

Course code	Course Name	L-T-P - Credits	Year of Introduction
EE306	POWER SYSTEM ANALYSIS	3-0-0-3	2016
<b>Prerequisite: Nil</b>			
<b>Course Objectives</b>			
<ul style="list-style-type: none"> <li>• To enable the students to analyse power systems under normal and abnormal conditions.</li> <li>• To understand the need for load flow analysis and different methods</li> <li>• To understand power system modeling</li> <li>• To understand the need for stability studies and their analysis</li> </ul>			
<b>Syllabus</b>			
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			
<b>Expected outcome .</b>			
The students will be able to:			
<ol style="list-style-type: none"> <li>i. Analyse power systems under normal and abnormal conditions.</li> <li>ii. Carry out load flow studies under normal and abnormal conditions</li> </ol>			
<b>References:</b>			
<ol style="list-style-type: none"> <li>1. Cotton H. and H. Barber, <i>Transmission &amp; Distribution of Electrical Energy</i>, 3/e, Hodder and Stoughton, 1978.</li> <li>2. Gupta B. R., <i>Power System Analysis and Design</i>, S. Chand, New Delhi, 2006.</li> <li>3. Gupta J.B., <i>Transmission &amp; Distribution of Electrical Power</i>, S.K. Kataria &amp; Sons, 2009.</li> <li>4. Hadi Saadat, <i>Power System Analysis</i>, 2/e, McGraw Hill, 2002.</li> <li>5. Kothari D. P. and I. J. Nagrath, <i>Modern Power System Analysis</i>, 2/e, TMH, 2009.</li> <li>6. Kundur P., <i>Power system Stability and Control</i>, McGraw Hill, 199</li> <li>7. Soni, M.L., P. V. Gupta and U. S. Bhatnagar, <i>A Course in Electrical Power</i>, Dhanpat Rai &amp; Sons, New Delhi, 1984.</li> <li>8. Stevenson W. D., <i>Elements of Power System Analysis</i>, 4/e, McGraw Hill, 1982.</li> <li>9. Uppal S. L. and S. Rao, <i>Electrical Power Systems</i>, Khanna Publishers, 2009.</li> <li>10. Wadhwa C. L., <i>Electrical Power Systems</i>, 33/e, New Age International, 2004.</li> <li>11. Weedy B. M., B. J. Cory, N. Jenkins, J. B. Ekanayake and G. Strbac, <i>Electric Power System</i>, John Wiley &amp; Sons, 2012.</li> </ol>			
<b>Course Plan</b>			
Module	Contents	Hours	Sem. Exam Marks
<b>I</b>	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	
<b>II</b>	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.		
<b>FIRST INTERNAL EXAMINATION</b>			
<b>III</b>	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%
<b>IV</b>	Automatic Generation Control: Load frequency control: single area and two area systems - Automatic voltage control.	6	15%
<b>SECOND INTERNAL EXAMINATION</b>			
<b>V</b>	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	
<b>VI</b>	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	
<b>END SEMESTER EXAM</b>			

**QUESTION PAPER PATTERN:**

Maximum Marks: 100

Exam Duration: 3Hours.

**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.