**23EE22T2-POWER SYSTEMS-I**

**(EEE)**

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| **Course Category:** | Professional core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Basic concepts of machines, renewable and non renewable sources. | **Sessional Evaluation: External Exam Evaluation:**  **Total Marks:** | 30  70  100 |

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| **Course Objectives** | Students undergoing this course are expected to learn: | | |
| 1. The different types of power plants, operation of power plants 2. The concepts of distribution systems, underground cables, economic aspects and tariff 3. About various substations that are located in distribution systems. 4. To apply the above concepts to illustrate different power generation layouts. 5. To Analyze various economic aspects related to power generation and distribution | | |
| **Course Outcomes** | After completing the course the student will be able to | | **Blooms level** |
| CO1 | Understand the different types of power plants, operation of power  plants | **L2** |
| CO2 | Understand the concepts of distribution systems, underground  cables, economic aspects and tariff | **L2** |
| CO3 | Understand various substations that are located in distribution  systems | **L2** |
| CO4 | Apply the above concepts to illustrate different power generation  layouts | **L3** |
| CO5 | Analyze various economic aspects related to power generation and  distribution | **L4** |
| **Course Content** | **UNIT I**  **Hydroelectric Power Stations:**  Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation  **Thermal Power Stations:**  Selection of site, general layout of a thermal power plant. Brief description of components: boilers, super heaters, economizers and electrostatic precipitators, steam turbines: impulse and reaction turbines, condensers, feed water circuit, cooling towers and chimney.  **UNIT II**  **Nuclear Power Stations:**  Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactorsand brief description of PWR, BWR and FBR. Radiation: radiation hazards and shielding, nuclear waste disposal.  **UNIT III**  **Substation**s:  **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. | | |

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|  | **Gas Insulated Substations (GIS)** – advantages of gas insulated substations, constructional aspects of GIS, comparison of air insulated substations and gas insulated substations.  **UNIT IV**  **Distribution Systems:**  Classification of Distribution systems, A.C Distribution, Overhead versus Underground system, Connection schemes of Distribution system, Requirements of Distribution system, Design considerations in Distribution system.  **Underground Cables:**  Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable. Capacitance of single and 3-Core belted Cables. Grading of cables: capacitance grading and intersheath grading.  **UNIT V**  **Economic Aspects & 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, plant 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, Time of Day (ToD) tariff and Time of Use (ToU) tariff. |
| **Text Books & Reference Books** | **Textbooks:**   1. S. N. Singh, Electric Power Generation, Transmission and Distribution, PHI Learning Pvt Ltd, New Delhi, 2nd Edition, 2010 2. J. B. Gupta, Transmission and Distribution of Electrical Power, S. K. Kataria and sons,10th Edition, 2012   **Reference Books:**   1. I. J. Nagarath & D.P. Kothari, Power System Engineering, McGraw-Hill Education, 3rd Edition, 2019. 2. C. L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy, New Age International Publishers, 6th Edition, 2018. 3. V. K. Mehta and Rohit Mehta, Principles of Power System, S. Chand, 4th Edition, 2005. 4. Turan Gonen, Electric Power Distribution System Engineering, McGraw-Hill, 1985. 5. Handbook of switchgear, BHEL, McGraw-Hill Education, 2007. |
| **E-**  **Resources** | 1. <https://nptel.ac.in/courses/108102047> 2. [http://iete-elan.ac.in](http://iete-elan.ac.in/) 3.<http://freevideolectures.com/university/iitm> |