COURSE CONTENT

POWER SYSTEM TRANSMISSION AND DISTRIBUTION								
IV Semester: EEE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AEEE11	**Core**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Electrical Machine								

I. COURSE OVERVIEW:

This course deals with the modeling, analysis and design of electrical power transmission lines. It gives an emphasis on overhead line insulators, underground cables, corona phenomena, sag and tension calculation, AC and DC distribution systems, substation design and equipment, voltage drop calculations in AC and DC distributors fed at one end or both ends. Also, a brief overview is presented about Indian grid scenario and the Indian Electricity rules

II. COURSE OBJECTIVES:

The students will try to learn:

I. The mathematical solutions for transmission line parameters of a single phase and three phase system.
II. The mathematical modeling of short, medium and long transmission lines along with the transient behavior.
III. The mechanical design of overhead transmission lines, the use of insulators and underground cables in electrical power transmission system.
IV. The requirements of distribution system, substation equipment and voltage drop calculations in AC and DC distributors.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1 Compute the line parameters and corona loss for electrical design of a transmission line system.
CO2 Model the short, medium and long transmission lines using ABCD constants for evaluating the performance of transmission system under no load and surge impedance loading conditions.
CO3 Examine the different types of insulators and the methods for improving string efficiency in the design of overhead transmission system.
CO4 Calculate the insulation resistance, capacitance and dielectric stress in underground cable transmission system to increase the efficiency and quality operation of cables.
CO5 Analyze the sag and tension for designing the overhead transmission line under various loading and weather conditions.
CO6 Determine the voltage drop in AC and DC distribution feeders and select the appropriate substation equipment for efficient distribution of electrical power to consumers

IV. COURSE CONTENT:

MODULE-I: TRANSMISSION LINE PARAMETERS (9)

Transmission line parameters: Types of conductors, simple diagrams of typical towers and conductors for 400, 220 and 132 kV operations, calculation of resistance for solid conductors, calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR and GMD, symmetrical and asymmetrical conductor configuration with and without transposition, numerical problems, capacitance calculations for symmetrical and asymmetrical single and three phase lines, single and double circuit lines, effect of ground on capacitance, numerical problems; Corona: Types, critical disruptive voltages, factors affecting corona, methods for reducing corona power loss, charge voltage diagram, audible noise, radio interference.

MODULE-II MODELLING AND PERFORMANCE OF TRANSMISSION LINES (10)

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 and asymmetrical networks, numerical problems, mathematical solutions to estimate regulation and efficiency of all types of lines, numerical problems; Long transmission line: Rigorous solution, evaluation of A, B, C, D constants, interpretation of the long line equations, methods of voltage control, Ferranti effect, incident, reflected and refracted waves, surge impedance and surge impedance loading of long lines, wave length and velocity of propagation of waves, representation of long lines, equivalent T and equivalent π network model, numerical problems.

MODULE-III: OVER HEAD INSULATORS AND UNDER GROUND CABLES (10)

Overhead insulators: Types of insulators, voltage distribution, string efficiency and methods for improvement, capacitance grading and static shielding, numerical problems.

Underground cables: Types of cables, construction, types of insulating materials, calculations of insulation resistance and stress in insulation, capacitance of single and three core belted cables, grading of cables, capacitance grading, description of inter sheath grading, numerical problems

MODULE-IV: MECHANICAL DESIGN OF TRANSMISSION LINES (9)

Sag and tension calculations: Sag and tension calculations with equal and unequal heights of towers, effect of wind and ice on weight of conductor, stringing chart and sag template and its applications, numerical problems.

MODULE-V: DISTRIBUTION SYSTEMS (10)

Distribution systems: Classification, comparison of DC vs AC and underground vs overhead, radial and ring main system, requirements and design features, Substation: Substation design, equipment's, types of substations, bus bar arrangement layout, bus schemes, location, Kelvin's law for the design of feeders and its limitations; voltage drop calculations in DC distributors: Radial DC distributor fed at one end and at both the ends (equal / unequal voltages) and ring main distributor, voltage drop calculations in AC distributors, power factors referred to receiving end voltage and with respect to respective load voltages, numerical problems; Basic concept of interconnected systems: Indian electricity rules, various voltage levels of transmission and distribution systems, Indian grid scenario...

V. TEXT BOOKS

1. C L Wadhwa, "Electric Power Systems", New age publications, New Delhi, 9th Edition, 2007.
2. Singh S N, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India Pvt. Ltd., New Delhi, 2nd Edition, 2002.
3. Turan Gonen, "Electrical Power Distribution System Engineering", CRC Press, 3rd Edition, 2014.
4. V Kamaraju, "Electrical Power Distribution Systems", TMH, Publication, Edition 2009

VI. REFERENCE BOOKS:

1. J B Gupta, "A Course in Power Systems", S K Kataria and Sons, 2013 Edition, 2013
2. D Kothari and I J Nagrath, "Power System Engineering", McGraw-Hill Education, 2nd Edition, 2007.
3. V K Mehta and Rohit Mehta, "Principles of Power System", S Chand, 3rd revised Edition, 2015
4. M L Soni, P V Gupta, U S Bhatnagar and A Chakrabarthy, "A Text Book on Power System Engineering", Dhanpat Rai and Co Pvt. Ltd., revised Edition, 2009.

VII. WEB REFERENCES

1. https://www.en.wikipedia.org/wiki/Electric_power_transmission
2. https://www.en.wikipedia.org/wiki/Electric_power_transmission
3. https://www.iec.ch/about/brochures/pdf/technology/transmission.pdf
4. https://www.teriin.org/upfiles/pub/papers/ft33.pdf
5. https://www.energy.gov/sites/prod/files/2015/09/f26/QTR2015-3F-Transmission-and-Distribution_1.pdf

VIII. MATERIALS ONLINE

1. Course Outline Description
2. Lecture notes
3. PowerPoint presentation
4. Definitions and Terminology
5. Tutorial Question Bank
6. Case Studies
7. Real life Examples
8. Complex Engineering Problems
9. Tech Talk Topics
10. Concept Video Topics.
11. Open-ended Exercises.
12. Assignments.
13. Model Question Paper – I
14. Model Question Paper – II
15. GATE Question Bank.
16. Previous Question Papers and Solutions.
17. Early Learning Readiness Videos (ELRV).