

EE309: POWER SYSTEM ANALYSIS
CREDITS = 5 (L=3, T=0, P=2)

Course Objective:

The course aims to:

1. Understand the concept of various types of faults on power system.
2. Utilize the concepts of symmetrical components to analyze and evaluate the currents and voltages during faults in power system networks.
3. Understand the power flow methods.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P		Theory		Practical		Total Marks
			ESE	CE	ESE	CE		
3	0	2	5	70	30	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1.	<p><u>Symmetrical Three-Phase Faults:</u></p> <p>Transients in RL Series circuits, Short-Circuit currents and the reactance of Synchronous machines, Internal voltages of loaded machines under transient conditions, The bus impedance matrix in fault calculations, A bus impedance matrix equivalent network, The selection of circuit breakers.</p>	06
2.	<p><u>Symmetrical Components:</u></p> <p>Synthesis of Unsymmetrical Phasors from their symmetrical components, The symmetrical components of unsymmetrical Phasors, Phase shift of symmetrical components in Star-Delta Transformer Banks, Power in terms of symmetrical components, Sequence circuits of Y and Δ impedances, Sequence circuits of a symmetrical transmission line, Sequence circuits of the synchronous machine, Sequence circuits of a Y- Δ transformer, Unsymmetrical series impedances, Sequence networks.</p>	08
3.	<p><u>Unsymmetrical Faults:</u></p> <p>Single line to ground fault on an unloaded generator, Line to Line fault on an unloaded generator, Double Line to Ground fault on an unloaded generator, Unsymmetrical faults on power systems, Single line to Ground fault on a power system, Line to Line fault on a power system, Double Line to Ground fault on a power system, Interpretation of the interconnected sequence networks, Analysis of unsymmetrical faults using the bus impedance matrix, Faults through impedance, Computer calculations of fault currents.</p>	08

Unit No.	Topics	Teaching Hours
4	<u>Network Formation and Calculations:</u> Introduction, Bus Admittance matrix, formation of Ybus Using step by step method, formation of Y bus and Z bus using singular transformation.	07
5	<u>Power Flow Solutions:</u> Power flow equations and methods of solution, approximate power flow study, gauss seidel method for power flow studies, Newton raphson method for power flow studies, fast decoupled power flow, comparison of power flow studies.	08
6	<u>Optimal Dispatch of Generation:</u> Introduction, nonlinear function optimization, operating cost of a thermal power plant, economic dispatch neglecting losses and no generator limits, economic dispatch neglecting losses and including generator limits, economic dispatch including losses, derivation of loss formula. Loss co-efficient & Exact loss co-efficient.	08
TOTAL		45

References books:

1. D P Kothari and I J Nagrath. "Modern Power System Analysis", 4th Edition, McGraw Hill.
2. B R Gupta. "Power system Analysis and Design", 6th Edition, S Chand and Company.
3. John J Grainger and William D Stevenson Jr. "Power System Analysis", Indian Edition. McGraw Hill Education
4. Hadi Saadat, "Power system Analysis", 2th Edition, Tata McGraw-Hill, 2002.
5. C. L .Wadhwa, "Electrical Power Systems", 6th Edition New Age International publishers.
6. J. Duncan Glover and Mulukutla S Sharma, "Power system Analysis and Sharma", 5th Edition Cengage Learning, Stamford USA...

Web Resources:

1. Module two and three of the web course on power system Analysis available on NPTEL website. <http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/power-system/ui/TOC.htm>
2. <http://nptel.ac.in/courses/108105067>
3. <http://www.nptelvideos.in/2012/11/power-sys-generation-transmission.html>

Course Outcomes (Cos):

At the end of this course students will be able to ...

- CO1. Analyze the three-phase faults and determine fault (short-circuit) currents
- CO2. Understand the concept of symmetrical components
- CO3. By utilizing the symmetrical component techniques, determine Short-circuit currents for different unsymmetrical faults.
- CO4. Understand and carry out the Formation of Impedance and Admittance matrices.
- CO5. Understand and carry out the load flow analysis for power system.
- CO6. Understand and perform the Economic Dispatch of Generation.