

# GUJARAT TECHNOLOGICAL UNIVERSITY

## B.E. SEMESTER : VIII

### ELECTRICAL ENGINEERING

Subject Name: **COMMISSIONING OF ELECTRICAL EQUIPMENTS**

Sr. No.	Course Contents	Total Hrs
1.	<b>Transformer:</b> Testing procedure for HV testing ,Phase shifting/ phase group , Radio interference, Ratio Test , Load loss ,Separate source voltage testing ,Induced voltage testing , Impulse & Surge testing , Noise level & vibration testing , Short circuit withstand test ,Tan Delta test , Core insulation voltage test, Measurement of impedance ,Testing of auxiliaries & safety device , Oil testing , Classification of testing methods , Testing of bushing. DC & AC Resistance measurement, Temp. Rise test, Short circuit test, Dielectric test, Partial discharge, Insulation resistance testing. Polarity testing, Short time current rating, Impulse & surge testing, Determination of error & 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 & Filtration Procedure for Transformer oil. Troubleshooting & Maintenance of transformer.	08
2.	<b>Induction Motor: Testing (3-phase &amp; 1-phase):</b> Hammer test, Testing against variation of voltage/current/frequency, Load test, NL & BR test, DC & 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 & maintenance of induction motor	06
3.	<b>Substation Equipments:</b> <b>Bus bar</b> Temp. Rise test, Rated short time current test, HV test, Power frequency voltage withstand test, Impulse / surge testing, Vibration. <b>Earthing</b> Earthing resistance measurement, Substation grid Earthing, Soil resistivity measurement. <b>Isolator Testing</b> Temp. Resistance test, Short circuit test, Charging current making & breaking test, Inductive current making & breaking test.	06
4.	<b>Circuit breaker: Testing of HV/LV circuit breaker:</b> No load Mechanical Operation, Mechanical endurance test, Temp. Rise test, Impulse & surge testing, short time current test. Short circuit making & breaking test, Line Charging current making & breaking test, Cable charging & capacitor bank making & breaking test, Out of phase switching, Short line fault test, and Electrical & Mechanical endurance test for LT switch gear like MCB / MCCB / ELCB etc. C.T. & P.T. Testing, Relay testing, Coupling capacitors, Station Batteries for D.C. Supply, Fire Shifting Equipments. Testing & Commissioning of Lightning Arrestor, Substation Commissioning by Thermograph. Troubleshooting & maintenance of circuit breakers.	06
5.	<b>DC Machine: Testing</b> Voltage drop test or bar to bar test, Load test, Open circuit & 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 & Heat run test Drying out process Commissioning steps for DC machines Troubleshooting & maintenance	06
6.	<b>Synchronous machine: Testing</b> OC & SC test, Characteristics, Loss measurement, Temp. rise test , Over speed test , HV testing , Insulation resistance wave form interference , DC & AC Resistance of armature & field winding measurement , Dielectric testing on armature & field winding , Mechanical balance , Magnetic balance , Current balance , Phase sequence ,	06

	Harmonic analysis , reactance & time constant , Speed torque current , Vibration & 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 & maintenance.	
<b>7.</b>	<b>Commissioning of transmission line &amp; Cable:</b> Derating of cable capacity, HV test, AC & DC Resistance check, Insulation resistance, Impedance measurement, Location finding technique for fault in underground cables (Murray loop test & Warley loop test), Testing of open circuit faults in cables. Line charging, loading & Dropping.	<b>04</b>

#### **Term work:**

Term work shall be based on above syllabus.

#### **Reference Books:**

1. Testing, Commissioning & maintenance of electrical equipment By S. S. Rao, khanna publications
2. The commissioning of Electrical Plant by RCH Richardson (Chapman & Hall)

