COURSE CONTENT

POWER SYSTEMS-II								
II Semester: EEE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
2540228	**Core**	3	0	0	3	40	60	100
Contact Classes:45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:45**		
Prerequisites: **Electrical Circuits-I & II and Power Systems–I.**								

Course Overview:

This course provides a comprehensive understanding of power transmission and distribution systems**.** Students learn the design and analysis of overhead transmission lines, including conductors, insulators, and sag/tension calculations, as well as the performance of short, medium, and long lines. The course covers voltage control, power factor improvement, and system compensation, introduces the per-unit system and travelling waves, and explains symmetrical components and fault analysis. It equips students with the knowledge to analyze, design, and maintain reliable and efficient power systems.

Course Objectives:

1. To understand the concepts of overhead transmission lines, line parameters, and insulator performance.
2. To explain the performance characteristics of transmission lines under different loading and line length conditions.
3. To describe the phenomena of corona, the methods of voltage control and compensation in power systems.
4. To illustrate the use of per-unit quantities and travelling wave phenomena in transmission line studies.
5. To develop the ability to compute fault currents using symmetrical component analysis for different types of faults.

Course Outcomes: After Completion of the Course, Students should be able to

1. Calculate transmission line parameters such as inductance and capacitance considering conductor configuration, GMR, GMD, and earth effects.
2. Analyze the performance of short, medium, and long transmission lines using equivalent circuit models.
3. Examine corona effects, voltage control methods, and power factor improvement techniques in power transmission systems.
4. Apply per-unit representation and travelling wave concepts to power system analysis.
5. Determine symmetrical components and fault currents for various fault conditions in power systems.

UNIT - I: Overhead Transmission Lines: Line conductors, Composite conductors transposition, bundled conductors, Inductance and capacitance of single phase and three phase lines with symmetrical spacing, and effect of earth on capacitance, skin and proximity effects.

Overhead Line Insulators: Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators, Sag and Tension calculations.

UNIT - II: Performance of Lines: Representation of lines, short transmission lines, medium length lines, nominal T and PI- representations, long transmission lines. The equivalent circuit representation of along Line, A, B, C, and D constants, Ferranti Effect.
Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Advantages and Disadvantages of corona, interference between power and Communication lines.

UNIT - III: Voltage Control & Power Factor Improvement: Introduction – methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers, power factor improvement methods.
Compensation in Power Systems: Introduction - Concepts of Load compensation — Load ability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line.

UNIT - IV: **Per Unit Representation of Power Systems:** The one-line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system.
Travelling Waves on Transmission Lines: Production of travelling waves, open circuited line, short-circuited line, line terminated through a resistance, line connected to a cable, Reflection and Refraction coefficients.

UNIT - V: Symmetrical Components and Fault Calculations: Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks, fault calculations, sequence network equations, single line to ground fault, line to line fault, double line to ground fault, three phase fault, faults on power systems, faults with fault impedance, reactors and their location, short circuit capacity of a bus.

TEXT BOOKS:

1. C.L.Wadhwa, "Generation, Distribution and Utilization of ElectricalEnergy",3rdEdition, New Age International, 2009.
2. D.P. Kothari and I.J.Nagrath, "Modern Power System Analysis", Tata Mc Graw Hill Pub.Co., New Delhi, Fourth edition, 2011.

REFERENCE BOOKS:

1. A.Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, "ATextbook on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.
2. W.D.Stevenson, "Elements of Power System Analysis", 4th Edition, Mc Graw Hill, 1984.
3. John J.Grainger &W.D.Stevenson, "Power System Analysis", Mc Graw Hill International, 1994.
4. Hadi Sadat, "Power System Analysis", Tata Mc Graw Hill Pub.Co. 2002.

ELECTRONIC RESOURCES:

1. https://www.electrical4u.com/overhead-transmission-lines/
2. https://www.electricaltechnology.org/2012/06/transmission-line-parameters.html
3. https://www.electrical4u.com/power-factor-improvement/
4. https://www.electrical4u.com/per-unit-system/
5. https://www.electrical4u.com/symmetrical-components/
6. https://archive.nptel.ac.in/courses/108/104/108104052/

MATERIALS ON LINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper–I
8. Model question paper–II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)