** Hours: 2 hours per week. **Mode:** Practical session	**Course Assessment Methods** (Internal: 30; External: 70) Internal continuous assessment of 30 marks on the basis of class performance and attendance in practical classes. For the end semester practical examination the assessment will be done out of 70 marks by the external and internal examiners.

Prerequisite: Student should have prior knowledge of reading the equipment with accuracy and theoretical knowledge of Transducer and their applications.

Objectives:

- The objective of this course is to study and verify the theoretical values with the experimental.
- Obtain the knowledge about various types of Transducers and their working principle
- To enable the students to select and design suitable instruments to meet the requirements of industrial applications and various transducers used for the measurement of various physical quantities

Course outcomes:

CO1. An ability to know the standards to measure and to compute the statistical error analysis.
CO2. An ability to analyze and understand various Transducer based on its classification and working principle.
CO3. An ability to identify the problem and to use the appropriate transducer.

LIST OF EXPERIMENTS:

1. To Measure Temperature using RTD.
2. To Measure Displacement using L.V.D.T.
3. To Measure Load using Load Cell.
4. Pressure Measurement using Cantilever.
5. Light Measurement using LDR & Photo Cell.
6. To Measure Angular Displacement using Capacitive Transducer.
7. To Measure the Variation in Water Level using Capacitive Transducer.
8. To Measure Speed of DC Motor using Reluctance Method.
9. To Measure Strain using Strain Gauge.
10. To Measure Speed using Photo Interrupter Method.

NOTE: At least eight experiments are to be performed in the semester, out of which at-least six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

Circuit Simulation Lab

Course Code: EE-407-P Course Credits: 1 Type: Compulsory Contact Hours: 2 hours per week. Mode: Practical session	**Course Assessment Methods (Internal: 30; External: 70)** Internal continuous assessment of 30 marks on the basis of class performance and attendance in practical classes. For the end semester practical examination the assessment will be done out of 70 marks by the external and internal examiners.

Prerequisite: Student should have prior knowledge of electrical and electronic circuits and their components.

Objectives:

- The objective of circuit Simulation laboratory is to impart hands on experience in verification of circuit parameters.
- It also gives practical exposure to the usage of different circuits with different condition
- Study of circuit characteristics using PSPICE

Course outcomes:

CO1. Be able to verify the laws and principles of electrical simulation circuits, understand the relationships and differences between theory and practice.

CO2. Be able to gain practical experience related to electrical circuits, stimulate more interest and motivation for further studies of electrical circuits;.

CO3. Become familiar with the basic circuit components and know how to connect them to make a real electrical circuit.

LIST OF EXPERIMENTS:

1. Design of Low pass filter with a Cut of frequency of 10 KHz and gain = 2
2. Design a Band Pass filter with lower cut of frequency = 1 KHz and upper cut of frequency of = 2KHz and gain = 2.
3. Design a high pass filter with cut of frequency = 10 KHZ and gain = 2
4. Design a positive and negative clipper using op amp 741
5. Design a positive and negative clamper using op amp 741.
6. Design a practical integrator with a frequency of 2 KHz
7. Design a practical differentiator with a frequency of 4 KHz.
8. Design a square wave generator with frequency of 2 KHz.
9. Design a Wein bridge oscillator with frequency of 1 MHz.
10. Design a phase shift oscillator with frequency of 1Khz.
11. To study RLC series resonance.
12. To study RLC parallel resonance.

NOTE: At least eight experiments are to be performed in the semester, out of which at-least six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

Power System Lab

General Course Information:

Course Code: EE-409-P Course Credits: 1 Type: Compulsory Contact Hours: 2 hours per week. Mode: Practical session	**Course Assessment Methods (Internal: 30; External: 70)** Internal continuous assessment of 30 marks on the basis of class performance and attendance in practical classes. For the end semester practical examination the assessment will be done out of 70 marks by the external and internal examiners.

Prerequisite: Power system analysis and protection

Objectives:

- To provide clear understanding of working of various protective relays
- To measure the dielectric strength of transformer oil and the string efficiency of a string insulator with/without guard rings
- To provide hands on experience of determining the important parameters and characteristics of transmission line

Course outcomes:

CO1. Apparent understanding of operation of various protective relays
CO2. Ability to determine the dielectric strength of transformer oil and string efficiency of string insulators
CO3. Ability to understand the ABCD parameters and characteristics of transmission line and hence it's designing.

LIST OF EXPERIMENTS:

1. To find out the dielectric strength of transformer oil.
2. To find zero sequence component of three phase line.
3. To draw the characteristics of thermal overload relay.
4. To study an IDMT over current relay to obtain and plot its characteristic curves i.e. the graph between current and time.
5. To measure the ABCD parameters of a given transmission line.
6. To plot the power angle characteristics of given transmission lines.
7. To find the string efficiency of a string insulator with/without guard rings.
8. To study the characteristics of transmission line for T-network & pie- network.
9. To study and testing of a current transformer.
10. To study various types of distance relay

NOTE: At least eight experiments are to be performed in the semester, out of which at-least six experiments should be performed from above list. Remaining experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

Minor Project

General Course Information:

Course Code: EE -411-P Course Credits: 1.0 Type: Compulsory Contact Hours: 2 hours per week (L-T-P: 0-0-2) Mode: Practical	**Course Assessment Methods (External: 1.0)** The project should be initiated by the student in the beginning of the 7th semester and will be evaluated at the end of the 7th semester on the basis of its presentation delivered, viva-voce and report taken by internal examiner

Objectives:

- To introduce the students to various emerging fields in Electrical Engg.
- To provide an opportunity to exercise the creative and innovative qualities in group project environment
- To excite the imagination of aspiring engineers, innovators and technopreneurs

Course Outcomes:

CO1. Exhibit the strength and grip on the fundamentals of the subjects studied during the course.

CO2. An ability to write technical documents and give oral presentation related to minor project work completed

Practical Training-II Report

General Course Information:

Course Code: EE -413-P Course Credits: 1.0 Type: Compulsory Contact Hours: 2 hours per week (L-T-P: 0-0-2) Mode: Practical	**Course Assessment Methods (External: 100)** Assement of Practical Training-II will be based on presentation/seminar delivered, viva-voce, report and certificate for the practical training taken at the end of 6th semester.

Objectives:

- To acquaint with industry environment
- To bridge the gap between academia and industry with the practical application of the theoretical knowledge of the subjects learnt during the course
- To inculcate the leadership as well as team spirit qualities

Course Outcomes:

CO1. Exposure to the industry environment
CO2. Ability to grasp practical application of the subjects taught during the course
CO3. Ability to understand the practical tolerances in real time applications
CO4. Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the industry

GENERAL PROFICIENCY

General Course Information:

Course Code: EE -415-P Course Credits: 1 Type: Compulsory Mode: Overall performance throughout degree.	**Course Assessment Methods (External: 100)** For the end semester examination the assessment will be done out of 100 marks by the external examiner Principal/ Director/ Professor /or any senior Person with experience more than 10 years) at the end of the semester

Objectives:

- To inculcate the sense of professionalism
- To emphasize the substance of communication skills and personality development.
- To develop positive attitude, leadership ability, emotional competence and to perform well under varied circumstances.

Course Outcomes:

CO1. Inculcate the significance of general awareness

CO2. Reveal the importance of good etiquettes and manners in life and face GD/PI confidently.

CO3. Sharpening of presentation skills to enhance employability.

NON-CONVENTIONAL SOURCES OF ENERGY & MANAGEMENT

Course Code: EE-417-L Course Credits: 3.5 Mode: Lecture(L) and Tutorial(T) Type: Programme Elective Contact Hours: 3 hours (L) + 01 hour (T) per week. Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 30; External: 70)** Two minor test each of 20marks, class performance measured through percentage of lecture attended (4 marks), assignments, quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination, nine question are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus, it will contain seven short answer type question. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Prerequisite: Basic knowledge of Non-conventional energy sources such as geothermal, wind, solar, hydroelectric and bio-power.

Objectives:

- The Student will learn the concepts about energy sources like solar energy, wind energy, energy from biomass, geothermal energy, energy from the ocean.
- Recent advancements in energy generations like magneto hydrodynamic power generation, fuel cell technology and management of energy.
- To impart knowledge on power quality and reliability issues in power system.

Course outcomes:

CO-1 Understand difference way to produce energy by unconventional energy sources: solar energy, wind energy, tidal energy, geothermal energy.

CO-2 Understand Special methods of energy production: fuel cells, MHD power plants.

CO-3 Analyzes the potential of alternate energy sources and their scope and limitations.

UNIT I

Introduction: Limitations of Conventional Energy sources, uses & growth of alternate energy sources, Basic schemes & application of direct energy conversion.

Energy Management: Principles of energy conservation, Energy Audit, energy conservation approach/technologies, co-generation, waste heat utilization, power factor improvement, regeneration methods, energy storage, efficient energy management techniques, and energy management system in India.

UNIT II

MHD Generators: Basic principle, gaseous conduction & Hall effect, generator & motor effect, different types of MHD generators, practical MHD generators, applications & economic aspects.

Thermo-Electric Generators: Thermoelectric effects, Thermoelectric converters, figure of merit, properties of thermoelectric materials, brief description of construction of thermoelectric generators, applications & economic aspects.

UNIT III

Photo Voltaic Effect & Solar Energy: Photo Voltaic effect, different types of photoelectric cells, cell fabrication, characteristics of photo voltaic cells, conversion efficiency, solar batteries, solar radiation analysis, solar energy in India, solar collector, solar furnaces & applications.

UNIT IV

Miscellaneous Sources: Fuel cells, principle of action, general description of fuel cells, conversion efficiency, operational characteristics & applications. Low level hydro plants, definition of low head hydropower, Choice of site, choice of turbines. Wind power, history of wind power, wind machines, theory of wind power, characteristics of suitable wind power sites, Bio mass energy, conversion processes. Different bio mass energy resources, electric equipment, precautions, and applications.

REFERENCE BOOKS

1. Energy Resources; Demand & Conservation with special reference to India by KashbariTMH
2. An Introduction to Direct Energy Conservation by R.A. Coormbe.
3. Direct Energy Conversion by Kettani, M.
4. Energy Hand book by Robert L. Loftness.
5. Energy Technology Hand Book by Considine.
6. Non-Conventional sources of Energy by G.D. Rai.
7. Energy Technology, Non-Conventional, Renewable & conventional by S. Rao, Parulekar.
8. Energy storage for Power system, A Ter-Gazarian (peter Peragimus Ltd.)

SOFT COMPUTING TECHNIQUES

General Course Information:

urse Code: EE-419-L urse Credits: 3.5 de: Lecture (L) pe: Programme Elective ntact Hours: 3 hours (L) per ek. amination Duration: 03 urs.	**Course Assessment Methods (Internal: 30; Exte nal: 70)** Two minor test each of 20 marks, class performance measured through percentage of lecture attended (4 marks), assignments, quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus; it will contain seven short answer type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Objectives:

- To review the fundamentals of ANN and fuzzy set theory.
- To make the students understand the use of ANN for modeling and control of non linear system and to get familiarized with the ANN tool box.
- To impart knowledge of using Fuzzy logic for modeling and control of non-linear systems and get familiarized with the FLC tool box.
- To make the students to understand the use of optimization techniqu s.

Course outcomes:

CO1. Knowledge of the basic ANN architectures, algorithms and their limitations.
CO2. Ability to apply different operations on the fuzzy sets.
CO3. Capable of developing ANN based models and control schemes for non-linear system.
CO4. Get expertise in the use of different ANN structures and online training algorithm.
CO5. Capable to use Fuzzy logic for modeling and control of non-linear systems.

Course Content:

UNIT I

Overview of artificial neural network (ann) & fuzzy logic: Review of fundamentals - Biological neuron, Artificial neuron, Activation function, Single Layer Perceptron – Limitations – Multi Layer Perceptron – Back propagation algorithm (BPA); Fuzzy set theory – Fuzzy sets – Operation on Fuzzy sets - Scalar cardinality, fuzzy cardinality, union and intersection, complement (yager and sugeno), equilibrium points, aggregation, projection, composition, fuzzy relation – Fuzzy membership functions.

UNIT II

Neural networks for modelling and control: Generation of training data - optimal architecture – Model validation- Control of non linear system using ANN- Direct and Indirect neuro control schemes- Adaptive neuro controller – Case study - Familiarization of Neural Network Control Tool Box.

UNIT III

Fuzzy logic for modelling and control: Modeling of non linear systems using fuzzy models (Mamdani and Sugeno) –TSK model - Fuzzy
Logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification-Adaptive fuzzy systems- Case study - Familiarization of Fuzzy Logic Tool Box.

UNIT IV

Genetic Algorithm: Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters, Solution of typical control problems using genetic algorithm. Concept on some other search techniques like Tabu search, Ant-colony search and Particle Swarm Optimization.

REFERENCE BOOKS:

1. Laurene V. Fausett, "Fundamentals of Neural Networks, Architecture, Algorithms, and Applications", Pearson Education, 2008.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Wiley, Third Edition, 2010.
3. David E. Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning", Pearson Education, 2009.
4. W.T. Miller, R.S. Sutton and P.J. Webrose, "Neural Networks for Control", MIT Press, 1996.
5. George J.Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", Prentice Hall, First Edition, 1995.
6. N.P Padhy, S.P. Simon "Soft Computing With MATLAB Programming", OXFORD print February 2015.

Computer Networks and Data Communication

General Course Information:

Course Code: EE-421-L Course Credits: 3.5 Type: Programme Elective Contact Hours: 3.0 hours/week Mode: Lectures Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Two minor tests each of 20 marks, Class Performance measured through percentage of lectures attended (4 marks) Assignment and quiz (6 marks), and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the remaining four units. All questions carry equal marks.

Pre-requisites: Basics of communication engineering & fundamentals of computers.

Objectives:

- To provide students with an overview of the concepts and fundamentals of data communication and computer networks.
- To familiarize students with the basic taxonomy and terminology of computer networking area.
- To make students aware about the designing and managing of communication protocols.
- To provide good exposure about the TCP/IP protocol suite and other latest IEEE standards.

Course Outcomes:

CO1. Conceptualize all the OSI Layers.
CO2. Use appropriate network tools to manage network performance.
CO3. Understand the role of various protocols for network communication.
CO4. Know the standard security procedures used for Internet.

Course Content:

Unit 1

Introduction to computer networks: Data Communication, Networks, Internet, Network Models, OSI model, TCP/IP model & protocol suite. Data rate limits, Shannon's Theorem, Circuit switched Networks, Datagram Networks, Virtual Circuit Networks. Network Topologies, Types of Networks (LAN, MAN, WAN, PAN).

Unit 2

Physical layer and channel control: Physical layer encoding (NRZ, Manchester, 4B/5B), Physical layer interfaces (RS232/ EIA232/USB), Medium Access control (Aloha, CSMA/CD, CSMA/CA), Congestion control algorithm, flow control algorithm, shortest path algorithm.

Unit 3

Addressing & Protocols: Logical addressing, IPv4, IPv6, transition from IPv4 to IPv6, Domain Name System (DNS), Dynamic Domain name system, DNS in the internet.

Protocols- ICMP, IGMP, ARP, RARP, TCP, UDP, HDLC, SMTP, SNMP, POP, http

Unit 4

Network Security & latest IEEE trends: IEEE standards- 802.3, 802.4, 802.5, 802.11, 802.15, 802.16, 802.20, 802.22.

Network security- model for network security, RSA algorithm, Digital Signature, e-mail security, Firewalls, VPNs, Proxy servers.

Reference Books:

1. Tanenbaum Andrew S., Computer Networks, 4th edition (2nd Impression 2006)
2. Stallings William, Data and Computer Communications, 7th Edition, PHI
3. Halsall Fred, Data Communications, Computer Networks and OSI, 4th edition
4. Stallings William, Cryptography and Network Security Principles and Practices, 4th Edition, PHI
5. Forouzan B.A., Data Communication & Networking, TMH

Nano Dielectrics

General Course Information:

Course Code: EE-423-L Course Credits: 3.5 Mode: Lecture (L) and Tutorial (T) Type: Programme Elective Contact Hours: 3 hours (L) + 1 hour (T) per week. Examination Duration: 03 hours.	**Course Assessment Methods (Internal: 30; External: 70)** Two minor test each of 20marks, class performance measured through percentage of lecture attended (4 marks), assignments, quiz etc. (6 marks) and end semester examination of 70 marks. For the end semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus; it will contain seven short answer type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt any other four questions selecting one from each of the four units. All questions carry equal marks.

Prerequisite: Basics of Physics and Chemistry, Electrical Engg. materials and semiconductors

Objectives:

- To enable the students to become familiar with different types and properties of nano materials.
- To expose the knowledge on synthesization of nano materials.
- To impart knowledge on characterization methods of nano composites and nano polymers.

Course outcomes:

CO1. Awareness towards the nano materials, properties, synthesization methods and measurement techniques.
CO2. Ability to synthesize new nano materials.
CO3. Ability to design and fabricate the electrical insulations with nano dielectric materials.

Course Content:

UNIT I

Introduction To Nano Materials: Introduction to nanomaterials- Definition of nanocomposite, nanofillers, classification of nanofillers, carbon and noncarbon based nanofillers - Properties of nanomaterials- role of size in nanomaterials, nanoparticles, semiconducting nano-particles, nanowires, nanoclusters, quantum wells, conductivity and enhanced catalytic activity in the macroscopic state

UNIT II

Properties of Nanomaterials: Nanocomposites and Properties- Metal-Metal nanocomposites, Polymer-Metal nanocomposites, Ceramic nanocomposites: Dielectric and CMR based nanocomposites. Mechanical Properties, Modulus and the Load-Carrying Capability of Nanofillers, Failure Stress and Strain Toughness, Glass Transition and Relaxation Behavior, Abrasion and Wear Resistance, Permeability, Dimensional Stability Contents, Thermal Stability and Flammability, Electrical and Optical Properties, Resistivity, Permittivity and Breakdown Strength, Refractive Index.

UNIT III

Synthesization And Characterization Methods: Synthesis of Nanomaterials by Physical Methods - Inert gas condensation, Arc discharge, Ball Milling, Molecular beam epitaxy-Chemical vapour deposition method and Electro deposition Chemical methods for Synthesis of Nanomaterials: Chemical precipitation and coprecipitation, Sol-gel synthesis, Microwave heating synthesis,

Sonochemical synthesis; Electrochemical synthesis; Photochemical synthesis. Introduction to microscopy- Scanning Electron Microscopy, Transmission Electron Microscopy, Optical Absorption and Emission Spectroscopy, Thermogravimetric Analysis, Differential Scanning Calorimetry

UNIT IV

Nanocomposite: Direct Mixing, Solution Mixing ,Preparation and characterization of inorganic nanofillersproperties ,synthesis, characterization and applications of SiO2, TiO2, ZrO2, Al2O3 and CNTcomposite

Nanopolymers: Polymerization, Particle Processing Ceramic/Polymer Composites, Preparation and characterization of Copolymer based nanocomposites- Barrier properties of polymer nanocomposites- Permeation and diffusion models - Thermo Electric Materials – Applications.

REFERENCE BOOKS:

1. Handbook of Nanofabrication. Edited by Gary Wiederrcht. Elsevier, 2010.
2. Nanocomposite Science and Technology: by P.M. Ajayan, L.S. Schadler, P.V.Braun, 2003 WILEY-VCH Verlag GmbH Co. KGaA, Weinheim.
3. Nanoporous materials: Advance techniques for characterization, Modeling and Processing Edited by Nick Kanello Poulos. CRC press, 2011.
4. Inorganic Nanoparticles: Synthesis, Application and Perspectives. Edited by Claudia Altavilla and Enrico Ciliberto. CRC Press, 2011.
5. Polymer nanocomposites: by Yiu-Wing Mai and Zhong-Zhen Yu, First published 2006, Woodhead Publishing Limited and CRC Press LLLC, USA.
6. CRC Handbook of Thermoelectrics, Ed. CR Rowe.