

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRICAL ENGINEERING ELECTRICAL POWER SYSTEM – I SUBJECT CODE: 2150908 B.E. 5th SEMESTER

Type of course: Engineering Science (Electrical)

Prerequisite: Nil

Rationale: NA

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
		PA	ALA		ESE	OEP				
3	0	0	3	70	20	10	0	0	0	100

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Supply Systems: Electric supply system, Typical AC power supply Scheme, Comparison of DC and AC transmission, Advantages of high transmission voltage, Various system of power transmission, Comparison of conductor material in overhead system, Comparison of conductor material in underground system, Comparison of various systems of transmission, Elements of a transmission line, Economics of power transmission, Economical choice of conductor size, Economic choice of transmission voltage, Requirement of satisfactory electric supply.	6	15
2	Mechanical Design of Transmission Lines: Main components of over head lines, Conductor materials, Line supports, insulators, Types of insulators, Potential distribution over suspension insulators, String efficiency, Methods of improving string efficiency, Sag in over head lines and sag calculations.	6	15
3	Inductance and Resistance of Transmission Line: Introduction, Definition of Inductance, Flux Linkages of an isolated current carrying conductor, Inductance of a single phase two wire line, Conductor types, Flux Linkages of one conductor in group, Inductance of composite conductor lines, Inductance of three phase lines, Double circuit three phase lines, Bundled conductors, Resistance, Skin effect and Proximity effect, Magnetic field induction.	8	15
4	Capacitance of Transmission Lines: Introduction, Electric field of a long straight conductor, Potential difference between two conductors of a group of parallel conductors, Capacitance of a two wire line, Capacitance of a three phase line with equilateral spacing, Capacitance of a three phase line with unsymmetrical spacing, Effect of earth on transmission line capacitance, Method of GMD, Bundled conductors, Electrostatic induction.	6	15
5	DC and AC distribution : Distribution system, classification of Distribution systems, AC distribution, DC distribution, Connection scheme	6	15

	of distribution system, Types of DC distributors, DC distribution calculations, DC distributor fed at one end, uniformly loaded distributor fed at one end, distributor fed at both ends, Distributor with both concentrated and uniform loading, Ring distributor, Ring main distributors with interconnector, AC distribution calculations, Methods of solving AC distribution problems, 3-phase unbalanced loads – 4 wire, Star connected unbalanced loads, Ground detectors.		
6	Representation of power system component: Introduction, Single phase Representation of balanced three phase networks, The one line diagram and impedance or reactance diagram, Per unit system, Advantages of pu system, Per unit representation of a transformer, Per unit impedance diagram of a power system, Complex power, The steady state model of synchronous Machine, Power factor and power control, Salient pole synchronous generator, Loading capability diagram [3], Power transformer, Transmission of electric power, System protection, Representation of load.	6	15
7	Underground cables: Underground cables, Construction of cables, Classification of cables, Cables for three phase services, Insulation resistance of a single core cable, Capacitance of a single core cable, Dielectric stresses in a single core cable, Most economical conductor size in a cable, Grading of cables, Capacitance grading and inter sheath grading, Capacitance of three core cable and measurement of capacitance.	6	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25%	25%	20%	15%	10%	5%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Modern Power System Analysis by D P Kothari and I J Nagrath : Fourth Edition: McGraw Hill [3, 4, 6]
2. Principles of Power System by V.K.Mehta and RohitMehta : Reprint 2014 : S. Chand [1, 2, 5, 7]
3. Power Systems Analysis : John J. Grainger and W. D. Stevenson Jr., Tata McGrawHill International.
4. Electrical Power systems: C. L .Wadhwa, 5th Edition, New Age InternationalPublishers.

Course Outcome:

After learning the course the students should be able to:

1. Understand Supply Systems
2. Explain mechanical design of transmission line
3. Calculation of line parameters (Resistance, inductance and capacitance)
4. Compare DC and AC distribution

5. Explain the representation of different power system components and loading capability of a generator
6. Describe underground cables

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.