

GOVT COED POLYTECHNIC, RAIPUR

1. Name of the department	Electrical Engineering
2. Name of the Teacher	
3. Title of the course	Power System Operation& Protection
4. Course Code	2024572(024)
5. Credits	5

Course Outcomes (Cos)	CO-1 Represent the power system components in p.u. system.
	CO-2 Implement methods to regulate the power system stability.
	CO-3 Apply various stragies for active and reactive power control.
	CO-4 Identify elements of protection and circuit interrupting devices.
	CO-5 select suitable protective relays ,circuits breakers for protection of alternators,transformers and motors.

Session: Semester: 5th Class room instruction start Date

Session Outcomes	Class room instruction topics	No. of periods planned	Actual number of periods taken	Remarks
UNIT 1: Representation of Power system. SO 1.1 Represent an interconnected synchronous generator with sending end and receiving end transformers and end loads using single line diagram	Single line Representation of a simple power system with standard symbols.	1		
	Single Phase representation of balanced three phase networks	1		
	Per unit (PU system) : Introduction, representation, change of base and simple numerical	1		
	Tutorial No 1	1		
SO 1.2 Represent a given three phase balanced system by single phase equivalent network	Complex power flow, Concept of torque or Load angle (δ) and Power factor angle (θ)	1		
	Tutorial No 2	1		
SO 1.3 Calculate the p.u. values of a power system parameter	Simplified representation of Synchronous Machines	1		
	Power angle curve of a synchronous generator	1		
	Tutorial No 3	1		
UNIT 2: Power System faults and Stability	Symmetrical Faults: Definition of transients in a transmission	1		

SO 2.1 Differentiate symmetrical and unsymmetrical faults in Transmission lines	lines, Sub- transient, transient and steady state period; reactance offered, LLL and LLLG faults			
	Short Circuit Capacity (SCC) of a bus, Simple Numerical	1		
	Tutorial No 4	1		
SO 2.2 Analyze the unsymmetrical faults (LG, LL & LLG)	Unsymmetrical faults : LG, LL, LLG faults and their effects	1		
	Stability: Introduction, Steady state and transients stability, Stability limit	1		
UNIT 3: SO 3.1 concept of real and reactive power transfer in transmission lines	Introduction to active and reactive power in power system and their sources	1		
	Requirement of reactive power in power system.	1		
	Tutorial No 5	1		
SO 3.2 Explain the need to control transmission line voltages	Effect of DC excitation on lagging and leading of a synchronous machine.	1		
	V curve of a synchronous machine.	1		
SO 3.3 Distinguish the application of Series, shunt, series- shunt FACT controllers with its strengths and limitations	Voltage control in power system: shunt reactor, synchronous phase modifier	1		
	shunt capacitors, series capacitors, static VAR system	1		
	Tutorial No 6	1		
UNIT 4: Elements of Protection and Circuit Interrupting Devices SO 4.1. Describe the functions of basic elements of a protective system	Basic elements of a protective system	1		
	Types, causes and effects of various Faults	1		
	Protection zones : Backup protection zones	1		
SO 4.2 Explain the use of CT and PT in protection system	CT and PT: Specifications and Connection diagram (single phase and 3 phase)	1		
	Current limiting reactors.	1		
	Neutral Earthing	1		
SO 4.3 Describe protective system showing different circuit interrupting devices using	Interrupting devices: Sequence of operation and interlocking	1		
	Isolators and Fuses: types, features, testing and	2		

a line diagram.	applications			
		1		
SO 4.4 Explain arc formation and zero current interruption	Construction, working and testing of circuit breakers: Air break, Air Blast	1		
	Construction, working and testing of circuit breakers : Hexa Fluoride (SF ₆), vacuum	1		
	Construction, working and testing of circuit breakers:	1		
	Auto-reclosure, Arc phenomena and extinction	1		
SO 4.5 Compare arc quenching in A.C. and D.C. circuit breaker.	HVDC: Working principle of arc quenching in HVDC circuit breaker	1		
		1		
SO 4.6: Explain the resistance switching for the given situation.	Resistance switching	1		
	Tutorial No 7	1		
UNIT 5 Protective Relays and Circuit Breaker SO 5.1 Explain the terms related to relays	Protective relay: Principle of working, construction and operation of electromagnetic induction (shaded pole, watt-hour meter and induction cup), Settings	2		
SO 5.2 Describe need for different types of relays	Relay Types: Thermal relay, Directional relay, Distance relay (impedance, reactance and mho) Negative phase sequence relay, Static relay, Microprocessor based relay: Principle and working of.	2		
SO 5.3 Carryout testing of given relays SO 5.4 Explain the various faults and abnormalities in alternator. And in motor and their protection schemes.	Maintenance and testing of relays	1		
	Various faults and abnormal operating conditions in Alternator and its protection schemes	1		
	Various faults and abnormal occurring in the Motor and its protection schemes	1		
SO 5.5 Explain various protection schemes for	Differential Protection of Bus Bars Over current, Percentage	2		

transformer	differential and restricted earth fault protection of Transformers			
	Inrush phenomenon and over fluxing phenomenon in Transformer	1		
	Buchholz Relay, analysis of trapped gases	1		
SO 5.6 Describe the protection scheme for transmission line.	Protection scheme -Overload protection, Over- current and earth fault protection, Time graded and current graded protection, Current balance differential protection	1		
	Carrier aided protection, Carrier inter-tripping, acceleration and blocking scheme	1		
	Distance /Impedance protection, Auto reclosing	1		
SO 5.7 Explain protection of given feeders and ring mains and Bus bar	Protection of parallel feeders and Ring Mains	1		

Number of Total periods planned :

Number of Total periods actually taken:

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(Department of Electrical Engineering)