

GOVT. POLYTECHNIC BALANGIR**Department of Electrical Engineering****LESSON PLAN: 2025-26****Name of the Faculty: Sujata Bhoi****Subject: SWITCH GEAR & PROTECTIVE DEVICE**

Program: Diploma in Electrical Engineering

Semester: 6TH

Total Contact Hours: 75 Total

Marks: 100

Assessment: Progressive –20, End Term – 80

Credits: 5

COURSE OBJECTIVES:

After completion of the course, the students will be able to

- Explain the optimized working of the thermal power plant
- Describe the efficient operation of large hydropower plants.
- Describe the efficient operation micro hydropower plants.
- Select the adequate mix of power generation based on economic operation.

Unit 1: Introduction to switchgear (Total Classes-6)				
Class No.	Topic	Subtopic (Elaborated)	Simple Teaching Aids/Activities	Course Objective
1	Introduction to switchgear	1.1 Essential Features of switchgear.	Chalkboard definition writing, students repeat definitions, discussion on Essential Features of switchgear.	CO1
2	Introduction to switchgear	1.2 Switchgear Equipment.	Chalkboard definition and discussion and video clip	CO1
3	Introduction to switchgear	1.3 Bus-Bar Arrangement.	discussion on BUS-BAR ARRANGEMENT, TYPES OF BUS-BAR, NEED OF BUS-BAR	CO1
4	Introduction to switchgear	1.4 Switchgear Accommodation.	Group discussion and PPT slides	CO1
5	Introduction to switchgear	1.5 Short Circuit. 1.6 Short circuit.	PPT slides, short video clip	CO1
6	Introduction to switchgear	1.7 Faults in a power system.	students repeat definitions, discussion on working of thermal power plant	CO1
Unit 2: FAULT CALCULATION (Total Classes-10)				
Class No.	Topic	Subtopic (Elaborated)	Simple Teaching Aids/Activities	Course Objective
1	TYPES OF FAULT IN OVER HEAD	2.1 Symmetrical faults on 3-phase system.	Chalkboard definition writing, students repeat definition	CO2

	LINES			
2	FAULTS AND LIMITATION OF FAULT	2.2 Limitation of fault current.	definitions, discussion on working of large hydropower	CO2
3	FAULT CALCULATION	2.3 Percentage Reactance	students repeat definition	CO2
4	FAULT CALCULATION	2.4 Percentage Reactance and Base KVA.	discussion on working of large hydropower	CO2
5	FAULT CALCULATION	2.5 Short – circuit KVA	PPT slide and presentation	CO2
6	FAULT CALCULATION	2.6 Reactor control of short circuit currents.	Class discussion and note making	CO2
7	FAULT CALCULATION	2.7 Location of reactors	PPT slide and presentation	CO2
8	FAULT CALCULATION	2.8 Steps for symmetrical Fault calculations.	short video clip	CO2
9	FAULT CALCULATION	2.9 Solve numerical problems on symmetrical fault.	PPT slide and presentation	CO2
10	FAULT CALCULATION	2.9 Solve numerical problems on symmetrical fault.	Class discussion and note making	CO2

Unit 3: FUSES (Total Classes-06)				
Class No.	Topic	Subtopic (Elaborated)	Simple Teaching Aids/Activities	Course Objective
1	INTRODUCTION OF FUSES	3.1 Desirable characteristics of fuse element.	Chalkboard definition writing, students repeat definitions,	CO3
2	FUSES ELEMENT	3.2 Fuse Element materials.	discussion on working of Micro-Hydro power plant	CO3
3	TYPES OF FUSES	3.3 Types of Fuses and important terms used for fuses	Chalkboard definition writing	CO3
4	VOLTAGE RATING OF FUSES	3.4 Low and High voltage fuses.	Chalkboard definition writing	CO3
5	CURRENT CARRYING CAPACITY OF FUSES	3.5 Current carrying capacity of fuse element	PPT slide and presentation	CO3
6	DIFFERENCE BETWEEN FUSES& CB	3.6 Difference Between a Fuse and Circuit Breaker.	PPT slide and presentation	CO3
Unit 4: CIRCUIT BREAKERS (Total Classes-10)				
Class No.	Topic	Subtopic (Elaborated)	Simple Teaching Aids/Activities	Course Objective
1	CIRCUIT BREAKERS	4.1 Definition and principle of Circuit Breaker.	Chalkboard definition writing, students repeat definitions, discussion on CIRCUIT BREAKER	CO4

2	CIRCUIT BREAKERS	4.2 Arc phenomenon and principle of Arc Extinction.	PPT slides	CO4
3	CIRCUIT BREAKERS	4.3 Methods of Arc Extinction	PPT slides	CO4
4	CIRCUIT BREAKERS	4.4 Definitions of Arc voltage, Re-striking voltage and Recovery voltage	Chalkboard definition writing	CO4
5	CIRCUIT BREAKERS	4.5 Classification of circuit Breakers.	Chalkboard definition writing	CO4
6	CIRCUIT BREAKERS	4.6 Oil circuit Breaker and its classification.	Chalkboard definition writing	CO4
7	CIRCUIT BREAKERS	4.7 Plain brake oil circuit breaker. 4.8 Arc control oil circuit breaker. 4.9 Low oil circuit breaker.	PPT slide and presentation	CO4
8	CIRCUIT BREAKERS	4.10 Maintenance of oil circuit breaker. 4.11 Air-Blast circuit breaker and its classification.	Short video clip, presentation	CO4
9	CIRCUIT BREAKERS	4.12 Sulphur Hexa-fluoride (SF6) circuit breaker. 4.13 Vacuum circuit breakers.	Short video clip, Chalkboard definition	CO4
10	Blackout Levels	4.14 Switchgear component 4.15 Problems of circuit interruption. 4.16 Resistance switching. 4.17 Circuit Breaker Rating.	Chalkboard definition, PPT slide	CO4

Unit 5: PROTECTIVE RELAYS (Total Classes-08)

CLASS NO	TOPIC	Subtopic (Elaborated)	Simple Teaching Aids/Activities	Course Objective
1	DEFINE RELAY & PROPERTY OF RELAY	5.1 Definition of Protective Relay 5.2 Fundamental requirement of protective relay.	Chalkboard definition writing, students repeat definitions,	CO5
2	OPERATION OF RELAY	5.3 Basic Relay operation 5.3.1. Electromagnetic Attraction type 5.3.2. Induction type	Chalkboard definition writing	CO5
3	DEFINE THE TERMS	5.4 Definition of following important terms 5.5 Definition of following important terms. 5.5.1. Pick-up current. 5.5.2. Current setting. 5.5.3. Plug setting Multiplier. 5.5.4. Time setting Multiplier.	Chalkboard definition writing	CO5

4	Classification of Relay	5.6 Classification of functional relays	PPT slide and presentation	CO5
5	Induction Type relay	5.7 Induction type over current relay (Non-directional)	PPT slide presentation and video clip	CO5
6	Induction Type relay	5.8 Induction type directional power relay 5.9 Induction type directional over current relay	PPT slide presentation and video clip	CO5
7	Differential relay	5.10 Differential relay 5.10.1. Current differential relay 5.10.2. Voltage balance differential relay	PPT slide and presentation	CO5
8	Protection of relay	5.11 Types of protection	PPT slide and presentation	CO5
Unit 6: PROTECTION OF ELECTRICAL POWER EQUIPMENT AND LINES(Total Classes-06)				
1	Protection of alternator	6.1 Protection of alternator.6.2 Differential protection of alternators.	Chalkboard definition writing, students repeat definitions,	CO5
2	Earth faults	6.3 Balanced earth fault protection	Chalkboard definition writing, students repeat definitions,	CO5
3	Protection of Transformer	6.4 Protection systems for transformer. 6.5 Buchholz relay.	PPT slide and presentation	CO5
4	Protection of Bus-Bar	6.6 Protection of Bus bar.	PPT slide and presentation	CO5
5	Protection of Transmission line	6.7 Protection of Transmission line.	PPT slide and presentation	CO5
6	Protection of Feeder	6.8 Different pilot wire protection (Merz-price voltage Balance system) 6.9 Explain protection of feeder by over current and earth fault relay.	PPT slide presentation and video clip	CO5
Unit 7: PROTECTION AGAINST OVER VOLTAGE AND LIGHTING(Total Classes-08)				
1	Voltage surge and its cause	7.1. Voltage surge and causes of over voltage.	Chalkboard definition writing, students repeat definitions	CO6
2	cause of over voltage	7.2. Internal cause of over voltage	Chalkboard definition writing, students repeat definitions	CO6
3	cause of over voltage	7.3. External cause of over voltage (lighting)	Chalkboard definition writing, students repeat definitions	CO6
4	lightning discharge.	7.4. Mechanism of lightning discharge.	PPT slide and presentation	CO6

5	Types of lightning strokes.	7.5. Types of lightning strokes.	PPT slide and presentation	CO6
6	Effects of Lightning	7.6. Harmful effect of lightning.	PPT slide and presentation	CO6
7	Different types of lightning arresters	7.7. Lightning arresters and Type of lightning Arresters. 7.7.1. Rod-gap lightning arrester. 7.7.2. Horn-gap arrester. 7.7.3. Valve type arrester.	Chalkboard definition writing, PPT slide and presentation	CO6
8	Surge Absorber	7.8. Surge Absorber	PPT slide and presentation	CO6
Unit 8: Static relay(Total Classes-06)				
1	Static relay	8. 1 Advantage of static relay.	Chalkboard definition writing, students repeat definitions	CO6
2	Advantages of static relay	8. 1 Advantage of static relay.	Chalkboard definition writing, students repeat definitions	CO6
3	Over Current relay	8. 2 Instantaneous over current relay	Chalkboard definition writing, students repeat definitions	CO6
4	Over Current relay	8. 2 Instantaneous over current relay	Chalkboard definition writing, students repeat definitions	CO6
5	IDMT relay	8. 3 Principle of IDMT relay.	PPT slide and presentation	CO6
6	Working of IDMT relay	8. 3 Principle of IDMT relay.	PPT slide and presentation	CO6

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