



FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: Bachelor of Technology (Electrical Engineering)

Semester: VII

Course Code: 202050707

Course Title: Testing and Commissioning of Electrical Equipment

Course Group: Professional Elective Course-III

Course Objectives: Power Systems and Industrial Plants consist of number of electrical drives, transformers, circuit breakers and other equipments which require installation, commissioning, and regular maintenance to prevent permanent breakdown. It is required to carry out/supervises installation, commissioning, and maintenance of various electrical equipments in power stations, substations and industry. This course will enable the students to understand the concepts, principles and acquire basic skills of installation, commissioning, and maintenance of electrical equipments in power stations, substations, and industry.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				Total		
Lecture	Tutorial	Practical		Theory		J/V/P*				
				Internal	External	Internal	External			
3	0	2	4	50 / 18	50 / 17	25 / 09	25 / 09	150 / 53		

* J: Jury; V: Viva; P: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Safety Management: Objectives, Safety Management during Operation and Maintenance, Clearance and Creepage, Electric Shock, need of Earthing, different methods of Earthing, factors affecting the Earth Resistance, methods of measuring the Earth Resistance, Equipment Earthing and System Grounding, Earthing Procedure - Domestic appliances, Industrial premises, Earthing of substation, generating station and overhead line.	05



2	Transformer: Testing procedure for HV testing, Classification of testing methods, Phase shifting/phase group, Vector group test, 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 bushing. DC & AC Resistance measurement, Temp. Rise 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. Determination of polarization index for transformer. Drying out procedure for transformer. Commissioning steps for transformer, Oil testing, Purification & Filtration Procedure for Transformer oil. Troubleshooting & Maintenance of transformer.	13
3	Installation and Commissioning of Rotating Electrical Machines: Degree of protection, cooling system, degree of cooling with IP- IC code (brief discussion), enclosures, rating and duty of industrial rotating electric machine, Hammer test, Testing against variation of voltage/current/frequency, Load test installation, Insulation measurement, starting test, Temp. Rise test, Slip measurement, HV test, Testing on auxiliaries, Vibration Test, Noise level test. commissioning of induction motor and rotating electric machine, drying out of electric rotating machine, insulation resistance measurement, site testing and checking, care, services and maintenance of motors, commissioning of synchronous generator.	10
4	Substation Equipments: Operation, Mechanical endurance test, Temp. Rise test, Impulse & surge testing, short time current test. substation equipment, busbar system, Location of lightening arrester with reasons, GIS (gas insulated substation). Bus bar: Busbar system, Temp. Rise test, rated short time current test, HV test, Power frequency voltage withstand test, Impulse / surge testing, Vibration.	08
5	Transmission line: Commissioning of A.C transmission line and HVDC transmission, power cable, low power control cable, 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 & Varley loop test).	06

List of Practicals / Tutorials:

1	To study Temperature rise test on 3 phase transformer.
2	To study about phase shift in Delta/Star transformer.
3	To perform Polarity test on single phase transformer and polarity and ratio test on current transformer.
4	To study about vector group of transformer and also perform vector group testing on transformer.
5	To study about Separation of Losses in a DC Shunt Machine.
6	To study and perform practical on Earthing resistance measurement through earth tester.
7	Study of 440 voltage induction motor power, control and indicator diagram.
8	To obtain CT saturation characterizes and RCF curve.



9	To perform oil testing of transformer oil and study of purification and filtration process.
10	To find the fault location in an underground cable by Murray Loop Test.
11	To study the types of faults, causes, remedies and troubleshooting chart for induction machines.
12	To measure the slip of a 3 Ø Induction Motor.

Reference Books:

1	Rao, S., "Testing, commissioning, operation and maintenance of electrical equipment", 6/E., Khanna Publishers, New Delhi.
2	Paul Gill, "Electrical power equipment maintenance and testing", CRC Press, 2008.
3	Singh Tarlok, "Installation, commissioning and maintenance of Electrical equipment", S.K. Kataria and Sons, New Delhi.
4	Relevant Indian Standards (IS Code) and IEEE Standards for-Installation, maintenance and commissioning of electrical equipments/machines.

Supplementary learning Material:

1	https://electrical-engineering-portal.com/
2	https://www.electrical4u.com/
3	www.nptel.ac.in
4	https://interestingengineering.com/electrical-engineering-salaries-worldwide

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation: The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						R : Remembering; U : Understanding; A : Applying; N : Analyzing; E : Evaluating; C : Creating
R	U	A	N	E	C	
30%	30%	20%	10%	10%	0%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Performing test on various electrical equipment like, transformer, rotating machine and switchgear as per standards or guidelines and analyze results.	30
CO-2	Preparation of maintenance schedule of different equipment and machines.	20
CO-3	Commissioning process and troubleshooting chart for various electrical equipment like transformer, rotating machines.	30
CO-4	Familiar about electrical safety regulations and rules during maintenance and procedure of different types of earthing.	20

Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025