



NILASAILA INSTITUTE OF SCIENCE & TECHNOLOGY  
SERGARH-756060, BALASORE (ODISHA)  
(Approved by AICTE& affiliated to SCTE&VT, Odisha)



## LESSON PLAN

**SUBJECT: Th-2 (SWITCH GEAR AND PROTECTIVE DEVICES)**

### CHAPTER WISE DISTRIBUTION OF PERIODS

Sl.No.	Name of the chapter as per the Syllabus	No. of Periods as per the Syllabus	No. of periods actually needed
1	Introduction to switchgear	6	6
2	Fault calculation	10	10
3	Fuses	6	6
4	Circuit breakers	10	10
5	Protective relays	8	8
6	Protection of electrical power equipment and lines	6	6
7	Protection against over voltage and lighting	8	8
8	Static relay	6	6
TOTAL		75	75

Discipline: ELECTRICAL& ELECTRONICS ENGG.	Semester: 6TH	Name of the Teaching Faculty: Er. Prakash Kumar Mohanty
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Week	Class Day	Theory / Practical Topics
<b>1<sup>st</sup></b>	<b>1<sup>st</sup></b>	INTRODUCTION TO SWITCHGEAR 1.1 Essential Features of switchgear
	<b>2<sup>nd</sup></b>	1.2 Switchgear Equipment
	<b>3<sup>rd</sup></b>	1.3 Bus-Bar Arrangement
	<b>4<sup>th</sup></b>	1.4 Switchgear Accommodation
	<b>5<sup>th</sup></b>	TUTORIAL
<b>2<sup>nd</sup></b>	<b>1<sup>st</sup></b>	1.5 Short Circuit
	<b>2<sup>nd</sup></b>	1.6 Short circuit
	<b>3<sup>rd</sup></b>	1.7 Faults in a power system.
	<b>4<sup>th</sup></b>	2. FAULT CALCULATION Symmetrical faults on 3-phase system.
	<b>5<sup>th</sup></b>	TUTORIAL
<b>3<sup>rd</sup></b>	<b>1<sup>st</sup></b>	2.2 Limitation of fault current.
	<b>2<sup>nd</sup></b>	2.3 Percentage Reactance.
	<b>3<sup>rd</sup></b>	2.4 Percentage Reactance and Base KVA.
	<b>4<sup>th</sup></b>	2.5 Short – circuit KVA.
	<b>5<sup>th</sup></b>	TUTORIAL
<b>4<sup>th</sup></b>	<b>1<sup>st</sup></b>	2.6 Reactor control of short circuit currents
	<b>2<sup>nd</sup></b>	2.7 Location of reactors.
	<b>3<sup>rd</sup></b>	2.8 Steps for symmetrical Fault calculations.
	<b>4<sup>th</sup></b>	2.9 Solve numerical problems on symmetrical fault.
	<b>5<sup>th</sup></b>	TUTORIAL

<b>5<sup>th</sup></b>	<b>1<sup>st</sup></b>	3. FUSES Desirable characteristics of fuse element.
	<b>2<sup>nd</sup></b>	3.2 Fuse Element materials.
	<b>3<sup>rd</sup></b>	3.3 Types of Fuses and important terms used for fuses.
	<b>4<sup>th</sup></b>	3.4 Low and High voltage fuses
	<b>5<sup>th</sup></b>	TUTORIAL
<b>6<sup>th</sup></b>	<b>1<sup>st</sup></b>	3.5 Current carrying capacity of fuse element.
	<b>2<sup>nd</sup></b>	3.6 Difference Between a Fuse and Circuit Breaker.
	<b>3<sup>rd</sup></b>	CIRCUIT BREAKERS 4.1 Definition and principle of Circuit Breaker.
	<b>4<sup>th</sup></b>	4.2 Arc phenomenon and principle of Arc Extinction.
	<b>5<sup>th</sup></b>	TUTORIAL
<b>7<sup>th</sup></b>	<b>1<sup>st</sup></b>	4.3 Methods of Arc Extinction Definitions of Arc voltage, Re-striking voltage and Recovery voltage. 4.4
	<b>2<sup>nd</sup></b>	Classification of circuit Breakers. Oil circuit Breaker and its classification.
	<b>3<sup>rd</sup></b>	Oil circuit Breaker and its classification Plain brake oil circuit breaker.
	<b>4<sup>th</sup></b>	Plain brake oil circuit breaker. Arc control oil circuit breaker.
	<b>5<sup>th</sup></b>	TUTORIAL
<b>8<sup>th</sup></b>	<b>1<sup>st</sup></b>	Low oil circuit breaker. Maintenance of oil circuit breaker.
	<b>2<sup>nd</sup></b>	4.11 Air-Blast circuit breaker and its classification
	<b>3<sup>rd</sup></b>	Sulphur Hexa-fluoride (SF6) circuit breaker Vacuum circuit breakers.

	4 <sup>th</sup>	Vacuum circuit breakers. Switchgear component. Problems of circuit interruption.
	5 <sup>th</sup>	TUTORIAL
9 <sup>th</sup>	1 <sup>st</sup>	Resistance switching. Circuit Breaker Rating.
	2 <sup>nd</sup>	PROTECTIVE RELAYS Definition of Protective Relay. Fundamental requirement of protective relay.
	3 <sup>rd</sup>	Basic Relay operation Electromagnetic Attraction type Induction type 5.4 Definition of following important terms
	4 <sup>th</sup>	Definition of following important terms. Pick-up current. Current setting. Plug setting Multiplier. Time setting Multiplier.
	5 <sup>th</sup>	TUTORIAL
10 <sup>th</sup>	1 <sup>st</sup>	Definition of following important terms. Pick-up current. Current setting. Plug setting Multiplier. Time setting Multiplier.
	2 <sup>nd</sup>	Classification of functional relays Induction type over current relay (Non-directional)
	3 <sup>rd</sup>	Induction type directional power relay. Induction type directional over current relay.
	4 <sup>th</sup>	Differential relay Current differential relay Voltage balance differential relay.
	5 <sup>th</sup>	TUTORIAL

<b>11<sup>th</sup></b>	<b>1<sup>st</sup></b>	5.11 Types of protection
	<b>2<sup>nd</sup></b>	PROTECTION OF ELECTRICAL POWER EQUIPMENT AND LINES Protection of alternator. Differential protection of alternators
	<b>3<sup>rd</sup></b>	6.3 Balanced earth fault protection.
	<b>4<sup>th</sup></b>	Protection systems for transformer. Buchholz relay.
	<b>5<sup>th</sup></b>	TUTORIAL
<b>12<sup>th</sup></b>	<b>1<sup>st</sup></b>	6.6 Protection of Bus bar.
	<b>2<sup>nd</sup></b>	6.7 Protection of Transmission line.
	<b>3<sup>rd</sup></b>	6.8 Different pilot wire protection (Merz-price voltage Balance system)
	<b>4<sup>th</sup></b>	6.9 Explain protection of feeder by over current and earth fault relay
	<b>5<sup>th</sup></b>	TUTORIAL
<b>13<sup>th</sup></b>	<b>1<sup>st</sup></b>	PROTECTION AGAINST OVER VOLTAGE AND LIGHTING 7.1. Voltage surge and causes of over voltage.
	<b>2<sup>nd</sup></b>	7.2. Internal cause of over voltage.
	<b>3<sup>rd</sup></b>	7.3. External cause of over voltage (lighting)
	<b>4<sup>th</sup></b>	7.4. Mechanism of lightning discharge.
	<b>5<sup>th</sup></b>	TUTORIAL
	<b>1<sup>st</sup></b>	7.5. Types of lightning strokes
	<b>2<sup>nd</sup></b>	7.6. Harmful effect of lightning.

<b>14<sup>th</sup></b>	<b>3<sup>rd</sup></b>	Lightning arresters and Type of lightning Arresters. Rod-gap lightning arrester. Horn-gap arrester. Valve type arrester.
	<b>4<sup>th</sup></b>	7.8. Surge Absorber
	<b>5<sup>th</sup></b>	TUTORIAL
<b>15<sup>th</sup></b>	<b>1<sup>st</sup></b>	STATIC RELAY: 8. 1 Advantage of static relay.
	<b>2<sup>nd</sup></b>	8. 2 Instantaneous over current relay.
	<b>3<sup>rd</sup></b>	8. 2 Instantaneous over current relay.
	<b>4<sup>th</sup></b>	8. 3 Principle of IDMT relay
	<b>5<sup>th</sup></b>	TUTORIAL