

**POWER SYSTEMS-I**

**Prerequisites:** Basic Electrical Engineering, Electrical Machines-I and Circuits Theory

**Objectives:**

1. To understand the conventional and non-conventional power generating stations.
2. To understand economic aspects of power generation.
3. To understand mechanical design of transmission lines and underground cables.
4. To understand and calculate Transmission line parameters

**UNIT 1: (~11 Lecture Hours)**

Introduction to Power systems and present -Day scenario.

**Thermal Power Stations:** Line diagram of Thermal Power Station (TPS)- Brief description of TPS components.

**Hydroelectric Power Stations:** Schematic arrangement of hydro-electric power station-types; Components of Hydro- electric power station. Estimation of power developed from a given catchment area; heads and efficiencies.

**Nuclear Power Stations:** Functional Block diagram of nuclear Power Station (NPS). Principle of operation of nuclear reactor. Brief description of NPS components.

**Gas Power Stations:** Principle of Operation and Components (Block Diagram Approach Only)

**Renewable Energy source:** Types of sources for power generation; Concept of Solar power generation and wind power generation.

**UNIT 2: (~9 Lecture Hours)**

**Economic Aspects of Power Generation:** Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors. Power factor - disadvantages of low power factor - causes of low power factor, power factor improvement techniques - Numerical problems.

**Tariff Methods:** Costs of Generation and their division into Fixed, Semifixed and Running Costs. Desirable Characteristics of a Tariff.-Tariff Methods: Flat Rate, Block-Rate, two-part, three -part and power factor tariff methods - Numerical Problems.

**UNIT 3: (~9 Lecture Hours)**

**Overhead Line Insulators:** Types of Insulators, String efficiency and Methods for improvement, Capacitance grading and Static Shielding- Numerical Problems.

**Sag and Tension Calculations:** Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of

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Conductor, Numerical Problems - Stringing chart and sag template and its applications.

**UNIT 4:** (~8 Lecture Hours)

**Underground Cables:** Types of Cables, Construction, Types of Insulating materials, Calculation of Insulation resistance and stress in insulation, Capacitance of Single and 3-Core belted cables, Grading of Cables - Capacitance grading - Description of Inter-sheath grading - Numerical Problems.

**UNIT 5:** (~8 Lecture Hours)

**Transmission Line Parameters:** Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase lines, concept of Geometrical Mean Radius(GMR) & Geometrical Mean Diameter(GMD), Calculation of capacitance for single phase and three phase lines, effect of ground on capacitance - Numerical Problems.

**Text Books:**

1. J.B. Gupta "A course in Power systems" s.k.kataria & sons publishers, 2016.
2. M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti "A Text Book on Power System Engineering", Dhanpat Rai & Co. Pvt. Ltd., 2009.
3. C.L.Wadhwa "Electrical Power Systems" New age International (P) Limited, Publishers, 7<sup>th</sup> edition, 2016.

**Reference Books:**

1. John J.Grainer & W.D.stevenson: power system analysis - McGraw Hill Education; 1 edition (1 July 2017)
2. S.N.Singh "Electrical Power Generation, Transmission and Distribution", second edition, PHI publications, 2008.
3. B.R.Gupta "Power system analysis and design" S.Chand & co publishers, 2005.

**Course Outcomes:**

The students will be able to:

1. Understand the operation of conventional generating stations like Thermal, Hydro, Nuclear and renewable energy sources.
2. Understand the economic aspects and tariff methods of power.
3. Understand design of Insulators, sag and tension.
4. Understand structure of different underground cables and design.
5. Understand transmission line parameters.
6. Calculate transmission line parameters.

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