

8th Semester

POWER SYSTEM PROTECTION (3-0-0)

MODULE-I

(10 Hours)

Introduction and Basic Principles: Basic Idea of relay protection, Nature and causes of faults, Zones of protection, Primary and back-up protection, Basic principle of operation of protective system, Methods of discrimination, Derivation of single phase quantity from three phase quantity, Components of Protection.

Relay (Principle, Construction and Characteristics): Relay classification, Principal Types of Electromagnetic relays, Theory of Induction relay torque, Relay design and construction, General Equations of Comparators and Electromagnetic Relays, Over Current relays, Directional relays, Distance relays, Differential relays. Book-1: CH 1.1, 1.2, 1.5, 1.7, 1.8, 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 3.4, 4.2, 4.3, 4.4, 4.7, 4.8, 4.9.

MODULE-II

(12 Hours)

Fault analysis using symmetrical components: Symmetrical & unsymmetrical faults.

3-Phase systems, Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedance, fault calculations, Single line to ground fault, Line to ground fault with Z_f , Faults in Power systems, Concept of short circuit capacity of a Bus. Book-3: CH 13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.8, 13.10, 13.13.

Feeder Protection: Overcurrent, Distance and Pilot Protection Schemes. Book-1: CH 5.2, 5.3, 5.4.

Apparatus Protection: Transformer Protection, Generator Protection, Motor Protection, Bus zone protection schemes. Book-1: CH 6.2, 6.3, 6.4, 6.5.

MODULE-III

(12 Hours)

Static Relays: Comparators and different relays.

Amplitude comparator, Phase Comparator, Coincidence type phase comparator, Basic elements of a static relay, OverCurrent Relays, Differential Protection, Static distance Protection. Book-1: CH 11.1, 11.2, 11.3 & CH 12.1, 12.2, 12.3, 12.4.

Numerical relays:

Block Diagram of Numerical Relay, Signal Sampling & Processing, Numerical Over-current protection, Numerical Transformer differential Protection, Numerical distance Protection of Transmission Line. Book-2: CH 11.2, 11.3, 11.7, 11.8, 11.9.

Switchgears: Autoreclosing fundamentals, Circuit breaker rating, Circuit constants and circuit conditions, Theory of Circuit interruption, Restriking voltage transients, characteristics of Restriking Voltage, Interaction between breaker and circuit, Current chopping, Automatic switch, Air-break circuit breakers, Oil circuit breakers, Air-blast circuit breakers, Vacuum circuit breakers, SF₆ circuit breakers, DC circuit breakings.

Book-1: CH 7.1, 7.2, 7.3, 7.4, CH 13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 14.2, 14.3, 14.4, 14.5, 14.6, 14.7, 15.1, 15.2, 15.3, 15.5, 16.2, 16.3, 16.4.

Text Book(s):

- 1) Power System Protection and Switchgear–B Ravindranath & M Chander–New Age International Publishers. (Book-1)
- 2) Fundamentals of Power system Protection–Y G Paithankar & S R Bhide, PHI Pub.(Book-2)
- 3) Electrical Power System by C L Wadhwa New Age International Publishers. (4th Ed),(Book3)

Reference books:

- 1) Power System relaying by Horwitz, Phadke, Research Press.
- 2) Power System Protection and Switchgear by B.Oza, N.K Nair, R.Mehta,V.H.Makwana, TMH