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III Year B.Tech, EEE, I-Semester

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POWER SYSTEMS – II

Prerequisite: Power Systems -I, Electromagnetic fields

Course Objectives:

1. To understand performance of short, medium and long transmission lines.
2. To understand factors influencing performance of transmission lines and power transients.
3. To understand different substations and distribution system.
4. To understand voltage control and per unit representation.

UNIT-I (~12 Lecture Hours)

Performance of Transmission lines: Classification of Transmission Lines: Performance of Short and Medium Transmission Lines: model representations - Short, medium regulation and efficiency for symmetrical & Asymmetrical Networks- - Nominal-T, Nominal-π, A, B, C, D Constants, Numerical Problems.

Performance of Long Transmission Lines: Long Transmission Line model representation- Rigorous Solution, evaluation of A,B,C,D Constants, Surge Impedance and SIL of Long Lines, Equivalent-T and Equivalent π network models -Numerical problems.

UNIT-II (~10 Lecture Hours)

Various Factors Governing the Performance of Transmission Line: Skin and Proximity effects - Description and effect on Resistance of Solid Conductors - Ferranti effect – Charging Current - Effect on Regulation of the Transmission Line. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss- Numerical problems.

Power System Transients: Types of System Transients - Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T Junction, Lumped Reactive Junctions. Bewley's Lattice Diagrams -Numerical problems.

UNIT – III (~8 Lecture Hours)

Substations: Classification of substations: Air insulated substations - Indoor & Outdoor substations: layout and equipment. Different Bus bar arrangements in the Sub-Stations with relevant diagrams.

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

Per Unit representation of Power System:

Single line representation of Power system, impedance and reactance diagrams, Per-Unit Systems. Changing the base of per unit quantities. Advantages of p.u. systems- Numerical problems.

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UNIT-IV (~10 Lecture Hours)
Voltage Control and Compensation
Introduction-Methods of voltage control, shunt and Series capacitors and inductors, tap changing transformers, Synchronous Phase modifiers. Concepts of Load Compensation-Load ability characteristics of overhead lines, uncompensated transmission lines-symmetrical line-radial line with asynchronous load- compensation of lines- Numerical problems.

UNIT-V (~8 Lecture Hours)
D.C. Distribution Systems: Classification- Comparison of DC vs. AC and Under-Ground vs. Over Head Distribution Systems- Requirements and Design features of Distribution Systems-Voltage Drop Calculations- Radial D.C Distributor fed at one end and at both ends with equal and unequal Voltages - Ring Main Distributor- Numerical Problems.
A.C. Distribution Systems: Voltage Drop Calculations- power factor referred to receiving end voltage and w.r.t. load voltages- Numerical Problems.

TEXT BOOKS:

1. C.L.Wadhwa, "Electrical Power Systems", 7th edition, New Age International (P) Limited, 2016.
2. John J.Grainer & W.D. Stevenson, "Power System Analysis", 1st edition, McGraw Hill Education, 2017.
3. M. L. Soni, P. V. Gupta, U.S. Bhatnagar, A. Chakrabarthy, "Power System Engineering", Dhanpat Rai & Co Pvt. Ltd, 2013.

REFERENCE BOOKS:

1. J. Nagarath & D. P Kothari, "Power Systems Engineering", TMH, 2nd Edition, 2010
2. J.B. Gupta, "A course in Power systems", S.K.Kataria & Sons Publishers, 2016.
3. B. R. Gupta, "Power System Analysis and Design", S.Chand and Co, 2005.

Course Outcomes: The students will be able to:
1. Analyze the performance of small, medium and Long Transmission lines.
2. Understand various factors governing the performance of transmission lines and power transients.
3. Understand Air insulated and Gas Insulated Substations.
4. Understand Voltage control in power systems.
5. Understand per unit representation.
6. Analyze and Understand D.C and A.C distribution systems.