

ELEMENTS OF POWER SYSTEMS

Course Code: 20EEM101

L T P C

3 1 0 4

Prerequisites: Mathematics, Basic Electrical and Electronics Engineering / Principles of Electrical Engineering

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

- CO 1:** Explain the principle of operation of different types of conventional power generating stations(L2)
- CO 2:** Classify the transmission lines and analyze mechanical design calculations of transmission lines(L4)
- CO 3:** Compute the various factors associated with power distribution(L3)
- CO 4:** Design Illumination systems for various applications and distinguish the various heating and welding methods(L6)
- CO 5:** Describe and calculate tractive power and specific energy consumption(L2)

UNIT-I:

10

Lectures

CONVENTIONAL POWER GENERATING SYSTEMS & ECONOMICS OF POWER GENERATION

Thermal Power: Block Diagram of Thermal Power Station (TPS), Brief Description of TPS Components.

Hydro Power: Selection of Site, Classification, Layout, Description of Main Components.

Nuclear Power: Nuclear Fission and Chain Reaction-Principle of Operation of Nuclear Reactor and description of Main Components.

Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors, Numerical Problems.

Learning Outcome: The student will be able to

1. analyze different types of steam cycles and its efficiencies in a steam power plant (L3)
2. describe basic working principles of Hydro and Nuclear power plants (L3)
3. evaluate performance of power plants based on load variations (L5)

UNIT-II:

10

Lectures

CLASSIFICATION OF TRANSMISSION LINES AND MECHANICAL CONSIDERATIONS OF TRANSMISSION LINES

Classification of Transmission Lines - Short, medium and long line and their model representations - Nominal-T, Nominal-Pie, performance analysis of Transmission lines, Numerical Problems.

Sag and Tension Calculations with equal heights of towers, Effect of Wind and Ice on weight of Conductor.

Types of Insulators- String efficiency.

Learning Outcome: The student will be able to

1. classify the transmission lines (L2)
2. evaluate the Sag effect in transmission lines (L5)
3. classify various types of Insulators and calculate the String efficiency (L4)

**UNIT-III:
GENERAL ASPECTS OF DISTRIBUTION SYSTEMS**

10 Lectures

Types of Distribution Systems – Radial, Ring Main systems. Kelvin’s law-Limitations of Kelvin’s law, Voltage & Power factor correction methods. DC distributor fed at one end and both ends- concentrated loading, numerical problems. Equipments in a sub-station, Classification of sub-stations.

Learning Outcome: The student will be able to

1. distinguish between the different types of distribution systems (L2)
2. illustrate the power factor correction methods (L3)
3. understand the concept of substations (L2)

**UNIT-IV:
ELECTRIC HEATING, WELDING AND ILLUMINATION**

10 Lectures

Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating.

Electric welding, resistance and arc welding, comparison between A.C. and D.C. Welding.

Introduction, terms used in illumination, laws of illumination, polar curves, Types and design of lighting and flood lighting, Numerical problems.

Learning Outcome: The student will be able to

1. understand different methods of electrical heating (L2)
2. evaluate comparison between A.C. and D.C. Welding (L5)
3. analyze terms used in illumination, laws of illumination(L4)

**UNIT-V:
ELECTRIC TRACTION**

10 Lectures

Speed-time curves for different services – trapezoidal speed time curves. Calculations of tractive effort, power, specific energy consumption for a given run, Numerical Problems.

Learning Outcome: The student will be able to

1. apply Speed-time curves for different services (L3)
2. understand the effect of varying acceleration and braking retardation (L2)
3. understand the concept of coefficient of adhesion (L2)

TEXT BOOKS:

1. C.L.Wadhwa, “*Generation, Distribution and Utilization of Electrical Energy*” New Age International (P) Limited, 3rd Edition. (Unit- I,III, IV, V).
2. C.L.Wadhwa, “*Electrical Power Systems*” New Age International (P) Limited, 6th Edition, 2010, Reprint 2014. (Unit-II).

REFERENCES:

1. M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakrabarti, "*A Text Book on Power System Engineering*", Dhanpat Rai & Co. Pvt. Ltd., 1999, Reprint 2014.
2. S.N.Singh, *Electrical Power Generation, Transmission and Distribution*, PHI, 2003.