Course code	Course Name	L-T-P - Credits	Year of Introduction
EE306	POWER SYSTEM ANALYSIS	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To enable the students to analyse power systems under normal and abnormal conditions.
- To understand the need for load flow analysis and different methods
- To understand power system modeling
- To understand the need for stability studies and their analysis

Syllabus

Per unit quantities - modeling of power system components - methods of analyzing faults in symmetrical and unsymmetrical case - load flow studies - Automatic Generation Control - Automatic voltage control – Economic load dispatch - Unit commitment - Power system stability - Solution of swing equation - Methods of improving stability limits

Expected outcome .

The students will be able to:

i. Analyse power systems under normal and abnormal conditions.
ii. Carry out load flow studies under normal and abnormal conditions

References:

1. Cotton H. and H. Barber, Transmission & Distribution of Electrical Energy, 3/e, Hodder and Stoughton, 1978.
2. Gupta B. R., *Power System Analysis and Design*, S. Chand, New Delhi, 2006.
3. Gupta J.B., Transmission *& Distribution of Electrical Power*, S.K. Kataria & Sons, 2009.
4. Hadi Saadat, *Power System Analysis*, 2/e, McGraw Hill, 2002.
5. Kothari D. P. and I. J. Nagrath, *Modern Power System Analysis*, 2/e, TMH, 2009.
6. Kundur P., *Power system Stability and Control*, McGraw Hill, 199
7. Soni, M.L., P. V. Gupta and U. S. Bhatnagar, *A Course in Electrical Power*, Dhanpat Rai & Sons, New Delhi, 1984.
8. Stevenson W. D., *Elements of Power System Analysis*, 4/e, McGraw Hill, 1982.
9. Uppal S. L. and S. Rao, *Electrical Power Systems*, Khanna Publishers, 2009.
10. Wadhwa C. L., *Electrical Power Systems*, 33/e, New Age International, 2004.
11. Weedy B. M., B. J. Cory, N. Jenkins, J. B. Ekanayake and G. Strbac, *Electric Power System*, John Wiley & Sons, 2012.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Per unit quantities-single phase and three phase-selection of base quantities -advantages of per unit system –changing the base of per unit quantities-Simple problems.	2	15%
	Modelling of power system components - single line diagram – per unit quantities. Symmetrical components- sequence impedances and sequence networks of generators, transformers and transmission lines.	3	
II	Methods of analyzing faults in symmetrical and unsymmetrical case- effects of faults - Power system faults - symmetrical faults - short circuit MVA - current limiting reactors-	8	15%

	Unsymmetrical faults - single line to ground, line to line, double line to ground faults -consideration of prefault current-problems.		
FIRST INTERNAL EXAMINATION			
III	Load flow studies – Introduction-types-network model formulation - formation of bus impedance and admittance matrix, Gauss-Siedel (two iterations), Newton-Raphson (Qualitative analysis only) and Fast Decoupled method (two iterations) - principle of DC load flow.	8	15%
IV	Automatic Generation Control: Load frequency control: single area and two area systems - Automatic voltage control.	6	15%
SECOND INTERNAL EXAMINATION			
V	Economic Operation - Distribution of load between units within a plant - transmission loss as a function of plant generation - distribution of load between plants - Method of computing penalty factors and loss coefficients.	5	20%
	Unit commitment: Introduction — Constraints on unit commitments: Spinning reserve, Thermal unit constraints-Hydro constraints. -	2	
VI	Power system stability - steady state, dynamic and transient stability-power angle curve-steady state stability limit	3	20%
	Mechanics of angular motion-Swing equation – Solution of swing equation - Point by Point method - RK method - Equal area criterion application - Methods of improving stability limits.	5	
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3Hourrs.

Part A: 8 compulsory questions.

One question from each module of Modules I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x5)=40

Part B: 3 questions uniformly covering Modules I & II. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part C: 3 questions uniformly covering Modules III & IV. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part D: 3 questions uniformly covering Modules V & VI. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.