

COURSE TITLE	POWER SYSTEM-II
COURSE CODE	01EE2501
COURSE CREDITS	4

Objective:

- 1 The course is aimed to provide exposure about the modeling of power systems components and transmission lines and its performance analysis, fault analysis of power systems, and introduction to power factor improvement, corona discharge and transient phenomenon in power system.

Course Outcomes: After completion of this course, student will be able to:

- 1 Apply per unit system to various power system components.
- 2 Evaluate the performance of short, medium and long transmission lines.
- 3 Carry out symmetrical and unsymmetrical fault analysis in power system.
- 4 Describe power factor improvement methods, various disturbances and transients in power system.

Pre-requisite of course:Power System– I

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Representation of Power System Components One line and impedance diagram, Per unit system, Per unit representation of transformer, Per unit impedance diagram of power system, Examples – per unit system and impedance diagram	4
2	Transmission Line Modelling and Performance Introduction, Short transmission line, Medium transmission line, Long transmission line – Rigorous solution, Evaluation of ABCD constants, Interpretation of long line equations, Ferranti effect, Tuned power lines, Power through a transmission line, Circle diagrams, Methods of voltage control	9
3	Symmetrical Fault Analysis Introduction, Transient on a transmission line, Short circuit of a synchronous machine on no load, short circuit of a loaded synchronous machine, ZBUS building algorithm (Type – 1, 2, 3, 4 modifications)	4

Contents : Unit	Topics	Contact Hours
4	Unsymmetrical Fault Analysis Symmetrical component transformation, Sequence impedances of transmission lines, Sequence - impedances and networks of synchronous machine and transformers, Construction of sequence networks of a power system, Symmetrical component analysis of unsymmetrical faults, Single line to ground fault, Line to line fault, Double line to ground fault, Open conductor faults	10
5	Various phenomenon in Power System Corona Discharge: Causes and consequences of Corona Discharge phenomenon, Effect of corona discharge on transmission line performance, Transients in Power Systems: Causes and consequences of over-voltages, Switching and lightning transients, Protection against over-voltages, Travelling waves on transmission lines under various operating conditions, Attenuation of travelling waves, Capacitance switching, Arcing ground	9
6	Power factor improvement Need of power factor improvement, power factor improvement – static capacitor, synchronous condenser, phase advancer, Calculations of power factor correction, Importance of power factor improvement, Most economical power factor	6
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment-1 Determine Voltage Regulation & Transmission Efficiency of a short transmission line.	2
2	Experiment-2 Determine voltage regulation & transmission efficiency of a medium transmission line using end condenser and nominal-T method.	2
3	Experiment-3 Determine voltage regulation & transmission efficiency of a medium transmission line using nominal-p method.	2
4	Experiment-4 Analyse the performance of long transmission line for specified load impedance.	2
5	Experiment-5 Develop program for formulation of ZBUS matrix through ZBUS building algorithm.	2
6	Experiment-6 Simulate transient in series R-L circuit with special attention to change in DC offset current for application of excitation at different instant.	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
7	Experiment-7 Develop program to transform three phase unbalanced phasor into its symmetrical components.	2
8	Experiment-8 Develop program to transform symmetrical components into its original phasors.	2
9	Experiment-9 Analyze three phase fault on terminal of unloaded synchronous generator.	2
10	Experiment-10 Analyze L-L, L-G & L-L-G fault in power system.	2
11	Experiment-11 Simulation of switching transient in power system.	2
Total Hours		22

Textbook :

- 1 Modern Power System Analysis, D. P. Kothari, I J Nagrath, R K Saket, McGraw Hill, 2022
- 2 Electrical Power systems, C. L .Wadhwa, New Age International Publishers, 2016
- 3 Principles of Power System, V. K. Mehta, Rohit Mehta, S. Chand Publications , 2005

References:

- 1 Power System Analysis, Power System Analysis, Hadi Saadat, Mc-GrawHill series publication, 2004
- 2 Power System Analysis, Power System Analysis, John Grainger, William Stevenson, Jr., McGraw Hill Education, 2017
- 3 Electrical Transients in power systems, Electrical Transients in power systems, 8. Allan Greenwood, Wiley-Interscience, 2018
- 4 Computer Techniques in Power System Analysis, Computer Techniques in Power System Analysis, M. A. PAI, McGraw Hill , 2006

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	20.00	25.00	25.00	10.00	10.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs, etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and classroom.
- 3 Practical examinations will be conducted at the end of the semester to evaluate the performance of students in the laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, and Virtual Laboratory.

Supplementary Resources:

- 1 https://swayam.gov.in/nd1_noc19_ee61/preview
- 2 https://swayam.gov.in/nd1_noc19_ee62/preview
- 3 <https://www.powerworld.com/download-purchase/demo-software/simulator-demo-download>
- 4 <http://vp-dei.vlabs.ac.in/Dreamweaver/list.html>