

POWER SYSTEMS-I

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|--|-------------------|---------------------------------|-------|----------------------|-----------------------------|
| Course Code | 23EE3401 | Year | II | Semester(s) | II |
| Course Category | Professional Core | Branch | EEE | Course Type | Theory |
| Credits | 3 | L-T-P | 3-0-0 | Prerequisites | Electrical Circuit Analysis |
| Continuous Internal Evaluation: | 30 | Semester End Evaluation: | 70 | Total Marks: | 100 |

Course Outcomes

Upon successful completion of the course, the student will be able to

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| CO1 | Understand the layout and operation of different types of power plants, substations, cables, distribution system configurations, economic factors and tariffs.(L2) |
| CO2 | Apply the principles of physical sciences to understand different types of power plants, operation of power plants.(L3) |
| CO3 | Illustrate the different components of substations and cables.(L3) |
| CO4 | Analyze different economic factors of power generation, tariffs, performance of cables and distribution system configurations.(L4) |
| CO5 | Describe the layout and operation of power plants, substations, cables, distribution system configurations, economic variables, and tariffs, and submit a report. |

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | | | | | | | | | | | | | | |
| CO2 | 3 | | | | | 1 | 1 | | | | | | 2 | 2 |
| CO3 | 3 | | | | | | | | | | | | 2 | 2 |
| CO4 | | 3 | | | | | | | | | | | 2 | 2 |
| CO5 | | | | 3 | | | | | 3 | 3 | | | 2 | 2 |

SYLLABUS

| Unit No. | Contents | Mapped CO |
|-----------------|---|-------------------|
| I | <p>Hydroelectric Power Stations: Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation</p> <p>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.</p> | CO1 CO2 CO5 |
| II | <p>Nuclear Power Stations: Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components:</p> | CO1 CO2 CO5 |

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| | moderators, control rods, reflectors and coolants, types of nuclear reactors and brief description of PWR, BWR and FBR. Radiation: radiation hazards and shielding, nuclear waste disposal. | |
| III | <p>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, constructional aspects of GIS, comparison of air insulated substations and gas insulated substations.</p> | CO1 CO3 CO5 |
| IV | <p>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. Distribution Systems: Classification of Distribution systems, A.C Distribution, Overhead versus Underground system, Connection schemes of Distribution system, Requirements of Distribution system, and Design consideration factors in Distribution system.</p> | CO1 CO3 CO4 CO5 |
| V | <p>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.</p> | CO1 CO4 CO5 |

Learning Resources

Text Books

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. BHEL, "Handbook of switchgear", McGraw-Hill Education, 2007.

Online Learning Resources:

1. <https://nptel.ac.in/courses/108102047>