III Year II Semester **L T P C**

Code: 20EE6011 **3 0 0 3**

POWER SYSTEM ANALYSIS

Preamble: The course is planned to give students the regarding the formation of Z_{bus}, calculation of power flows using various approaches and importance of the short circuit analysis, steady state and transient stabilities of the power systems.

Course Objectives

1. To develop impedance diagram (p.u), formation of Y_{bus} and Z_{bus}
2. To study the different load flow methods.
3. To study short circuit calculation for symmetrical faults
4. To study the effect of unsymmetrical faults and their effects.
5. To study the rotor angle stability of power systems.

Course Outcomes

1. Able to evaluate the per unit quantities and to form Y_{bus} and Z_{bus} for a power system networks.
2. Able to analyze the load flow solution of a power system using different methods.
3. Able to determine the fault currents for various faults to design the protecting devices.
4. Able to find the sequence components of currents for unbalanced power system network.
5. Able to analyze the steady state, transient and dynamic stability concepts of a power system.

CO – PO & CO – PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3			2								3	2	
CO 2	3	3	3	2	3								3	3	
CO 3	3	3	1	1									3	2	
CO 4	3	2	1	1									3	2	
CO5	3	2	1	1	2								3	2	

1 – Weak, 2 – Moderate and 3 - Strong

Unit – I: Per Unit Representation & Network Topology 12 Hours

Per Unit Quantities–Single line diagram– Impedance diagram of a power system–Graph theory definition – Formation of element node incidence and bus incidence matrices –Primitive network representation – Formation of Y–bus matrix by singular transformation and direct inspection methods - Formation of Z_{bus}: Algorithm for the Modification of Z_{bus} Matrix (without mutual impedance).

Unit – II: Power Flow Studies 12 Hours

Necessity of power flow studies – Derivation of static power flow equations – Power flow solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar

coordinates form) –Decoupled and Fast Decoupled methods – Algorithmic approach –Problems on 3–bus system only.

Unit – III: Symmetrical Fault Analysis **12 Hours**

Transients on a Transmission line-Short circuit of synchronous machine(on no-load) – 3– Phase short circuit currents and reactances of synchronous machine–Short circuit MVAcalculations - Series reactors – selection of reactors.

Unit – IV: Symmetrical Components & Fault analysis **12 Hours**

Definition of symmetrical components - symmetrical components of unbalanced three phase systems – Power in symmetrical components – Sequence impedances – Synchronous generator – Transmission line and transformers – Sequence networks –Various types of faults LG– LL– LLG and LLL on unloaded alternator–unsymmetrical faults on power system.

Unit – 5: Power System Stability Analysis **12 Hours**

Elementary concepts of Steady state– Dynamic and Transient Stabilities– Description of Steady State Stability Power Limit–Transfer Reactance–Synchronizing Power Coefficient –Power Angle Curve and Determination of Steady State Stability –Derivation of Swing Equation– Determination of Transient Stability by Equal Area Criterion–Applications of Equal Area Criterion–Methods to improve steady state and transient stability.

Text Books:

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
2. Modern Power system Analysis – by I. J. Nagrath& D. P. Kothari: Tata McGraw–Hill Publishing Company, 2nd edition.

Reference Books:

1. Power System Analysis – by A. R. Bergen, Prentice Hall, Inc.
2. Power System Analysis by Hadi Saadat – TMH Edition.
3. Power System Analysis by B. R. Gupta, Wheeler Publications.
4. Power System Analysis and Design by J. Duncan Glover, M. S. Sarma, T. J. Overbye Cengage Learning publications.