

Ramgarhia Polytechnic College, Phagwara



Electrical Engineering Department

Head of Department:	S. Jasvir Singh
Name of the Faculty:	Er. Sandeep Singh
Discipline:	Electrical Engineering Department
Semester:	5 th
Subject:	Installations and Maintenance of Electrical Equipment
Lesson Plan Duration:	16 Weeks

RATIONALE

In his career as a supervisor, an electrical engineering technician will be called upon to inspect, test and modify the work done by skilled workers or artisans working under him. Many a times it will become necessary for him to demonstrate the correct











method and procedure of doing certain operations. Normally manufacturers of heavy electrical equipment provide service manuals, instructions for installation, maintenance and fault location. Indian Electricity Rules and Indian Standard Specifications also provide enough guidelines.

This syllabus has been designed to provide certain guidelines and broad principles regarding the above activities. Appropriate field trips will reinforce the learning

Learning Outcomes

After undergoing this course, the students will be able to:

- CO1. Erect/install various electrical equipment as per IER Act by adopting all safety measures.
- CO2. Prepare specifications for different items required for transmission lines.
- CO3. Design and excavation of cable trenches.
- CO4. Lay underground cables.
- CO5. Test cables and their termination.
- CO6. Check HT/LT circuit treeless, transformers and related equipment in a substation.
- CO7. Carry out earthing net more laid and make earth pits and takes earth resistance Values.
- CO8. Find fault in a transmission/distribution system.
- CO9. Carry out preventive maintenance to minimize breakdowns.

PO ⇒	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO ⇩							
CO1							
CO2							
CO3							
CO4							
CO5							
CO6							
CO7							
CO8							
CO9							

Syllabus

Units	Details	Hours
1.	Tools and Accessories Tools, accessories and instruments required for installation, maintenance and repair work. Knowledge of Indian Electricity rules, safety codes, causes and prevention of accidents, artificial respiration of an electrocuted person, workmen's safety devices	(04 hrs)
2.	Installation 2.1 Installation of transmission and Distribution Lines: Erection of steel structures, connecting jumpers, tee-off points, joints and dead ends; crossing of roads, streets,	(18 hrs)

power/telecommunication lines and railway line crossings, clearances; earthing of transmission lines and guarding, spacing and configuration of conductors: Arrangement for suspension and strain insulators, bird guards, anti-climbing devices and danger plates; sizes of conductor, earthwire and guy wires, Testing and Commissioning. Laying of service lines, earthing, provision of service fuses, installation of energy meters.

2.2 Laying of Underground Cables:

Inspection, storage, transportation and handling of cables, cable handling equipment, cable laying depths and clearances from other services such as: water, sewerage, gas, heating and other mains, and also a series of power and telecommunication cables and coordination with these services, excavation of trenches, direct cable laying, including laying of cable from the drum, laying cable in the trench, taking all measurements and making drawings, back filling of trenches with earth or sand, laying protective layer of bricks etc,) laying of cables into pipes and conduits and within buildings, introduction to cable filling compounds, epoxy resins and hardeners, cable jointing and terminations, testing and commissioning.

2.3 Elementary idea regarding, inspection and handling of transformers; pole mounted substations, plinth mounted substations, grid substation, busbars, isolators, voltage and current transformers, lightning arrestors, control and relay panels, HT/LT circuit breakers, LT switches, installation of power/distribution transformers, dehydration. Earthing system, fencing of yard, equipment foundations and trenches etc..

2.4 Testing of various electrical equipment such as electrical motor, transformers cables and generator and motor control centres, medium voltage distribution panels, power control centres, motor control centres, lighting arrangement, storage, pre-installation checks, connecting and starting, pre-commissioning checks, drying out.

3.	<p>Maintenance</p> <p>3.1 Types of maintenance, maintenance schedules, procedures</p> <p>3.2 Maintenance of Transmission and Distribution System</p> <p>Authorized persons, danger notice, caution notice, permit to work, arranging of shutdowns personally and temporary earths cancellation of permit and restoration of supply.</p> <p>Patrolling and visual inspection of lines - points to be noted during patrolling from ground; special inspections and night inspections; Location of faults using Meggar, effect of open or loose neutral connections, provision of proper fuses on service lines and their effect on system, causes and dim and flickering lights.</p> <p>3.3 Maintenance of Distribution Transformers</p> <p>Transformer maintenance and points to be attended to in respect of various items of equipment Checking of insulation resistance, transformer oil level and BDV test of oil, measurement of earth resistance.</p> <p>3.4 Maintenance of Grid Substations</p> <p>Checking and maintenance of busbars, isolating switches, HT/LT circuit breakers, LT switches. Power transformers.</p> <p>3.5 Maintenance of Motors</p> <p>Over hauling of motors, preventive maintenance, trouble shooting of electric motors.</p> <p>3.6 Domestic Installation</p> <p>Introduction, testing of electrical installation of a building, testing of insulation resistance to earth, testing of insulation and resistance between conductors continuity or open circuit test.</p>	(42 hrs)
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Reference Books:

1. Testing, Commissioning, Operation and Maintenance of Electrical Equipment by S Rao, Khanna Technical Publication, New Delhi
2. Preventive Maintenance of Electrical Apparatus by SK Sharotri, Katson Publishing House, Ludhiana

Delivery/Instructional Methodologies

Sr.No.	Description
1.	Chalk and Talk
2.	PowerPoint Presentation

Assessment Methodologies

Sr. No.	Description	Type
1.	Student Assignment	Direct
2.	Test	Direct
3.	Board Examination	Direct
4.	Student Feedback	Direct

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
	N/A	N/A	N/A

Topics beyond syllabus/advanced topics

Units	Details	Hours
N/A	N/A	N/A

Web Source References

Sr. No.	URL
1.	https://nptel.ac.in/

Lesson Plan

Week	Theory		Practical	
	Lecture Day		Practical Day	
1 st	1 st	Tools, accessories and instruments required for installation, maintenance and repair work	1.	N/A
	2 nd	Knowledge of Indian Electricity rules, safety codes, causes and prevention of accidents		
	3 rd	artificial respiration of an electrocuted person		

	4 th	workmen's safety devices		
2 nd	5 th	Erection of steel structures, connecting jumpers, tee-off points, joints and dead ends; Crossing of roads, streets, power and telecommunication lines and railway line crossings, clearances;	2.	N/A
	6 th	Earthing of transmission lines and guarding, spacing and configuration of conductors: Arrangement for suspension and strain insulators, bird guards, anti-climbing devices and danger plates		
	7 th	Sizes of conductor, earth wire and guy wires, Testing and Commissioning.		
	8 th	Laying of service lines, earthing, provision of service fuses, installation of energy meters		
	9 th	Visit to the actual site.		

3 rd	10 th	Inspection, storage, transportation and handling of cables, cable handling equipment, cable laying depths	3.	N/A
	11 th	clearances from other services such as: water, sewerage, gas, heating and other mains, and also a series of power and telecommunication cables and coordination with these services,		
	12 th	excavation of trenches, direct cable laying, including laying of cable from the drum, laying cable in the trench, taking all measurements and making drawings		
4 th	13 th	Back filling of trenches with earth or sand, laying protective layer of bricks etc,) laying of cables into pipes and conduits and within buildings	4.	N/A
	14 th	Introduction to cable filling compounds, epoxy resins and hardeners, cable jointing and terminations, testing and commissioning.		

	15 th	Elementary idea regarding, inspection and handling of transformers		
	16 th	pole mounted substations, plinth mounted substations, grid substation		
5 th	17 th	Busbars, isolators, voltage and current transformers, lightning arrestors, control and relay panels,	5.	N/A
	18 th	HT/LT circuit breakers, LT switches, installation of power/distribution transformers, dehydration		
	19 th	Earthing system, fencing of yard, equipment foundations and trenches etc.		
	20 th	Testing of various electrical equipment such as electrical motor, transformers cables and generator		
	21 st	motor control centres, medium voltage distribution panels, power control centres, motor control centres		

6 th	22 nd	Lighting arrangement, storage, pre-installation checks, connecting and starting, pre-commissioning checks, drying out	6.	N/A
	23 rd	REVISION		
	24 th	1st Sessional Test (Tentative)		
7 th	25 th	Types of maintenance	7.	N/A
	26 th	Maintenance schedules, procedures		
	27 th	Maintenance of Transmission and Distribution System		
	28 th	Authorized persons, danger notice, caution notice		
	29 th	Permit to work, arranging of shutdowns personally and temporary earths		

8 th		cancellation of permit and restoration of supply.	8.	N/A
	30 th	Patrolling and visual inspection of lines - points to be noted during patrolling from ground; special inspections and night inspections;		
	31 st	Location of faults using Meggar, effect of open or loose neutral connections,		
	32 nd			
9 th	33 rd	Provision of proper fuses on service lines and their effect on system, causes and dim and flickering lights	9.	N/A
	34 th			
	35 th	Maintenance of Distribution Transformers		
	36 th			

10 th	37 th	Transformer maintenance and points to be attended to in respect of various items of equipment	10.	N/A
	38 th	Checking of insulation resistance, transformer oil level and BDV test of oil		
	39 th			
	40 th			
11 th	41 st	Measurement of earth resistance	11.	N/A
	42 nd			
	43 rd			
	44 th	REVISION		
	45 th	PTM		

12 th			12.	N/A
	46 th	2nd Sessional Test (Tentative)		
	47 th	Maintenance of Grid Substations		
48 th				
13 th	49 th	Checking and maintenance of busbars, isolating switches, HT/LT circuit breakers, LT switches. Power transformers	13.	N/A
	50 th			
	51 st			
	52 nd			
	53 rd	Maintenance of Motors Over hauling of motors, preventive maintenance,		
	54 th			

14 th		trouble shooting of electric motors	14	N/A
	55 th			
	56 th	Domestic Installation		
15 th	57 th			15.
	58 th	Introduction, testing of electrical installation of a building, testing of insulation resistance to earth		
	59 th			
	60 th	Testing of insulation and resistance between conductors continuity or open circuit test		
16 th	61 st		16.	N/A
	62 nd	PTM		
	63 rd			

		REVISION		
	64 th	3rd Sessional Test (Tentative)		

NBA has defined the following seven POs for an Engineering diploma graduate:

- i) **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
- ii) **Problem analysis:** Identify and analyze well-defined engineering problems using codified standard methods.
- iii) **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
- iv) **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
- v) **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.

vi) **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

vii) **Life-long learning:** Ability to analyze individual needs and engage in updating in the context of technological changes.

Program Specific Outcomes (PSOs)

PSOs are a statement that describes what students are expected to know and be able to do in a specialized area of discipline upon graduation from a program. Program may specify 2-4 program specific outcomes, if required.

These are the statements, which are specific to the particular 11 program. They are beyond POs. Program Curriculum and other activities during the program must help in the achievement of PSOs along with POs.