Course Name Power System-II

Course Code EE602

Course Credit 3

Contact Hour 2L+1T

Prerequisite Power System I(EE502) Electrical Machine I & II(EE401 & EE 501)

Course Objective

The objectives of this course are

1. To prepare students to analysis of Electrical Power system Network to implement in Power Industry and Job.
2. To teach and learn about different types of load flow analysis, so that empowers students to understand the solution technique of power distribution and calculation of different parameters.
3. To understand different types of protection scheme which is implements for power system protection
4. To analyze power requirements, stability of power capability, efficiency, operating characteristics, control requirements and electrical demands of various machines and also get idea of fault calculation.

Course Outcome

On completion of the course students will be able to

1. Gain the knowledge about the dynamic mechanisms behind angle and voltage stability problems ,fault analysis in electric power systems
2. Formulate and then analyze the working process of different load flow solution technique using mathematical model under loaded and unloaded conditions.
3. Understand and explain the principle of operation and performance of different types of relay, circuit breakers and implies it in different protection scheme.
4. Formulate and then analyze the different fault calculations.
5. Developed knowledge and skills of design of 11KV, 33KV,66 KV substation

CO Mapping with departmental POs

H: High, M: Medium, L: Low

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	H	H	M	H	M							
CO 2	H	M	L	H	H							
CO 3	H	H	L	H	H							
CO 4	H	H	M	H								
CO5	H	H	L									

Course Content

Module I: Representation of Power system components **2L**

Single-phase representation of balanced three phase networks, the one-line diagram and the impedance or reactance diagram, per unit (PU) system.

Module II: Distribution substation: **6L**

Types of substations, location of substations, substation equipments and accessories, earthling (system & equipment), feeder and distributors, radial and loop systems

Module III: Load flow studies **8L**

Network model formulation, formation of Y bus , load flow problem, Gauss-Siedel method, Newton-Raphson method, Decoupled load flow studies, comparison of load flow methods.

Module IV: Faults in Electrical systems **8L**

Transient on a transmission line, short circuit of a synchronous machine under no load & loaded condition. Symmetrical component transformation, sequence impedance and sequence network of Power system, synchronous machine, transmission lines and transformers. Symmetrical component analysis of unsymmetrical faults, single line-to –ground fault, line-to-line fault, double line-to- ground fault.

Module V: Power system stability **8L**

Steady state stability, transient stability, equal area criteria, swing equation, multi machine stability concept, Voltage stability, Voltage Collapse, Power Quality Improvement, and Islanding of Grid.

Module VI: Power system protection **16L**

Protective zones, Relaying elements and quantities. Protective relays, basic requirements and type of protection, phase and amplitude comparator, grading (time & current), classification of Electromagnetic relays, Directional relay, Distant relay, Differential relay, basic aspects of static and digital relays, relay protection scheme for transformer, feeder, generators and motors.

Circuit breakers, circuit breaking transients, transient recovery voltage, current chopping and resistance switching, circuit breaker rating, arc and arc extinction, circuit breaker types, oil circuit breaker, vacuum circuit breaker, air blast circuit breaker, SF6 circuit breaker and operating mechanism, advantages and disadvantages of different types.

Text Books

1. Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.
2. Electrical Power Systems, Subir Ray, PHI
3. Switchgear protection and power systems, Sunil S Rao, Khanna Publications.
4. A text book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S. Bhatnagar & A. Chakrabarti, Dhanpat Rai & CO

Reference Books

1. Protection & Switchgear, B. Bhalja, R.P. Maheshwari, N.G.Chothani, Oxford.
2. Power system protection & switchgear, B.Ram & D.N. Vishwakarma, Tata McGraw Hill.
3. Handbook of Electrical Power Distribution, G. Ramamurthy, University Press
4. Electric Power Transmission and Distribution, S. Sivanagaraju, S.Satyanarayana, Pearson Education.
5. Power Systems Stability, Vol. I,II & II, E.W. Kimbark, Wiley.
6. Power Engineering, D.P Kothari & I.J. Nagrath, Tata McGraw Hill.
7. Power Systems Analysis, A. R. Bergen & V. Vittal, Pearson Education.
8. Computer Aided Power systems analysis, Dr. G. Kusic, CEC press.