ACADEMIC LESSON PLAN OF SUMMER 2023

Discipline: **Electrical Engineering**	Semester: 6^{th} **(SEC-A)**	Name of the Teaching Faculty: **Sandeep Mohapatra**
Subject:**TH-2 (SWITCH GEAR AND PROTECTIV E DEVICE)**	No. of days/per week class allotted:**4p/week Tutorial:1p/week**	Semester From: **14^{th} FEB 2023 to 23^{rd} MAY 2023**
Week	Class Day	Theory Topics
1^{st}	1^{st}	**1. INTRODUCTION TO SWITCHGEAR** 1.1 Essential Features of switchgear. 1.2 Switchgear Equipment.
	2^{nd}	1.3 Bus-Bar Arrangement.
	3^{rd}	1.4 Switchgear Accommodation.
	4^{th}	1.5 Short Circuit.
	5^{th}	Tutorial Period
2^{nd}	1^{st}	1.6 Short circuit
	2^{nd}	1.7 Faults in a power system
	3^{rd}	**2. FAULT CALCULATION** 2.1 Symmetrical faults on 3-phase system.(Contd.)
	4^{th}	2.1 Symmetrical faults on 3-phase system.
	5^{th}	2.2 Limitation of fault current.
3^{rd}	1^{st}	Tutorial Period
	2^{nd}	2.3 Percentage Reactance. 2.4 Percentage Reactance and Base KVA.(Contd.)
	3^{rd}	2.4 Percentage Reactance and Base KVA.
	4^{th}	2.5 Short – circuit KVA
	5^{th}	Tutorial Period
4^{th}	1^{st}	2.6 Reactor control of short circuit currents.
	2^{nd}	2.7 Location of reactors.
	3^{rd}	2.8 Steps for symmetrical Fault calculations. 2.9 Solve numerical problems on symmetrical fault.(Contd.)
	4^{th}	2.9 Solve numerical problems on symmetrical fault.
	5^{th}	Tutorial Period
5^{th}	1^{st}	**3. FUSES** 3.1 Desirable characteristics of fuse element. 3.2 Fuse Element materials.
	2^{nd}	3.3 Types of Fuses and important terms used for fuses.
	3^{rd}	3.4 Low and High voltage fuses.(Contd.)
	4^{th}	3.4 Low and High voltage fuses.
	5^{th}	Tutorial Period
6^{th}	1^{st}	3.5 Current carrying capacity of fuse element.
	2^{nd}	3.6 Difference Between a Fuse and Circuit Breaker.
	3^{rd}	**4. CIRCUIT BREAKERS** 4.1 Definition and principle of Circuit Breaker.
	4^{th}	4.2 Arc phenomenon and principle of Arc Extinction. 4.3 Methods of Arc Extinction. 4.4 Definitions of Arc voltage, Re-striking voltage and Recovery voltage.
	5^{th}	Tutorial Period
7^{th}	1^{st}	4.5 Classification of circuit Breakers. 4.6 Oil circuit Breaker and its classification. 4.7 Plain brake oil circuit breaker.
	2^{nd}	4.8 Arc control oil circuit breaker.
	3^{rd}	4.9 Low oil circuit breaker. 4.10 Maintenance of oil circuit breaker.
	4^{th}	4.11 Air-Blast circuit breaker and its classification.
	5^{th}	Tutorial Period
8^{th}	1^{st}	4.12 Sulphur Hexa-fluoride (SF6) circuit breaker.
	2^{nd}	4.13 Vacuum circuit breakers. 4.14 Switchgear component.
	3^{rd}	4.15 Problems of circuit interruption
	4^{th}	4.16 Resistance switching.

		4.17 Circuit Breaker Rating.
	5th	Tutorial Period
9th	1st	**5. PROTECTIVE RELAYS** 5.1 Definition of Protective Relay.
	2nd	5.2 Fundamental requirement of protective relay.
	3rd	5.3 Basic Relay operation
	4th	5.3.1 Electromagnetic Attraction type 5.3.2 Induction type
	5th	Tutorial Period
10th	1st	5.4 Definition of following important terms 5.5 Definition of following important terms
	2nd	5.5.1 Pick-up current.
	3rd	5.5.2 Current setting. 5.5.3 Plug setting Multiplier. 5.5.4 Time setting Multiplier.
	4th	5.6 Classification of functional relays 5.7 Induction type over current relay (Non-directional)
	5th	Tutorial Period
11th	1st	5.8 Induction type directional power relay.
	2nd	5.9 Induction type directional over current relay.
	3rd	5.10 Differential relay 5.10.1 Current differential relay 5.10.2 Voltage balance differential relay
	4th	5.11 Types of protection
	5th	Tutorial Period
12th	1st	**6. PROTECTION OF ELECTRICAL POWER EQUIPMENT AND LINES** 6.1 Protection of alternator. 6.2 Differential protection of alternators.
	2nd	6.3 Balanced earth fault protection.
	3rd	6.4 Protection systems for transformer. 6.5 Buchholz relay.
	4th	6.6 Protection of Bus bar. 6.7 Protection of Transmission line.
	5th	Tutorial Period
13th	1st	6.8 Different pilot wire protection (Merz-price voltage Balance system)
	2nd	6.9 Explain protection of feeder by over current and earth fault relay.
	3rd	**7. PROTECTION AGAINST OVER VOLTAGE AND LIGHTING** 7.1 Voltage surge and causes of over voltage. 7.2 Internal cause of over voltage.
	4th	7.3 External cause of over voltage (lighting)
	5th	Tutorial Period
14th	1st	7.4 Mechanism of lightning discharge.(Contd.)
	2nd	7.5 Types of lightning strokes.
	3rd	7.6 Harmful effect of lightning. 7.7 Lightning arresters and Type of lightning Arresters.
	4th	7.7.1 Rod-gap lightning arrester 7.7.2 Horn-gap arrester
	5th	Tutorial Period
15th (Extra Class)	1st	7.7.3 Valve type arrester.
	2nd	7.8 Surge Absorber
	3rd	**8. STATIC RELAY** 8.1 Advantage of static relay.(Contd.)
	4th	8.1 Advantage of static relay.
	5th	Tutorial Period
16th (Extra Class)	1st	8.2 Instantaneous over current relay.(Contd.)
	2nd	8.2 Instantaneous over current relay.
	3rd	8.3 Principle of IDMT relay.(Contd.)
	4th	8.3 Principle of IDMT relay.
	5th	Tutorial Period

Signature of Teaching Faculty

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	4th	1.5 Short Circuit.
	5th	Tutorial Period
2nd	1st	1.6 Short circuit
	2nd	1.7 Faults in a power system
	3rd	**2. FAULT CALCULATION**
	4th	2.1 Symmetrical faults on 3-phase system.(Contd.)
	5th	Tutorial Period
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	2nd	2.2 Limitation of fault current.
	3rd	Tutorial Period
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	3rd	2.6 Reactor control of short circuit currents.
	4th	2.7 Location of reactors.
	5th	2.8 Steps for symmetrical Fault calculations. 2.9 Solve numerical problems on symmetrical fault.(Contd.)
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	2nd	Tutorial Period
	3rd	**3. FUSES** 3.1 Desirable characteristics of fuse element. 3.2 Fuse Element materials.
	4th	3.3 Types of Fuses and important terms used for fuses.
	5th	3.4 Low and High voltage fuses.(Contd.)
6th	1st	3.4 Low and High voltage fuses.
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	3rd	3.5 Current carrying capacity of fuse element.
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8th	1st	4.11 Air-Blast circuit breaker and its classification.
	2nd	4.12 Sulphur Hexa-fluoride (SF6) circuit breaker.
	3rd	4.13 Vacuum circuit breakers. 4.14 Switchgear component.

	4th	4.15 Problems of circuit interruption
	5th	Tutorial Period
9th	1st	4.16 Resistance switching. 4.17 Circuit Breaker Rating.
	2nd	**5. PROTECTIVE RELAYS** 5.1 Definition of Protective Relay. 5.2 Fundamental requirement of protective relay.
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Signature of Teaching Faculty