

S.E. (Electrical Engineering) (Semester- V)

Power System I

Scheme of Instructions		Scheme of Examination	
Lectures:	04 Hours/Week	Theory	100
Tutorial	----	Term work	50
Laboratory	2	OE	
Total	6	Total	150

Course Objectives

- C – I To explain the generation of Electric Energy by different sources
- C – II To describe the basic structure of power system and its components
- C – III To explain Distribution system with classification
- C – IV To discuss the overhead transmission line and Underground cables
- C – V To describe the importance and equipments used to improve the power factor.
- C – VI To explain Economic Aspects of Power Generation

1. Generation of Electric Energy and Power System Components (08 Hrs)

Schematic/ Block diagram of Hydro power plant, Thermal power plant, Nuclear power plant and Diesel power plants and their working. Basic structure of an AC power system, Distribution voltage level, Sub-transmission level, Single line diagram. Brief Description of Power system elements such as Synchronous Machine, Transformer, Bus bar, Circuit Breaker, isolator, CT, PT.

2. Distribution Systems (06 Hrs)

Classification of Distribution Systems, AC Distribution- Primary and Secondary Distribution systems, Overhead and Underground systems, Connection scheme of distribution system, Radial system, Ring main system, Interconnected systems, feeders and distributors, AC distribution calculations,

3. Overhead Transmission Lines and Underground Cables (10 Hrs.)

Types of conductors- Hard drawn copper, hard drawn aluminum, steel cored aluminum, ACSR, SSC, AAC, Smooth Body ACSR, Expanded ACSR, ACAR, bundled conductor, Resistance, inductance and capacitance for single and double circuit lines, skin effect and proximity effect.

Main components of over head lines, conductor materials, line supports, Types of line supports, insulators, types of insulators, potential distribution over suspension insulators, string efficiency, methods of improving string efficiency. Corona, factors affecting corona, important terms, advantages and disadvantages of corona, methods of reducing corona effect, sag in over head lines and sag calculations.

Construction and classification of cables for single and three phase service, Methods of laying underground cables.

4. Characteristics and Performance of Transmission Line: (10 Hrs.)

Short, medium and long lines, Voltages and currents at sending and receiving end of line, ABCD constants, Sending end and receiving power circle diagrams, universal power circle diagram, voltage and current waves, surge impedance loading of transmission line, Complex Power flow through transmission line, Power transmission capability, Ferranti effect, tuned power lines, methods of voltage control, voltage regulators, tap changing transformers, booster transformers, synchronous phase modifiers,.

5. Power Factor Improvement: (08 Hrs.)

Causes and disadvantages of Low power factor, power factor improvement Equipments-using Static capacitors, synchronous condensers, phase advancers, Calculation of Power factor correction; Importance of power factor improvement, Most economical power factor derivation. .

6. Economic Aspects of Power Generation (06 Hrs.)

Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, Utilization and plant use factors- Numerical Problems. Costs of Generation and their division into Fixed, Semi-fixed and Running Costs. Desirable Characteristics of a Tariff Method.-Tariff Methods: Flat Rate, Block-Rate, two-part, three –part, and power factor tariff methods

Note: Numericals are expected on units

Term work:

Term work should consist of following:

1. Minimum 2 drawing sheets based on above theory
2. Minimum 8 experiments based on above theory using softwares like MATLAB, MiPower, PSIM, EMTP, and ETAP.
3. Hand written Technical Report (after visiting sub-station):

Technical report should consist of following theoretical and practical aspects of Sub-stations

Type of Sub-station and it's location,

Major components of sub-station and their functions with single line diagram,

Different Bus bar arrangements (Single and Duplicate bus bar Systems) Ratings and make of sub-station equipment

Text Books

1. Modern Power System Analysis by I. J. Nagrath, D. P. Kothari, 3rd Edition, Tata McGraw Hill Publishing Co. Ltd., 2003.
2. Power System Analysis and Design by J.D.Glover and M.Sarma, 3rd Edition, Brooks/ Cole Publishing, 2002.
3. Electric Power Systems by Weedy B M, Cory B J, John Wiley Publication, latest edition
4. Power System Analysis by Grainger John J and W D Stevenson Jr. McGraw Hill, 1994
5. Power System Analysis by Hadid Sadat, McGraw Hill International, latest edition

Additional Reading:

- [1] M.V. Deshpande , Elements of power station design , Tata Mc Graw Hill
- [2] Electrical Power Systems by C.L.Wadhawa New age International (P) Limited, Publishers 1997. D.H.Bacon, Engineering Thermodynamics, London butterworth
- [3] P. K. Nag, Power plant Engineering - steam & nuclear, Tata Mc Graw Hill
- [4] Fredrick T. Morse. Power plant Engineering , east west press private Ltd
- [5] Mahesh Varma : Power plant Engineering , Metrolitan book Co Pvt Ltd
- [6] George W. Suttan (Editor) : Direct Energy Conversion , Latur university, Electronics series Vol-3, Mc Graw hill
- [7] Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003
- [8] Electrical India Magazine