THIRD YEAR FIRST SEMESTER

Code	Subject	Category	Instruction Periods per Week (L+T+P)	Semester End Examination		Sessional Marks	Total Marks	Credits
				Duration (Hours)	Marks			
EEE 311	**Open Elective-I**	OE	3+1+0	3	60	40	100	3
EEE 312	Data Structures	ES	3+1+0	3	60	40	100	3
EEE 313	Pulse and Digital Circuits	PC	3+1+0	3	60	40	100	3
EEE 314	Linear IC's and Applications	PC	3+1+0	3	60	40	100	3
EEE 315	Electrical Power Generation & Utilization	PC	3+1+0	3	60	40	100	3
EEE 316	Linear Control Systems	PC	3+1+0	3	60	40	100	3
EEE 317	Digital Electronics & Microprocessors Lab	PC	0+0+3	3	50	50	100	2
EEE 318	Linear Integrated Circuits & Pulse and Digital Circuits Lab	PC	0+0+3	3	50	50	100	2
EEE 319	Verbal & Quantitative Aptitude-I	HS	4+0+0	—	—	100	100	2
Total			**34**	**—**	**460**	**440**	**900**	**24**

OE-I: Renewable Energy Technologies (EEE)

THIRD YEAR SECOND SEMESTER

Code	Subject	Category	Instruction Periods per Week (L+T+P)	Semester End Examination		Sessional Marks	Total Marks	Credits
				Duration (Hours)	Marks			
EEE 321	**Professional Elective-I**	PE	3+1+0	3	60	40	100	3
EEE 322	Thermo Dynamics and Mechanics of Fluids (TD&MF)	ES	3+1+0	3	60	40	100	3
EEE 323	Computer Architecture and Organization (CAO)	ES	3+1+0	3	60	40	100	3
EEE 324	Performance of Induction and Synchronous Machines (PISM)	PC	3+1+0	3	60	40	100	3
EEE 325	Power Electronics (PE)	PC	3+1+0	3	60	40	100	3
EEE 326	Power Transmission and Distribution (PT&D)	PC	3+1+0	3	60	40	100	3
EEE 327	Electrical Machines Laboratory- I (EM Lab-I)	PC	0+0+3	3	50	50	100	2
EEE 328	TD&MF Laboratory	ES	0+0+3	3	50	50	100	2
EEE 329	Soft Skills Laboratory	HS	0+0+3	—	—	100	100	2
EEE 3210	Verbal & Quantitative Aptitude-II	HS	4+0+0	—	—	100	100	2
Total			**37**	**24**	**460**	**540**	**1000**	**26**

PE-I:1) Electrical Instrumentation 2) Advanced Control Systems and Design
3) Non-Conventional Energy Sources & Applications 4) ANN, Fuzzy Systems & GA

DATA STRUCTURES	
EEE 312	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Course Outcomes:

By the end of the course, the student will be able to:	
CO 1	Understand the concepts of arrays, recursion and structures
CO 2	Understand and apply various data structure such as Linked lists, Stacks, Queues, Tress and Graphs.
CO 3	Implement linked data structure to solve various problems.
CO 4	Implement algorithms and how to apply customary algorithms for searching and sorting.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific Pos**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	0	0	2	0	0	0	0	0	2	2	0	0	1	0
CO 2	0	0	2	0	0	0	0	0	2	2	0	0	1	0
CO 3	0	0	2	0	0	0	0	0	2	3	0	0	1	0
CO 4	0	0	3	0	0	0	0	0	2	2	0	0	1	0

SYLLABUS

UNIT I: **[12 Periods]**

Introduction: Revision of 'c' language: over-view

Arrays and functions: Organization and use of one dimensional, two dimensional and multi dimensional arrays, handling of character strings, string operations, concept of function, parameter passing, recursion.

UNIT II: **[12 Periods]**

Structures, pointers & files: Definition of structure and union, programming examples, pointer, pointer expressions, programming examples, file operations and preprocess.

UNIT III: **[12 Periods]**

Linear data structures: Stack representation, operation, queue representation, operations, circular queues, list representation, operations, double linked and circular lists.

UNIT IV: **[12 Periods]**

Non-linear data structure: Trees, binary tree representation, tree transversals, conversion of a general tree to binary tree, representation of graphs.

UNIT V: **[12 Periods]**

Search Techniques: Basic search techniques, tree searching graphics, linked representation of graphs, graph transversal and spanning trees.

Text Books:

1. Balaguruswamy Programming in Ansi C By, May 2008, Tata Mgcraw Hill, 4th Edition.
2. A.M. Tanenbaum -Data Structures Using C, pearson education,7th edition, 2008

Reference Books:

1. Trmbly & Sorenson An Introduction To Data Structures With Applications Tata Mgcrew Hill, 2nd Edition.
2. Kernigan &Writchi -The 'C'- Programming Language, 2nd Edition, prentice publishers.

PULSE AND DIGITAL CIRCUITS	
EEE 313	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Course Outcomes:

At the end of the course student will be able to:	
CO1.	Determine the response of linear circuits for different input signals.
CO2.	Design application based nonlinear circuits.
CO3.	Analyze and design the multivibrators.
CO4.	Understand the operation & application of Miller, Bootstrap circuit and calculate errors present in sweep signals.
CO5.	Realize logic gates belonging to different logic families such as TTL, CMOS.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific Pos**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	3	2	1	1	0	0	2	1	0	0	2	0
CO 2	1	1	3	2	1	1	0	0	2	1	0	0	2	0
CO 3	1	1	3	2	1	1	0	0	2	1	0	0	2	0
CO 4	1	1	3	2	1	1	0	0	2	1	0	0	2	0
CO 5	1	1	3	2	1	1	0	0	2	1	0	0	2	0

SYLLABUS

UNIT I: Linear wave shaping: [14 Periods]

High pass and low pass RC circuits and their response for sinusoidal, step voltage, pulse, square wave, ramp and exponential inputs. High pass RC circuit as a differentiator. Low pass RC circuit as an integrator. Attenuators and their application as CRO probe. RL and RLC circuits and their response for step input. Ringing circuit.

UNIT II: Non-Linear Wave Shaping: [12 Periods]

Diode clippers.Clipping at two independent levels.Transistor Clippers, Comparator – Diode comparator,Applications of voltage comparators - Clamping operation.Clamping circuits using diode with different inputs.Clamping circuit theorem.Practical clamping circuits.Effect of diode characteristics on clamping voltage.

UNIT III: Multivibrators: [14 Periods]

Transistor as a switch - switching times of a transistor.Astable, monostable and bistablemultivibrators using transistors, resolution time of a binary. Methods of improving resolution time – methods of triggering a binary. Schmitt trigger.

UNIT IV: Sweep Circuits: **[10 Periods]**

Voltage sweep - simple exponential sweep generator.Errors that define deviation from linearity, UJT relaxation oscillator – methods of linearising a voltage sweep - bootstrap and miller circuits – current sweep – linearising a current sweep by adjusting the driving waveform.

UNIT V: Logic gates: **[10 Periods]**

Factors defining the performance of the logic gates, transistor – transistor logic gates, emitter coupled logic gates, integrated injection logic (I_2L), PMOS & NMOS logic gates, complementary MOSFET logic gates.

Text Books:

1. J. MillmanandH. Taub "Pulse, Digital and Switching Waveforms", McGraw – Hill, 1991.
2. K. VenkataRao, K. Rama Sudha&G. ManmadhaRao "Pulse & Digital and Circuits", McGraw - Hill"L. Strauss, Wave Generation And Shaping ,Mcgraw-Hill 1960.

Reference Books:

1. A. Anand Kumar "Pulse, Digital and Circuits", Pearson publications, 2nd edition, 2008.
2. L. Srauss "Wave Generation and Shaping", McGraw – Hill, 1960."

LINEAR IC'S AND APPLICATIONS	
EEE 314	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

1. Ohm's law, KVL and KCL.

2. Knowledge about analog and digital signals.

3. Knowledge about electronic circuits and their specifications and characteristics

Course Outcomes:

By the end of the course student should be able to	
CO1.	Understand the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques.
CO2.	Design and analyze linear and non-linear applications of an opamp and special application ICs.
CO3.	Understand concept of PLL and demonstrate different applications based on it.
CO4.	Differentiate D/A and A/D convertor, understand their types and analyze their applications.
CO5.	Demonstrate the applications of waveform generators, timers and Voltage regulators

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific Pos**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	3	2	1	1	0	0	2	1	0	0	2	0
CO 2	1	1	3	2	1	1	0	0	2	1	0	0	2	0
CO 3	1	1	3	2	1	1	0	0	2	1	0	0	2	0
CO 4	1	1	3	2	1	1	0	0	2	1	0	0	2	0
CO 5	1	1	3	2	1	1	0	0	2	1	0	0	2	0

SYLLABUS

UNIT I:Basics of Operational Amplifiers [9 Periods]

Advantages of ICs over discrete components – Basic information about op-amps-General operational amplifier stages and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

UNIT II: Applications of Operational Amplifiers [16 Periods]

Ideal voltage transfer curve, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic

amplifier, Comparator - Zero crossing detector -Active peak detector, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, - Active filters(Butterworth) - Types

UNIT III: Phase Locked Loop [10 Periods]

Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

UNIT IV: Analog to Digital and Digital to Analog Converters [11 Periods]

Digital to Analog converters - Binary weighed and R-2R Ladder types - Analog to digital converters - Counter ramp, successive approximation, single and dual slope - DAC/ADC performance characteristics and comparison.

UNIT V: Waveform Generators and Special Function ICs [14 Periods]

Sinusoidal Oscillators, Multivibrators and Triangular wave generator, 555 Timer Functional block diagram and description - Monostable and Astable operation - Applications, IC Voltage regulators - Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator -Switched capacitor filter IC

TEXT BOOKS:

1. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill, 2001
2. Roy Choudhury and Shail Jain "Linear Integrated Circuits", New Age Science, 2010

REFERENCE BOOKS:

1. Sonde, B.S, ―Introduction to System Design using Integrated Circuits‖, Second Edition, Wiley Eastern Limited, New Delhi, 1994.
2. Ramakant A. Gayakwad, "OP - AMP and Linear IC's ", Prentice Hall, 2002.
3. Michael Jacob J., "Applications and Design with Analog Integrated Circuits ", Prentice Hall of Inida, 1996.
4. Robert F Coughlin and Fedrick F Driscoll ―Operational amplifiers and linear Integrated Circuits‖, 6th edition, Prentice Hall of India, New Delhi, 2006.
5. Richard J. Higgins "Electronics with Digital and Analog Integrated Circuits‖, Prentice Hall of India, New Delhi, 1983.

ELECTRICAL POWER GENERATION AND UTILIZATION	
EEE 315	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

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

CO1	BL-2	**Explain** the operation of Thermal power plant based on environmental and material science aspects to **Discuss** their merits and demerits.
CO2	BL-2	**Describe** the operation of Hydro and Nuclear power plant based on environmental and material science aspects to **Differentiate** their similarities and dissimilarities.
CO3	BL-2	**Describe** the operation of non conventional power generation plant based on environmental and material science aspects to **Discuss** their merits and demerits.
CO4	BL-4	**Analyze** power/energy demand curves to **Determine** optimal selection of generating units. **Apply** different types of tariffs to **Calculate** cost/unit of electrical energy consumed.
CO5	BL-2	**Explain** interior and exterior lighting systems to **Recognize** illumination levels for different purposes. **Describe** the heating and welding methods to **Recognize** different process of utilizing electric energy for heating and welding for industrial purposes.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2						2					2	1	
CO2	2						2					2	1	
CO3	2						2					2	1	
CO4	3	2										2	2	
CO5	3	1										2	1	

CO'S and PO'S, PSO'S Justification

CO	PO	Level	Description
CO1	PO1	2	Apply principles of basic sciences to explain different sources of energy and operation of thermal power plant and its components
CO1	PO7	2	To identify the environmental risks/ impacts on the site selection of plant.
CO1	PO12	2	Recognize the need of thermal power plant to meet the future demands within the environmental constraints.
CO1	PSO1	1	Need to identify the environmental aspects of thermal power plant
CO2	PO1	2	Apply principles of basic sciences to explain the operation of hydro and nuclear power plant
CO2	PO7	2	To identify the environmental risks/ impacts on the site selection of plant.
CO2	PO12	2	Recognize the need of hydro and nuclear power plant to meet the future demands within the environmental constraints.

CO2	PSO1	1	Need to identify the environmental aspects of hydro and nuclear power plant
CO3	PO1	2	Apply principles of basic sciences and electrical engineering to explain of operation of gas and MHD power plant.
CO3	PO7	2	To identify the environmental risks/ impacts on the site selection of plant.
CO3	PSO1	1	Need to identify the environmental aspects of non conventional power plant
CO3	PO12	2	Recognize the need of gas and MHD power plant to meet the future demands within the environmental constraints.
CO4	PO1	3	Applying the basic principle of mathematics and electrical engineering to Plot the load/demand curves to determine optimal selection of units.
CO4	PO2	2	Using the fundamentals of basic electrical engineering and mathematics to calculate Cost/ per unit of electrical energy consumed
CO4	PO12	2	Need for determine the optimal selection of units to meet the future demand . Need to recognize application of different types of tariff methods to determine the Cost/ per unit of electrical energy consumed
CO5	PSO1	2	Need to determine the methods to identify economical aspects of generating power plant
CO5	PO1	3	Apply principle of basic sciences to study the different methods of heating, welding and illumination
CO5	PO2	1	Using principles of mathematics and basic sciences to identify, formulate the design of heating element
CO5	PO12	2	Recognize the heating and welding methods for the future application and types of lamps to be installed for illumination process.
CO5	PSO1	1	Need to identify the which process of heating, welding methods and illuminations levels for industrial and different purposes respectively.

SYLLABUS

UNIT I: **[12 Periods]**

Introduction: Power generation, comparison of different sources of energy.
Thermal power stations: line diagram, location, coal handling, draught, condensers, cooling water systems.

UNIT II: **[12 Periods]**

Hydro electric plants: choice of site, hydrology, classification of plants, general arrangement, functions of different components of a hydro plant.
Nuclear power plants: schematic arrangement, components of nuclear reactor, classification of reactors, different power reactors. (video lectures on the related topics may be shown).

UNIT III: **[12 Periods]**

Gas turbine plants: layout, components of a gas turbine plant, open cycle and closed cycle plants.
Magneto hydro dynamic (MHD) power generation: basic concepts, principle, classification,

coal burning MHD steam power plant, gas cooled nuclear MHD power, liquid metal MHD generator.

UNIT IV: **[12 Periods]**

Operational aspects of generating stations: load curves and associated definitions, selection of units, load duration curves.

Economic considerations: capital and running costs of generating stations, different tariffs, comparison of costs.

UNIT V: **[12 Periods]**

Heating and welding: introduction, power frequency and high frequency methods of electric heating, arc furnace. Resistance welding, arc welding, modern welding techniques.

Illumination: definitions, laws of illumination, polar curves, photometry, the electric lamps, cold cathode lamps, light fittings, illumination for different purposes, requirements of good lighting.

Indian Electricity Regulations.

Text Books:

1. Soni, Gupta, Bhatnagar & Chakrabarti, A Text Book On Power System Engineering, Dhanpat Rai & Co,9th Edition 2011.

Reference Books:

1. C.L.Wadhwa, Generation & Utilization, New Age Publications 6th Edition 2009.
2. S.L.Uppal, Electrics Power Systems By, Khanna Publishers 11th Edition 1984.

LINEAR CONTROL SYSTEMS	
EEE 316	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

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

CO 1	BL-3	**Apply** signal flow graph and block diagram reduction techniques to **Develop** Transfer function for Linear time invariant systems.
CO 2	BL-3	**Apply** the relationship between the variables of electrical and mechanical systems to **Develop** mathematical models of electrical and mechanical systems.
CO 3	BL-4	**Analyze** the performance of 1st and 2nd order Linear time invariant systems with and without feedback control to **Determine** time domain specifications and error for standard inputs.
CO 4	BL-4	**Apply** Routh-Hurwitz criterion and Root locus technique to **Analyze** the stability for LTI systems in time domain frame.
CO 5	BL-4	**Apply** bode, polar and Nyquist plots to **Analyze** the stability for LTI systems in frequency domain frame.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific Pos**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	1	-	-	-		-		2		2
CO 2	3	3	2		2	-	-	-		-		2		2
CO 3	2	2	3	1	2	-	-	-		-		2		2
CO 4	2	2	3		2	-	-	-		-		2		2
CO 5	2	2	3		2	-	-	-		-		2		2

JUSTIFICATION STATEMENT FOR CO-PO MAPPING			
COs	**POs**	**Level**	**Description**
1	1	3	The transfer functions of electrical systems are calculated using BDR and SFG techniques with the fundamental knowledge of basic electrical engineering and mathematics.
1	2	3	Transfer function is obtained by applying principles of mathematics and electrical engineering
1	3	1	Develop a block diagram and signal flow graph for a given electrical system
1	4	1	Investigation is performed on block diagram of a electrical system to obtain the transfer function
1	5	1	Using MATLAB, we can obtain the transfer function of given block diagram of a system.
1	12	2	Apply these methods of finding transfer functions to real time applications.
2	1	3	Find the transfer function of given mechanical system using basic principles of engineering mathematics
2	2	3	Modeling of electrical system from mechanical system (vice versa) using principles of engineering sciences
2	3	2	To develop complex electrical system from mechanical system using analogy techniques.
2	5	2	Modeling of electrical and mechanical systems using simulation software.
2	12	2	Modeling using analogy techniques can be applied to electro-mechanical systems
3	1	2	To obtain responses of given system by applying the knowledge of engineering mathematics
3	2	2	To determine error constants and steady state error of given system by applying mathematical and electrical engineering knowledge
3	3	3	Design of PI,PD,PID controller for a given system to meet the required performances.
3	4	1	To analyze the time domain specification for a complex problem
3	5	2	Using MATLAB,we can obtain a time domain specifications and response for a standard input
3	12	2	Recognize the need of finding the time response and time domain specifications to the advanced electrical system problems in any areas.
4	1	2	To determine the stability of a system using RH method by applying basic engineering knowledge
4	2	2	To determine the stability of a time system using root locus method by applying engineering knowledge.
4	3	3	Design of compensators using root locus techniques to meet the required stability conditions.

4	5	2	Using MATLAB, plot the root locus of a given system to find its stability
4	12	2	Recognize the need of time domain analysis to determine the stability of a given real time system under equilibrium conditions.
5	1	2	To obtain frequency domain specifications of given system by applying the knowledge of engineering mathematics
5	2	2	to determine the stability of a frequency domain system using bode plot method by applying engineering knowledge
5	3	3	Design of compensators using bode plot techniques to meet the required stability conditions.
5	5	2	Using MATLAB, plot the bode plot of a given system to find its stability
5	12	2	Recognize the need of frequency analysis to determine the stability of a given real time system under equilibrium conditions.

SYLLABUS

UNIT I: **[14 Periods]**

Transfer functions of linear systems-impulse response of linear systems-block diagrams of control systems-signal flow graphs-reduction techniques for complex block diagrams and signal flow graphs.

UNIT II: **[8 Periods]**

Introduction to mathematical modelling of physical systems-equations of electrical networks-modelling of mechanical systems- equations of mechanical systems.

UNIT III: **[12 Periods]**

Time domain analysis of control systems-time response of first and second order systems with standard input signals-steady state performance of feedback control systems-steady state error constants-effect of derivative and integral control on transient and steady state performance of feedback control systems.

UNIT IV: **[12 Periods]**

Concept of stability and necessary conditions for stability-Routh-Hurwitz criterion, relative stability analysis, the concept and construction of root loci, analysis of control systems with root locus.

UNIT V: **[14 Periods]**

Correlation between time and frequency responses - polar plots, **b**ode plots-log magnitude versus phase plots-all pass and minimum phase systems-Nyquist stability criterion-assessment of relative stability-constant M&N circles.

Text Books:

1. Control Systems Engineering by I.J. Nagrath& M.Gopal, Wiley Eastern Limited.
2. Automatic Control Systems by Benjamin C. Kuo, Prentice Hall of India.

Reference Book:

1. Modern Control Engineering by Ogata, Prentice Hall Of India.

DIGITAL ELECTRONICS & MICROPROCESSORS LABORATORY	
EEE 317	**Credits : 2**
Instruction : 3 Periods/Week	**Sessional Marks : 50**
End Exam : 3 Hours	**End Exam Marks : 50**

Prerequisites:

1. Digital Logic Design (EEE 216)
2. Microprocessor and Microcontroller (EEE 226)

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

COs	BLs	CO Statement
CO1	BL-4	**Test** the truth tables by **Design** of combinational and sequential circuits using K maps.
CO2	BL-4	**Develop** programs of 8085 microprocessor and **Obtain** the results.
CO3	BL-4	**Develop** programs of 8085 microprocessor to interface with the peripherals and **Obtain** the results.
CO4	BL-4	**Develop** Programs of 8086 microprocessor and **Obtain** the results.

Program Matrix

	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	3	2	1	0	0	1	1	0	1	1	0
CO2	2	3	1	3	2	1	0	0	1	1	0	1	1	0
CO3	2	3	1	3	2	1	0	0	1	1	0	1	1	0
CO4	2	3	1	3	2	1	0	0	1	1	0	1	1	0

S.No	Name of the Experiment	CO's
1	a. Verification of Truth Tables of basic gates. b. Function realization	CO1
2	a. Verification of Demorgan's law. b. Realization of logic gates using universal gates.	CO1
3	a. Design of half adder, full adder, half subtractor and full subtractor circuits. b. Design of Flip-Flops.	CO1
4	a. Design of code conversion circuits (BCD – Gray code). b. Design of parity generator and parity checker.	CO1
5	8085 microprocessor a. Addition of two 8-bit numbers with & without carry. b. Addition of two 16-bit numbers with & without carry.	CO2
6	a. Finding largest number in an array. b. Ascending and descending order of given numbers.	CO2
7	a. 8-bit multiplication. b. 8-bit division.	CO2
8	a. Square of the numbers. b. One's compliment.	CO2
9	8086 microprocessor a. Subtraction of two 8-bit numbers with & without carry. b. Subtraction of two 16-bit numbers with & without carry.	CO3
10	Interfacing of stepper motor.	CO4

LINEAR INTEGRATED CIRCUITS & PULSE AND DIGITAL CIRCUITS LABORATORY	
EEE 318	**Credits : 2**
Instruction : 3 Periods / Week	**Sessional Marks : 50**
End Exam : 3 Hours	**End Exam Marks : 50**

Prerequisites:

1. Pulse and Digital Circuits (EEE 313)
2. Linear IC's and Applications (EEE 314)

Course Outcomes:

At the end of the course student should be able to:	
CO1	Design the circuits using op-amps for various applications like adder, subtractor, integrator, differentiator and Schmitt trigger
CO2	Design active filters for the given specifications and obtain their frequency response characteristics.
CO3	Design and analyze multi vibrator circuits using op-amp, Transistor and 555Timer
CO4	Design application based on linear and nonlinear circuits
CO5	Understand the operation & application of Bootstrap circuit

Program Matrix

	Program Outcomes (POs)												**PSOs**	
	Domain Specific POs					**Domain Independent POs**								
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	3	3	1	1	0	0	2	1	0	0	1	0
CO2	1	1	3	1	1	1	0	0	2	1	0	0	1	0
CO3	1	1	3	2	1	1	0	0	2	1	0	0	1	0
CO4	1	1	3	3	1	1	0	0	2	1	0	0	1	0
CO5	1	1	3	1	1	1	0	0	2	1	0	0	1	0

List of Experiments:

1) Application of Operational Amplifiers.
2) Design and testing of Active LPF & HPF using op-amp.
3) Design of Schmitt Trigger using op-amp.
4) Design of Astablemultivibrator using a) op amp b) IC 555
5) Line and load regulation of three terminals IC Voltage Regulator.
6) Operation of R-2R ladder DAC and flash type ADC.
7) Design of Bistablemultivibrator using transistor.
8) Observe the process of the linear waver shaping for LPF and HPF.
9) Observe the process of the non- linear waver shaping for Clipper and Clamper.
10) UJT as a relaxation oscillator.
11) Boot strap ramp generator.

VERBAL AND QUANTITATIVE APTITUDE-I	
EEE 319	**Credits : 2**
Instruction : 4 Periods / Week	**Sessional Marks : 100**
End Exam : ---	**---**

Prerequisites: NIL

Course Objectives:

At the end of the course student should understand:

Quantitative Aptitude-I

- To prepare the students on various principles related to numerical computations.
- To explain concepts related to numerical estimation.
- To illustrate and explain the fundamentals related to geometry and mensuration.

Verbal Aptitude-I:

- To categorize and explain principles of grammar in order to minimize errors in English.
- To list and quote high frequency words by giving relevant examples.
- To categorize, apply and use data as per the requirement.
- To construct and make use of idioms, phrasal verbs and other expressions used in professional contexts.
- To critically evaluate reading material for better comprehension

Course Outcomes:

Quantitative Aptitude–I

At the end of the course student should be able to:	
1.	Solve problems related to numerical computations in company specific and other competitive tests.
2.	Recall and use the concepts to solve problems numerical estimation with respect to company specific and competitive tests.
3.	Apply basic principles related to geometry and mensuration & solve questions in company specific and competitive tests.

Verbal Aptitude-I:

At the end of the course student should be able to:	
1.	Detect grammatical errors in the text/sentences and rectify them while answering their competitive company specific tests and frame grammatically correct sentences while writing.
2.	Answer questions on synonyms, antonyms, hyponyms, hypernyms and other vocabulary based exercises while attempting company specific and other competitive tests.
3.	Use their logical thinking ability and solve questions related to reasoning based exercises.
4.	Choose the appropriate word/s/phrases suitable to the given context in order to make the sentence/paragraph coherent
5.	Analyze the given data/text and find out the correct responses to the questions asked based on the reading exercises; identify relationships or patterns within groups of words or sentences.

SYLLABUS

Section –A (Quantitative Aptitude –I)

UNIT I **[6 Periods]**
Numerical computation:
Applications based on Numbers, Chain Rule, Ratio Proportion.
UNIT II **[6 Periods]**
Numerical estimation – I

Applications Based on Time and work, Time and Distance
UNIT III **[4 Periods]**
Numerical estimation – II

Applications based on Percentages, Profit Loss and Discount, Simple interest and Compound Interest Partnerships, Shares and dividends
UNIT IV **[4 Periods]**
Data interpretation

Data interpretation related to Averages, Mixtures and allegations, Bar charts, Pie charts, Venn diagrams

UNIT V **[4 Periods]**
Application to industry in Geometry and Mensuration

Books for practice

1. Quantitative aptitude by RS Agarwal, S Chand Publications
2. Verbal and non verbal Reasoning by RS Agarwal from S Chand publications

References

1. Barron's by Sharon Welner Green and Ira K Wolf (Galgotia Publications pvt. Ltd.)
2. Quantitative Aptitude by U Mohan Rao Scitech publications
3. Quantitative Aptitude by Arun Sharma McGrawhill publications
4. Quantitative Aptitude by Ananta Asisha Arihant publications
5. Quantitative Aptitude by Abhijit Guha
6. Quantitative Aptitude by Pearson publications
7. Material from 'IMS, Career Launcher and Time' institutes for competitive exams.
8. Elementary and Higher algebra by HS Hall and SR knight.

Websites:

www.m4maths.com
www.Indiabix.com
800score
Official GRE site
Official GMAT site

Section –B (Verbal Aptitude–I)

UNIT I **[7 Periods]**

Grammar:

Parts of speech (with emphasis on appropriate prepositions, co-relative conjunctions, pronouns number and person, relative pronouns), articles(nuances while using definite and indefinite articles), tenses (with emphasis on appropriate usage according to the situation), subject – verb agreement (to differentiate between number and person) , clauses (use of the appropriate clause , conditional clauses), phrases(use of the phrases, phrasal verbs), degrees of comparison(comparing apples and oranges, comparison and number), modifiers(misplaced and dangling modifiers, absence of modifiers), determiners, parallelism in structure(symmetry in two part sentences), word order, subjunctive mood, redundancy, special types of sentences, miscellaneous types, identifying errors in a given sentence, correcting errors in sentences.

UNIT II **[4 Periods]**

Vocabulary:

Synonyms and synonym variants (with emphasis on high frequency words), antonyms and antonym variants (with emphasis on high frequency words), homonyms, hyponyms, hypernyms and General idioms.

UNIT III **[5 Periods]**

Reasoning:

Critical reasoning (understanding the terminology used in CR- premise, assumption, inference, conclusion), Sequencing of sentences (to form a coherent paragraph, to construct a meaningful and grammatically correct sentence using the jumbled text), to use logical reasoning and eliminate the unrelated word from a group.

UNIT IV **[4 Periods]**

Usage:

Sentence completion (with emphasis on signpost words and structure of a sentence), contextual meanings (to use the appropriate word according to the situation), supplying a suitable beginning/ ending/middle sentence to make the paragraph coherent, idiomatic language (with emphasis on business communication), punctuation depending on the meaning of the sentence, run on errors, sentence fragments, coma splices.

UNIT V **[4 Periods]**

Reading Comprehension:

Types of passages (to understand the nature of the passage), types of questions (with emphasis on inferential and analytical questions), style and tone (to comprehend the author's intention of writing a passage), strategies for quick and active reading(importance given to skimming, scanning), summarizing ,reading between the lines, reading beyond the lines, techniques for answering questions related to vocabulary (with emphasis on the context), supplying suitable titles to the passage, identifying the theme and central idea of the given passages.

Books for Practice

1. Practical English Grammar A. J. Thomson, A. V. Martinet by Oxford University press
2. Remedial English Grammar for Foreign Students by FT wood published by Macmillan Publishers.
3. Objective English-Edgar Torpe, Showick Thorpe-Pearson Education
4. Cambridge and Oxford Dictionaries

Reference Books and websites:

1. Barron's by Sharon Welner Green and Ira K Wolf (Galgotia Publications Pvt.Ltd.)
2. Websites: Indiabix, 800 score, official CAT, GRE and GMAT sites.
3. Material from 'IMS, Career Launcher and Time' institutes for competitive exams.
4. Collins Cobuild English Grammar by Goyal Publishers.
5. Word Power Made Easy by Norman Lewis-Goyal Publishers.

OPEN ELECTIVE-I RENEWABLE ENERGY TECHNOLOGIES	
EEE 311	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

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

CO1	**Describe** the generation of electricity from various renewable energy technologies, **calculate** the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation.
CO2	**Explain** the concepts involved in wind energy conversion system by studying its components, types and performance to **calculate** wind power extracted.
CO3	**Illustrate** ocean and geothermal energy systems to **Analyze** the operational methods of their utilization.
CO4	**Explain** the concepts involved in biomass energy conversion system and **discuss** the merits and demerits of it.
CO5	**Describe** Magneto hydrodynamics and Fuel cell technology and **explain** the operation of hybrid energy systems.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2					2					1		
CO2	2	2					2					1		
CO3	2						2					1		
CO4	2						2					1		
CO5	2						2					1		

CO'S and PO'S, PSO'S Justification

COs	Pos	Level	Description
CO1	**PO1**	**2**	Apply principles of basic sciences to explain different sources of electrical energy and operation of solar energy system.
CO1	**PO2**	**2**	Using the fundamentals of basic electrical engineering and mathematics to calculate the irradiation of solar energy and different angles related to solar irradiation.
CO1	**PO7**	**2**	To identify the environmental risks/ impacts on the site selection of solar power plant.
CO1	**PO12**	**1**	Recognize the need of solar energy system to meet the future demands within the environmental constraints.
CO2	**PO1**	**2**	Apply principles of basic sciences to explain the operation of wind energy system.
CO1	**PO2**	**2**	Using the fundamentals of basic electrical engineering and mathematics to calculate the wind power extracted.
CO2	**PO7**	**2**	To identify the environmental risks/ impacts on the site selection of wind power plant.
CO2	**PO12**	**1**	Recognize the need of wind power plant to meet the future demands within the environmental constraints.
CO3	**PO1**	**2**	Apply principles of basic sciences and electrical engineering to explain of operation of ocean and geothermal energy system.
CO3	**PO7**	**2**	To identify the environmental risks/ impacts on the site selection of ocean and geothermal power plant.
CO3	**PO12**	**1**	Recognize the need of ocean and geothermal power plant to meet the future demands within the environmental constraints.
CO4	**PO1**	**2**	Applying the basic principle of mathematics and electrical engineering to explain the operation of biomass energy conversion system.
CO4	**PO7**	**2**	To identify the environmental risks/ impacts on the site selection of biomass power plant.
CO4	**PO12**	**1**	Recognize the need of biomass energy conversion system to meet the future demands within the environmental constraints.
CO5	**PO1**	**2**	Apply principle of basic sciences and electrical engineering to explain the operation of MHD, fuel cells and hybrid energy system.
CO5	**PO7**	**2**	To identify the environmental risks/ impacts on the site selection of MHD, fuel cell and hybrid energy systems.
CO5	**PO12**	**1**	Recognize the need of MHD, fuel cell and hybrid energy systems to meet the future demands within the environmental constraints.

SYLLABUS

UNIT I: [15 Periods]

Introduction: Introduction to Energy Conversion, Principle of Renewable Energy Systems.

Solar energy: Solar Radiation, Thermoelectric Conversion, Principles of Solar Energy collection,Characteristics and principles of different types of collectors and their efficiencies. Solar energy applications, water heaters, air heaters, solar cooling, solar cooking, solar drying and power generation, solar tower concept, solar pump, Introduction to Photovoltaic cells,

PV array and PV module, Maximum power point tracking system.

UNIT II: **[10 Periods]**

Wind energy: Wind energy, Characteristics, Aerodynamics, Powerextraction, Types of wind machines, Performance of Wind Machines, Wind Mills, Applications, Economics of wind power.

UNIT III: **[10 Periods]**

Ocean & Geothermal Energy: Ocean Thermal Energy Conversion Systems, Tidal and Wave power applications. Principle of working of Geothermal Power Plants, Advantages and Disadvantages over other energy forms, Applications of Geothermal Energy.

UNIT IV: **[10 Periods]**

Bio-Energy: Energy from Bio-mass, Bio conversion processes. Bio-gas generation and utilization, Bio-gas plants various types, Industrial Wastes, Municipal waste, Burning, Plants, Energy from the Agricultural wastes.

UNIT V: **[15 Periods]**

MHD Power Generation, Fuel Cells & Hybrid-Energy System: MHD Generators, Application of MHD generation, Fuel cells types, applications. Diesel Generator and Photo-Voltaic System, Wind-Diesel Hybrid System, Wind-Photovoltaic Systems.
THERMOELECTRIC POWER CONVERSION & THERMIONIC POWER CONVERSION- Principle of working, performance and limitations.

Textbooks:

1. Non-Conventional Energy Sources, G.D.Rai, Khanna publishers, Fourth Edition, 2009.
2. Wind electrical systems, S.N.Bhadra, D. Kastha, S. Banerjee Oxford University press.

References:

1. Solar Energy: Principles of Thermal Collection and Storage, Sukhatme, S.P., Tata McGraw-Hill, New Delhi.
2. Fuel Cell Systems, James Larminie, Andrew Dicks, John Weily & Sons Ltd.
3. Wind Energy Explained, J.F.Manwell, J.G.McGowan, A.L.Rogers, John Weily & Sons
4. MHD Power Generation Engineering Aspects, E.J. Womack, Chapman and Hall Publication.

PROFESSIONAL ELECTIVE-I ELECTRICAL INSTRUMENTATION	
EEE 321 (1)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites: Electrical Measurements (EEE 222)

Course Outcomes:

At the end of the course student should be able to:	
CO1	Understand the calibration of measuring instrument and their standards.
CO2	Understand the source of errors and minimizing errors.
CO3	The different type of sensors.
CO4	Understand the complete theory behind electrical sensors.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	1	0	0	2	1	0	0	1	0
CO2	1	1	1	1	1	1	0	0	2	1	0	0	1	0
CO3	1	1	1	1	1	1	0	0	2	1	0	0	1	0
CO4	1	1	1	1	1	1	0	0	2	1	0	0	1	0

SYLLABUS

UNIT-I: **[12 periods]**

Measurements and Measurement Systems: What is measurement – Measuring Instruments and measurement systems – Functional elements and Block diagram of a measurement system – Classification of the measuring instruments - Specifications of Instruments – Standards of measurement – International system of units- Calibration of mea0.suring instruments.

UNIT –II: **[08 periods]**

Errors in measurements: Types of errors – Sources of errors – Methods of minimization or elimination of errors- Statistical analysis of errors – selection of instruments.

UNIT-III: **[12 periods]**

Sensing Elements and Transducers: Introduction – Elastic sensors – Diaphragms – Capsules – Bellows – Bourdon Tubes. Pneumatic Sensors – Flapper Nozzle Mechanism.– Differential Pressure sensor –Temperature sensors - Bi-metal – Obstruction type flow sensors – Orifice – Venturi – Pitot tube – Variable area sensors.

UNIT-IV: **[16 periods]**

Electrical Sensors: Resistive sensing elements – Potentiometer – Resistive strain gauge elements – Thermo electric - Resistive temperature sensors – Photo conductive sensors – Capacitive sensors- Variable area – Variable distance – Variable dielectric type sensors. Inductive sensors Variable reluctance type– Linear variable differential transformers. Photo voltage sensors – Piezo electric sensing elements – Turbine flow transducers – Electromagnetic flow sensors – Electromagnetic speed sensors – Photo electric speed sensors.

UNIT-V: **[12 periods]**

Thermo Electric Transducers: Photo voltage sensors – Piezo electric sensing elements – Turbine flow transducers – Electromagnetic flow sensors – Electromagnetic speed sensors – Photo electric speed sensors.

TextBooks:

1. A Course in Mechanical Measurements and Instrumentation – A.K.Sawhney
2. Mechanical and Industrial measurements – R.K.Jain.
3. Electrical and Electronic Measurements and Applications – A.K.Sawhney.
4. Measurement Systems: Application and Design – E.O.Doeblin.
5. Engineering Metrology – R.K.Jain.

Reference Books:

1. A Course in Mechanical Measurements and Instrumentation – A.K.Sawhney
2. Mechanical and Industrial measurements – R.K.Jain.
3. Electrical and Electronic Measurements and Applications – A.K.Sawhney.
4. Measurement Systems: Application and Design – E.O.Doeblin.
5. Engineering Metrology – R.K.Jain.

PROFESSIONAL ELECTIVE-I ADVANCED CONTROL SYSTEMS AND DESIGN	
EEE 321 (2)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

1. Control Systems (EEE 316)
2. Network Theory (EEE 214)
3. Signals & Systems (EEE 225)

Course Outcomes:

At the end of the course student should be able to:	
CO1	Develop the mathematical model for any electrical and mechanical systems.
CO2	Develop the state model and identify its stability of the given electrical and mechanical systems.
CO3	Observe the effect of a controller to improve the time response.
CO4	Design a compensator to improve the response.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	2	2	1	0	0	1	2	0	2	3	0
CO2	1	2	2	2	2	1	0	0	1	2	0	2	3	0
CO3	1	2	2	2	2	1	0	0	1	2	0	2	3	0
CO4	1	2	2	2	2	1	0	0	1	2	0	2	3	0

SYLLABUS

UNIT-I: **[12 periods]**

Control Systems Components: D.C & A.C. tachometers, synchros, A.C. and D.C. servo motors-stepper motors and its use in control systems, amplidyne – metadyne - magnetic amplifier–principle, operation and characteristics – ward – leonard system.

UNIT –II: **[12 periods]**

State Variable Analysis: Concept of state variables & state models, state model for line a continuous time systems, solution of state equation, state transition matrix.

UNIT-III: **[12 periods]**

Concept of controllability & observability (simple problems to understand theory), pole

placement by state feedback method, design of state feedback controller.

UNIT-IV: [12 periods]

Introduction and effect of proportional (P), Proportional plus Integral (PI), Proportional plus Derivative (PD), Proportional plus Integral plus Derivative (PID) controller and finding the system response.

UNIT-V: [12 periods]

Introduction to lag, lead, lag-lead compensating networks and realization of networks. Design of lag, lead and lag-lead compensators by using Root locus technique, design of lag, lead, lag-lead compensators by using Bode plot method.

TextBooks:

1. I.J. Nagrath and M.Gopal, 'Control Systems Engineering', New Age International Publications.
2. G.J. GibsonTuetor, 'Control systems components'.
3. B.C. Kuo, 'Automatic control systems' (5th Edition), Prentice Hall of India, 1988.

Reference Books:

1. Ogata K. "Modern Control Engineering", 4th Edition, Prentice Hall
2. Ogata K. "System Dynamics", 3rd Edition, Prentice Hall
3. M. Gopal, "Control Systems Principles and Design", 2nd Edition, Tata Mc Graw Hill
4. Norman S. Nise, "Control Systems Engineering", 3rd Edition, Wiley
5. George Ellis, "Control System Design Guide – A Practical Guide",3rd Edition, Academic Press

PROFESSIONAL ELECTIVE-I NON-CONVENTIONAL ENERGY SOURCES AND APPLICATIONS	
EEE 321 (3)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Course Outcomes:

At the end of the course student should be able to:	
CO1	Acquire knowledge on the Non-Conventional Energy Sources related to electrical and electronics engineering.
CO2	Acquire knowledge about the fundamental principles of Solar Energy, Wind Energy, Energy from Oceans etc.
CO3	Acquire knowledge on the Non-Conventional Energy Sources.
CO4	Acquire and establish on the small Bio-Gas Energy Power Plant in home.
CO5	Apply the acquired knowledge in Non-Conventional Energy Sources for the benefit of the society

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	0	2	0	1	1	0	0	1	0	1	1	0
CO2	1	2	0	2	0	1	1	0	0	1	0	1	1	0
CO3	1	2	0	2	0	1	1	0	0	1	0	1	1	0
CO4	1	2	0	2	0	1	1	0	0	1	0	1	1	0
CO5	1	2	0	2	0	1	1	0	0	1	0	1	1	0

SYLLABUS

UNIT I: **[13 Periods]**

Solar Energy: Introduction to conventional, non-conventional energy sources, advantages and disadvantages. Basic principle of solar energy, solar radiation, solar collectors, applications, advantages and limitations. Introduction to Photovoltaic cells, PV module and PV array, Maximum power point tracking system.

UNIT II: **[13 Periods]**

Wind Energy: Basic principles, components of wind energy conversion system (WECS), classification of WECS, applications, advantages and limitations.

UNIT III: **[12 Periods]**

Bio-Energy: Introduction, difference between bio-mass and bio-gas, biomass-energy conversion, wet & dry process, classification of biogas plants, constructional details of few main digesters, biogas from wastes, applications.

UNIT IV: **[12 Periods]**

Geo-Thermal Energy: Introduction, sources, prime movers for Geo-Thermal Energy, Applications.

Energy from the oceans: Introduction, ocean-thermal electrical conversion (OTEC), open and closed cycles. Tidal energy principles, single and double basin arrangements, wave energy conversion devices.

UNIT V: **[10 Periods]**

Fuel Cells: Introduction, classification, types, conversion efficiency, applications.

Introduction to Wind-Diesel Hybrid System, Wind-Photovoltaic Hybrid System.

Texts Books:

1. Non-Conventional Energy Sources by G.D. Rai, Khanna Publications.

Reference Books:

1. Non- Conventional Energy Resources by B.H. Khan by Tata Mc Graw-Hill.
2. Energy Technology Non-Conventional, Renewable & Conventional by S. Rao.
3. Future sources of electrical power by M.P. Agarwal First Edition, S. Chand & Co, 1999.

PROFESSIONAL ELECTIVE-I ANN, FUZZY SYSTEMS& GENETIC ALGORITHM	
EEE 321 (4)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Course Outcomes:

At the end of the course student should be able to:	
CO1	Understand the concepts of artificial neural networks
CO2	Understand various learning methods in artificial neural networks
CO3	Understand the concept of fuzziness involved in various systems and fuzzy set theory
CO4	Analysis the applications of fuzzy logic controllers
CO5	Understand the concepts of Genetic Algorithm

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	0	2	2	3	0	0	0	1	0	0	0	3	0
CO2	0	0	2	2	3	0	0	0	1	0	0	0	3	0
CO3	0	0	2	2	3	0	0	0	1	0	0	0	3	0
CO4	0	0	2	2	3	0	0	0	1	0	0	0	3	0
CO5	0	0	2	2	3	0	0	0	1	0	0	0	3	0

SYLLABUS

UNIT I: **[12 Periods]**

Introduction to Artificial Neural Networks: Biological foundations, ANN models: Feed forward & Feedback Networks,Recurrent network, Types of activation functions. Network architectures: Single Layer Feed Forward Network (MLFFN) &Multi Layer Feed Forward Network (MLFFN),Characteristics of neural networks.

UNIT II: **[12 Periods]**

Learning process of Neural Networks: Learning process, Supervised and unsupervised learning, Error-correction learning, Perceptron learning, Hebbian learning, Boltzmann learning, Single layer and multilayerperceptrons: Back propagation algorithm.

UNIT III: **[12 Periods]**

Introduction to Fuzzy Logic: Crisp sets, Properties of crisp sets, Fuzzy sets, operations of fuzzy sets, properties of fuzzy sets, The cardinality of fuzzy sets, Resolution identity, Convex fuzzy sets, crisp and Fuzzy Relations, Fuzzy arithmetic, Membership functions, Fuzzy to crisp conversion, Fuzzification and defuzzificationmethods,fuzzy inference, fuzzy rule base system.

UNIT IV: **[12 Periods]**

Fuzzy Control & Applications: Fuzzy control systems, Fuzzy logic controller application to: Automatic remote control for television set, Inverted pendulum, air conditioner control, simple momentum model for air craft landing, automatic washing machine system.

UNIT V: **[12 Periods]**

Genetic Algorithm: Basic concepts, GA schema theorem, creation of offspring's,encoding(binary), fitness function, reproduction(rank selection), cross over: single and two stage, inversion & deletion, mutation.

Texts Books:

1. "Neural Network, Fuzzy Logic & Genetic Algorithm", S. Rajasekaran, G. A. VijayalakshmiPai, PHI publications, 2007.
2. "Artificial Neural Networks", bose& Liang, Tata Mcgrawhill,1996.
3. "Neural Networks: A Comprehensive Foundation", Simon Haykins, Pearson Education, Asia, 2nd edition.
4. "Fuzzy Logic with Engineering Applications", Timothy J. Ross, McGraw Hill, New York, 2nd edition.

Reference Books:

1. "An introduction to neural networks", Ben Krose& P. Vander Smagt, nov. 1996, 8th Edition.
2. "Fuzzy Set Theory and its Applications", H.J. Zimmermann, Kluwer Academic Publishers, London,3rd edition.
3. "Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications", Stamatios V Kartalopoulos, Prentice Hall of India (P) Ltd., New Delhi, 2000.

THERMO DYNAMICS & MECHANICS OF FLUIDS	
EEE 322	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

1. Engineering Physics (EEE 113)
2. Engineering Mathematics-II (EEE 121)
3. Engineering Mechanics (MEC 213)

Course Outcomes:

By the end of the course, the student will be able to:	
CO1	Understand the physical significance of laws of thermodynamics.
CO2	Apply thermodynamic principles to analyze the performance of IC engines.
CO3	Comprehend the fundamentals of fluid mechanics and properties of fluids.
CO4	Apply Bernoulli's equation and impulse momentum equation to practical applications.
CO5	Distinguish different classes of hydraulic turbines and analyze their performance.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO2	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO3	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO4	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO5	1	0	0	0	0	0	1	0	3	0	0	0	0	1

SYLLABUS

UNIT I: [12 Periods]

Laws of Thermodynamics (statements only), Gas laws, Relation between gas constant and specific heat at constant pressure and constant volume. Thermodynamic processes of perfect gases and entropy.

UNIT II: [12 Periods]

I C ENGINES:Classification, Otto cycle, Diesel cycle and Dual combustion cycle-Air Standard efficiency, working of 2-stroke and 4-stroke engines. Petrol engines and Diesel engines.Power and efficiency of IC engines.

UNIT III: **[12 Periods]**

Introduction to Fluid mechanics, Fluid properties, mass density, specific weight, specific gravity, viscosity, surface tension, capillarity, compressibility & bulk modulus of elasticity, vapour pressure.

Fluid statics: Fluid pressure and its measurement, Pascal's law, Hydrostatic law, pressure distribution, Simple & Differential manometers.

UNIT IV: **[14 Periods]**

Fluid Kinematics-Types of fluid flows, Stream line, Path line, Streak line, Continuity equation, Stream function, Velocity potential function.

Fluid Dynamics: Euler's equation, Bernoulli's equation and its applications -Venturimeter, Orificemeter, Impulse-momentum equation and its applications to pipe bends, Flow through pipes, Darcy weishbach equation, Major and Minor losses in pipes.

UNIT V: **[14 Periods]**

Hydraulic machines: Impact of jets on series of stationary and moving vanes, Velocity triangles, workdone.

Turbines: Classification, Component parts and working principles of Pelton and Francis turbines hydraulic, mechanical and overall efficiency, unit quantities & specific speed.

Text Books:

1. R.S. Khurmi and J.K. Gupta, *Thermal Engineering*, S.Chand& Co publishers
2. Dr. R.K. Bansal, *Fluid Mechanics and Hydraulic machinery edition 9*Laxmi publications.

Reference Books:

1. P.N. Modi& S.M. Seth, *Hydraulics and fluid mechanics: including hydraulic machines, 2009, Standard Book House*
2. R. K. Rajput, *Thermal Engineering* 10th edition, Laxmi publication (P) Ltd.

COMPUTER ARCHITECTURE & ORGANIZATION	
EEE 323	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites: Digital Logic Design (EEE 216)

Course Outcomes:

At the end of the course student should be able to:	
CO1	Apply the basic knowledge of the design of digital logic circuits computer organization.
CO2	Acquire the knowledge on instruction codes and instruction cycle.
CO3	Understand the Micro Programming Control and detail understanding of CPU.
CO4	Learn and apply Input and output organization.
CO5	Learn about the Memory Organization.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	0	2	0	0	0	0	0	2	2	0	0	0	0
CO2	0	0	2	0	0	0	0	0	2	2	0	0	0	0
CO3	0	0	2	0	0	0	0	0	2	2	0	0	0	0
CO4	0	0	2	0	0	0	0	0	2	2	0	0	0	0
CO5	0	0	2	0	0	0	0	0	2	2	0	0	0	0

SYLLABUS

UNIT I: **[12 Periods]**

Register Transfer and Micro Operations: Register Transfer Language, Register Transfer, Busand Memory Transfers, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-opeations, Arithmetic Logic Shift Unit.

UNIT II: **[15 Periods]**

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Complete Computer Description.

UNIT III: **[13 Periods]**

Micro programmed Control: Control Memory, Address Sequencing, Micro Instruction Format.

Central Processing Unit: Introduction, General Register Organization, Stack Organization,

Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control.

UNIT IV: **[10 Periods]**

Input-output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access.

UNIT V: **[10 Periods]**

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory,Cache Memory, Virtual Memory.

Text Book:

1. Computer System Architecture, M. Morris Mano, Third Edition, Pearson Education Inc.,2003

ReferenceBook:

1. Computer Systems Organization and Architecture, John D. Carpinelli, Pearson Education Inc., 2003

PERFORMANCE OF INDUCTION AND SYNCHRONOUS MACHINES	
EEE 324	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

1. Fundamentals of EEE (EEE 215)
2. Network Theory (EEE 214)
3. Electromagnetics (EEE 213)
4. Performance Electrical Machines-I (EEE 223)

Course Outcomes:

CO	BL	CO Statement
CO1	BL-3	**EXPLAIN** the working of 3-phase induction motor, generator & **ANALYZE** the performance charactiristics of 3-phase induction motor
CO2	BL-3	**DISCUSS** the working of 1-phase induction motor, other special motors & **ANALYZE** the performance charactiristics of 1-phase induction motor
CO3	BL-3	**EXPLAIN** the working of 3-phase alternator & **DETERMINE** the emf induced, regulation of alternator by different methods
CO4	BL-3	**ANALYZE** the synchronization process & parallel operation of alternators in detail.
CO5	BL-3	**EXPLAIN** the working of 3-phase synchronous motor & **DISCUSS** the effects of change in excitation & load on the machine when connected to infinite busbar.

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	3	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	1	-	-

JUSTIFICATION STATEMENT FOR CO-PO MAPPING			
COs	**POs**	**Level**	**Description**
CO1	PO1	3	The working of 3-phase Induction motor Including torque equations is **discussed** in detail by using **basic engineering fundamentals.**
CO1	PO2	3	With the help circle diagram efficiency **calculations** are made and the performance characteristics of 3-phase Induction motor are **analyzed**
CO1	PO12	1	Recognize the need for complete analysis of 3-phase induction machine for better exposure in manufacturing industry.
CO2	PO1	3	The working of 1-phase Induction motor & Other special motors is **discussed** in detail by using **basic engineering fundamentals.**
CO2	PO2	3	With the help of double field revolving theory the efficiency **calculations** are made and performance characteristics of 1-phase Induction motor is **analyzed.**
CO2	PO12	1	Recognize the need for complete analysis of 3-phase induction machine for better exposure in manufacturing industry.
CO3	PO1	3	The working of 3-phase alternator is **discussed** in detail using **electrical engineering fundamentals**
CO3	PO3	1	The **design** aspects of armature winding effecting the induced emf in the alternator is **discussed** in detail
CO3	PO12	1	Recognize the need for design aspects of armature winding for providing harmonic free electrical power.
CO3	PO2	3	The voltage regulation **calculations** of 3-phase alternator are made by using different techniques and henceforth the most accurate technique is concluded.
CO4	PO2	3	The parallel operation & synchronization of alternators is discussed & the effects of change in excitation & steam input on the operation is **analyzed**.
CO4	PO12	1	Recognize the need for complete analysis of 3-phase synchronous generator for better understanding of practical issues.
CO5	PO1	3	The working of 3-phase Synchronous motor Including starting techniques is **discussed** in detail by using **basic engineering fundamentals.**
CO5	PO2	3	The Motor behavior with change in excitation & load when connected to infinite is **analyzed** in detail.

SYLLABUS

UNITI: [14 Periods]

Induction motor: Principle of operation of three phase induction motor, rotating magnetic field, types of rotor, torque expression, vector diagram, equivalent circuit and performance equations and calculations, slip-torque characteristic, circle diagram and performance calculations. Starting methods of induction motors, crawling and cogging, double squirrel cage induction motor, methods of speed control of induction motors, induction generator and principle of operation, self excitation of induction generator, Schrage motor, two phase motors.

UNIT II: [10 Periods]

Single phase induction motors: Types of single phase induction motor, double revolving field theory, equivalent circuit, performance analysis and characteristics of capacitor start motors, shaded pole, repulsion type, reluctance, hysteresis and ac series motors.

UNIT III: [12 Periods]

Synchronous Generators: Basic Concepts, types of synchronous machines, construction, armature windings, emf equation, effect of chording and winding distribution, armature reaction, regulation by synchronous impedance, mmf and potier triangle methods.

UNIT IV: [12 Periods]

Synchronization: Parallel operation of synchronous generators, synchronizing current and synchronizing power. Synchronizing to infinite bus-bars and operation of infinite bus. Power transfer equations, capability curve, two reaction model of salient pole synchronous machine and power angle characteristics, determination of X_d and X_q by slip test, short circuit transients in synchronous machine.

UNIT V: [12 Periods]

Synchronous Motor: Principle of operation, methods of starting, power developed, effects of changing load at constant excitation, and changing excitation at constant load, excitation and power circles for synchronous machine, V – and inverted V – curves, hunting and damper windings.

Text Books:

1. D.P. Kothari, I.J. Nagarath, Electrical Machines, Tata Mac Graw Hill publication, 3rd edition, 2004.
2. Dr. P.S. Bhimbra, Electrical Machinery, Khanna publishers, 7thedtion, 2010.

Reference Books:

1. Dr. P.S. Bhimbra, Generalized theory of Electrical Machines, Khanna publishers, 4thedtion, 1987.

POWER ELECTRONICS	
EEE 325	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

A basic knowledge of electronic devices and network analysis, DC and AC transients.

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

CO	BL	CO Statement
CO1	BL-3	**Discuss** thyristor operation and characteristics to **calculate** ratings and design parameters of thyristors.
CO2	BL-4	**Illustrate** the commutation circuits, triggering circuits & series-parallel operation of thyristors to **Select** the appropriate circuit & connection for a particular application of thyristor/thyristors.
CO3	BL-3	**Demonstrate** the operation and waveforms of phase controlled rectifiers to **Compute** the performance parameters of rectifiers.
CO4	BL-3	**Classify** various types of inverters to **Examine** their use in specific applications.
CO5	BL-3	**Illustrate** the operation of DC Choppers & AC to AC Converters to **Utilize** these converters for electric drive applications, **Summarize** the operation and characteristics of DIAC & TRIAC

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Non-Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	-	1	-	2
CO2	2	3	1	-	2	-	-	-	-	-	-	1	-	2
CO3	2	3	1	-	2	-	-	-	-	-	-	1	-	2
CO4	2	3	-	-	2	-	-	-	-	-	-	1	-	2
CO5	2	3	-		2	-	-	-	-	-	-	1	-	2

JUSTIFICATION STATEMENT FOR CO-PO MAPPING			
COs	**POs**	**Level**	**Description**
CO1	PO1	2	Thyristor construction, operation and performance characteristics are illustrated with the knowledge of basic engineering sciences and fundamental engineering.
CO1	PO2	2	Based on the specified limits of an individual thyristor, the snubber circuit parameters are calculated and results are analyzed based on thyristor ratings.
CO1	PO3	1	Design the protection circuit of a thyristor for a given application .
CO1	PO12	1	Recognize the need of thyristor knowledge in terms of their performance, characteristics and protection, in order to be compatible enough for high power drive and high power converter application based industries.
CO2	PO1	2	The fundamental knowledge of basic engineering mathematics, engineering physics and electrical engineering is utilized for demonstrating firing circuit designs and series-parallel thyristor operation.
CO2	PO2	3	Based on the knowledge of commutation circuits and thyristor firing circuits, design of circuit parameters are analyzed and their values are calculated.
CO2	PO3	1	The classification and basic configuration knowledge of firing circuits and commutation circuits of thyristor is utilized for designing thyristor based converter design based applicability.
CO2	PO5	2	Using MATLAB software the performance specifications of commutation circuits of thyristor is analyzed .
CO2	PO12	1	Recognize the need of auxiliary circuitary for thyristors, in order to be compatible enough for high power drive and high power converter application based industries.
CO2	PSO2	2	With the knowledge of circuit requirement for performing switching operation of thyristors, as per the requirement and availability, thyristor based power converters are analyzed.
CO3	PO1	2	With the knowledge of fundamental electrical engineering and engineering mathematics, rectifier operation, waveform and performance characteristics are demonstrated.
CO3	PO2	3	In reference to various rectifier configurations, mathematical derivations of output voltage are formulated and their performance parameters are computed.
CO3	PO3	1	Design rectifier circuits considering the practical effect of source inductance on rectifier performance.
CO3	PO5	2	Using MATLAB/SIMULINK software the operational performance of various rectifier configurations are analyzed.
CO3	PO12	1	Recognize the need of rectifier configuration design as per the requirement, since rectifiers are one of the most common power electronic device being implemented from low power level to high power level applications.
CO3	PSO2	2	With the knowledge of rectifier operation and characteristics, power electronic based applications such as electric drives are analyzed.
CO4	PO1	2	The fundamental knowledge of basic engineering science, engineering mathematics are utilized for analyzing output voltage expressions of inverter using fourier analysis .
CO4	PO2	3	With knowledge of different inverter configurations, their application criteria in specific applications are formulated and performance parameters are analyzed.
CO4	PO5	2	Using MATLAB/SIMULINK software, inverter circuit configurations are virtually tested to analyze their performance specifications.

CO4	PO12	1	Recognize the need of inverter configuration and suitability knowledge, as per its application, since inverter as a power electronic device constitutes a common component of any electric drive system, used in industrial and research sector.
CO4	PSO2	2	With the knowledge of inverter operation and characteristics, appropriate switching device applicability is analyzed, based on power and frequency rating of the inverter.
CO5	PO1	2	With the knowledge of fundamental electrical engineering and engineering mathematics, DC choppers & AC-AC converters operation, waveform and performance characteristics are demonstrated.
CO5	PO2	3	For different chopper configurations, mathematical derivations of output voltage are formulated and their performance parameters are computed.
CO5	PO5	2	Using MATLAB/SIMULINK software the operational performance of various chopper and converter configurations are analyzed.
CO5	PO12	1	Recognize the need of DC-DC converter and AC-AC converter configuration design knowledge, since DC-DC converters plays a vital role in designing power supply unit in electrical and electronic devices and AC-AC converters are highly useful in electric drive applications.
CO5	PSO2	2	With the knowledge of various DC and AC converter operation and characteristics, their role in applications like electric drives for industrial and research sectors are analyzed.

SYLLABUS

UNIT I: **[8 Periods]**

Thyristors: Introduction, principle of operation, two transistor model, static V-I characteristics, dynamic characteristics, gate characteristics, turn on methods, thyristor ratings, measurement of thyristor parameters, protection circuits.

UNIT II: **[12 Periods]**

Gate Triggering Circuits and Commutation Circuits: Resistance firing, resistance-capacitor firing, UJT triggering, class A, class B, class C, class D, class E, class F commutation circuits.
Series and Parallel Operation of Thyristors: Equalizing networks, string efficiency, derating.

UNIT III: **[12 Periods]**

Phase Controlled Rectifiers: Single phase -half wave, fullwave & bridge controlled rectifiers. Three phase half wave and fullwave controlled rectifiers, three phase fully controlled bridge rectifier effect of source inductance on single phase and three phase converters.

UNIT IV: **[12 Periods]**

Inverters: Classification, voltage source inverters, current source inverters, the Mc murray inverter, series and parallel inverters, the Mc murray–bedford inverter.

UNIT V: **[16 Periods]**

Choppers: Principle of operation, stepup, stepdown choppers, two quadrant type A chopper, four quadrant chopper, Jones chopper, Morgan chopper, AC voltage controllers R, R-L loads.

Cyclo Converters: Principle of operation, single phase to single phase cyclo converter.
Principle of operation and static characteristics of diac and triac.

Text Books:

1. Dr. P.S. Bimbra – Power Electronics, 4th Edition, 2012, Khanna Publishers.
2. M.D. Singh, K.B. Khanchandani – Power Electronics, 2nd edition, 2006,Tata Mcgraw – Hill Publishing Company Limited.

Reference Books:

1. Muhammad H Rashid – Power Electronics, Circuits, Devices & Applications,4th Edition, 2003, Pearson Education.
2. Ashfeq Ahmed – Power Electronics for Technology, 1998 prentice hall Education.

POWER TRANSMISSION & DISTRIBUTION	
EEE 326	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

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

CO	BL	CO Statement
CO1	BL-2	**Compare** various supply systems and **Determine** the most economical size of the conductor and **Estimate** the minimum voltage drop of distributors with concentrated loads.
CO2	BL-2	**Determine** the inductance and capacitance of solid, stranded and bundled conductors.
CO3	BL-3	**Analyze** the performance of short, medium and long transmission lines to **Determine** regulation and efficiency.
CO4	BL-3	**Calculate** the sag and tension of transmission tower supports at equal and unequal levels and **Determine** the string efficiency of suspended type insulators.
CO5	BL3	**Determine** the capacitance of single core and three core belted cables and **Calculate** the power loss due to corona.

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	-	-	-	-	-	-	-	-	1	2	-
CO2	2	3	2	-	-	-	-	-	-	-	-	1	3	-
CO3	2	3	2	-	2	-	-	-	-	-	-	1	3	-
CO4	2	3	2	-	2	-	-	-	-	-	-	1	3	-
CO5	2	3	2	-	2	-	-	-	-	-	-	1	3	-

JUSTIFICATION STATEMENT FOR CO-PO MAPPING			
COs	**POs**	**Level**	**Description**
CO1	PO1	2	Comparisons of various supply systems are made with the knowledge of fundamentals of basic electrical engineering and mathematics.
CO1	PO2	3	Analyze the most economical size of conductor with the Kelvin's law
CO1	PO3	1	Analyze the distribution calculations to design the voltage compensation at the low voltage bus
CO1	PO12	1	Recognize the need of distribution calculations in solving the advanced power distribution problems in the area of distribution power flows.
CO1	PSO1	2	Design the modern power distribution components and also solve the advances power distribution problems in the area of power distribution specialization using distribution power flow algorithms.
CO2	PO1	2	Develop the inductance and capacitance expressions for transmission lines with the knowledge of fundamentals of basic electrical engineering and mathematics.

CO2	PO2	3	Calculate the inductance and capacitance for 1-phase and 3-phase lines and analyze the effect of earth on inductance and capacitance calculations through method of images.
CO2	PO3	2	Design the phase impedance matrix and phase admittance matrix by considering the mutual coupling between the three-phase lines.
CO2	PO12	2	Recognize the need of inductance and capacitance calculations for exact modeling of three-phase lines in the area of power systems.
CO2	PSO1	3	Solve the parameters for bundle conductors and double circuit lines in the area of power system specialization with the knowledge of GMD and GMR.
CO3	PO1	2	Modeling of transmission lines and calculation of transmission parameters are made with the knowledge of basic electrical engineering and mathematics.
CO3	PO2	3	Analyze the short, medium and long transmission lines to determine the voltage regulation and efficiency.
CO3	PO3	2	Design the capacitor banks for reactive power compensation from the voltage regulation calculations
CO3	PO5	2	Using MATLAB software's the voltage regulation and efficiency are analyzed for the given transmission lines.
CO3	PO12	1	Recognize the of performance analysis of transmission lines in the area of power systems.
CO3	PSO1	3	Analyze the different types of transmission lines with the knowledge of transmission parameters.
CO4	PO1	2	Sag and tension expressions are derived with the knowledge of basic electrical engineering and mathematics.
CO4	PO2	3	Analyze the different methods to improve the string efficiency of suspension insulators. Analyze the sag on transmission line under bad weather conditions.
CO4	PO3	2	Design the height of tower to get required clearance from the ground under any weather conditions for equal and unequal level towers.
CO4	PO5	2	Using MATLAB software's the string efficiency and voltage distribution across the insulator disks are determined.
CO4	PO12	1	Recognize the need of mechanical design of transmission lines to determine the sag for ice coated lines and lines under wind pressure.
CO4	PSO1	3	Analyze the different methods for equalizing the potential distribution across the suspension insulators in overhead transmission system.
CO5	PO1	2	Construction of cables and insulation resistance and grading of cables are explained with the knowledge of basic electrical engineering and mathematics
CO5	PO2	3	Analyze the different grading methods to minimize the maximum stress on the insulation.
CO5	PO3	2	Analyze the experiments conducted on 3-core belted cable to determine its capacitance.
CO5	PO5	2	Design critical disruptive voltage and visual disruptive voltage under any weather conditions and for any conductor surface for overhead lines.
CO5	PO12	1	Recognize the need of bundle conductor configuration for reducing the power loss due to corona in EHV lines.
CO5	PSO1	3	Comparisons can be made between underground and overhead transmission and distribution of electrical power which will be helpful in the area of power system developments.

SYLLABUS

UNIT I: [**16 Periods]**

Electric Power Supply Systems: Single line diagram of A.C power supply system, comparison between A.C and D.C systems for transmission and distribution, comparison between various supply systems, effect of system voltage on transmission, choice of working voltage for transmission, economic size of conductor – Kelvin's Law.

Power Distribution Systems: Classification of distribution systems, types of distributors, D.C and A.C distributor calculations with concentrated loads.

UNIT II: [**16 Periods]**

Transmission Line Constants: Inductance of a 1-ϕ, 2-wire line, inductance of composite conductors, concept of GMR & GMD, inductance of 3-ϕ symmetrical & unsymmetrical spaced transmission lines, transposition of power lines, inductance of double circuit 3-ϕ line, bundle conductors, skin effect & proximity effect.

Capacitance of 1-ϕ, 2-wire line, capacitance of 3-ϕ symmetrical & unsymmetrical spaced transmission lines, capacitance of double circuit 3-ϕ line, effect of earth on transmission line capacitance.

UNIT III: [**12 Periods]**

Performance of Transmission Lines: Short transmission lines, medium length lines, long transmission lines, surge impedance, surge impedance loading, rigorous line modeling, equivalent T & π model of a long transmission line, Ferranti effect.

UNIT IV: [**08 Periods]**

Mechanical Design of Transmission Lines: Sag and tension calculations, supports at equal & different levels, effect of ice and wind, stringing chart, sag template, vibration and vibration dampers, conductor materials.

Over Head Line Insulators: Types of insulators, potential distribution across the string of insulators, string efficiency, methods of equalizing the potential.

UNIT V: [**08 Periods]**

Underground Cables: Comparison between over head & underground systems, types of cables, construction of cables, insulation resistance of cables, grading of cables, capacitance of 3-core belted cables.

Corona: Phenomenon of corona, critical voltages, power loss due to corona, factors effecting corona loss, radio interference.

Text books:

1. Soni, Gupta, Bhatnagar & Chakrabarti, 'A Text Book on Power System Engineering', Dhanpatrai & Co, Ninth Edition, 2011.
2. D.P. Kothari, I. J. Nagrath, 'Power System Engineering', Tata McGraw-Hill Publishing Company Limited, New Delhi, Second Edition, 2008.
3. C.L.Wadhwa, 'Electrical Power Systems', New Age International Publications, Sixth Edition, 2010.

Reference Books:

1. D. Das,' Electrical Power Systems', New Age International Publications, 2010.
2. J. B. Gupta, 'Transmission and Distribution of Electrical Power', S.K. Kataria & sons publications, 2009.

ELECTRICAL MACHINES LABORATORY-I	
EEE 327	**Credits : 2**
Instruction : 3 Periods /Week	**Sessional Marks : 50**
End Exam : 3 Hours	**End Exam Marks : 50**

Prerequisites: Basic knowledge of Electrical Engineering concepts

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

COs	BLs	CO Statement
CO1	BL-4	**Obtain** the OCC, Load and efficiency characteristics of DC generators and **Analyze** their performance.
CO2	BL-4	**Obtain** the regulation and efficiency characteristics of single phase transformer and **Analyze** their performance.
CO3	BL-4	**Obtain** the speed-torque and efficiency characteristics of DC motor and **Analyze** their performance.

Program Matrix

COs	Program Outcomes (POs)												PSOs	
	Domain Specific POs					Domain Independent POs								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	3		1			1	1		1	0	1
CO2	2	3	1	3		1			1	1		1	0	0
CO3	2	3	1	3		1			1	1		1	1	0

S.No	Name of the Experiment	CO's
1	Swinburne's Test.	CO3
2	Load test on DC shunt motor.	CO3
3	Load test on DC series motor.	CO3
4	Speed control of DC shunt motor.	CO3
5	Speed control of DC series motor.	CO3
6	OCC & Load characteristics of DC shunt generator.	CO1
7	OCC & Load characteristics of DC separately excited shunt generator.	CO1
8	Load characteristics of DC compound generator.	CO1
9	Prediction of internal and external characteristics of a DC shunt generator.	CO1
10	Retardation Test.	CO1
11	Separation of losses in a DC machine.	CO3
12	Hopkinson's Test.	CO1
13	OC & SC tests on a 1-phase Transformer.	CO2
14	Sumpner's Test	CO2

THERMO DYNAMICS AND MECHANICS OF FLUIDS LABORATORY	
EEE 328	**Credits : 2**
Instruction : 3 Periods /Week	**Sessional Marks : 50**
End Exam : 3 Hours	**End Exam Marks : 50**

Course objective:

- The Experiments are designed to develop the fundamental knowledge in thermodynamics and mechanics of fluids.
- This is attained by conducting experiments on calibration of devices like pressure gauge and flow meters and analyzing the performance of IC engines and turbo-machinery.

Course Outcomes:

By the end of the course, the student will be able to:	
CO1	Calibrate pressure gauge and flow measuring devices such as venturimeter and orificemeter.
CO2	Determine the properties of fuels and lubricating oils.
CO3	Determine the friction factor and minor losses in pipes.
CO4	Determine the force exerted by jet on vane and compare with theoretical values.
CO5	Analyze the performance of IC engines and turbo-machinery.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO2	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO3	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO4	1	0	0	0	0	0	1	0	3	0	0	0	0	1
CO5	1	0	0	0	0	0	1	0	3	0	0	0	0	1

List of Experiments:

<u>Group-A (ThermoDynamics Experiments)</u>

1. Determination of flash and fire points of oils.
2. Determination of Viscosity using Redwood Viscometer-I&II
3. Calibration of Pressure gauge.
4. Determination of Calorific value of gaseous fuel using Junkers gas calorimeter.
5. Valve timing diagram of 4-stroke engine.
6. Port timing diagram of 2-stroke engine.
7. Load test on 4-stroke diesel engine.

Group-B (Fluid Mechanics Experiments)

1. Verification of Bernoulli's theorem.
2. Determination of coefficient of discharge through Orifice.
3. Calibration of flow meters.

a. Venturimeter
b. Orificemeter

4. To determine the head losses for flow through pipes and further obtain friction factor
5. Impact of jet on a

a. Flat vane (or)
b. Curved vane

6. To draw the performance characteristic curves for Pelton turbine.
7. To draw the performance characteristic curves for Francis turbine.

SOFT SKILLS LABORATORY	
EEE 329	**Credits : 2**
Instruction : 3 Periods /Week	**Sessional Marks : 100**

Prerequisites:

Basic English language skills- LSRW, English theory, English Language Lab.

Course Objectives

1. To inculcate effective communication skills with appropriate body language.
2. To produce potent leaders, productive team players and effective individuals with proper professional ethics.
3. To enable students to make successful oral presentations using relevant content.
4. To train students for Group discussions and job Interviews which improves their employability skills.
5. To facilitate students the importance of setting realistic goals and achieving them using time management techniques.

Course Outcomes

At the end of the course, students will be able to:	
CO1	Comprehend the core engineering subjects using effective communication skills.
CO2	Present accurate and relevant information efficiently, using suitable material aids.
CO3	Work effectively as an individual as well in teams and emerge as responsible leaders.
CO4	Participate in group discussions and interviews using analytical and problem solving abilities, which enhance their employability skills.
CO5	Set time bound goals and realize them through strategic plans for successful career.

Program Matrix

	Program Outcomes (POs)												**PSOs**	
COs	**Domain Specific POs**					**Domain Independent Pos**								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	0	0	0	0	0	0	0	0	3	0	0	0	0
CO2	0	0	0	0	0	0	0	0	0	3	0	0	0	0
CO3	0	0	0	0	0	0	0	0	0	3	0	0	0	0
CO4	0	0	0	0	0	0	0	0	0	3	0	0	0	0
CO5	0	0	0	0	0	0	0	0	0	3	0	0	0	0

SYLLABUS

UNIT-I :Art of communication **[9 Periods]**

- Definition of Communication
- Types of Communication
- Non-verbal Communication

- Listening skills
- Feed back

D.A. –Practice of proper hand shake, practice of different postures and gestures and activity on giving feedback

UNIT- II:Presentation Skills **[6 Periods]**

- Purpose
- Effective presentation strategies
- Analysis of audience
- Preparing an outline of the presentation,
- Audio –visual aids
- Body language**.**

D.A. –Group presentation by each team

UNIT- III:Group Discussions **[9 Periods]**

1. Introduction- as a part of selection process-guidelines for GD
2. Types of GD
3. Nature of topics of G.D
4. Roles to be played by participants in a GD
5. Evaluation process

D.A–Group discussions

UNIT – IV: Team Building and Leadership **[6 Periods]**

1. Importance of team work
2. Different stages of team formation
3. Good team vs. effective team
4. Team player and Team leader
5. Types of leadership
6. Decision making and negotiating skills

D.A-Decision making for a given situation

UNIT–V:Time- Management **[3 Periods]**

1. Importance of time-management
2. Time-Management models
3. Prioritization
4. The art of saying 'No'
5. Identifying Time Wasters

D.A –Time- Bound activities devised by the facilitator

UNIT- VI:Goal-Setting **[3 Periods]**

1. Different type of Goals (Immediate and Short term)
2. 'SMART' Goals
3. Strategies to achieve goals

D.A– Prepare a chart of immediate, short term and long term goals

UNIT- VI:Job- Interviews **[9 Periods]**

1. Preparing Resumes and C.V's

2. Preparing for the interview

3. FAQ's (Integrity, Stress management, Close- Ask questions)

D.A –Mock interviews

REFERENCE BOOKS:

1. Sanjay Kumar and Pushpalata, ***Communication Skills*** ,Oxford University Press , 2011.
2. Allan Pease, **Body Language,** Sheldon Press,1997.
3. John A. Kline and BhavnaBhalla, ***Speaking Effectively; Achieving Excellence in Presentations***, Pearson publication, 2013.
4. Marc Mancini, ***Time Management***, Tata McGraw Hill publishing Comp.Ltd.,2003.
5. Peter Veruki, ***The 250 Job Interview Questions,***Adams Media Corporation Avon,Massachusetts,1999.

VERBAL AND QUANTITATIVE APTITUDE-II	
EEE 3210	**Credits : 2**
Instruction : 4 Periods /Week	**Sessional Marks : 100**
End Exam : 3 Hours	**End Exam Marks : ---**

Prerequisites: NIL

Course Objectives:

Quantitative Aptitude –II:

- To Categorize, apply and use thought process to distinguish between concepts of reasoning
- To Prepare and explain the fundamentals related to various possibilities and probabilities related to quantitative aptitude.
- To Critically evaluate numerous possibilities related to puzzles.

Verbal Aptitude-II:

- To prepare the students on the various aspects of writing, organizing data, and applying their writing skills in their professional career.
- To demonstrate and recommend the techniques required when interacting in different situations.
- To apply the professional qualities/skills necessary for a productive career and to instill confidence through attitude building.
- To plan activities in order to expose students to the different abilities required for working in a team, encourage them to glean information on current affairs and promote factual reading.
- To illustrate and explain the intricacies/nuances involved in framing responses to the questions asked, reading between lines and reading beyond lines.

Course Outcomes:

Quantitative Aptitude –II

By the end of the course student will be able to :	
1.	Use their logical thinking and analytical abilities to solve reasoning questions from company specific and other competitive tests.
2.	Solve questions related to permutation & combinations and probabilities from company specific and other competitive tests.
3.	Understand and solve puzzle related questions from specific and other competitive tests.

Verbal Aptitude-II:

By the end of the course student will be able to :	
4.	Write paragraphs on a particular topic, essays (issues and arguments), e mails, summaries of group discussions, make notes, statement of purpose (for admission into foreign universities), letters of recommendation (for professional and educational purposes)
5.	Converse with ease during interactive sessions/seminars in their classrooms, compete in literary activities like elocution, debates etc., raise doubts in class, participate in JAM sessions/versant tests with confidence and convey oral information in a professional manner using reason.

6.	Prepare his/her resume, apply the business English concepts learnt in the course, and refine one's overall demeanor which would be very essential to face the corporate world
7.	Respond to their interviewer/employer with a positive mind, customize answers to the questions asked during their technical/personal interviews, exhibit skills required for the different kinds of interviews (stress, technical, HR) that they would face during the course of their recruitment process

SYLLABUS

Section –A (Quantitative Aptitude –II)

UNIT I [**8 Periods]**

Numerical Reasoning:

Problems related to Number series, Analogy of numbers, Classification of numbers, Letter series, Seating arrangements, Directions, blood relations and puzzle test.

UNIT II [**4 Periods]**

Combinatorics:

Counting techniques, Permutations, Combinations and Probability

UNIT III [**4 Periods]**

Data sufficiency Syllogisms

UNIT IV **[4 Periods]**

Application of Base system:

Clocks (Base 24), Calendars (Base7), Cutting of Cubes and cuboids

UNIT V **[4 Periods]**

Puzzle Solving & Time Management using various problems solving tools and techniques:

Selective puzzles from previous year placement papers
Selective puzzles from book Puzzles to puzzle you by shakunataladevi
Selective puzzles from book more puzzles by shakunataladevi
Selective puzzles from book puzzles by George summers

Books for practice

1. Quantitative aptitude by RS Agarwal, S Chand Publications
2. Verbal and non verbal Reasoning by RS Agarwal from S Chand publications
3. Puzzles to puzzle you by shakunataladevi orient paper back publication
4. More puzzles by shakunataladevi orient paper back publication
5. Puzzles by George summers orient paper back publication.

References:

1. Barron's by Sharon Welner Green and Ira K Wolf (Galgotia Publications pvt. Ltd.)
2. Material from 'IMS, Career Launcher and Time' institutes for competitive exams.
3. Reasoning by BS Sijwali Arihant publications
4. Reasoning Arun Sharma McGrawhill publications

Websites:

1. www.m4maths.com
2. www.Indiabix.com
3. 800score
4. Official GRE site
5. Official GMAT site

Section –B (Verbal Aptitude –II)

UNIT I **[4 Periods]**

General Essay writing, writing Issues and Arguments(with emphasis on creativity and analysis of a topic), paragraph writing, story writing, guidance in framing a 'Statement of purpose', 'Letters of Recommendation', business letter writing, email writing, email and business letter writing etiquette, letters of complaints/responses to complaints. Information transfer is taught with the help of tables, bar diagrams, and pie charts while framing /sending lengthy data where testing is done through Reading comprehension and Critical reasoning. Contextual meanings with regard to inflections of a word, frequently confused words, words often mis-used, words often mis-spelt, multiple meanings of the same word (differentiating between meanings with the help of the given context), foreign phrases. Enhanced difficulty level in spotting errors will be taken up with reference to competitive test based exercises.

UNIT II **[4 Periods]**

Just a minute sessions, reading news clippings in the class, extempore speech, telephone etiquette, making requests/suggestions/complaints, elocutions, debates, describing incidents and developing positive non verbal communication. Analogies, YES-NO statements (sticking to a particular line of reasoning)

UNIT III **[4 Periods]**

Corporate readiness, business idioms and expressions, reading newspapers/magazines, brushing up on general awareness, latest trends in their respective branches, resume preparation, understanding business /corporate language, managing emotions, problem solving, importance of team work, goal orientation, professional grooming, positive attitude, assertiveness and inter personal skills. Data sufficiency (answering questions within the ambit of the given text), Fact-Inference-Judgment (to identify statements as FIJ), Syllogisms (with emphasis on fallacies in reasoning), strong and weak arguments.

UNIT IV **[6 Periods]**

Voice, direct & indirect speech, question tags, one word substitutes, and foreign phrases. An overview on group discussions, preparation for a group discussion, intricacies of a group discussion, topics for GDs (with special focus on controversial topics), structure of participation in a group discussion, roles played by the participants in a group discussion, constructive criticism, standard procedures followed whilst participating in a group discussion, frameworks that can be used for discussion, analysis of the discussion and exposure to case-based group discussions.

UNIT V **[6 Periods]**

Different types of interviews (with emphasis on personal interview), preparation for an interview, areas of questioning, answering questions on general traits like strengths/weaknesses/hobbies/extra-curricular activities, choosing role models, importance of non-verbal communication while participating in interviews, tips to reduce nervousness during personal interviews, handling stress, suggestions for responding to tough/unknown questions, preparation on self and personality development.

Note: The concepts learnt in Semester I will be tested in the Mid-term and Semester end exams during the II Semester as well.

Reading/ Listening material:

1. Newspapers like 'The Hindu', 'Times of India', 'Economic Times'.

2. Magazines like Frontline, Outlook and Business India.

3. News channels NDTV, National News, CNN

References:

1. Books written by Stephen Covey and Dale Carnegie-Seven Habits of Highly Effective People etc-Simon & Schuster, Running Press book publishers
2. Books written by Bertrand Russell-Oxford University Press

Suggested General Reading

1. **Who Moved My Cheese?** By Spencer Johnson-GP Putnam's Sons
2. **The art of War**-Sun Tzu by Nabla, Barnes & Noble
3. **The Monk Who Sold Ferrari**-Robin Sharma by Harper Collins, Jaico Publishers
4. **The Hobbit** and other books by JRR Tolkein-Harper Collins

Authors

1.	William Dalrymple	**2.**	V.S.Naipaul
3.	Kushwanth Singh	**4.**	Ernest Hemingway
5.	Charles Dickens	**6.**	Leo Tolstoy
7.	R.K. Narayan	**8.**	Amitav Ghosh
9.	Oscar Wilde		