JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE STRUCTURE-R19

III Year – II SEMESTER		L	T	P	C
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POWER SYSTEM ANALYSIS

Preamble:
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 Z_{bus} 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.

Learning Objectives:
- To development the impedance diagram (p.u) and formation of Y_{bus}
- To study the different load flow methods.
- To study the concept of the Z_{bus}building algorithm.
- To study short circuit calculation for symmetrical faults
- To study the effect of unsymmetrical faults and their effects.
- To study the rotor angle stability of power systems.

UNIT –I:
Circuit Topology & Per Unit Representation
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 - Per Unit Quantities–Single line diagram– Impedance diagram of a power system.

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 Algorith & Symmetrical Fault Analysis:
Formation of Z_{bus}**:** Algorithm for the Modification of Z_{bus} Matrix (without mutual impedance).

Symmetrical Fault Analysis:
Reactances of Synchronous Machine – Three Phase Short Circuit Currents - Short circuit MVA calculations for Power Systems.

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UNIT –IV:
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 for numerical problems only.

UNIT – V:
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.

`Learning Outcomes:
After the completion of the course the student should be able to:

- draw impedance diagram for a power system network and to understand per unit quantities.
- form a Y_{bus} and Z_{bus} for a power system networks.
- understand the load flow solution of a power system using different methods.
- find the fault currents for all types faults to provide data for the design of protective devices.
- find the sequence components of currents for unbalanced power system network.
- analyze the steady state, transient and dynamic stability concepts of a power system.

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 – Cengage Learning publications.