III Year-II Semester		L	T	P	C
		4	0	0	3

POWER SYSTEM ANALYSIS (R1632022)

Prerequisite Course: Power Systems-II.

Course Description and Objectives:

The course is designed to give students the required knowledge for the design and analysis of electrical power grids. Calculation of power flow in a power system network using various techniques, formation of Zbus and its importance are covered in this course. It also deals with short circuit analysis and analysis of power system for steady state and transient stability.

Objectives:

1. To development the impedance diagram (p.u) and formation of Ybus
2. To study the different load flow methods.
3. To study the concept of the Zbusbuilding algorithm.
4. To study short circuit calculation for symmetrical faults
5. To study the effect of unsymmetrical faults and their effects.
6. To study the rotor angle stability of power systems.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes.

Cos	Course Outcomes	Pos
1	Able to draw impedance diagram for a power system network and to understand per unit quantities.	5
2	Able to form aYbusand Zbusfor a power system networks.	2
3	Able to understand the load flow solution of a power system using different methods.	4
4	Able to find the fault currents for all types faults to provide data for the design of protective devices.	4
5	Able to findthe sequence components of currents for unbalanced power system network. motor.	4
6	Able to analyze the steady state, transient and dynamic stability concepts of a power	5

Syllabus:

UNIT–I:

Per Unit Representation & Topology

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.

UNIT–II:

Power Flow Studies

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:

Z–Bus formulation

Formation of Z–Bus: Partial network– Algorithm for the Modification of Zbus Matrix for addition element for the following cases: Addition of element from a new bus to reference– Addition of element from a new

bus to an old bus– Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems).– Modification of Z–Bus for the changes in network (Problems).

UNIT–IV:

Symmetrical Fault Analysis

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 MVA calculations -Series reactors – selection of reactors.

UNIT-V

Symmetrical Components & Fault analysis

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-VI

Power System Stability Analysis

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 HadiSaadat – 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 – CengageLearning publications.