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UNIT I

Syllabus : Necessity, functions of protective system. Normal and Abnormal Conditions. Types of faults and their causes. Protection zones and backup protection. Short circuit fault calculations in lines fed by generators through transformers. Need of current limiting reactors and their arrangements.

UNIT II

Syllabus : Isolators : Vertical break, Horizontal break and Pantograph type. HRC fuses : Construction, working, characteristics and applications. Arc formation process, methods of arc extinction (High resistance and Low resistance), Arc voltage, Recovery voltage, Re-striking voltage, RRRV. HT circuit breakers (Sulphur – hexa Fluoride (SF6), Vacuum circuit breaker) – Working, construction, specifications and applications. L.T. circuit breaker (Air circuit breakers (ACB), Miniature circuit breakers (MCB), Moulded case circuit breakers (MCCB), MPCB, RCBO and Earth leakage circuit breaker (ELCB)) – Working and applications. Selection of LT and HT circuit breakers (ratings). Selection of MCCB for motors. Gas insulated switchgear. Insulation Coordination : Type 1 and Type 2 coordination, Introduction to ETAB

UNIT III

Syllabus : Fundamental quality requirements : Selectivity, Speed, Sensitivity, Reliability, Simplicity, Economy. Basic relay terminology – Protective relay, Relay time, Pick up, Reset current, current setting, Plug setting, multiplier, Time setting multiplier. Protective relays : Electromagnetic disc relay operation, Thermal relay. Block diagram and working of Static relay, over voltage relay. Over current relay – Time current characteristics. Microprocessor based protection relays : Block diagram, working and protection features. Distance relaying – Principle, Directional relay : Need and operation with block diagram. Operation of current and voltage differential relay.

UNIT IV

Syllabus : Alternator Protection : Faults, Differential protection : over current, earth fault, overheating and field failure protection. Reverse power protection. **Transformer Protection:** Faults, Differential, over current, earth fault, over heating protection. Limitations of differential protection. Buchholz relay: Construction, operation, merits and demerits. Introduction to Microprocessor based transformer protection.

UNIT V

Syllabus : Motor : Faults, Short Circuit Protection, Overload Protection, Single Phase Preventer, **Bus-bar and Transmission Lines,** Faults on Bus-bar and Transmission Lines. Bus bar Protection : Differential and Fault Bus Protection. Transmission Line : Over current, Distance and Pilot wire Protection.

UNIT VI

Syllabus : Causes of over voltages. Lightning phenomena, over voltage due to lightning, typical waveform of lightning surge. Protection of transmission line & substation from direct stroke. Types of lightning arresters - Rod gap, Horn gap, Expulsion and Thyrite type, their construction & principle of operation. Surge absorber - Definition & working with neat diagram. Protection against traveling waves. Necessity of Insulation co-ordination.

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