

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Commissioning, Testing and Maintenance of Electrical Equipments
Course Code:	2ET1090701T
Pre-requisite Course:	--

Course Objectives:

1. The students will acquire the knowledge regarding the fundamentals of commissioning, testing and maintenance of electrical machines.
2. To explore the knowledge of commissioning and testing of different substations Equipments.
3. This course will enable the students to understand the concepts, principles and acquire basic skills of installation, commissioning and maintenance of transmission lines and cables.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Transformer: Commissioning steps, Foundation details, Transformer oil testing and filtering procedure, Drying out, Testing of winding, Bushing, Auxiliaries and safety device, Maintenance steps and schedule, Principle of dissolved gas analysis, partial discharge and frequency response analysis for condition monitoring and fault diagnosis, Causes of troubles and failure [Ref: IS 2026:Part_1-10-Power Transformers: Methods of Test; IS 13956:1994- Testing Transformers, IEC 60076: Standard for transformer testing]	08	20
2	Induction Motors: Installation and commissioning of induction motor, Location of the motors, Foundation details, Control apparatus, Fitting of windings, Drying out of induction machines, Duty standard for cooling and protection, Various tests, Troubleshooting and maintenance [Ref: IS 4029:2010-Guide for Testing Three Phase Induction motors, IEC 60034: Standard for induction motor testing].	07	15
3	Synchronous Machines: Commissioning steps, Physical inspection, Foundation details, Alignments, Cooling and control gear, Drying out, Various Tests, Commissioning of DG sets, Drying out procedure, Troubleshooting and maintenance [Ref: IS 7132:1973-Guide for Testing Synchronous Machines].	07	15
4	DC Machine: Commissioning steps for DC machines, Various tests, Drying out process, Troubleshooting & maintenance [Ref: IS 9320:1979-Guide for Testing of Direct Current Machines].	05	10
5	Substation Equipments: Bus bar: Temperature rise test, rated short time current test, HV test, Power frequency voltage withstand test, Impulse testing, Vibration test. Earthing: Earth resistance measurement, Substation grid earthing, and Soil resistivity measurement.	08	20

	Isolator Testing: Temperature resistance test, Short circuit test, Making and breaking tests. Lightning Arrester: Testing and commissioning of lightning arrestor. Substation commissioning: Routine and preventive maintenance process of substation, Substation commissioning by thermograph.		
6	Switchgear: Commissioning steps, Testing of circuit breaker, Relay, CT, PT, Station battery, Troubleshooting and maintenance of circuit breakers, Relay, CT, PT.	05	10
7	Transmission line & Cable: Commissioning steps for transmission line and cable, Various tests, Fault location technique for underground cables, Line charging, Loading and dropping.	05	10

Text Books:

1. Testing, commissioning, operation and maintenance of electrical equipment - S Rao, Khanna Publishers, 6th edition, 2015.
2. Installation, commissioning and maintenance of Electrical equipment - Tarlok Singh, S.K. Kataria and Sons, 2nd edition reprint, 2022.

Reference Books:

1. Installation, Maintenance and testing- B.V.S. Rao, vol. I & II, S. Chand & Co, 2007.
2. Electrical Power Equipment Maintenance and Testing"- Paul Gill, CRC Press, 2nd edition, 2009.
3. Study of Electrical Appliances and Devices- K.B. Bhatia, Khanna Publishers, 2015.
4. Preventive Maintenance of Electrical Apparatus- S.K. Sharotri, Katson Publishing House Ludhiana.
5. Relevant Indian Standards (IS Code) and IEEE Standards for- Installation, maintenance and commissioning of electrical Equipments/machines.
6. Electrical Equipment Handbook: Troubleshooting and Maintenance- Philip Kiameh, McGraw Hill
7. The commissioning of Electrical Plant- RCH Richardson, Chapman & Hall, 2008.

ICT/ MOOCS:

1. <https://nptel.ac.in/courses/108/105/108105017/>
2. <https://nptel.ac.in/courses/108101039/>
3. <https://nptel.ac.in/courses/108105131/>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the process of commissioning.	2 Understanding
CLO2	Prepare the steps of various maintenance methods / techniques.	1 Remembering
CLO3	Analyzing the trouble shooting methods to improve life of electrical equipment.	4 Analyzing
CLO4	Apply the required testing procedure for different equipment using proper tools and methods.	3 Applying

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PS O2	PSO 3	PSO4
CLO1	H	H	H	M	H	L	L		H	L	H	L			M	L
CLO2	H	H	H	H	L	M	L		M	L	M	L	M		M	
CLO3	H	H	H	M	M	M	L		M	L	M	L	H	M		M
CLO4	H	H	H	H	M	M	L		L	L	M	L	M	M	M	

H: High, M: Medium, L: Low