EE4T3   TRANSMISSION AND DISTRIBUTION   Credits: 4

Lecture: 4 periods/week   **Internal assessment: 30 marks**
Tutorial: 1 period /week   **Semester end examination: 70 marks**

Objective:
This course is an extension of Electrical Power Generation course. It deals with basic theory of transmission lines modelling and their performance analysis. Also this course gives emphasis on mechanical design of transmission lines, cables and insulators.

Learning outcomes:
1. Upon completing the course students are able to gain knowledge on various tansmission systems and their parameter calculations,
2. Students will understand the methods of improving power factor
3. Understand the various types of insulators and mechanical design of overhead lines underground cables
4. Understand the difference between AC & DC distribution systems

UNIT-I   Transmission Line Parameters:

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, - Numerical Problems.
Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT-II   Performance of Short and Medium Length Transmission Lines:

Classification of Transmission Lines -Short, medium and long line and their model   representations - Nominal-T, Nominal-Π and A,B,C,D Constants for symmetrical & Asymmetrical Networks, Numerical Problems.
Mathematical Solutions to estimate regulation and efficiency of all types of lines - Skin and Proximity effect – Ferranti effect, charging current, Corona, factors effecting corona, power loss - Numerical Problems.

UNIT-III Performance of Long Transmission Lines:

Long Transmission Line-Rigorous Solution, evaluation of A, B, C, D Constants, Interpretation of the Long Line Equations, Incident, Reflected and Refracted Waves -Surge Impedance and SIL of Long Lines, Wave Length and Velocity of Propagation of Waves - Representation of Long Lines - Equivalent-T and Equivalent Pie network models.

UNIT-IV Power factor and Voltage Control:

Causes of low p.f -Methods of Improving p.f -Phase advancing and generation of reactive KVAR using Static Capacitors-Most economical p.f. for constant KW load and constant KVA type loads, Numerical Problems.
Shunt Capacitors, Series Capacitors, Synchronous Capacitors and their location in the power system – Numerical problems

UNIT-V Insulators:
Types of Insulators, String efficiency and Methods for improvement, Numerical Problems - voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding.

Unit-VI Mechanical design of overhead transmission lines:
Sag and Tension Calculations - Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and Sag template and its applications.

UNIT-VII DC & AC Distribution systems:
Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems-
 D.C.Distribution Systems-Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.
 A.C.Distribution Systems-Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

UNIT-VIII Underground Cables:

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems.
Capacitance of Single and 3-Core belted cables, Numerical Problems.
Grading of Cables - Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

TEXT BOOKS:

1. Modern Power System Analysis by I.J.Nagarat and D.P.Kothari, Tata McGraw Hill, 2nd Edition.
2. Power system Analysis by John J Grainger William D Stevenson, TMC Companies, 4th edition
3. Electrical power systems by C.L.Wadhwa, New Age International (P) Limited, Publishers.

REFERENCE BOOKS:
1. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
2. Power System Analysis – by W.M.Stevenson,
3. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd.