

GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS (24)

BASIC POWER SYSTEMS

SUBJECT CODE: 2142404

B.E. 4th SEMESTER

Type of Course: Engineering Science (Electrical)

Prerequisite: 2110005 - Elements of Electrical Engineering

Rationale: This subject is oriented towards the study of Generation, Distribution and Transmission of Electricity and the understanding of Power Factor.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M) PA ALA		PA (V) ESE OEP		PA (I)		
3	0	0	3	70	20	10	30	0	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Electric Power and Generating Stations: Electric Power System – Sources of Electrical Energy – Generation, Transmission and Distribution of Electric Power Schematic Arrangement of Different Power Plants like Hydro, Thermal, Nuclear, Diesel, Solar, Wind, etc. – Other Renewable Sources of Energy – Gas Turbine Power Plant – Schematic Arrangement of Gas Turbine Power Plant – Comparisons of Various Power Plants	05	10
2	Power Factor Improvement: Power Factor – Power Triangle – Disadvantages of Low Power Factor – Causes of Low Power Factor – Advantages of Power Factor Improvement – Methods of Improving Power Factor – Calculations of Power Factor Correction – Most Economical Power Factor	04	10
3	Mechanical Considerations of Transmission Lines: Transmission Types: Overhead & Underground – Main Components of Overhead Lines – Conductor Materials – Line Supports – Insulators – String Efficiency – Corona Effect – Sag and Calculation of Sag in Overhead Transmission Line	04	10
4	Transmission Line Parameters: Constants of Transmission Lines – Flux Linkage in Current Carrying Conductors – Inductance of a Single Phase Two Wire Line and Composite Conductor Lines – Inductance of Three Phase Lines With Symmetrical and Unsymmetrical Spacing With and Without Transposition – Double Circuit Three Phase Lines – Bundled Conductors Resistance in Transmission Lines – Skin Effect – Proximity Effect Capacitance of a Single Phase and Three Phase Transmission Line	06	20
5	Performance of Transmission Lines: Representation of Power Systems Components – One Line Diagram	06	20

	and Impedance/Reactance Diagram – Per Unit (PU) System – Types of Overhead Transmission Line – Performance of Short, Medium and Long Transmission Lines – Ferranti Effect – Power Circle Diagram: Receiving End and Sending End Power Circle Diagram – Universal Circle Diagram – Concept of Symmetrical Components		
6	HVDC Transmission: Introduction – Converter Basics – Types of DC Links – Structure and Principles of HVDC Control – Converter Performance – Advantages and Disadvantages – Applications	05	10
7	Neutral Grounding: Grounding or Earthing – Isolated Neutral – Requirement and Advantages of Neutral Grounding – Earth Neutral Systems: Solid, Resistance and Resonant Grounding (Earthing) – Arc Suppression Coil Grounding (Resonant Grounding) – Voltage Transformer Earthing – Grounding (Earthing) Transformer	05	10
8	Sub-stations: Introduction – Classification of Sub-station – Types And Comparison of Sub-station – Symbols for Equipment in Sub-stations – Equipment in a Transformer Sub-stations – Bus-bar Arrangements in Substation – Under Ground Sub Stations	05	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
40%	40%	20%	0%	0%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate 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. Principles of Power System, Fourth Edition by V. K. Mehta & Rohit Mehta, S. Chand
2. Modern Power System Analysis, Fourth Edition by Kothari & Nagrath, McGraw Hill
3. Electrical Power Systems by C. L. Wadhwa, New Age
4. HVDC Power Transmission Systems by K. R. Padiyar, New Age
5. A Course in Electrical Power by Soni, Gupta & Bhatnagar, Dhanpat Rai
6. Utilization of Electric Power and Electric Traction by J. B. Gupta, Katson
7. Power System Analysis by J. B. Gupta, Katson

Course Outcomes:

This subject is focused on getting the student acquainted with the basic power system engineering which includes generation, transmission and distribution of electricity, different substations used and transmission line fundamentals.

After learning this course, the student should be able to:

1. Understand electric power generation, transmission and distribution.
2. Understand different power stations and transmission line performance parameters along with mechanical considerations for transmission line.
3. Understand power factor fundamentals, methods to improve the same and solve problems based on it.
4. Understand various types of sub stations used in electrical network.

5. Understand the importance of neutral grounding.

List of Open Source Software/learning website:

<http://nptel.iitm.ac.in/courses.php>

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – 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.