

GANPAT UNIVERSITY									
FACULTY OF ENGINEERING AND TECHNOLOGY (DIPLOMA PROGRAMMES)									
Programme	Diploma Engineering				Branch/Spec.	Electrical Engineering			
Semester	VI				Version	1.0.0.0			
Effective from Academic Year		2020-21			Effective for the batch Admitted in			July 2018	
Subject code	1EE2604		Subject Name		MAINTENANCE OF TRANSFORMER & CIRCUIT BREAKER				
Teaching scheme					Examination scheme (Marks)				
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	4	0	1	0	5	Theory	40	60	100
Hours	4	0	2	0	6	Practical	30	20	50

Course Learning Outcomes:
<ul style="list-style-type: none"> <li>• Undertake /apply preventive maintenance.</li> <li>• Maintain power and distribution transformers.</li> <li>• Commission different types of transformers</li> <li>• Maintain different types of circuit breakers</li> </ul>

Theory syllabus				
UNIT	Unit Content	Unit Learning Outcomes	Marks	Hrs
Unit – I Preventive Maintenance	1a. Maintenance and its types - Preventive and Breakdown 1b. Advantages of preventive maintenance 1c. Scope of preventive maintenance 1d. Economics of preventive maintenance	1.1 State the types of maintenance. 1.2 Explain the significance of Preventive maintenance. 1.3 Describe the economy of maintenance.	10	10
Unit – II Maintenance of Transformers	2a. Significance of transformer maintenance 2b. Parts of transformer-tank. Core, winding, conservator, radiators, bushings, terminals, temperature measurement system, safety valves, tap changers and accessories/ fittings etc. 2c. Factors affecting the life of transformer-moisture, water oxygen, solid impurities, varnish, slackness of windings and dust.	2.1 Describe maintenance of different parts of power transformer. 2.2 Explain the different factors affecting the life of transformer. 2.3 Prepare maintenance schedule of different types of transformer. 2.4 Explain the importance of quality of transformer oil. 2.5 Describe the transformer oil filtration procedure 2.6 List the parameters for quality of oil. 2.7 Describe Trouble shooting	18	18

	<p>2d. Inspection-sensory, records and electrical test.</p> <p>2e. General/Typical maintenance schedule of power transformers-up to 1000 Kva and above 1000 kVA</p> <p>2f. Maintenance of transformer oil characteristic, interpretation of tests, procedure of testing BDV, filtering plant</p> <p>2g. Causes of failures of power transformers and preventive actions.</p> <p>2h. Detective devices used in Transformer</p> <p>2i. Check list of maintenance of power transformers</p> <p>2j. Causes and methods to reduce Audible Noise (AN) from transformer</p> <p>2k. Maintenance of distribution transformer</p> <p>2l. Procedure of measuring the insulation resistance of transformer windings</p>	<p>procedure of power transformer.</p> <p>2.8 Inspect and maintain distribution and power transformer.</p> <p>2.9 Describe the causes of failure of transformers</p> <p>2.10 Describe the methods to reduce the noise level in transformer.</p> <p>2.11 Describe how from analyses of gas collected in Buchholz relay, condition of transformer may be ascertained.</p> <p>2.12 State procedure for measuring of insulation resistance of transformers.</p> <p>2.13 State safety precautions to be absorbed during maintenance of transformers</p>		
<p>Unit – III Commissioning and Recharging of Transformers</p>	<p>3a. Concept of commissioning and recharging of transformer.</p> <p>3b. General checks</p> <p>3c. Insulation resistance test</p> <p>3d. Measurement of oil characteristics</p> <p>3e. Off circuit tap switch</p> <p>3f. Continuity test</p> <p>3g. Measurement of winding resistance</p> <p>3h. Voltage ratio tests</p> <p>3i. Magnetizing current</p> <p>3j. Charging of the transformer</p> <p>3k. Do's and Don'ts for transformer</p> <p>3l. Various commissioning tests on a power</p>	<p>3.1 Understand the procedure of commissioning of power transformer.</p> <p>3.2 Perform required test after commissioning of transformer.</p> <p>3.3 State do's and don'ts for power transformer.</p> <p>3.4 Describe the procedure of loading the transformer.</p>	17	17

	transformers 3m. Procedure of loading the transformers. 3n. Transformer grounding			
Unit - IV Maintenance of Circuit Breaker	4a. Steps in maintenance of CB 4b. Maintenance of moulded case circuit breakers - Frequency and routine maintenance tests 4c. Maintenance of low-voltage circuit breakers - Frequency and maintenance procedures 4d. Maintenance of medium voltage circuit breakers – Air, Oil and Vacuum circuit breakers – 4e. Frequency of maintenance, safety practices and maintenance procedures for each of the above 4f. Maintenance of high-voltage circuit breakers - frequency of inspections, External and internal inspection guidelines, typical internal breaker problems, Influence of duty imposed, Types of tests performed. 4g. OIL CB, Post fault maintenance, Steps in maintenance of MOCB 4h. Maintenance for AIR CB and Frequency of maintenance. 4i. Maintenance of AIR BLAST CB 4j. Maintenance of SF6 gas circuit breakers 4k. Maintenance of VACCUM CB 4l. Causes of failure of CB, trouble shooting and procedure of failure analysis. 4m. Typical Record card for	4.1 Describe the importance of maintenance of circuit breaker. 4.2 Describe the procedure for the maintenance of Moulded circuit breaker. 4.3 State the frequency of maintenance and its procedure for various Voltage rating of circuit breaker. 4.4 Describe the Maintenance of Oil, Air, Air blast, SF6 and Vacuum circuit breaker. 4.5 State the causes of Failure of circuit breaker 4.6 Describe the trouble shooting procedure of circuit breaker. 4.7 Explain the operating mechanism of circuit breaker. 4.8 Describe the procedure for filling SF6 in Circuit Breaker. 4.9 State the characteristics of SF6 Gas which makes it useful for CB. 4.10 Describe factor effecting life of arcing contacts of CB. 4.11 List causes of failure of CB 4.12 Describe operating mechanism of HVAC Circuit Breaker. 4.13 State safety precautions to be observed during maintenance of CB	15	15

	maintenance work of CB 4n. Commissioning tests on HVAC CB 4o. Operating mechanism used in HV A.C. CB 4p. Safety precautions to be taken in maintenance of CB			
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#### List of Practical

1	TO STUDY ABOUT MAINTENANCE AND ANALYSIS BETWEEN PREVENTIVE AND BREAKDOWN MAINTENANCE
2	PREPARE A REPORT ON VARIOUS ACCESSORIES AND FITMENTS ON A POWER TRANSFORMER IN A SUBSTATION
3	TO STUDY AND PERFORM VARIOUS TESTS APPLIED TO AN INSULATING OIL
4	PREPARE A TECHNICAL REPORT ON VARIOUS CAUSES OF TROUBLES AND FAILURE OF POWER TRANSFORMER
5	PREPARE A TYPICAL MAINTENANCE SCHEDULE FOR TRANSFORMER UP TO 1000KVA
6	PREPARE A TYPICAL MAINTENANCE SCHEDULE FOR TRANSFORMER ABOVE 1000KVA
7	PREPARE A TECHNICAL REPORT ON FILTERING PROCESS AND FILTERING PLANT FOR TRANSFORMER OIL FILTERATION
8	PREPARE TEST REPORT OF A POWER TRANSFORMER AFTER COMMISSIONING.
9	TO STUDY THE INSULATION RESISTANCE TEST OF TRANSFORMER
10	PERFORM VOLTAGE RATIO TESTS OF THREE PHASE TRANSFORMER
11	TO STUDY ABOUT TECHNICAL SPECIFICATIONS DATA SHEET FOR CIRCUIT BREAKERS
12	TO STUDY ABOUT VARIOUS TYPES OF TESTS PERFORMED ON HIGH VOLTAGE AC CIRCUIT BREAKER
13	TO STUDY ABOUT THE MAINTENANCE OF VACUUM CIRCUIT BREAKER
14	PREPARE TEST REPORT OF TESTS ON CIRCUIT BREAKERS AFTER COMMISSIONING

#### List of Instruments/Equipments/ Trainer Board

1	Oil testing kit.
2	Megger.
3	Model of transformer
4	Voltage ratio test kit.
5	Model of circuit breaker.

#### List of Text Books

1	Testing Commissioning operation and maintenance of Electrical Equipments.	Rao S	Khanna Publication (latest edition)
2	Transformers	BHEL	TATA McGraw-Hill

#### List of Reference Books

1	Substation operation and Maintenance		Alexander Publication
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#### Link of Learning Resources

1	<a href="http://electrical-engineering-portal.com/">http://electrical-engineering-portal.com/</a>
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