



C.U.SHAH UNIVERSITY

FACULTY OF: Technology & Engineering

DEPARTMENT OF: Electrical Engineering

BRANCH: Electrical Engineering

SEMESTER: VI

COURSE: B.Tech

CODE: 4TE06TCM1

NAME – Testing and Commissioning of Electrical Machines

Teaching & Evaluation Scheme

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE06TCM1	Testing and Commissioning of Electrical Machines	4	0	2	6	5	30	1.5	70	3	--	20	30	150

OBJECTIVES

1. To study various electrical high voltage devices namely transformer, dc motor, ac motor, and high voltage devices mathematical modelling of physical systems.
2. To study design and implementation of modelling high voltage testing and measuring components.
3. To study design and simulation of high voltage testing and commissioning components

PREREQUISITES

1. Basics and fundamental testing for high voltage electrical machine devices.

COURSE OUTLINES

Sr. No.	Course Contents	Hours
1	Transformers: Testing procedure for HV testing ,Phase shifting/ phase group , Radio interference, Ratio Test , Load loss ,Separate source voltage testing ,Induced voltage testing , Impulse and Surge testing , Noise level and vibration testing , Short circuit withstand test ,Tan Delta test , Core insulation voltage test, Measurement of impedance ,Testing of auxiliaries and safety device , Oil testing , Classification of testing methods , Testing of bushing. DC and AC Resistance measurement, Temp. Rise test, Short circuit test, Dielectric test, Partial discharge, Insulation resistance testing. Polarity testing, Short time	14

	<p>current rating, Impulse and surge testing, Determination of error and accuracy class, Power frequency voltage withstand test, over voltage inter-turn test. Determination of polarization index for transformer. Drying out procedure for transformer. Commissioning steps for transformer, Purification and Filtration Procedure, Overview of DGA, Sweep Frequency Analysis, Furan Analysis.</p> <p>DC Machine:</p> <p>Voltage drop test or bar to bar test, Load test, Open circuit and magnetizing test, Insulation resistance, Starting performance, Dielectric test. Swinburne's test, Hopkinson's test, Field test, Separation of losses in DC shunt machine. Temp. Rise test and Heat run test Drying out process Commissioning steps for DC machines Troubleshooting and maintenance.</p>	
2	<p>Induction Motor: Testing (3-Phase And 1-Phase):</p> <p>Hammer test, Testing against variation of voltage/current/frequency, Load test, NL and BR test, DC and AC, Resistance measurement, Insulation measurement, Starting test, Temp. Rise test, Slip measurement, HV test, Testing on auxiliaries, Vibration Test, Noise level test. Drying out methods / Polarization Index / Hot Temperature measurement Degree of protection (IP Grade) Commissioning steps for Induction motor, Heat Run Test. Commissioning of Induction Generator. Troubleshooting and maintenance of induction motor.</p> <p>Synchronous Machine:</p> <p>Testing OC and SC test, Characteristics, Loss measurement, Temp. rise test , Over speed test , HV testing , Insulation resistance wave form interference , DC and AC Resistance of armature and field winding measurement , Dielectric testing on armature and field winding , Mechanical balance , Magnetic balance , Current balance , Phase sequence , Harmonic analysis , reactance and time constant , Speed torque current , Vibration and noise measurement , SC test , Synchronizing circuit testing , Testing of voltage regulators , Excitation circuit testing ,Voltage recovery test , Retardation test on load / no load .Drying out procedure Commissioning steps for synchronous machines Troubleshooting and maintenance, Natural Frequency Test.</p>	16
3	<p>Substation Equipments:</p> <p>Bus bar Temp. Rise test, Rated short time current test, HV test, Power frequency voltage withstand test, Impulse / surge testing, Vibration.</p> <p>Earthing:</p> <p>Earthing resistance measurement, Substation grid Earthing, Soil resistivity measurement.</p> <p>Isolator Testing:</p> <p>Temp. Resistance test, Short circuit test, charging current making and breaking test, Inductive current making and breaking test.</p> <p>Circuit Breaker: Testing Of HV/LV Circuit Breaker:</p> <p>No load Mechanical Operation, Mechanical endurance test, Temp. Rise test, Impulse and surge testing, short time current test. Short circuit making and breaking test, Line Charging current making and breaking test, Cable charging</p>	12

	and capacitor bank making and breaking test, Out of phase switching, Short line fault test, and Electrical and Mechanical endurance test for LT switch gear like MCB / MCCB / ELCB etc. C.T. and P.T. Testing, Relay testing, Coupling capacitors, Station Batteries for DC Supply, Fire Shifting Equipments. Testing and Commissioning of Lightning Arrestor, Substation Commissioning by Thermograph. Troubleshooting and maintenance of circuit breakers.	
4	Commissioning Of Transmission Line And Cable: De-rating of cable capacity, HV test, AC and DC Resistance check, Insulation resistance, Impedance measurement, Location finding technique for fault in underground cables (Murray loop test and Warley loop test), Testing of open circuit faults in cables. Line charging, loading and Dropping.	12

Learning Outcomes

After the completion of this course the students would be able to:

1. Design and simulation of electrical high voltage machines.
2. Understand the testing of high voltage commissioning and testing of electrical machines.

Books Recommended

- 1 Y. G. Parithankar and S. R. Bhide, "Fundamentals of Power System Protection" 2nd edition, PHI.
- 2 S. S. Rao, "Switchgear and Protection" Khanna publication.
- 3 R C H Richardson, "The Commissioning of Electrical Plant", Chapman and Hall
- 4 S. Rao, "Testing, Commissioning, Maintenance and Operation of Electrical Equipments", Khanna Tech. Publications.