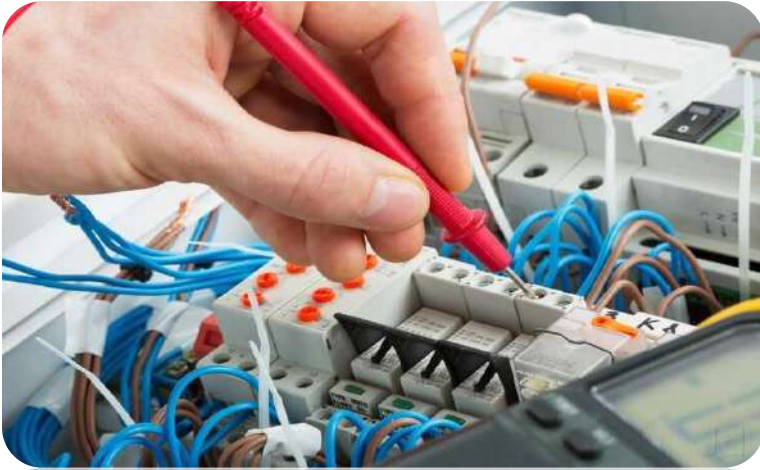


# ELECTRICIAN

NSQF LEVEL - 6



SECTOR- POWER

**COMPETENCY BASED CURRICULUM**  
**CRAFT INSTRUCTOR TRAINING SCHEME (CITS)**



GOVERNMENT OF INDIA  
Ministry of Skill Development & Entrepreneurship  
Directorate General of Training  
**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**  
EN-81, Sector-V, Salt Lake City, Kolkata – 700091

# **ELECTRICIAN**

**Also Applicable for – WIREMAN**

**(Engineering Trade)**

**SECTOR – POWER**

**(Revised in 2019)**

**Version 1.1**

**CRAFT INSTRUCTOR TRAINING SCHEME (CITS)**

**NSQF LEVEL - 6**

Developed By  
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EN-81, Sector-V, Salt Lake City,  
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**CONTENTS**

<b>SNo.</b>	<b>Topics</b>	<b>Page No.</b>
1.	Course Overview	1
2.	Training System	2
3.	General Information	6
4.	Job Role	8
5.	Learning Outcome	10
6.	Course Content	11
7.	Assessment Criteria	19
8.	Infrastructure	25
	Annexure I –List of Trade Experts	32

## 1. COURSEOVERVIEW

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The Craft Instructor Training Scheme is operational since inception of the Craftsmen Training Scheme. The first Craft Instructor Training Institute was established in 1948. Subsequently, 6 more institutes namely, Central Training Institute for Instructors (now called as National Skill Training Institute (NSTI)), NSTI at Ludhiana, Kanpur, Howrah, Mumbai, Chennai and Hyderabad were established in 1960 by DGT. Since then the CITS course is successfully running in all the NSTIs across India as well as in DGT affiliated institutes viz. Institutes for Training of Trainers (IToT). This is a competency based course for instructors of one year duration. “Electrician” CITS trade is applicable for Instructors of “Electrician” and “Wireman” CTS Trades.

The main objective of Craft Instructor training programme is to enable Instructors explore different aspects of the techniques in pedagogy and transferring of hands-on skills so as to develop a pool of skilled manpower for industries, also leading to their career growth & benefiting society at large. Thus promoting a holistic learning experience where trainee acquires specialized knowledge, skills & develops attitude towards learning & contributing in vocational training ecosystem.

This course also enables the instructors to develop instructional skills for mentoring the trainees, engaging all trainees in learning process and managing effective utilization of resources. It emphasizes on the importance of collaborative learning & innovative ways of doing things. All trainees will be able to understand and interpret the course content in right perspective, so that they are engaged in & empowered by their learning experiences and above all, ensure quality delivery.

## 2. TRAINING SYSTEM

### 2.1 GENERAL

CITS courses are delivered in National Skill Training Institutes (NSTIs) & DGT affiliated institutes viz., Institutes for Training of Trainers (IToT). For detailed guidelines regarding admission on CITS, instructions issued by DGT from time to time are to be observed. Further complete admission details are made available on NIMI web portal <http://www.nimionlineadmission.in>. The course is of one-year duration. It consists of Trade Technology (Trade skills and Trade knowledge), Training Methodology and Engineering Technology/ Soft skills. After successful completion of the training programme, the trainees appear in All India Trade Test for Craft Instructor. The successful trainee is awarded NCIC certificate by DGT.

### 2.2 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year:

S No.	Course Element	Notional Training Hours
1.	<b>Trade Technology</b>	
	Professional Skill (Trade Practical)	640
	Professional Knowledge (Trade Theory)	240
2.	<b>Engineering Technology</b>	
	Workshop Calculation & Science	80
	Engineering Drawing	120
3.	<b>Training Methodology</b>	
	TM Practical	320
	TM Theory	200
	<b>Total</b>	<b>1600</b>

### 2.3 PROGRESSION PATHWAYS

- Can join as a Technical Instructor in A Vocational Training Institute/ Technical Institute.
- Can join as a supervisor in Industries.

### 2.4 ASSESSMENT & CERTIFICATION

The CITS trainee will be assessed for his/her Instructional skills, knowledge and attitude towards learning throughout the course span and also at the end of the training program.

a) The Continuous Assessment (Internal) during the period of training will be done by Formative Assessment Method to test competency of instructor with respect to assessment criteria set against each learning outcomes. The training institute has to maintain an individual trainee portfolio in line with assessment guidelines. The marks of internal assessment will be as per the formative assessment template provided on [www.bharatskills.gov.in](http://www.bharatskills.gov.in)

b) The **Final Assessment** will be in the form of **Summative Assessment Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT at the end of the year as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The external examiner during final examination will also check the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

### 2.4.1 PASS CRITERIA

**Allotment of Marks among the subjects for Examination:**

Sl. No.	Subject		Marks	Internal assessment	Full Marks	Pass Marks	
						Final Exam	Internal assessment
1.	Trade Technology	Trade Theory	100	40	140	40	24
2.		Trade Practical	200	60	260	120	36
3.	Engineering Technology	Workshop Cal. & Sc.	50	25	75	20	15
4.		Engineering Drawing	50	25	75	20	15
5.	Training Methodology	TM Practical	200	30	230	120	18
6.		TM Theory	100	20	120	40	12
<b>Total Marks</b>			<b>700</b>	<b>200</b>	<b>900</b>	<b>360</b>	<b>120</b>

The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%. There will be no Grace marks.

## 2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. While assessing, the major factors to be considered are approaches to generate solutions to specific problems by involving standard/non-standard practices.

Due consideration should also be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising of the following:

- Demonstration of Instructional Skills (Lesson Plan, Demonstration Plan)
- Record book/daily diary
- Assessment Sheet
- Progress chart
- Video Recording
- Attendance and punctuality
- Viva-voce
- Practical work done/Models
- Assignments
- Project work

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming yearly examination for audit and verification by examining body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an <b>acceptable standard</b> of crafts instructorship with <b>occasional guidance</b> and engage students by demonstrating good attributes of a trainer.	<ul style="list-style-type: none"> <li>• Demonstration of <b>fairly good</b> skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field.</li> <li>• Average engagement of students for learning and achievement of goals while undertaking the training on specific topic.</li> <li>• A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson.</li> <li>• Occasional support in imparting effective training.</li> </ul>

<b>(b) Weightage in the range of 75%-90% to be allotted during assessment</b>	
<p>For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a <b>reasonable standard</b> of crafts instructorship with <b>little guidance</b> and engage students by demonstrating good attributes of a trainer.</p>	<ul style="list-style-type: none"> <li>• Demonstration of <b>good</b> skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field.</li> <li>• Above average in engagement of students for learning and achievement of goals while undertaking the training on specific topic.</li> <li>• <b>Agood</b> level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson.</li> <li>• Little support in imparting effective training.</li> </ul>
<b>©Weightage in the range of more than 90% to be allotted during assessment</b>	
<p>For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a <b>high standard</b> of crafts instructorship with <b>minimal or no support</b> and engage students by demonstrating good attributes of a trainer.</p>	<ul style="list-style-type: none"> <li>• Demonstration of <b>high</b> skill level to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field.</li> <li>• Goodengagement of students for learning and achievement of goals while undertaking the training on specific topic.</li> <li>• <b>Ahigh</b> level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson.</li> <li>• Minimal or no support in imparting effective training.</li> </ul>



### 3. GENERAL INFORMATION

<b>Name of the Trade</b>	<b>ELECTRICIAN –CITS</b>
<b>Trade Code</b>	DGT/ 4001
<b>Reference NCO 2015</b>	2356.0100,7411.0100, 7412.0200, 7411.0301, 3122.6000, 3123.0400
<b>NSQF Level</b>	Level-6
<b>Duration of CraftInstructor Training</b>	One Year
<b>Unit Strength (No. Of Student)</b>	25
<b>Entry Qualification</b>	<p>Degree in appropriate branches of Electrical/ Electrical &amp; Electronic Engineering from AICTE/UGC recognized Engineering College / University.</p> <p style="text-align: center;">OR</p> <p>Diploma in appropriate branches of Electrical/ Electrical &amp; Electronic Engineering from AICTE/ recognized board / Institution.</p> <p style="text-align: center;">OR</p> <p>National Trade Certificate in <b>Electrician</b> or related trades.</p> <p style="text-align: center;">OR</p> <p>National Apprenticeship Certificate in <b>Electrician</b> or related trades.</p>
<b>Minimum Age</b>	18 years as on first day of academic session.
<b>Space Norms</b>	140 Sq. m
<b>Power Norms</b>	5.2 KW
<b>Instructors Qualification for</b>	
<b>1. Electrician -CITS Trade</b>	<p>B.Voc/Degree in Electrical / Electrical &amp; Electronics Engineering from AICTE/UGC recognized University with two years experience in relevant field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in Electrical/ Electrical &amp; Electronics Engineering from AICTE/recognized board/ Institution or relevant Advanced Diploma (Vocational) from DGT with five years experience in relevant field.</p> <p style="text-align: center;">OR</p> <p>NTC/ NAC passed in Electrician trade with seven years experience in relevant field.</p> <p><b>Essential Qualification:</b> National Craft Instructor Certificate (NCIC) in Electrician trade, in any of the variants under DGT.</p>
<b>2. Workshop Calculation &amp;</b>	B.Voc/Degree in any Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field.

<b>Science</b>	<p style="text-align: center;"><b>OR</b></p> <p>03 years Diploma in any Engineering AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years experience in relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/ NAC in any Engineering trade with seven years experience in relevant field.</p> <p><b>Essential Qualification:</b> National Craft Instructor Certificate (NCIC) in relevant trade</p> <p style="text-align: center;"><b>OR</b></p> <p>NCIC in RoDA or any of its variants under DGT</p>					
<b>3. Engineering Drawing</b>	<p>B.Voc/Degree in Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/ NAC in any one of the 'Electrical group (Gr-II) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with seven years experience.</p> <p><b>Essential Qualification:</b> National Craft Instructor Certificate (NCIC) in relevant trade</p> <p style="text-align: center;"><b>OR</b></p> <p>NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT</p>					
<b>4. Training Methodology</b>	<p>B.Voc/Degree in any discipline from AICTE/ UGC recognized College/ university with two years experience in training/ teaching field.</p> <p style="text-align: center;"><b>OR</b></p> <p>Diploma in any discipline from recognized board / University with five years experience in training/teaching field.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/ NAC passed in any trade with seven years experience in training/ teaching field.</p> <p><b>Essential Qualification:</b> National Craft Instructor Certificate (NCIC) in any of the variants under DGT / B.Ed /ToT from NITTTTR or equivalent.</p>					
<b>5. Minimum Age for Instructor's</b>	21 Years					
<b>Distribution of training on Hourly basis: (Indicative only)</b>						
<b>Total Hrs /week</b>	<b>Trade Practical</b>	<b>Trade Theory</b>	<b>Workshop Cal. &amp; Sc.</b>	<b>Engg. Drawing</b>	<b>TM Practical</b>	<b>TM Theory</b>
40 Hours	16 Hours	6Hours	2 Hours	3 Hours	8 Hours	5 Hours



## 4. JOB ROLE

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### Brief description of job roles:

**Manual Training Teacher/Craft Instructor;** instructs students in ITIs/Vocational Training Institutes in respective trades as per defined job role. Imparts theoretical instructions for the use of tools & equipments of related trades and related subjects. Demonstrate process and operations related to the trade in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment and tools in stores.

**Electrician General;** installs, maintains and repairs electrical machinery equipment and fittings in factories, workshops power house, business and residential premises etc. Studies drawings and other specifications to determine electrical circuit, installation details etc. Positions and installs electrical motors, transformers, switchgears. Switchboards and other electrical equipment, fittings and lighting fixtures. Makes connections and solders terminals. Tests electrical installations and equipment and locates faults using megger, test lamps etc. Repairs or replaces defective wiring, burnt out fuses and defective parts and keeps fittings and fixtures in working order. May do armature winding, draw wires and cables and do simple cable jointing. May operate, attend and maintain electrical motors, pumps etc.

**Electrical Fitter;** fits and assembles electrical machinery and equipment such as motors, transformers, generators, switchgears, fans etc., studies drawings, wiring diagrams of fittings, wiring and assemblies to be made. Collects prefabricated electrical and mechanical components according to drawing and wiring diagrams and checks them with gauges, megger etc. to ensure proper function and accuracy. Fits mechanical components, resistance, insulators, etc., as per specifications, doing supplementary tooling where necessary. Follows wiring diagrams, makes electrical connections and solders points as specified. Checks for continuity, resistance, circuit shorting, leakage, earthing, etc. at each stage of assembly using megger, ammeter, voltmeter and other appliances and ensures stipulated performance of both mechanical and electrical components fitted in assembly. Erects various equipment such as bus bars, panel boards, electrical posts, fuse boxes switch gears, meters, relays etc. using non-conductors, insulation hoisting equipment as necessary for receipt and distribution of electrical current to feeder lines. Installs motors, generators, transformer etc. as per drawings using lifting and hoisting equipment as necessary, does prescribed electrical wiring, and connects to supply line. Locates faults in case of breakdown and replaces blown out fuse, burnt coils, switches, conductors etc. as required. Checks, dismantles, repairs and overhauls electrical units periodically or as required according to scheduled procedure. May test coils. May specialize in repairs of particular equipment manufacturing, installation or power house work and be designated accordingly.

**Wireman, Light and Power;** installs various kinds of electrical wiring such as cleat, conduit, casing, concealed etc. in houses, factories, workshops and other establishments for light and power supply. Studies diagram and plan of wiring and marks light, power and other points accordingly. Fixes wooden pegs, size tubes, saws casings, etc. by common carpentry fitting and other processes, according to type of wiring needed. Erects switch boards and fixes

switch box casings cleats, conduits ceiling roses, switches, meters etc. according to type and plan of wiring. Draws wire in two way or threeway wiring system as prescribed and makes electrical connections through plugs and switches to different points exercising great care for safety and avoiding short circuit and earthing at any stage of wiring. Fixes fuses and covers as per diagram and insulates all naked wires at diversions and junctions to eliminate chances of short circuit and earthing. Fits light brackets, holders, shades, tube and mercury lights, fans etc. and makes electrical connection as necessary. Tests checks installed wiring for leakage and continuity using megger, removes faults if any and certifies wiring as correct for connecting mains. Checks existing wiring for defects and restores current supply by replacing defective switches, plug sockets, blown fuse etc. or removing short circuits and faulty wiring as necessary. May repair simple electrical domestic appliances.

**Electrical Supervisor, Wiring** plans, prepares, estimates and supervises installation of commercial, industrial and domestic wiring in factories, establishments and residential buildings. Visits site, decides number of points to be fixed and estimates costs according to type of wiring to be installed. Plans and prepares wiring diagram according to building layout, power and light points to be fixed, equal distribution of load, minimum exposure to weather, easy access for repairs and other factors as necessary to suit customer's requirements. Marks location of points, cut-outs, ceiling roses junction boxes etc., and explains circuit to be drawn to Wireman. Arranges for materials, supervises installation of wiring and guides workers as necessary to ensure conformity with safety and electricity rules. Tests whole wiring systems with merger on completion of work to ensure continuity and proper installation. Connects to main switch fixed at convenient place and certifies on prescribed form that there is no leakage and wiring has been done in accordance with electricity act. May supervise installation of temporary wiring. May supervise installation of geyser, air-conditioners, booster pumps and other domestic appliances.

**Line Supervisor, Electrical;** supervises installation and drawing of overhead and underground electrical line for street lighting and power supply. Studies diagrams and details of line to be drawn. Visits area, determines electrical towers and poles to be installed and/or underground cables to be laid and explains working details to linemen. Marks locations of poles and tower or earth to be dug and gets them installed or set according to electricity act ensuring proper earthing. Gets brackets and other accessories fitted according to specifications. Informs power house or appropriate authority to switch off electric supply in area in which working, if necessary. Directs linemen and other workers to draw electric line as scheduled ensuring safety and minimum sagging. Guides joining of cables, fuses, junction boxes, etc., as appropriate and ensures continuity and proper installation. May do lead burning and join cables. May take charge of particular area and maintain power supply line by conducting repairs and replacements as necessary.

**Reference NCO-2015:**

- a) 2356.0100 - Manual Training Teacher/Craft Instructor
- b) 7411.0100 - Electrician General
- c) 7412.0200 - Electrical Fitter
- d) 7411.0301 - Wireman, Light and Power
- e) 3122.6000 - Line Supervisor, Electrical
- f) 3123.0400 - Electrical Supervisor, Wiring

## 5. LEARNING OUTCOME

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*Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.*

### 5.1. TRADE TECHNOLOGY

1. Ensure implementation of safe working practices, environment regulation and housekeeping.
2. Explain verification & measurement of different characteristics of electrical circuits.
3. Demonstrate installations, testing and maintenance of batteries & solar cells.
4. Train to estimate, assemble, install and test various wiring systems, winding and Insulating materials.
5. Explain verification & measurement of different characteristics of Magnetic effect of electric current, parts of DC Generator, DC motor and Power factors.
6. Evaluate testing, performance and maintenance of transformer.
7. Monitor testing, check connections, verify errors, calibrate various instruments and electrical Illumination systems.
8. Assess construction of simple electronic circuits and test for functioning.
9. Demonstrate planning, execution, commissioning and performance of various AC motors & Alternator/ MG set.
10. Analyse detection of faults and troubleshooting of inverter, stabilizer, UPS etc.
11. Demonstrate estimation, testing, servicing & troubleshooting components of various domestic/industrial programmable systems & their control circuits.
12. Evaluate planning, execution, commissioning & evaluate performance of various conventional/non-conventional power generation, transmission & distribution components.

## 6. COURSE CONTENT

SYLLABUS FOR ELECTRICIAN - CITS TRADE			
TRADE TECHNOLOGY			
Duration	Reference Learning Outcome	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
Practical 16 Hrs  Theory 06 Hrs	Ensure implementation of safe working practices, environment regulation and housekeeping.	<b>Safety Practices</b> <ul style="list-style-type: none"> <li>• Demonstrate fires in electrical Circuits &amp; Precautions.</li> <li>• Identify fire extinguishers &amp; its types, General Safety of Tools &amp; Equipment.</li> <li>• Rescue a person who is in contact with live wire and treat a person for electric shock/ injury.</li> <li>• Use of discharge rod.</li> </ul>	General Safety, Fire Fighting. Safely handling Tools & Equipment. Use of proper Tools & Equipment & its maintenance. Rescue of person who is in contact with live wire. Treat a person for electric shock/ injury. Personal Protective Equipment
Practical 16 Hrs  Theory 06 Hrs	Explain verification & measurement of different characteristics of electrical circuits.	<b>Basic Electricity</b> <ul style="list-style-type: none"> <li>• Verify Ohm's Law.</li> <li>• Measure current &amp; voltage in series and parallel circuits.</li> <li>• Measure Resistance using Wheat- stone bridge.</li> <li>• Verify Kirchhoff's Laws.</li> <li>• Check bare conductor joint.</li> <li>• Test PVC wire joints.</li> <li>• Check Crimping of lugs.</li> <li>• Demonstrate Soldering.</li> </ul>	Fundamentals, Ohm' Law, Kirchhoff's Laws, Series & Parallel combination of Resistors, Inductors & Capacitors. Laws of Resistance, Wheatstone bridge, PVC wires, Conductors & cables. Wire joints, Soldering.
Practical 32 Hrs  Theory 12Hrs	Demonstrate Installations, testing and maintenance of batteries & solar cells.	<b>Effects of Electric current</b> <ul style="list-style-type: none"> <li>• Connect heating elements &amp; solenoid coil.</li> <li>• Prepare electrolyte.</li> <li>• Measure specific gravity.</li> <li>• Perform grouping of Cells.</li> <li>• Test the battery with High rate discharge tester &amp; Hydrometer.</li> <li>• Apply different methods of battery charging with due Care &amp; Maintenance.</li> <li>• Determine the number of solar cells in series/ parallel for given power requirement.</li> </ul>	Heating, lighting, magnetic & chemical effect of electric current. Joule's law. Electrolysis & its laws Cells and Batteries- Primary & secondary cells, their construction & working. Lead Acid battery in detail- Hybrid cell, Alkaline cell, Charging Methods. Care & Maintenance of Battery. Principle and operation of solar cell.

<p>Practical 32 Hrs</p> <p>Theory 12Hrs</p>	<p>Train to estimate, assemble, install and test various wiring systems, winding &amp; Insulating materials.</p>	<p><b>Wiring systems and types –</b></p> <ul style="list-style-type: none"> <li>• Apply method of using wire gauge and micrometer.</li> <li>• Demonstrate PVC Casing-capping, Conduit wiring, Testing, Maintenance and repairing of wiring.</li> <li>• Apply fuse, MCB, ELCB relays.</li> <li>• Demonstrate multi-storied building wiring.</li> <li>• Measure Earth resistance by Earth tester.</li> <li>• Protective multiple earthing (PME),</li> </ul>	<p>National Electrical Code, SWG, common electrical Accessories - MCB, ELCB, MCCB, RCCB etc.</p> <p>Comparison between different types of wirings.</p> <p>Installation, Testing methods – Wiring estimations &amp; cost.</p> <p>Earthing, types, methods, improving earth resistance, Earth tester.</p> <p>Protective multiple earthing (PME), concept of chemical earthing</p>
<p>Practical 112 Hrs</p> <p>Theory 42Hrs</p>	<p>Explain verification &amp; measurement of different characteristics of Magnetic effect of electric current, parts of DC Generator, DC motor and Power factors.</p>	<p><b>Magnetism, Alternating current &amp; Poly phase system</b></p> <ul style="list-style-type: none"> <li>• Check preparation of electromagnet.</li> <li>• Test different types of capacitor.</li> <li>• Measure R, L, C, Z, Power, Power Factor, Energy by different methods – Single Phase &amp; 3Phase.</li> <li>• Measure the line &amp; phase values of voltage &amp; current in star &amp; Delta connection.</li> </ul> <p><b>DC Generator</b></p> <ul style="list-style-type: none"> <li>• Check different parts of DC generator.</li> <li>• Build up the voltage on Shunt Generator.</li> <li>• Connect Compound Generator &amp; Build up voltage.</li> <li>• Test and verify characteristics of series, Shunt and Compound generator.</li> <li>• Demonstrate dismantling &amp; reassembling of DC Generator.</li> <li>• Manual voltage control</li> </ul>	<p>Terminology used in magnetic circuit.</p> <p>Permanent Magnet, Principle of electromagnet Capacitor &amp; its types. Faraday's laws of Electromagnetic Induction. Fleming's rule, B-H Curve. Fundamental terms.</p> <p>Solving RLC circuit –series &amp; parallel resonance. Star &amp; Delta connections.</p> <p>Three phase three wires &amp; three phase four wires system.</p> <p>Three phase Power.</p> <p>Construction &amp; Principle. Types-Series, Shunt &amp; Compound Generator. EMF equation, Characteristics (OCC &amp; LCC). Armature reactions, commutation Efficiency, regulation &amp; Applications. Parallel operations Care and maintenance &amp; Trouble shooting.</p> <p>Compensating winding, interpoles and voltage control method.</p>



		<p><b>DC Motor</b></p> <ul style="list-style-type: none"> <li>Identify different parts of DC motor.</li> <li>Demonstrate starting and running of series, shunt &amp; compound Motors.</li> </ul>	<p>Construction &amp; Principle. Types- Series, Shunt &amp; Compound Motors. Characteristics curve.</p>
		<p><b>Work, Power, Energy &amp; Power factor</b></p> <ul style="list-style-type: none"> <li>Measure the power &amp; Power Factor in a balanced &amp; unbalanced load by two wattmeter method and by using Power Factor meter.</li> <li>Improve the power factor of a circuit using static capacitor.</li> <li>Measure Energy in single phase Load.</li> </ul>	<p>Active &amp; Reactive Power. Simple calculation for Work, Power &amp; Energy. Definition, significance Causes &amp; effects of low power factor. Methods of Improving power factor. Calculation of capacitor banks. Automatic power factor correction (APFC) Panels. Smart meters, Automated meter readers.</p>
<p>Practical 32 Hrs</p> <p>Theory 12Hrs</p>	<p>Evaluate testing, performance and maintenance of transformer.</p>	<p><b>Transformer</b></p> <ul style="list-style-type: none"> <li>Test and measure different transformation ratio.</li> <li>Demonstrate Open Circuit (OC) Test, Short Circuit (SC) test.</li> <li>Measure efficiency &amp; load Regulation</li> <li>Demonstrate parallel Operation.</li> <li>Demonstrate connection of star and Delta.</li> <li>Test and assess different transformer Oils.</li> <li>Detect faults and troubleshoot transformers.</li> <li>Verify the voltage of autotransformer with different tapings.</li> <li>Measure high current &amp; voltage using CT and PT.</li> </ul>	<p>Principle, Construction. Classification of Transformers EMF equation, rating Loading, Losses &amp; Efficiency Regulation. Parallel Operation Cooling methods, Transformer oil testing. Care and maintenance, Protective devices. Tap Changer –ON load and OFF load. Auto transformer, Instrument Transformer- CT &amp; PT. Welding Transformer.</p>
<p>Practical 64Hrs</p> <p>Theory 24Hrs</p>	<p>Monitor testing, check connections, verify errors and calibrate various instruments and</p>	<p><b>Electrical Measuring instruments</b></p> <ul style="list-style-type: none"> <li>Identify different types of electrical instruments.</li> <li>Determine errors using PMMC and MI meters.</li> </ul>	<p>Types –PMMC, MI Meters. Principle and construction. Digital meters. Megger &amp; Earth tester. Calibrations of meters.</p>

	electrical Illumination systems.	<ul style="list-style-type: none"> <li>• Test and calibrate different meters including Energy meter.</li> <li>• Measure insulation resistance.</li> </ul> <p><b>Illumination</b></p> <ul style="list-style-type: none"> <li>• Connect &amp; Install all kinds of lamps.</li> <li>• Connect single &amp; twin tube light fittings.</li> <li>• Connect HPMV &amp; HPSV lamp.</li> <li>• Construct and design Decorative Light.</li> <li>• Use Lux- meter.</li> <li>• Repairing of LED Bulbs.</li> </ul>	<p>Electronic measuring instruments &amp; sensors</p> <p>Laws of Illumination. Terminology used in Illumination. Types of Lamps-Incandescent Lamp and Discharge Lamp-fluorescent, HPMV, HPSV Lamps. Drum Switch, Lighting calculations. Energy efficient lighting systems (CFL, LED etc.)</p>
<p>Practical 32 Hrs</p> <p>Theory 12Hrs</p>	Assess Construction of simple electronic circuits and test for functioning.	<p><b>Basic Electronics</b></p> <ul style="list-style-type: none"> <li>• Identify different colour coding of Resistors.</li> <li>• Construct Rectifier circuits.</li> <li>• Check the different wave shape using CRO.</li> <li>• Test the Transistor Single stage Amplifier circuit.</li> <li>• Design Simple circuit containing power diode &amp; power transistor.</li> <li>• Construct UJT triggering circuit.</li> <li>• Use FET &amp; MOSFET as an amplifier.</li> <li>• Assess construction of control circuits for – SCR, DIAC, TRIAC, IGBT.</li> <li>• Assemble different OP-AMP circuits using IC 741.</li> <li>• Verify truth tables of Logic gates.</li> </ul>	<p>Semi-conductor diodes, Characteristics Zener diode Rectifiers &amp; filter circuits. Working principle and use of CRO. Transistor, Amplifier &amp; types. Introduction to Oscillator. Basic concept of Power diode, power transistor, Introduction to- UJT, FET, SCR, DIAC, TRIAC, MOSFET, IGBT.</p> <p>Introduction to Operational Amplifiers (IC-741). Digital Electronics –Number System, Logic gates.</p>
<p>Practical 96Hrs</p> <p>Theory 36Hrs</p>	Demonstrate Planning, execution, commissioning and performance of various AC motors & Alternator/ MG set.	<p><b>Three phase Induction motor</b></p> <ul style="list-style-type: none"> <li>• Analyse connection of various starters.</li> <li>• Start, run &amp; load ac 3 phase Squirrel cage &amp; Wound rotor Induction motors for performance testing.</li> <li>• Check the change of direction of rotation.</li> <li>• Measure speed, torque, slip, current, power, PF etc.</li> </ul>	<p>Squirrel Cage &amp; Wound Rotor: - Construction, parts, working principle. Concept of rotating magnetic field Applications. Types of starters-DOL, Star delta, Auto transformer starter etc. Rotor resistance type starter. Introduction to Speed control of 3 phase Induction motor. Torque-speed characteristics.</p>

			Losses & efficiency. Doubly Fed Induction Generators (DFIG) & its applications in renewable energy.
		<b>Single phase &amp; Special type of motors</b> <ul style="list-style-type: none"> <li>• Demonstrate starting and running of single phase motors &amp; change DOR (direction of rotation).</li> <li>• Check dismantling and reassembling of different types of 1-<math>\emptyset</math> motors.</li> </ul>	Classification, Construction, Working Principle & uses. Methods of starting. - Stepper motor, servo motor etc.
		<b>Alternator</b> <ul style="list-style-type: none"> <li>• Install an alternator and identify various parts and terminals of the same.</li> <li>• Demonstrate build up voltage, excitation, loading Characteristics.</li> <li>• Calculate load regulation &amp; performance efficiency.</li> <li>• Synchronise (by Parallel Operation) Alternators by Different Methods.</li> <li>• Start and Run, build up voltage and load MG set.</li> </ul>	Types- Hydro & Turbo Construction, Working Principle. Excitation methods, EMF Equation, Phase sequence, loading and characteristics. Efficiency & Voltage regulation. Parallel operations, conditions for Synchronisation. Brushless alternator. AVR (Automatic voltage regulator). MG set – Description, specifications & Characteristics.
		<b>Synchronous Motor</b> <ul style="list-style-type: none"> <li>• Identify different parts of Synchronous Motor.</li> <li>• Connect, Start and Run the Synchronous Motor.</li> <li>• Demonstrate Plotting of V-curve.</li> <li>• Demonstrate different applications of synchronous motor.</li> <li>• Check and correct Power factor.</li> </ul>	Construction, Working Principle, Starting Method. Effect of change of excitation on load. V-curve and Inverted V -curve. Power factor correction. Applications of synchronous motors, damper winding.
		<b>Winding and Insulating materials</b> <ul style="list-style-type: none"> <li>• Demonstrate small transformer winding.</li> <li>• Test burnt out DC machine for re-winding.</li> <li>• Demonstrate Winding procedure.</li> </ul>	Small transformer winding technique. DC machine winding, various types and methods, development diagram, winding procedure.

		<ul style="list-style-type: none"> <li>• Check small armature winding, impregnation, baking.</li> </ul>	
		<p><b>AC motor stator Re-winding</b></p> <ul style="list-style-type: none"> <li>• Test burnt stator and demonstrate rewinding procedure.</li> <li>• Check single &amp; double layer winding.</li> <li>• Demonstrate Impregnations, Varnishing, Baking &amp; Assembling.</li> </ul>	AC Motor stator Re-winding- Single phase & Three phase winding development diagram. Winding procedure.
Practical 16Hrs  Theory 06Hrs	Analyze detection of faults and troubleshooting of inverter, stabilizer, UPS etc.	<p><b>Basic Rectifiers and Inverter circuits</b></p> <ul style="list-style-type: none"> <li>• Check Basic Rectifiers and Inverter ckt.</li> <li>• Demonstrate Speed control of DC Motor using DC Drive.</li> <li>• Verify speed control of AC Motor (Induction Motor) using AC Drive.</li> <li>• Demonstrate maintenance of AC/DC machines, voltage stabiliser, UPS, Inverter &amp; Drives.</li> </ul>	Working principle, Construction, parameterization, Speed control. DC drive. AC drive. Preventive & Break down Maintenance of DC / AC machines, Voltage stabilizer, UPS, Inverter.
Practical 96Hrs  Theory 36Hrs	Demonstrate estimation, testing, servicing & troubleshooting of various domestic/industrial programmable systems & their control circuits.	<p><b>Industrial Wiring</b></p> <ul style="list-style-type: none"> <li>• Demonstrate wiring of motors.</li> <li>• Test and service protective devices, control panel etc.</li> <li>• Check wiring on UPS &amp; Inverter.</li> <li>• Demonstrate control cabinet/control panel assembly, wiring, checking/buzzing &amp; testing for the following exercises on 3 <math>\phi</math> induction motor. <ul style="list-style-type: none"> <li>i) DOL starter with push button control.</li> <li>ii) Forward / Reverse starter Automatic Star/Delta starter.</li> </ul> </li> </ul> <p><b>Domestic appliances</b></p> <ul style="list-style-type: none"> <li>• Repair and test various domestic appliances and equipments.</li> <li>• Demonstrate dismantling, servicing, re-assembling &amp; testing.</li> <li>• Demonstrate Care &amp;</li> </ul>	Wiring of Electrical Motor and Control Panel. Machine control cabinet /control panel layout, assembly & wiring – Power & control circuits, control elements- Push button switches, contactor, overload Relay etc. Selection of cables (Size & length) for industrial applications.
		<ul style="list-style-type: none"> <li>• Demonstrate Care &amp;</li> </ul>	Working principle and circuits of common domestic equipment and appliances:-Heaters, geysers, electric iron, domestic Mixer, Hair drier, UPS Inverter, Microwave Oven, Induction Heater,

		Maintenance of Domestic appliances.	Washing Machine etc. Concept of neutral and earth. Concept of Energy efficiency & energy efficient equipments. BEE Star Ratings, Labelling & Standardisation.
		<b>Planning, Estimation &amp; Costing of Wiring:</b> <ul style="list-style-type: none"> <li>Plan and carry out Domestic, Industrial, Commercial and Multi-storeyed building Workshop.</li> <li>Demonstrate estimation and costing labour/ Materials-accessories as per layout.</li> </ul>	Concept-Principle of plan-estimation and cost-preparation of wiring layout domestic/Industrial/Commercial. Safety Regulation 2010 for multi-storeyed building.
Practical 96Hrs  Theory 36Hrs	Evaluate planning, execution, commissioning & performance of various conventional/non-conventional power generation, transmission & distribution components.	<b>Power Generation</b> <ul style="list-style-type: none"> <li>Visit and Prepare layout plan/ single line diagram of the Thermal /Hydro /Nuclear power plant.</li> <li>Prepare layout plan for Non-conventional power plant.</li> <li>Prepare layout plan and identify different elements of solar power system.</li> <li>Assemble and connect solar panel for illumination.</li> </ul>	Block diagram of Hydro, Thermal & Nuclear Power plants. Non-conventional energy: - Introduction, various types of non-conventional energy resources –Wind, Solar, Small Hydro and Bio-mass. Principle and operation of solar panel.
		<b>Transmission of electric power, UG cables &amp; Distribution of power:</b> <ul style="list-style-type: none"> <li>Identify different types of insulators and binding insulators, fix jumper by crimping tool.</li> <li>Check various joints in UG cables.</li> <li>Visit HT/LT Substation; identify various parts of relay and ascertain the operation.</li> <li>Demonstrate setting of pick up current and time setting multiplier for relay operation.</li> <li>Identify the parts of circuit breaker and check its operation.</li> </ul>	Single Line Diagram of Substations. Electric supply system-comparison of EHVAC and HVDC transmission. Advantages of high voltage transmission Overhead lines: - Poles & Towers, bushings, Insulators & its types. Corona effect, Bundle-conductors, Sag, Skin effect & Ferranti effect. Fault studies. Construction, material, insulation, classification. 3 phase service-cable fault. Sub-Station HT/LT –Function, equipment, types of distribution system

		<ul style="list-style-type: none"> <li>• Test tripping characteristic of circuit breaker for over current and short circuit current.</li> <li>• Demonstrate repair and maintenance of circuit breaker.</li> </ul>	accessories-protective relays, Types of relays and its operation, Types of circuit breakers, their applications and functioning ,circuit breakers-lightning arrestor used in HT line .
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SYLLABUS FOR CORE SKILLS
1. Workshop Calculation & Science(Common for all Engineering CITS trades) (80 Hrs)
2. Engineering Drawing (Group II) (120Hrs)
3. Training Methodology (Common for all trades) (320Hrs + 200Hrs)

Learning outcomes, assessment criteria, syllabus and Tool List of above Core Skills subjects which is common for a group of trades, provided separately in [www.bharatskills.gov.in](http://www.bharatskills.gov.in)

## 7. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
<b>TRADE TECHNOLOGY</b>	
1. Ensure implementation of safe working practices, environment regulation and housekeeping.	Explain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy.
	Check and report all unsafe situations according to site policy.
	Demonstrate necessary precautions on fire and safety hazards and report according to site policy and procedures.
	Classify, handle and store / dispose off dangerous goods and substances according to site policy and procedures following safety regulations and requirements.
	Evaluate and observe site policies and procedures in regard to illness or accident.
	Demonstrate basic first aid and use them under different circumstances.
	Explain different fire extinguisher and use the same as per requirement.
2. Explain verification & measurement of different characteristics of electrical circuits.	Explain verification of characteristics of series, parallel and its combination circuit using Ohm's law and Kirchhoff's Laws.
	Analyze the effect of the short and open in series and parallel circuits.
	Explain verification of relation of voltage components of RLC series circuit in AC.
	Identify the phase sequence of a 3 $\phi$ supply using a phase-sequence meter.
	Group the given capacitors to get the required capacity and voltage rating.
3. Demonstrate Installations, testing and maintenance of batteries & solar cells.	Demonstrate assembling a DC source 6V/500 mA using 1.5V cells.
	Determine the internal resistance of cell and make grouping of cells.
	Appraise installation and maintenance of batteries.
	Determine total number of cells required for a given power requirement.
4. Train to estimate, assemble, install and test various wiring systems, winding and Insulating	Ensure Compliance with Safety Regulation 2010 when performing the wiring.
	Plan Preparation and mounting of the energy meter board.
	Evaluate drawing and wire up the consumers main board with ICDP switch and distribution fuse box.

materials.	Assess the types of fuses their ratings and applications.
	Check the parts of a relay, MCB & ELCB and its operation.
	Estimate the cost of material for wiring in PVC channel for an office room having 2 lamps, 1 Fan, one 6A socket outlet and wire up.
	Estimate the requirement for conduit wiring (3 phase) and wire up.
	Estimate the materials and wire up the lighting circuit for a godown.
	Estimate the materials and wire up a lighting circuit for a corridor in conduit.
	Test, locate the fault and repair a domestic wiring installation.
	Check testing of burnt out DC machine for re- winding.
5. Explain verification & measurement of different characteristics of Magnetic effect of electric current, parts of DC Generator, DC motor and Power factors.	Explain measurement of the power and energy in a single & three phase circuit using wattmeter and energy meter with CT and PT.
	Determine the power factor by direct and indirect methods in an AC single phase RLC parallel circuit.
	Explain construction of solenoid and determine its polarity for the given direction of current.
	Monitor a connection of lamp load in star and delta and determine relationship between line and phase values with precaution.
	Explain connection of balanced and unbalanced loads in 3 phase star system and to measure the power of 3 phase loads.
	Evaluate measurement of electrical parameters using tong tester in three phase circuits.
	Determine the load performance of different types of DC generator on load.
	Explain to connect, start, run and reverse direction of rotation of different types of DC motors.
	Review the load performance tests on different type of DC motor.
	Explain controlling the speed of a DC motor by different method.
Plan to maintain, service and trouble shoot the DC motor starter.	
6. Evaluate testing, performance and maintenance of transformer.	Plan work in compliance with standard safety norms related with transformer.
	Explain the types of transformers and their specifications.
	Verify the transformation ratio of a single phase transformer.
	Evaluate connection and testing of a single phase auto-transformer.
	Determine the losses (iron loss and copper loss) and the regulation of a single phase transformer at different loads.



	Assess measurement of the current and voltage using CT and PT.
	Plan to carry out winding for small transformer of 1KVA rating.
	Test the transformer oil with oil testing kit.
	Check connection of 3 single phase transformers for 3 phase operation of - a) delta-delta b) delta-star c) star-star d) star-delta.
	Plan to connect the given two single phase transformers a) parallel b) series (secondary only) and measure voltage.
	Assess connection & testing of 3 phase transformer in parallel.(Parallel operation).
7. Monitor testing, check connections, verify errors, calibrate various instruments and electrical illumination systems.	Monitor calibration of different meters viz. PMMC, MI etc.
	Plan connection & installation of all kinds of lamps.
	Assess connection of single & twin tube light fittings.
	Monitor connection, installation and testing the HPMV & HPSV lamp with accessories.
	Monitor testing of a decorative serial lamp set for 240 V using 6V bulb and flasher.
	Monitor installation of light fitting for show case window lighting.
8. Assess Construction of simple electronic circuits and test for functioning.	Monitor soldering on components, lug and board with safety.
	Identify the passive /active components by visual appearance, Code number and check testing for their condition.
	Identify the control and functional switches in CRO and assess measurement of the D.C. & A.C. voltage, frequency and time period.
	Assess construction and review testing of half & full wave rectifiers with and without filter circuits.
	Monitor construction of circuit by using transistor as a switch.
	Evaluate construction and testing of a UJT as relaxation oscillator & electronic timer.
	Assess construction of amplifier circuit using Transistor, FET and JFET and testing.
	Plan to Construct and test lamp dimmer using TRIAC/DIAC.
	Test IGBT and use in circuit for suitable operation.
	Plan to construct and test the universal motor speed controller using SCR with safety.
	Appraise construction and testing of logic gate circuits.
9. Demonstrate Planning, execution, commissioning and performance of various AC motors & Alternator/ MG set.	Assess circuit diagram drawing and connection of forward & reverse 3 phase squirrel cage induction motor.
	Plan to start, run and reverse an AC 3 phase squirrel cage induction motor by different type of starters.
	Evaluate measurement of the slip of 3 phase squirrel cage induction motor by tachometer for different output. Check

	Drawing of slip/load characteristics of the motor.
	Determine the efficiency of 3 phase squirrel cage induction motor by no load test/ blocked rotor test and brake test.
	Plot the speed torque (Slip/Torque) characteristics of slip ring induction motor.
	Monitor speed control of 3 phase induction motor.
	Demonstrate planning to connect, start and run a 3 phase synchronous motor.
	Demonstrate planning to connect start, run, control speed and reverse the DOR of different type of single phase motors.
	Assess installation of a single phase AC motor.
	Test continuity and insulation of various AC motors.
	Assess maintenance, service and troubleshooting of the AC motor&starter.
	Ensure planned work in compliance with standard safety norms related with Alternator & MG set.
	Demonstrate planning to connect start and run an alternator and build up the voltage.
	Determine the load performance of a 3 phase alternator.
	Assess starting and loading of a MG set with 3 phase induction motor coupled to DC shunt generator and build up the voltage.
	Evaluate alignment of MG set.
	Appraise preventive and breakdown Maintenance of alternator / MG set.
	Explain the effect of excitation current in terms of V-curves of synchronous motor.
10. Analyse detection of faults and troubleshooting of inverter, stabilizer, UPS etc.	Analyse operation and maintenance of inverter.
	Evaluate planning to troubleshoot, service and maintain a voltage stabilizer.
	Assess the parts, trace the connection and test the DC regulated power supply with safety.
	Evaluate troubleshooting and servicing a DC regulated power supply.
	Monitor battery charger for its operation.
	Evaluate preparation of an emergency light.
	Appraise maintenance of UPS.
11. Demonstrate estimation, testing, servicing & troubleshooting components of various domestic/industrial programmable systems & their control circuits.	Evaluate the parts, trace the connection and test the control panels of the equipments.
	Assess assembling of the various parts of control panels.
	Explain the wiring as per the drawings including terminations.
	Assess troubleshooting and servicing of various controls in the

	panels.
	Explain battery connections and maintenance.
	Test battery charger for its operation.
	Evaluate planning of work in compliance with standard safety norms related with domestic appliances.
	Monitor service and Repair of calling bell/ buzzer/ Alarm.
	Explain service and repair an automatic iron.
	Assess repair and service of oven having multi-range heat control.
	Check replacing the heating element in a kettle and test.
	Appraise service and repair of an induction heater.
	Monitor service and repair of a geyser.
	Assess service and repair of a mixer.
	Evaluate service and repair of washing machine.
	Monitor service and repair of table fan.
	Demonstrate service, repair and installation of ceiling fan.
	Ensure Compliance with Safety Regulation 2010 when performing the Industrial wiring.
	Monitor wire-up PVC Conduit wiring for lighting circuit & 3 phase motor circuit with due care and safety.
	Estimate the material required for the given layout for metal conduit wiring for 3 phase 3 HP squirrel cage induction motor & wire-up as per Safety Regulation 2010.
	Ensure termination to the feeder cable in bus bar & to service cable through plug-in box with due care and safety.
	Assess erection of a bus bar chamber on an angle iron board and wire-up for 3 phase induction motor with due care and safety.
	Determine the size of cable for main & distribution board of a workshop.
	Evaluate testing of an industrial wiring installation by using Megger.
12. Evaluate planning, execution, commissioning & performance of various conventional/non-conventional power generation, transmission & distribution components.	Assess preparation of single line diagram of thermal, hydel, solar and wind power plants.
	Monitor preparation of layout plan and single line diagram of transmission line.
	Evaluate drawing of overhead and domestic service line.
	Assess erection of an overhead service line pole for single phase 240v distribution system.
	Explain different types of insulators used in HT and LT line.
	Assess connection of feeder cable with domestic service line.
	Ensure plans to work in compliance with solar panel installation norms.
	Assess combination of solar cells for given power requirement.

	Explain assembling and installation of solar panel.
	Evaluate the functionality of solar panel.
	Demonstrate preparation of layout plan and single line diagram of Distribution substation.
	Illustrate application of relays in control circuits and examine its operation.
	Judge identification of parts of circuit breaker and check its operation.

## 8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT FOR ELECTRICIAN (CITS)			
Forbatch of 25 candidates			
S No.	Name of the Tool & Equipment	Specification	Quantity
<b>A. TRAINEES TOOL KIT</b>			
1.	Steel Tape	10 mtr length	25+1 nos.
2.	Plier Insulated	150 mm	25+1 nos.
3.	Plier Side Cutting	150 mm	25+1 nos.
4.	Screw Driver	100 mm	25+1 nos.
5.	Screw Driver	150 mm	25+1 nos.
6.	Electrician Connector, screw driver insulated handle thin stem	100 mm	25+1 nos.
7.	Heavy Duty Screw Driver	200 mm	25+1 nos.
8.	Electrician Screw Driver thin stem insulated handle	250 mm	25+1 nos.
9.	Punch Centre	150 mm X 9 mm	25+1 nos.
10.	Knife Double Bladed Electrician		25+1 nos.
11.	Neon Tester		25+1 nos.
12.	Steel Rule	300 mm	25+1 nos.
13.	Hammer, cross peen with handle		25+1 nos.
14.	Hammer, ball peen With handle		25+1 nos.
15.	Gimlet	6 mm.	25+1 nos.
16.	Bradawl		25+1 nos.
17.	Scriber (Knurled centre position )		25+1 nos.
18.	Pincer	150 mm	25+1 nos.
19.	Wire Stripper		25+1 nos.
20.	Tennon Saw	250 mm	25+1 nos.
21.	Firmer chisel wood	12mm	25+1 nos.

B. INSTRUMENT AND GENERAL SHOP OUTFIT			
22.	C- Clamp	200 mm, 150 mm and 100 mm	2 Nos each
23.	Spanner Adjustable	150 mm, 15 degree	2 Nos
24.	Blow lamp	0.5 ltr	2Nos
25.	Melting Pot		1No
26.	Ladel		2Nos
27.	Chisel Cold firmer	25 mm X 200 mm	2 Nos
28.	Chisel	25 mm & 6 mm	4 Nos each
29.	Hand Drill Machine	0 to 6 mm capacity	1No
30.	Portable Electric Drill Machine	6 mm capacity	1No
31.	Pillar Electric Drill Machine	12 mm capacity	1No
32.	Allen Key		1 set
33.	Oil Can	0.12 ltr	2 Nos
34.	Grease Gun		1 No
35.	Out Side Micrometer	0 to 25 mm	1No
36.	Motorised Bench Grinder		1No
37.	Rawl plug tool & bit		2 sets
38.	Pulley Puller	3 legs 250 mm adjustable	2Nos
39.	Bearing Puller le	3 legs 120 mm flexi	2Nos
40.	Hydrometer		2 sets
41.	Thermometer	0 to 100 deg Centigrade	1 No
42.	Scissors blade	150 mm	4 Nos
43.	Crimping Tool		1 set
44.	Crimping Tools Heavy duty		2 Nos
45.	Chisel Cold flat	12 mm	2 Nos
46.	Mallet hard wood	0.50 kg	4 Nos
47.	Hammer Exeter type	0.40 kg	8 Nos
48.	Hacksaw frame	200 mm 300 mm adjustable	4 Nos
49.	Try Square	150 mm blade	4 Nos
50.	Outside & Inside Divider Caliper		2 Nos each
51.	Pliers flat nose	100 mm	4 Nos
52.	Pliers round nose	100 mm	4 Nos
53.	Plier longnose	150 mm	4 Nos
54.	Tweezers	100 mm	4Nos
55.	Snip Straight & Bent	150 mm	2 Nos each

56.	Spanner D.E. metric standard		4 Nos
57.	Drill hand brace	0 to 100 mm	4 Nos
58.	Drill S.S. Twist block	2 mm, 5 mm 6 mm set of 3	4 sets
59.	Plane, smoothing cutters	50 mm	4 Nos.
60.	Gauge, wire imperial(SWG)		4 Nos
61.	File flat	200 mm 2 <sup>nd</sup> cut	8 Nos
62.	File half round	200mm2 <sup>nd</sup> cut	4 Nos
63.	File round	200 mm 2 <sup>nd</sup> cut	4 Nos
64.	File flat	150 mm rough	4 Nos
65.	File flat	250 mm bastard	4 Nos
66.	File flat	250 mm smooth	4 Nos
67.	File Rasp, half round	200 mm bastard	4 Nos
68.	Soldering Iron	25 watt, 65 watt, 125 watt	4 Nos each
69.	Copper bit soldering iron	0.25 kg.	4 Nos
70.	De soldering Gun		4 Nos
71.	Hand Vice	50 mm jaw	4 Nos
72.	Table Vice	100 mm jaw	8 Nos
73.	Pipe Cutter to cut pipes	up to 5 cm. dia	2 Nos
74.	Pipe Cutter to cut pipes	above 5 cm dia	1 No
75.	Stock and Die set for	20 mm to 50 mm G.I. pipe	1 No
76.	Ohm Meter; Series Type & Shunt Type		1 No each
77.	Stock and Dies conduit		4 Nos
78.	Multi Meter (analog)	0 to 1000 M Ohms, 2.5 to 500 V	1 No
79.	Digital Multi Meter	3 ½ digit	8 Nos
80.	A.C. Voltmeter	M.I. 0 –500V A.C	1 No
81.	Milli Voltmeter		6 Nos
82.	D.C. Milliammeter	0 -500m A (Digital+ Analog)	1 No
83.	Ammeter	MC 0-1A, 0-5 A, 0- 25 A	1 No
84.	A.C. Ammeter		2 Nos each
85.	A.C. Ammeter	M.I 0-10 -20 A, 0-15-25 A	2 Nos each
86.	Kilo Wattmeter	0-5 kw (CC-0-5-10 A,PC-0-250-500V)	2 Nos
87.	A.C. Energy Meter,	Single phase 5 amp. Three Phase 15 amp	2 Nos
88.	Power Factor Meter	single phse-230 volt (Analog+ Digital)	1 No each
89.	Frequency Meter (Analog+Digital)	Analog + Digital	1 No each

90.	Tachometer with stop watch	Analog + Digital	1 No each
91.	Current Transformer Primary-	0-10-20 A, Sec- 5 A)	2 Nos
92.	Potential Transformer	0-230-400V/110V	2 Nos
93.	Growler Internal+ External		1 No each
94.	Tong Tester / Clamp Meter	0 – 100 amp. AC Analog+ Digital)	1No
95.	Megger	500 volts	1No
96.	Wheat Stone Bridge with galvanometer & battery		1No
97.	Earth Tester	0-30 Ohm	2 Nos
98.	Contactor & auxiliary contacts	3 phase, 440 volt, 32 amp.	1 No each
99.	Load Bank 5 KW( Lamp / heater Type)		1No
100.	Brake Test arrangement with two spring balance 0 to 25 kg rating		2 sets
101.	DC Power Supply 0-440v , 15A		2 Nos
102.	Inverter- Input- 12 volt DC, Output- 220 volt AC	1 KVA with 12 V Battery	1No
103.	Voltage Stabiliser Input: AC Output:	150 – 230 volt 220 volt AC , 1 KVA	1 No
104.	Rheostat :	0 -1 Ohm, 5 Amp 0 -10 Ohm, 5 Amp 0- 25 Ohm, 10Amp 0-300Ohm,3Amp	2 Nos each
105.	Flux meter		2 Nos
106.	Laboratory Type Induction Coil		1 no
<b>C. MACHINERIES</b>			
107.	Used DC Generators-series, shunt and compound type for overhauling practice		2 Nos
108.	D.C. Shunt Generator with control panel,	2.5 KW, 230 V	1No
109.	D.C.Compound Generator with control panel including fitted rheostat, voltmeter, ammeter and breaker,	2.5KW, 230V	1No
110.	DC Series Motor coupled with mechanical load	0.5 to 2 HP, 220 Volts	1No
111.	DC Shunt Motor	2 to 3 HP, 220 volts	1No
112.	DC compound Motor with starter and switch	2 to 3 HP, 220 volts	1No
113.	<b>Electrical Machine Trainer –</b> Suitable for demonstrating the construction and functioning of different types of DC machines and AC machines (single phase and three phase). Should be fitted with friction brake arrangement, dynamometer, instrument panel		1No



	and power supply unit.		
114.	<p><b>Motor-Generator (AC to DC) consisting of :</b> SquirrelCageInductionMotorwithstardeltastarteranddirectlycoupled to DC shunt generator and switch board mounted with regulator, air breaker, ammeter, voltmeter, knifebladeswitchesandfuses,setcomplete withcaseironandplate, fixing bolts, foundation bolts and flexiblecoupling. <u>Induction Motor rating:</u> <u>DC Shunt Generator rating:</u></p>	7 HP, 400V, 50 cycles, 3 phase 5 KW, 440V	1No
115.	<p><b>Motor Generator(DC to AC) set consisting of-</b> ShuntMotorwithstartingcompensatorand switchdirectlycoupledtoAC generator with exciter and switch board mounted with regulator, breaker, ammeter,voltmeter frequencymeter,knife bladeswitchandfusesetc.Set complete with cast iron bed plate, fixing bolts, foundation bolts and flexible coupling. <u>Shunt Motor rating :</u> <u>AC Generator rating :</u></p>	5 HP, 440V 3-Phase, 4 wire, 3.5 KVA, 400/230 Volts, 0.8 pf, 50cycles	2 Nos.
116.	Thyristor /IGBT controlled D.C. motor drive with Tacho– generatorfeedback arrangement.	2 HP	1 No
117.	Thyristor /IGBT controlled A.C. motor drive with VVVF control	3 Phase, 2 HP	1 No
118.	DieselGeneratorSetwithchangeoverswitch,overcurrentbreakerand water-cooledwitharmature,star-deltaconnectionsAC.	3phase,5KVA, 230 volt	1No
119.	AC Squirrel Cage Motor with star delta starter and triple pole iron clad switch fuse.	2 to 3 HP, 3-phase ,400 volts, 50 cycles	2Nos
120.	AC phase-wound slip ring Motor with starter and switch.	5 HP, 400 volts, 3-phase, 50 cycles	1No
121.	A.C. Series type Motor with mechanical load.	¼ HP, 230V, 50 cycles	1No
122.	Single Phase Capacitor Motor with starter switch.	1 HP 230 volt 50 cycles	1No
123.	Universal Motor with starter/switch	230 volt, 50 cycles ¼ HP	1No
124.	Stepper Motor with Digital Controller		1No

125.	Shaded Pole Motor		1No
126.	Servo Motor with Control		1 No
127.	Cut model	3 phase induction motor	1 No
128.	Cut model of watermill and hydro power		1 No each
<b>D. GENERAL INSTALLATIONS</b>			
129.	Oscilloscope Dual Trace,	30 MHZ	1No
130.	Function Generator		1No
131.	Discrete Component Trainer		1No
132.	3- point D.C. Starter		2 Nos
133.	4- point D.C. Starter		2 Nos
134.	Single phase Transformer, core type, air cooled		3 Nos
135.	Three phase transformer, shell type oil cooled		1 No
136.	Variable Auto Transformer		1 No
137.	Linear I.C.Trainer		1No
138.	Digital I.C.Trainer		1 No
139.	Bath Impregnating		1 No
140.	Oven Stove		1 No
141.	Oil Testing Kit		1 No
142.	Battery	12 v	1 No
143.	Battery Charger		1 No
144.	Solar panel with Battery	18watt	1 set
145.	Hygrometer		1 No
146.	Domestic Appliances- a. Electric Hot Plate b. Electric Kettle, c. Electric Iron d. Immersion Heater e. A.C. Fan f. Geyser (Storage type) g. Mixture &Grinder. h. Microwave Oven i. Washing Machine j. HairDrier k. Induction Heater	1500 watt,220v with temp.control 1750watts,230v 1500 watts,230v with temp.Control 750/1000/1500 watt,230V 230v 25 ltrminimum,230V.  20 lpltrconvection. 6.5 kg fullyautomatic.	2Nos 2Nos 2Nos 2Nos 1 No 2 Nos 2Nos 1 No 2 Nos
147.	<u>Relays-</u> a. Cutout b. Reverse current c. Overcurrent d. Under voltage		1 no.each
148.	<u>Starters for -</u> a. Resistance typestarter b. Direct on lineStarter c. Star Delta Starter-manual, semi-automatic andautomatic	<u>2 to 5 H.P. A.C Motors</u>	1 No each

	d. Auto Transformertype		
149.	Synchronous scope Meter		2 Nos
150.	Phase Sequence Meter		2 Nos
151.	Component of Typical small hydro power unit		1 set
152.	Component of Typical water mill		1 set

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**ANNEXURE I**

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The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts and all others who contributed in revising the curriculum. Special acknowledgement is extended by DGT to the expert members who had contributed immensely in this curriculum.

<b>List of Expert members participated for finalizing the course curriculum of Electrician/Wireman (CITS)trade held on at CSTARI, Kolkata.</b>			
<b>SNo.</b>	<b>Name &amp; DesignationSh/Mr/Ms</b>	<b>Organization</b>	<b>Remarks</b>
1.	DEEPANKAR MALLICK DDG (Trg.)	DGT, MSDE, New Delhi	Chairman
2.	H. V. SAMVATSAR Director	CSTARI, Kolkata	Secretary (Trade Committee)
3.	SANJAY KUMAR Joint Director of Trg.	CSTARI, Kolkata	Member & Coordinator
4.	B. K. NIGAM Training Officer	CSTARI, Kolkata	Member & Coordinator
5.	S. D. SATISH CHANDRA Manager (HR), Trg.	HAL – Koraput, Odisha	Member
6.	SUMANTA MODAK General Manager (Works)	Eveready Industries Pvt. Ltd./ CII	Member
7.	R. N. BADYOPADHYAYA Chairman	Board of Studies & Skill, WBSCT&VE&SD	Member
8.	S. BHATTACHARY DGM (EE)	AAI, Netaji Subhash Chandra Bose International Airport, Kolkata	Member
9.	AMALENDU JANA Manager	TATA Communication Pvt. Ltd. Ultadanga, Kolkata	Member
10.	RANADIP MITRA Manager (HRD)	GRSE Ltd., Kolkata	Member
11.	JOYDEEP PAL MAJUMDER Asst. Work Manager	Rifle Factory, Ishapore, Ministry of Defence, Kolkata	Member
12.	DEEPAK KUMAR SSE/Drg./C&W	Railway Workshop, Kanchrapara, Kolkata	Member
13.	P. C. BHANDARI Technical Advisor	J K Cement Ltd., Kanpur	Member
14.	VIVEK CHAUDHARI Principal	Ujjwal ITI Nashirabad, Dist-Jalgaon, Maharashtra	Member
15.	Fr. JOSE PADAMATTAM Principal	Don Bosco Technical Institute, Park Circus, Kolkata	Member

16.	TUSHAR BAGCHI Principal	L & T CSTI, Kolkata	Member
17.	SUDHANGSHU MUKHERJEE Sr. Tech./DyCEE/KPA	Eastern Railway, Kanchrapara, Kolkata	Member
18.	D. W. PATNE Secretary/Principal	Association of Non Govt. ITI, Maharastra	Member
19.	SUNIRMAL BASU Asst. Inspecting Officer	Railway Workshop, Kanchrapara, Kolkata	Member
20.	L. K. MUKHERJEE Dy. Director of Trg.	CSTARI, Kolkata	Member
21.	ASHOKE RARHI Dy. Director of Trg.	CSTARI, Kolkata	Member
22.	NIRMALYA NATH Asst. Director of Trg.	CSTARI, Kolkata	Member
23.	SATYABADI SATAPATHY Training Officer	HAL – Koraput, Odisha	Member
24.	PRADIP KUMAR MONDAL Instructor	Govt. ITI Gariahat, Kolkata	Member
25.	R. GANGOPADHYAY Instructor	Supervisor Training Centre, ER Kanchrapara, Kolkata	Member
26.	S. N. TAMBATKAR Craft Instructor	Govt. ITI, Adheri, Mumbai	Member
27.	S. N. TAMBATKAR Craft Instructor	Govt. ITI, Adheri, Mumbai	Member
28.	SUMAN KARMAKAR Vocational Instructor	R. K. Mission, Belurmath, Kolkata	Member

## MEMBERS OF SECTOR MENTOR COUNCIL

S No.	Name	Organization	Mentor Council Designation
1.	Dr. S.P. Gupta	Professor, IIT Roorkee,	Chairman
2.	Dr.P. Mahanto	Professor, IIT, Guwahati	Member
3.	K.K. Seth	Ex. Director, BHEL, Noida	Member
4.	N. Chattopadhyay	Sr. DGM, BHEL, Kolkatta	Member
5.	A K Gohshal	Professor, IIT, Guwahati	Member
6.	Dr. Bharat Singh Rajpurohit	Asst. Professor, IIT, H.P.	Member
7.	Sunand Sharma	Chairman ALSTOM Projects India Ltd.	Member
8.	Dinesh Singhal	Rithani, Delhi road,	Member

		Meerut	
9.	J S SRao	Principal Director, NTPC, Faridabad	Member
10.	Bhim Singh	Professor, IIT Delhi	Member
<b>Mentor</b>			
11.	Amrit Pal Singh	Dy. Director, DGET, New Delhi	Mentor
<b>Member of Core Group</b>			
12.	R. Senthil Kumar	Director, ATI, Chennai	Member
13.	R.N. Bandopadhyay	Director, CSTARI, Kolkata	Member
14.	S. Mathivanan	Dy. Director, ATI, Chennai,	Team Leader
15.	L K Mukherjee	Dy. Director, CSTARI, Kolkata	Member
16.	B.N. Sridhar	Dy Director, FTI, Bangalore	Member
17.	Ketan Patel	Dy Director, RDAT, Mumbai	Member
18.	B. Ravi	Dy Director, CTI, Chennai	Member
19.	A.S. Parihar	Dy Director, RDAT, Kolkata	Member
20.	NirmalyaNath	Asst Director, CSTARI, Kolkata	Member
21.	Parveen Kumar	Asst Director, ATI-EPI, Hyderabad	Member
22.	C.C. Jose	Trg Officer, ATI, Chennai	Member
23.	L.M. Pharikal	Trg Officer, ATI, Kolkata	Member
24.	C.M. Diggewadi	Trg Officer, RDAT, Mumbai	Member
25.	Mohan Raj	Trg Officer, NIMI Chennai	Member
26.	M. Asokan	Trg Officer, CTI, Chennai	Member
27.	U.K. Mishra	Trg Officer, ATI, Mumbai	Member
28.	Prasad U.M.	Voc Instructor, MITI, Calicut	Member
29.	D. Viswanathan	ATO. Govt ITI, North Chennai	Member
30.	B. Navaneedhan	ATO, ITI. North Chennai	Member
31.	R. Rajasekar	ATO, ITI, Ambattur, Chennai	Member
32.	K. Amaresan	ATO, Govt ITI, Guindy, Chennai	Member
33.	Dr. S.P. Gupta	Professor, IIT Roorkee, (CHAIRMAN)	Member
34.	R.N. Bandopadhyay	Director, CSTARI, Kolkatta	Member
35.	R. Senthil Kumar,	Director, ATI, Chennai	Member
36.	A VenkateshwaraRao	Joint Director, ATI, Chennai	Member
37.	P. Saibaba,	Joint Director, ATI, Chennai	Member
38.	K.L. Kuli,	Joint Director, CSTARI, Kolkatta	Member
39.	K. Srinivasa Rao	Joint Director, CSTARI, Kolkatta	Member
40.	M. Thamizharasan	Joint Director, CSTARI, Kolkatta	Member
41.	S. Mathivanan,	Dy Director, ATI, Chennai, (TEAM LEADER)	Member
42.	Amrit Pal Singh	Dy. Director, DGET, New Delhi.(MENTOR)	Member

43.	BN Sridhar,	Dy Director, FTI, Bangalore	Member
44.	Ketan Patel	Dy Director, RDAT, Mumbai	Member
45.	B. Ravi,	Dy Director, CTI, Chennai	Member
46.	A.S. Parihar,	Dy Director, RDAT, Kolkata	Member
47.	Nirmalya Nath	Asst Director, CSTARI, Kolkatta	Member
48.	Parveen Kumar,	Asst Director, ATI-EPI, Hyderabad	Member
49.	C.C. Jose,	Trg Officer, ATI, Chennai	Member
50.	L.M. Pharikal,	Trg Officer, ATI, Kolkata	Member
51.	M. Asokan,	Trg Officer, CTI, Chennai	Member
52.	Mohan Raj,	Trg Officer, NIMI Chennai	Member
53.	UK Mishra,	Trg Officer, ATI, Mumbai	Member
54.	C.M. Diggewadi,	Trg Officer, RDAT, Mumbai	Member
55.	A. Chakraborty	Trg Officer, CSTARI, Kolkatta	Member
56.	T.K. Ghosh	Trg Officer, CSTARI, Kolkatta	Member
57.	Prasad U.M.	Voc Instructor, MITI, Calicut	Member
<b>Other industry representatives</b>			
58.	SurenduAdhikari	OTIS Elevator Co. India Ltd, Kolkata	Member
59.	K. Raju	Consultant- Energy Area, ASCI, Hyderabad	Member
60.	Ravi G Deshmukh	Certified Energy Auditor, PPS Energy solutions,	Member
61.	R. Thiruppathi	JTS, IIT, Madras, Chennai	Member
62.	M.N. Krishnamurthy	Retd. Ex Engineer, TNEB, Chennai	Member
63.	S. Kirubanandam	Asst. Ex Engineer, TANTRANSCO, Chennai	Member
64.	R. Kasi	Asst. Ex Engineer, TANTRANSCO, Chennai	Member
65.	L.R. Sundarajan	Jr. Works Manager, Heavy vehicles factory	Member
66.	B.S. Sudheendara	Consultant, VI micro systems pvt ltd, Chennai.	Member
67.	S. Ganesh	Manager, L&T , Chennai	Member
68.	G. Neethimani	Vice principal, Rane engine valves ltd, Chennai.	Member
69.	Dr.A.K. Ghoshal	Professor, IIT, Guwahati	Member
70.	Dr.P. Mahanto	Professor, IIT, Guwahati	Member
71.	K.K. Seth	Ex. Director, BHEL, Noida	Member
72.	N. Chattopadhyay	Sr. DGM, BHEL, Kolkata	Member
73.	Surendu Adhikari	OTIS Elevator Co. India Ltd, Kolkata Consultant- Energy	Member
74.	K. Raju	Area, ASCI, Hyderabad Certified Energy Auditor, PPS	Member
75.	Ravi G Deshmukh	Energy solutions, Pune	Member

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77.	B. Navaneedhan,	ITI. North Chennai ATO, ITI	Member
78.	R . Rajasekar,	Ambattur, Chennai	Member
79.	K. Amaresan,	ATO, Govt ITI, Guindy, Chennai Retd. Ex	Member
44.	M. N. Krishnamurthy	Engineer, TNEB, Chennai	Member
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47.	L.R. Sundarajan,	Jr. Works Manager, Heavy vehicles factory	Member
48.	B.S. Sudheendara	Consultant, VI Micro sSstems Pvt Ltd, Chennai.	Member
49.	S. Ganesh	Manager, L&T , Chennai Vice Principal, Rane engine	Member
50.	G. Neethimani	Valves Ltd, Chennai	Member



