II Year II Semester	L	Т	Р	С
17EE402	3	1	0	3

POWER SYSTEMS – I (GENERATION AND UTILIZATION)

Preamble:

Electrical Power plays significant role in day to day life of entire mankind. The aim of this course is to allow the students to understand the concepts of the generation and distribution of power along with economic aspects and Utilization

Learning Objectives:

- To study the principle of operation of different components of a thermal power nuclear power stations.
- To study the concepts of DC/AC distribution systems and voltage drop calculations.
- To study the constructional and operation of different components of an Air and Gas Insulated substations.
- To study different types of load curves and tariffs applicable to consumers.
- To understand the operating principles and characteristics of traction motors with
- respect to speed, temperature, loading conditions and To acquaint with the different types of heating and welding techniques.
- To study the basic principles of illumination and its measurement and to understand different types of lightning system including design.

Unit – I

Thermal and Nuclear Power Stations:

Thermal Power Station: Selection of site, general layout of a thermal power plant showing paths of coal, steam, water, air, ash and flue gasses, ash handling system, Brief description of components: Boilers, Super heaters, Economizers, electrostatic precipitators steam Turbines : Impulse and reaction turbines, Condensers, feed water circuit, Cooling towers and Chimney. **Nuclear Power Stations:** Nuclear Power Stations: Nuclear Fission and Chain reaction.-

Nuclear fuels.- Principle of operation of Nuclear reactor.-Reactor Components: Moderators, Control rods, Reflectors and Coolants.- Types of Nuclear reactors and brief description of PWR, BWR and FBR, Radiation hazards: Shielding and Safety precautions.

Unit – II

Distribution Systems:

Classification of distribution systems, design features of distribution systems, radial distribution, ring main distribution, voltage drop calculations: DC distributors for following cases - radial DC distributor fed at one end and at both ends (equal / unequal voltages), ring main distributor, stepped distributor and AC distribution, comparison of DC and AC distribution.

Unit – III Substations:

Air Insulated Substations - Indoor & Outdoor substations, Substations layouts of 33/11 kV showing the location of all the substation equipment. Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams.

Gas Insulated Substations (GIS) – Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, constructional aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

Unit – IV

Economic Aspects of Power Generation & Tariff:

Economic Aspects - Load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, power capacity factor and plant use factor, Base and peak load plants.

Tariff Methods- Costs of Generation and their division into Fixed, Semi-fixed and Running Costs, Desirable Characteristics of a Tariff Method, Tariff Methods: Simple rate, Flat Rate, Block-Rate, two-part, three-part, and power factor tariff methods.

Unit – V

Selection of Motors:

Choice of motor, type of electric drives, starting and running characteristics–Speed control– Temperature rise–Applications of electric drives–Types of industrial loads–continuous– Intermittent and variable loads–Load equalization.

Electric Heating & Welding

Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating – Arc furnaces – Direct and indirect arc furnaces Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding

Unit – VI

Illumination:

Introduction, terms used in illumination–Laws of illumination–Polar curves–Integrating sphere– Lux meter–Discharge lamps, MV and SV lamps – Lumen or flux method of calculation -Sources of light.

Various Illumination Methods:

Comparison between tungsten filament lamps and fluorescent tubes–Basic principles of light control– Types and design of lighting and flood lighting–LED lighting, principle of operation, street lighting and domestic lighting – Conservation of energy.

Course Outcomes:

- Students are able to identify the different components of thermal power plants and nuclear Power plants.
- Students are able to distinguish between AC/DC distribution systems and also estimate voltage drops of distribution systems.
- Students are able to identify the different components of air and gas insulated substations.
- Students are able to analyze the different economic factors of power generation and tariffs.
- Students are able to identify a suitable motor for electric drives and industrial applications and to identify most appropriate heating or welding techniques for suitable applications.

• Students are able to understand various level of illuminosity produced by different illuminating Sources and able to estimate the illumination levels produced by various sources and recommend the most efficient illuminating sources and should be able to design different lighting systems by taking inputs and constraints in view.

Text Books:

- 1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagarand A. Chakrabarti, DhanpatRai& Co. Pvt. Ltd.
- 2. Generation, Distribution and Utilization of Electric Energy by C.L.Wadhawa New age International (P) Limited, Publishers.
- 3. Utilization of Electric Energy by E. Openshaw Taylor, Orient Longman.

References:

- 1. Elements of Electrical Power Station Design by M V Deshpande, PHI, New Delhi.
- 2. A course in Power systems by J B Gupta S. K. KATARIA & SONS
- 3. Utilization of Electrical Power including Electric drives and Electric traction by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
- 4. Art & Science of Utilization of electrical Energy by Partab, DhanpatRai& Sons.