

Annexure – V

I Semester [First Year] B. Tech in Electrical Engineering

S.N.	Category	Course Code	Course title	Hours / week			C	CIA	SEE
				L	T	P			
1	BS		Engineering Mathematics-I	3	1	0	4		
2	BS		Engineering Physics	3	0	0	3		
	ES		Fundamentals of Web Technologies	1	0	0	1		
3	ES		Basic Electrical and Electronics Engineering	3	0	0	3		
			Elements of Mechanical Engineering	3	1	0	4		
4	ES		Programming for Problem Solving	3	0	0	3		
5	HS		Communicative English and Soft Skills	2	0	0	2		
6	HS		Human Values and Professional Ethics	1	0	0	1		
	BS		Dietetics and Nutrition						
PRACTICAL / SESSIONAL									
7	ES		Fundamentals of Web Technologies Laboratory	0	0	4	2		
8	ES		Basic Electrical and Electronics Engineering lab	0	0	2	1		
9	ES		Programming for problem solving lab	0	0	4	2		
10	HS		Communicative English and Soft Skills Lab	0	0	2	1		
11	ES		Engineering Graphics and Design	1	0	2	2		
			Engineering Workshop						
12	MC		Induction Program	-	-	-	0		
			TOTAL	16	1	10	22		

Bold – 1st Cycle

II Semester [First Year]

B. Tech in Electrical Engineering

S.N.	Category	Course Code	Course title	Hours / week			C	CIA	SEE
				L	T	P			
1	BS		Engineering Mathematics-II	3	1	0	4		
2	BS		Engineering Physics	3	0	0	3		
	ES		Fundamentals of Web Technologies	1	0	0	1		
3	ES		Basic Electrical and Electronics Engineering	3	0	0	3		
			Elements of Mechanical Engineering	3	1	0	4		
4	ES		Data Structure and Algorithms	3	0	0	3		
5	HS		Communicative English and Technical Communication	2	0	0	2		
6	HS		Human Values and Professional Ethics	1	0	0	1		
	BS		Dietetics and Nutrition						
PRACTICAL / SESSIONAL									
7	ES		Fundamentals of Web Technologies Laboratory	0	0	4	2		
8	ES		Basic Electrical and Electronics Engineering lab	0	0	2	1		
9	ES		Data Structure and Algorithms Lab	0	0	4	2		
10	HS		Communicative English and Technical Communication Lab	0	0	2	1		
11	ES		Engineering Graphics and Design	1	0	2	2		
			Engineering Workshop						
12	MC		Sports and Yoga or NSS / NCC	-	-	-	0		
			TOTAL	14	2	12	22		
			Cumulative Total	30	3	22	44		

Bold – 2nd Cycle

Subject Code- **Basic Electrical and Electronics Engineering**

L	T	P	C
3	0	0	3

(Common to all branches of B.Tech Programme)

Pre-requisites (if any): Mathematics, Physics

Course Educational Objectives:

CEO1:	Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
CEO2:	To provide comprehensive idea about AC and DC circuit analysis, working principles and applications of basic machines in electrical engineering.
CEO3:	To expose the students in the field of analog and digital electronics engineering and to acquire the fundamental knowledge in the field.

Assessment Methods

Direct
<ol style="list-style-type: none"> 1. Continuous assessment of skills 2. Class Test – 2Nos 3. Cycle Test – 2Nos 4. Semester End Examination
Indirect
<ol style="list-style-type: none"> 1. Course End Survey

CO-PO Mapping

COs	PROGRAMME OUTCOMES												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	2														
CO2	3	2														
CO3	2	1														
CO4	2	1														
CO5	2	1														
CO6	1	1														
Avg.	2.16	1.33														

Course Outcomes:

After completion of the course, the student will be able to

CO1:	Analyze the circuits by applying network theorems like Mesh, Nodal analysis, and Thevenin's theorem and find various electrical parameters.
CO2:	Illustrate the single-phase and three phase AC circuits along with the concept of impedance parameters and power.
CO3:	Understand the working principle, and applications of DC & AC machines.
CO4:	To acquire the knowledge about the characteristics and working principles of semiconductor diodes, Bipolar Junction Transistor.
CO5:	Explain the basic principles of CRO, function generator, number system and Boolean algebra.
CO6:	Understand the basic concept of generation, transmission, distribution and utilization of electrical energy.
Unit – I [15 hrs]	
<p>DC Circuits & Network Theorems: Introduction to electrical terminology, Ohm's Law, Equivalent Resistance, Star-delta transformation, Source conversion, Ideal and practical sources; Kirchhoff's Law, Mesh and Nodal Analysis; Thevenin's theorem excited by independent sources.</p> <p>Single Phase AC Circuits: AC Fundamentals: RMS & Average value, Complex algebra, AC through pure R, L, C, series RL & RC circuits.</p>	
Unit - II [10 hrs]	
<p>Three-Phase AC Circuits: Comparison between 1-ph & 3-ph AC circuit, phase sequence, Balanced Star & Delta connection, Relation between line and phase quantities.</p> <p>Elementary concept of DC & AC machines: Construction and working of DC Generator and motor, EMF equation, Types of DC machines, Applications, Single phase transformers: Construction, principle of working, e.m.f equation; Working principle of Alternator and Three Phase Induction Motor. Applications of various single phase induction motors.</p>	
Unit – III [10 hrs]	
<p>Semiconductor Diodes: Introduction; Ideal Diode; Semiconductor Materials; Energy Levels; Extrinsic Materials- <i>n</i>- and <i>p</i>-Type; Semiconductor Diode; Resistance Levels; Diode Equivalent Circuits; Half-Wave Rectification; Full-Wave Rectification</p>	

Bipolar Junction Transistors: Introduction; Transistor Construction; Transistor Operation; Common-Base Configuration; Transistor Amplifying Action; Common-Emitter Configuration; Common-Collector Configuration.

Unit – IV

[10 hrs]

Electronic Instrumentation: Introduction; Basic Principle; Digital Oscilloscope; Block Diagram of Cathode Ray Oscilloscope, function generator.

Digital Electronics Fundamentals: Binary, Octal, Hexadecimal and Decimal Number System and their Conversion; Binary Arithmetic; 1's and 2's Complements; Logic gates: AND, OR, NOT, Universal Gates, Axioms and Laws of Boolean Algebra, De Morgan's Theorem, Boolean expression and logic diagrams.

Unit – V

[5 hrs]

Introduction to Power System & Domestic Wiring:

General layout of electrical power system and functions of its elements, Generation of electricity (Hydro, Thermal and Nuclear power plant), standard transmission and distribution voltages, Service main, Meter board, Fuse, MCB, Earthing (pipe & plate earthing), House wiring, Electric shock & precautions.

Teaching Methods: Chalk & Board/ PPT/Video Lectures

1. Reference Text Books:

2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2012.
3. Electronic Devices and Circuit Theory by Robert L Boylestad and Louis Nashelsky, 11th Edition, Prentice Hall.
4. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
5. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
6. Digital Design by M. Morris Mano, 5th Edition, Pearson Education.
7. B.L. Thereja, A.K. Thereja, 'Electrical Technology' Volume-I, S. Chand.
8. S. Parker Smith: "Problems in Electrical Engineering" Asia Publications
9. Schaum's Outline of Basic Electrical Engineering.

III Semester [Second Year]

B. Tech in Electrical Engineering

S.N.	Category	Course Code	Course title	Hours / week			C	CIA	SEE
				L	T	P			
1	BS		Engineering Mathematics – III	3	1	0	4		
2	PC		Electrical Machines - I	3	0	0	3		
3	PC		Network theory	3	0	0	3		
4	PC		Electromagnetic Fields	3	0	0	3		
5	ES		OOP through JAVA	3	0	0	3		
6	HS		English Learning 01- Resume Building and Email writing	1	0	0	1		
PRACTICAL / SESSIONAL									
7	PC		Electrical Machines - I lab	0	0	2	1		
8	PC		Network theory lab	0	0	2	1		
9	ES		OOP through JAVA Lab	0	0	2	1		
10	PST		Summer Internship -I	0	0	2	1		
11	HS		English Learning 01 - Resume Building and Email Writing Laboratory	0	0	2	1		
12	MC		Constitution of India	-	-	-	0		
			Essence of Indian Traditional Knowledge						
			TOTAL	16	1	10	22		
			Cumulative Total	46	4	54	66		

Electrical Machines – I

L	T	P	C
3	0	1	4

(Common to EE & EEE 3RD Semester B. Tech Programme)

Course Educational Objectives

CEO1: To know basic construction of DC generators, motors, and transformers.

CEO2: To analyze the working principle the DC generators, motors, and transformers.

CEO3: Draw the different characteristic curves of DC generators and motors.

CEO4: To conduct various types test on DC generators, motors, and transformers.

Course Outcomes

CO1: Analyze the constructional features and operation of DC machines.

CO2: Investigate the characteristics and conducts different test of DC generators and motors.

CO3: Analyze the differences in operation of different DC machine configurations.

CO4: Understand the concepts and testing of single-phase transformers.

CO5: Understand the various configuration, connections of three phase transformers.

CO6: Analyze the operation of advanced machinery in industry.

Assessment Methods

Direct
<ol style="list-style-type: none">1. Continuous assessment of skills2. Class Test – 2Nos3. Cycle Test – 2Nos4. Semester End Examination
Indirect
<ol style="list-style-type: none">1. Course End Survey2. Feedback from Value Added Courses.

CO-PO Mapping

COs	PROGRAMME OUTCOMES												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	2	2														
CO2	2	2														
CO3	2	3														
CO4	2	2														
CO5	3	2														
CO6	2	2														
Avg.	2.16	2.16														

SYLLABUS

Unit – I

[10 Hrs]

Introduction, construction, types, emf equation, lap and wave windings, armature reaction, commutation, methods of improving commutation, equalizer rings. Demagnetizing and cross magnetizing ampere turns, various characteristics of shunt, series and compound generators, voltage build up, losses and efficiency, condition for maximum efficiency.

Unit – II:

[10 Hrs.]

Introduction, principals, back-emf, torque of motor, types, characteristics of shunt, series and compound motors, speed control (field and armature control methods), basic idea of solid state devices in controlling of DC motors, Starting of DC motors, three point and four point starters, losses and efficiency, testing (brake test and swimburnes test), electric braking of DC motors, Applications.

Unit – III

[12 Hrs.]

Single Phase Transformers: Constructional details, Core, windings, Insulation, principle of operation, EMF equation, magnetizing current and core losses, no load and on load operation, Phasor diagram, equivalent circuit, losses and efficiency, condition for maximum efficiency, voltage regulation, approximate expression for voltage regulation, open circuit and short circuit tests, Sumpner's test, Inrush of switching currents, harmonics in single phase transformers, Parallel operation of transformers. **Autotransformers** - construction, principle, applications and comparison with two winding transformers.

Unit – IV

[10 Hrs.]

Three phase transformers: Three phase Transformer: Constructional features of three phase transformers – three phase connection of transformers (Dd0, Dd6, Yy0, Yy6, Dy1, Dy11, Yd1, Yd11, zigzag), Scott connection, open delta connection, three phase to six phase connection,

oscillating neutral, tertiary winding, three winding transformer, equal and unequal turns ratio, parallel operation, load sharing, Distribution transformers, all day efficiency.

Unit – V

[08 Hrs.]

Construction and Principle of operation of BLDC Machine, Types of drone motors, Basic idea of welding transformer, energy efficient motors, and smart transformers.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books / Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
6. A Textbook of Electrical Technology - Volume II By BL Theraja

SUBJECT: NETWORK THEORY

Subject	Name of the Subject	L	T	P	C	Q									
BELPC3020	NETWORK THEORY	3	1	0	3	A									
Course Objectives															
1.	In this course, we will provide an introductory knowledge of electrical engineering circuits that is oriented towards solving problems.														
2.	The objective is to teach circuits how to obtain their transient response.														
3.	The goal is to become familiar with the basic characteristics and responses of circuit components.														
Course Outcomes															
CO1:	Utilize a variety of Network Theorems in order to solve complex networks.														
CO2:	Analyze coupled circuits using series & parallel resonance circuit terminology.														
CO3:	Examine the behaviour of circuits with two ports.														
CO4:	Apply the knowledge of Laplace and Fourier Transform for circuit analysis.														
CO5:	Develop an understanding of the applicability of Foster and Cauer forms.														
CO6:	Analyze dc and ac circuits and time domain response using P-Spice														
CO-PO & PSO Mapping															
COs	Programme Outcomes												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2											1		2
CO2	2	3											1		3
CO3	2	2											2		2
CO4	3	3											1		3
CO5	2	2											1		2
CO6	2	2	2										2		2
Avg.	2.16	2.3	0.3										1.3		2.3
SYLLABUS															
UNIT-I (12 Hrs)															
S.N.	TOPICS						Hours								
1.1	Basic of electrical circuit.						1								
1.2	Superposition theorem, Thevenin's theorem, Norton's Theorem						2								
1.3	Reciprocity Theorem, Maximum Power transfer theorem, Tellegen's theorem, and Millman's theorem						3								
1.4	Band Width and Q-factor for series and parallel resonant circuits						2								
1.5	Coupled circuits, coefficient of coupling, self & mutual inductance						2								
1.6	Dot Convention for representing coupled circuits, series aiding & opposing.						2								
UNIT-II (12 Hrs)															
S.N.	TOPICS						Hours								
2.1	Z, Y, H, ABCD parameters						4								
2.2	Condition of reciprocity and symmetry, Interrelation of two-port parameters, Interconnection of two-port networks.						4								
2.3	Significance of Poles and Zeros						2								

2.4	Restriction on location of Poles and Zeros, Time domain behaviour from Pole-Zero plots.	2
UNIT-III (10 Hrs)		
S.N.	TOPICS	Hours
3.1	Laplace transform of some basic functions, Laplace transform of periodic functions, Inverse Laplace transform.	3
3.2	Application of Laplace transform: Circuit Analysis (Steady State and Transient).	3
3.3	Fourier series, Fourier analysis and evaluation of coefficients	2
3.4	Steady state response of network to periodic signals, Fourier transform and convergence, Fourier transform of some functions.	2
UNIT-IV (10 Hrs)		
S.N.	TOPICS	Hours
4.1	Hurwitz property, Positive realness, properties of positive real functions.	4
4.2	Synthesis of R-L, R-C and L-C driving point functions in Foster and Cauer forms.	4
4.3	An overview of network filters.	2
UNIT-V (8 Hrs)		
S.N.	TOPICS	Hours
5.1	Wiring a house: Basic concepts and components	3
5.2	Transmitter and receiver circuit	2
5.3	P-SPICE simulator: To simulate, analyze, and optimize electrical circuits.	3
TOTAL		52
Text Book:		
<ol style="list-style-type: none"> 1. A.Chakrabarti - <i>Circuit Theory: Analysis and Synthesis</i> , 6th edition, Dhanpat Rai & Co. 2. <i>Fundamentals of Electric Circuits – Alexander & Sadiku– Tata McGraw Hil, 5thEditionl.</i> 		
Reference Book:		
<ol style="list-style-type: none"> 1. <i>Network Analysis – M E Van Valkenburg – Pearson Education, 3rd Edition.</i> 2. <i>Theory and problem of electrical circuits, Schaum's Outline Series, TMH – Joseph A. Edminister, MahmoodMaqvi.</i> 3. <i>Electric Circuits – David A.Bell – Oxford, 7th Edition, 2015.</i> 4. <i>M.S.Sukhija & T.K.NagSarkar- Circuits and Networks-Oxford.</i> 		

Electromagnetic Fields

L	T	P	C
3	0	0	3

(Common to EE & EEE 3RD Semester B. Tech Programme)

Course Educational Objectives

- CEO1:** To study about the concept of different Co-ordinate systems & Transformation.
CEO2: To get theoretical concept of calculation and derivation of electrostatic field and magneto static field
CEO3: To acquire knowledge about electromagnetic field and wave propagation.

Course Outcomes

- CO1:** Relate the vector calculus with electric and magnetic field in space.
CO2: Employ mathematical tools like integral & differential calculus to study electric and magnetic behaviour through a medium..
CO3: Solve electromagnetic relation using Maxwell formulae and analyse moving charges on magnetic fields.
CO4: Formulate the idea of applying properties of electromagnetic waves in transmission lines and design circuits using conductors as well as dielectrics.
CO5: Measure and decide the nature of a wave to propagate in a particular medium
CO6: Understand the industrial application of electric and magnetic field..

Assessment Methods

Direct
5. Continuous assessment of skills 6. Class Test – 2Nos 7. Cycle Test – 2Nos 8. Semester End Examination
Indirect
2. Course End Survey 3. Feedback from Value Added Courses.

CO-PO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2											1		2
CO2	1	2											1		3
CO3	2	1											2		2

CO4	2	2											1		3
CO5	3	2											1		2
CO6			2		2								2		2
Avg.	2	1.8	2		2								1.3		2.3

SYLLABUS

Unit – I	[12 Hrs]
<p>Introduction to scalars and vectors, dot product, cross product and basic operations on vectors</p> <p>cartesian co-ordinate systems and problems on cartesian co-ordinate systems. cylindrical co-ordinate systems and problems on cylindrical co-ordinate systems. spherical co-ordinate systems and problems on spherical co-ordinate systems. inter conversion between cartesian, cylindrical and spherical co-ordinate systems. inter conversion between cylindrical and spherical co-ordinate systems. inter conversion between cartesian and spherical co-ordinate systems. Differential length, Area & volume and problems on it Del operator, Gradient of a scalar, Divergence of a vector & divergence theorem and numerical curl of a vector & Stoke's theorem, laplacian of a scalar and numerical.</p>	
Unit – II:	[12 Hrs.]
<p>Electrostatic Fields: Coulomb's Law and numerical. Electric Fields due to point, line, surface Electric Fields due to volume charge Electric Flux Density Gauss's Law – Maxwell's Equation Applications of Gauss's Law and numericals. Electric Potential, Relationship between E and V – Maxwell's Equation. Electric Dipole & Flux Lines and numericals Energy Density in Electrostatic Fields. Poisson's & Laplace's Equations, Uniqueness theorem and numericals. General procedures for solving Poisson's or Laplace's Equation..</p>	
Unit – III	[10 Hrs.]
<p>Magnetostatic Fields Magnetic Field Intensity Biot-Savart's Law Ampere's circuit law- Maxwell's equation for static fields applications of Ampere's law Magnetic Flux Density- Maxwell's equations Maxwell's equation for static fields Magnetic Scalar potentials Magnetic Vector potentials.</p>	
Unit – IV	[11 Hrs.]
<p>Electromagnetic Fields and Wave Propagation introduction Faraday's Law Transformer & Motional Electromagnetic Forces Displacement Current Maxwell's Equation in Final forms Time Varying Potentials Time-Harmonic Field Electromagnetic Wave Propagation Wave Propagation in loss Dielectrics Plane Waves in loss less Dielectrics Power & pointing vector.</p>	
Unit – V	[08 Hrs.]

Principle of operation of antenna and transmission Application of electromagnetic field in electric motor Bio medical application of electromagnetic waves Mobile Communication Various sensors and actuating devices based on electromagnetism.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books / Reference Books:

7. 1. Matthew N. O. Sadiku, Principles of Electromagnetics, 4th Ed., Oxford Intl. Student Edition.
8. 1. C. R. Paul, K. W. Whites, S. A. Nasor, Introduction to Electromagnetic Fields, 3rd, TMH.
9. 2. W.H. Hyat, Electromagnetic Field Theory, 7th Ed, TMH.
10. 3. Edward C. Jordon , Keith G. Balmain,” Electromagnetic Waves and Radiating Systems”2nd Ed, Pearson Education.

IV Semester [Second Year]
B. Tech in Electrical Engineering

S.N.	Category	Course Code	Course title	Hours / week			C	CIA	SEE
				L	T	P			
1	PC		Electrical Machines - II	3	0	0	3		
2	PC		Control Systems	3	0	0	3		
3	PC		Electrical Power Transmission and Distribution	3	0	0	3		
4	PC		Analog and Digital Circuits	3	0	0	3		
5	ES		Data Base Management System	3	0	0	3		
6	HS		English Learning 02	1	0	0	1		
PRACTICAL / SESSIONAL									
7	PC		Electrical Machines - II lab	0	0	2	1		
8	PC		Control Systems lab	0	0	2	1		
9	ES		Data Base Management System Lab	0	0	2	1		
10	PST		Mirco Project – I	0	0	2	1		
11	HS		English Lab 02	0	0	2	1		
12	MC		Constitution of India	-	-	-	0		
			Essence of Indian Traditional Knowledge						
			TOTAL	16	0	10	21		
			Cumulative Total	62	4	64	87		

Electrical Machines – II

L	T	P	C
3	0	1	4

(Common to EE & EEE 4TH Semester B. Tech Programme)

Course Educational Objectives

- CEO1:** To understand the concept of three phase synchronous generator.
CEO2: To study about the characteristics and parameters of cylindrical rotor type and salient pole type three phase synchronous generators.
CEO3: To get concept of parallel operation of three phase synchronous generator.
CEO4: To study about principle and properties of synchronous motor.
CEO5: To acquire knowledge about working principle and properties of three phase and single-phase induction motors.

Course Outcomes

- CO1:** Interpreting the concept, characteristics and difference between cylindrical rotor and salient pole type three phase synchronous generator.
CO2: Understand the concept of parallel operation of alternator and its process of synchronization.
CO3: Acquiring knowledge about properties and concept of synchronous motor.
CO4: Understand the properties and concept of both three- and single-phase induction motor with some knowledge on various speed control techniques and starting procedures.
CO5: Understand the various testing procedures of both single and three phase induction motor.
CO6: Analyze the operation of advanced machinery in industry.

Assessment Methods

Direct
1. Continuous assessment of skills 2. Class Test – 2Nos 3. Cycle Test – 2Nos 4. Semester End Examination
Indirect
1. Course End Survey 1. Feedback from Value Added Courses.

CO-PO Mapping

COs	PROGRAMME OUTCOMES												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	2	2														
CO2	2	3														
CO3	2	2														
CO4	3	3														
CO5	2	2														
CO6	2	2														
Avg.	2.16	2.33														

SYLLABUS

Unit – I

[12 Hrs]

Three Phase Synchronous Generators: Synchronous Generator Construction (both Cylindrical Rotor and Salient Pole type), the Speed of Rotation of a Synchronous Generator, Induced voltage in A.C Machines, The Equivalent Circuit of a Synchronous Generator (Armature Reaction Reactance, Synchronous Reactance and Impedance).

Cylindrical Rotor type Three Phase Synchronous Generators: The Phasor Diagram of a Synchronous Generator, Power and Torque in Synchronous Generators (Power Angle Equation and Power Angle Characteristic), Measuring Synchronous Generator Model Parameters (Open Circuit and Short Circuit Tests and Determination of Synchronous Impedance and Reactance, The Short Circuit Ratio), Voltage Regulation and Speed Regulation. Voltage Regulation by Synchronous Impedance Method.

Unit – II:

[12 Hrs.]

Salient Pole type Three Phase Synchronous Generators: Two Reaction Concept, Development of the Equivalent Circuit of a Salient Pole type Three Phase Synchronous Generator (Direct axis and Quadrature axis Reactances, Phasor Diagram for various load power factors,), Torque and Power Equations of Salient Pole Synchronous Generator (Power Angle Equation and Power Angle Characteristic with stator resistance neglected). Slip Test for determination of Direct axis and Quadrature axis Reactances.

Parallel operation of Three Phase A.C. Synchronous Generators: The Conditions Required for synchronization, The General Procedure for Paralleling Generators.

Three Phase Synchronous Motors: Basic Principles of Motor operation, Steady State Synchronous Motor operation, Starting of Synchronous Motors, Operation of synchronous motors. Phasor diagrams for normal, under and over excited conditions, V and inverted V curves, Synchronous Motor Applications.

Unit – III	[10 Hrs.]
Three phase induction machines:	
<p>Constructional features and types; 3-phase distributed winding production of rotating magnetic field, Principle of Operation, The Effect of Coil Pitch and distribution factor on A.C. Machines, winding factor, Concept of Slip, Slip Speed; Phasor diagram and Development of equivalent circuit and derivation of torque equation; Typical torque-slip characteristic and influence of different parameters on it, No-Load and Blocked Rotor tests, Determination of Parameters, power flow diagram, Losses and Efficiency, Methods of starting and speed control. Cascade control method, Cogging, Crawling.</p>	
Unit – IV	[08 Hrs.]
<p>Single Phase Induction Motor: Double field revolving theory, Methods of starting using auxiliary winding, development of equivalent circuit. Types of Single-Phase Induction Motors and its applications, Universal Motor.</p>	
Unit – V	[08 Hrs.]
<p>Elementary concept of 3 Phase Induction Generator, different types of wind turbine motors, introduction to Servo motors- Stepper motors – introduction to magnetic levitation systems, concept of various electrical pumps. Application of induction motors in power plants.</p>	
Teaching Methods: Chalk& Board/ PPT/Video Lectures	
Text Books / Reference Books:	
<ol style="list-style-type: none"> 1. Stephen J. Chapman-‘Electric Machinery and Fundamentals’- McGraw Hill International Edition, (Fourth Edition), 2015. 2. M.G.Say-‘Alternating Current Machines’, English Language Book Society(ELBS)/ Longman, 5th Edition, Reprinted 1990. 3. P.C.Sen-‘Principles of Electric Machines and Power Electronics’-2nd Edition, John Wiley and Sons, Wiley India Reprint, 2014. 4. D.P. Kothari & I.J. Nagrath - Electric Machines – 4th Edition McGraw Hill – Reprint 2015. 5. P S Bimbhra– Electrical Machinery –Khanna Publishers. 6. A Textbook of Electrical Technology - Volume II By BL Theraja 	

Control Systems

L	T	P	C
3	0	0	3

(Common to EE & EEE 4th Semester B. Tech Programme)

Course Educational Objectives

CEO1: To provide the fundamental knowledge of control system engineering and the concept of mathematical modeling of the physical system..

CEO2: The subject gives various classical analysis tools for design and stability of system in time and frequency domain.

Course Outcomes

CO1: To derive the mathematical model & transfer function of various physical systems

CO2: To analyze the time-domain responses of linear systems for different test signals and its steady state characteristics

CO3: To apply Routh-Hurwitz's criterion & Root Locus method to assess the stability of different systems

CO4: To analyze frequency response and hence stability conditions of linear systems using Bode-Plot & Nyquist criterion

CO5: To understand the characteristics & tuning methods of P, PI & PID controllers for different dynamic systems

CO6: To apply MATLAB & SIMULINK tool to design & analysis of various controllers & compensators to improve the performance of systems

Assessment Methods

Direct
9. Continuous assessment of skills 10. Class Test – 2Nos 11. Cycle Test – 2Nos 12. Semester End Examination
Indirect
4. Course End Survey 5. Feedback from Value Added Courses.

CO-PO Mapping

COs	PROGRAMME OUTCOMES												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	2	2														
CO2	2	3														
CO3	2	2														
CO4	3	3														
CO5	2	2														
CO6	2	2														
Avg.	2.16	2.33														

SYLLABUS

Unit – I **[10 Hrs]**

Basic Concepts of Control Systems, Open Loop and Closed Loop Systems, Servo Mechanism/Tracking System. Mathematical Models of Physical Systems, Differential Equations of Physical Systems, Transfer functions, Block Diagram Algebra, Signal flow Graphs. Feedback characteristics of Control Systems, Effects of Disturbance Signals Using Feedback, and Regenerative Feedback.

Unit – II: **[12 Hrs.]**

Time Response Analysis: Standard Test Signals, Time Response of First Order & Second Order Systems, Steady State Errors and Static Error Constants of Different Types of Systems, Effect of Adding Poles/ Zeros on System Response, Design Specification of Second Order System, Performance Indices.

Unit – III **[12 Hrs.]**

Concepts of Stability, Necessary Conditions for Stability, Hurwitz Stability Criterion, Routh Stability Criterion, Absolute Stability, Conditional Stability and Relative Stability, Root Locus Concepts, Construction of Root locus, Root Contours. Stability Analysis of Various Dynamic Systems Using Root Locus Plot.

Unit – IV **[08 Hrs.]**

Frequency Response Analysis: Correlation between Time and Frequency Response, Polar Plots, Mathematical Preliminaries for Stability in Frequency Domain, Bode Plots of Various Dynamic Systems, Determination of Stability Using Bode Plot Methods, Stability Analysis Using Nyquist Stability Criterion, Constant M circles, Constant N-Circles, Nichol's chart

Unit – V**[08 Hrs.]**

Concept of Proportional, Derivative and Integral Control actions. Tuning Rules of P, PD, PI, PID Controller Parameters Using Zeigler-Nichol's Method; Design of Real Time P, PI and PID Controllers for Various Dynamic Systems, Control System Components: Stepper motor, AC & DC Servomotor, Synchro's, AC Tachometer.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Reference Books

- [1] Control Systems Engg. by I.J. Nagrath and M.Gopal, 5th Edition, New Age International Publishers
- [2] Modern Control Engineering by K. Ogata, 5th edition PHI
- [3] Automatic Control Systems by Benjamin C. Kuo, 7th Edition, Prentice-Hall India publication.
- [4] Design of Feedback Control Systems by R.T. Stefani, B. Shahian, C.J. Savator, G.H. Hostetter, Fourth Edition, Oxford University Press.
- [5] Control Systems (Principles and Design) by M.Gopal 3rd edition, TMH.
- [6] Control Systems 2nd edition, kindle edition by A. Anand kumar, PHI.
- [7] Automatic Control Systems (With MATLAB Programs) by Hasan Saeed, Arihant Publishers.

Subject Code- Electrical power Transmission & Distribution

L	T	P	C
3	0	0	3

(Common to EE, EEE, branches of IV Semester B.Tech Programme)

Pre-requisites (if any): Mathematics, Basic Electrical Engineering, Network Theory

Course Educational Objectives:

CEO1:	To develop skills to apply knowledge of AC power transmission & distribution for understanding of various parameters and performance of transmission lines.
CEO2:	To expose the students to the different electrical & mechanical aspects of the power network along with its environmental and safety constraints.
CEO3:	To understand the concept of testing and commissioning of overhead Distribution Lines and procedure of earthing a system.

Assessment Methods

Direct
<ol style="list-style-type: none"> 1. Continuous assessment of skills 13. Class Test – 2Nos 14. Cycle Test – 2Nos 15. Semester End Examination
Indirect
<ol style="list-style-type: none"> 1. Course End Survey 2. Feedback after visiting the in-house substation and local substation

CO-PO Mapping

COs	PROGRAMME OUTCOMES												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	2														
CO2	3	2														
CO3	2	3														

CO4	2	3				2								
CO5	1	2				2								
CO6	1	2				2								
Avg.	2	2.33				1								

Course Outcomes:

After completion of the course, the student will be able to

CO1:	Understand the effect of line parameters and other factors effecting the transmission of electric power.
CO2:	Analyze the transmission line models and evaluate the performance of short, medium and long transmission lines and Interpret corona.
CO3:	Describe the role of overhead line insulators and underground cables and evaluate their performance.
CO4:	Design the distribution system network, and able to evaluate sag and tension for overhead transmission line.
CO5:	Discuss the advantages of grounding the neutral of a system and able to design of earthing grid.
CO6:	Understand survey, Planning, Installing, Commissioning, Earthing and testing of distribution lines.

. Electrical power Transmission & Distribution

Unit – I	[10 hrs]
<p>Line Constant Calculations: Magnetic flux Density, Inductors and Inductance Magnetic field Intensity due to long current carrying conductors, Inductance of two wire transmission line, Flux linkages with one conductor in a group of conductors, Transposition of power lines, Composite Conductors, Inductance of Composite Conductors, Inductance of double circuit three phase line, Concept of GMD, Bundled conductors, Skin and Proximity effect.</p> <p>Capacitance of Transmission Lines: Electric Field of a Line of charge, Straight Conductor, The Potential Difference between Two Points due to a line Charge, Two infinite lines of charge, Capacitance of a Two Wire Line, Capacitance of a Three Phase Line with Unsymmetrical Spacing, Capacitance of a double circuit line, Inductance of three phase un symmetrically spaced transmission, Effect of Earth on the Capacitance of conductors.</p>	

Unit - II	[10 hrs]
<p>Performance of Lines: Representation of Lines, Short Transmission Lines, The Medium Transmission Lines, The Long Transmission Line: The Long Transmission Line, ABCD constants, Ferranti Effect Hyperbolic Form of The Equations, The Equivalent Circuit of a Long Line, Power Flow Through Transmission Line, Reactive Compensation of Transmission Line. Series and shunt compensation. Wave equation for uniform transmission lines.</p> <p>Overhead Line Insulators: Insulator Materials, Types of Insulators, Voltage Distribution over Insulator String, Methods of Equalizing the potential.</p>	
Unit – III	[12 hrs]
<p>Mechanical Design of Overhead Transmission Lines: The catenary curve, Sag Tension calculation, supports at different levels, Stringing chart, sag Template, Equivalent span, Stringing of Conductors, Vibration and Vibration Dampers</p> <p>Distribution: Comparison of various Distribution Systems, AC three-phase four-wire Distribution System, Types of Primary Distribution Systems, Types of Secondary Distribution Systems, Voltage Drop in DC Distributors, Voltage Drop in AC Distributors, Kelvin’s Law, Limitations of Kelvin’s Law, General Design Considerations.</p>	
Unit – IV	[10 hrs]
<p>Insulated Cables: The Insulation, Extra High Voltages Cable, Insulation Resistance of Cable, Grading of Cables, Capacitance of Single Core Cables, Heating of cables, Current rating of cables, Overhead lines Vs Underground Cables, Types of cable</p> <p>Corona:</p> <p>Phenomena, disruptive and visual critical voltages, corona loss. Advantages and disadvantages of corona. Methods of reducing corona.</p> <p>Power System Earthing: Soil Resistivity, Earth Resistance, Tolerable Step and Touch Voltage, Actual Touch and Step Voltages, Design of Earthing Grid.</p>	
Unit – V	[8 hrs]
<p>Construction, Testing and Commissioning of Overhead Distribution Lines: Introduction, Survey of Overhead lines, Planning of construction work, Points to be considered at the time of erection of overhead lines, Erection of support, Setting of stays, Fixing of cross-arms and insulators, Conductor erection, Repairing and jointing of conductors, dead end clamps, positioning of conductors and attachment to insulator, Jumpers, Tee-offs, Right-of-way,</p>	

Earthing of transmission lines, Guarding of Overhead lines, Testing and Commissioning of overhead distribution lines, Maintenance of overhead lines.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Reference Text Books:

1. *Stevenson, W.D., Power System Analysis, McGraw Hill (2007)*
2. *Gupta, B.R., Power System Analysis and Design, S. Chand (2009).*
3. *Nagrath, I.J. and Kothari, D.P., Power System Engineering, Tata McGraw Hill (2007).*
4. *Wadhwa, C.L., Electrical Power Systems, New Age International (P) Limited, Publishers (2008).*
5. *Chakrabarti, A., Soni, M.L., Gupta, P.V. and Bhatnagar, U.S., a Text Book on Power System Engineering, DhanpatRai (2008).*
6. *Electrical power systems Ashfaq Hussain CBS Publication 2009*

ANALOG AND DIGITAL CIRCUITS

L	T	P	C
3	0	0	3

(Common to EE & EEE 4TH Semester B. Tech Programme)

Course Educational Objectives

- CEO1:** To provide concepts that underpins the disciplines of Analog circuits, digital electronics and Microprocessor systems.
- CEO2:** To provide basic knowledge of designing Analog and digital circuits
- CEO3:** To provide the concept of various components.

Course Outcomes

- CO1:** Know the use and application of various voltage regulators and Analog electronic circuits.
- CO2:** Design and application of various circuits using OP-Amp.
- CO3:** Understand the basics of various digital circuits and its applications.
- CO4:** Design and develop combinational logic circuits.
- CO5:** Design and develop sequential logic circuits
- CO6:** Application of Analog and Digital circuits

Assessment Methods

Direct
16. Continuous assessment of skills 17. Class Test – 2Nos 18. Cycle Test – 2Nos 19. Semester End Examination
Indirect
6. Course End Survey 7. Feedback from Value Added Courses.

CO-PO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1		1									1		2
CO2	2	2	1	2									1		3
CO3	2	1											2		2
CO4	2	2		2									1		3
CO5	2	2	1										1		2

CO6			2									2		2
Avg.	2	1.6	2	1.6								1.3		2.3

SYLLABUS

Unit – I **[12 Hrs]**

Introduction to analog electronics. Various types of voltage regulators. Zener diode. Series and Shunt Regulator Regulator ICs 78XX, IC 79XX LED ,Schottky diode, Varactor diode Photo diodes, Liquid crystal Displays, Solar cells, Thermistor BJT Biasing DC operating point, BJT characteristics & parameters Different biasing circuits and its design Differential Amplifier, constant current source Current mirror FET and BJT comparison.

Unit – II: **[11 Hrs.]**

Introduction to Operational Amplifiers Block diagram representation, Ideal Op-amp, Equivalent circuit, Open-loop configuration, Transfer characteristics Frequency response. Basic op-amp applications IC 555 Timer,. Astable, and Monostable Multivibrator

Unit – III **[12 Hrs.]**

Number Systems and Codes Number system and its conversion Arithmetic operation and different codes in digital system Boolean Algebra and Logic Gates Theorems and Properties of Boolean Algebra, Standard SOP and POS form Reduction of Boolean functions using Algebraic method, K -map method Basic Digital Circuits Combinational Logic circuit Design.

Unit – IV **[09 Hrs.]**

Design SR, D, Flip Flop Design JK, , T Flip Flop Excitation Table JK Master Slave Flip Flop Flip-flop conversion.

Unit – V **[05 Hrs.]**

Shift Registers Bidirectional, Universal Shift Register UP/ DOWN Counter (Synchronous and Asynchronous) Ring and Johnson Counter..

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books / Reference Books:

11. Robert L. Boylestad, Louis Nashelsky, “Electronic devices and circuit Theory”, PHI
12. Ramakant A. Gaikwad, “Op-amp and linear Integrated circuits”, PHI
13. R. P. Jain, “Modern Digital Electronics”, Tata McGraw Hill.
14. Reference Book:
15. Martin s. Roden, Gordon L. Carpenter, William R. Wieserman “Electronic Design-From Concept to Reality”, Shroff Publishers and Distributors.
16. D. roy Choudhury, shail B .jain, “Linear integrated Circuits”, New age International Publisher
17. Jimmie j. Cathey, “Electronic Devices and Circuits”, Schaum's Outline,2nd Ed.
18. M. Morris Mano, Digital Design,6th Ed, Pearson ..