



## सीएसआईआर-भारतीय पेट्रोलियम संस्थान

CSIR-Indian Institute of Petroleum

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद

(Council of Scientific & Industrial Research)

पोस्ट आई. आई. पी. , मोहकमपुर, देहरादून-248005, उत्तराखंड (भारत)  
P.O. IIP, Mohkampur, Dehradun - 248005, Uttarakhand (INDIA)



### अधिसूचना /NOTIFICATION

No. 3(541)/2017-Pers

June 24, 2020

विषय: विज्ञापन संख्या 04/2018: लिखित व ट्रेड परीक्षा हेतु पाठ्यक्रम

Subject: Advt. No. 04/2018 : Syllabus for Trade Test/Written Examination.

इस संस्थान की समसंख्यक अधिसूचनाओं दिनांक 08.11.2019 तथा 10.02.2020 जिनके माध्यम से ट्रेड/लिखित परीक्षा हेतु योग्य पाये गए अभ्यर्थियों की सूची अधिसूचित की गई थी, के अनुसरण में निम्नलिखित पोस्ट कोड का पाठ्यक्रम सभी अभ्यर्थियों की सूचनार्थ अधिसूचित किया जा रहा है/ In continuation to this Institute's Notifications of even No. dated 08.11.2019 and 10.02.2020 wherein lists of shortlisted candidates who have been found eligible for Trade Test/Written Examination, the syllabus of Trade Test/Written Examination for following Posts/Post Codes as advertised vide Advt. No. 04/2018 are being Notified for information of all concerned.

Sl. No.	Post Code	Post Advertised & Pay Level	Area
(1)	SPD-1	Technical Assistant [Pay Level-6]	Chemical Science
(2)	BFD-1	Technician(1) [Pay Level-2]	Chemical Science
(3)	AFLAD-1	Technical Assistant [Pay Level-6]	Mechanical & Automobile
(4)	AFLAD-2	Technician(1) [Pay Level-2]	AFLAD (Fitter)
(5)	AFLAD-3	Technical Assistant [Pay Level-6]	Electronics & Instrumentation
(6)	AFLAD-4	Technician(1) [Pay Level-2]	Diesel Mechanic
(7)	ESD-1	Technical Officer [Pay Level-7]	Electronics/Instrumentation
(8)	ESD-2	Technician(1) [Pay Level-2]	Electrical
(9)	ESD-3	Technical Assistant [Pay Level-6]	Refrigeration & Air Conditioning
(10)	TCD-1	Technician(1) [Pay Level-2]	Combustion (Fitter)

पोस्ट कोड IT-1 तथा IT-2 का पाठ्यक्रम अलग से अधिसूचित किया जाएगा / The syllabus for Post Code IT-1 and IT-2 will be notified separately.

लिखित परीक्षा के अन्य विवरण अर्थात दिनांक, समय, स्थान, प्रवेश पत्र इत्यादि संबंधित सूचना अभ्यर्थियों को ईमेल तथा पोस्ट द्वारा सूचित कर दी जाएगी तथा संस्थान की वेबसाइट पर भी उपलब्ध होगी / Other details i.e. date, time, venue, admit cards etc. of trade/written test will be made available on our website under intimation to concerned candidates through e-mail and post.

अतः सभी उम्मीदवारों को सलाह दी जाती है कि वे संस्थान की वेबसाइट को अद्यतन सूचना हेतु देखते रहें / The Candidates are advised to visit our website www.iip.res.in regularly for updates.

(प्रशासन नियंत्रक)

प्रशासन नियंत्रक/Controller of Administration

सीएसआईआर भारतीय पेट्रोलियम संस्थान

CSIR Indian Institute of Petroleum

देहरादून/Dehradun - 248005

प्रति:

- (1) सभी सूचना पट्ट / All Notice Boards
- (2) प्रमुख IT - अधिसूचना को संस्थान के वेबसाइट में अपलोड करने हेतु / For uploading Notification on CSIR-IIP Website

**Advt. No. 04/2018: Syllabus for Post Code: SPD-1**  
**Post: Technical Assistant**  
**Area: Chemical Science**

**Syllabus for Trade Test**

1. Identification of Laboratory Glass wares
2. Setting-up of Distillation, Separation apparatus
3. Volumetric Titration
4. Liquid-liquid extraction
5. Determination of Melting Point of Organic compound

**Syllabus for Written Examination**

1. Acids and Bases
2. Chemical Bonding
3. Coordination Chemistry
4. Name Reaction
5. Organic Spectroscopy (UV, IR and NMR)
6. Phase Equilibrium
7. Solutions and Colligative properties
8. Chemical Kinetics
9. Thermodynamics
10. Separation Techniques

----

**Advt. No. 04/2018: Syllabus for Post Code: BFD-1**  
**Post: Technician(1)**  
**Area: Chemical Science**

**Syllabus for Trade Test**

1. Common equipments used for Laboratory safety and Personal Protective equipments
2. Identification of Common gas cylinders used in laboratory
3. Demonstration/identification of hand tools, machine tools and workshop equipment
4. Handling knowledge about common acid and base
5. Identification of laboratory routine glass wares used in chemical Laboratory
6. Basic knowledge about Different types of tube joints (metallic and PTFE) such as straight connectors, bends or elbows, tees, screwed fittings, coupling, flanges, plug, and stop cock. Tools for fitting and Gasket materials such as asbestos, copper, PTFE, rubber, graphite for particular applications
7. Operation of jaw crusher and ball mill: Introduction to crushing & grinding, working and applications of size reduction equipment, sieve analysis with a sieve shaker
8. Common equipments used to measure the pressure, temperature, gas flow(s) and their unit conversion

**Syllabus for Written Examination**

8<sup>th</sup> to 10<sup>th</sup> Class Physical & Chemical Science text book – CBSE Board

----

**Advt. No. 04/2018: Syllabus for Post Code: AFLAD-1**

**Post: Technical Assistant**

**Area: Mechanical & Automobile**

Computer Fundamentals

Engineering drawing

Engineering workshop

Basic Mechanical Engineering

- Introduction to Thermodynamics
- Internal Combustion Engines and Refrigeration
- Heat transfer
- Machine Tools and Machining Processes

Thermal Engineering

- Sources of Energy
- Internal Combustion Engines
- I.C. Engine Systems
- Performance of I.C. Engines
- Air Compressors
- Refrigeration & Air-conditioning

Automobile Engineering

- Introduction to basic structure of an automobile
- Cooling and lubrication system
- Fuel feed system
- Ignition system
- Advanced automobile engines
- Engine combustion
- Engine testing
- Fuels and alternative energy options
- Fuel economy, Air pollution and Emission control

Fluid Mechanics

- Properties of fluid
- Fluid Pressure & Pressure Measurement
- Flow Through Pipes

Theory of Machines & Mechanisms

- Cams and Followers
- Flywheel and Governors
- Brakes, Dynamometers, Clutches & Bearings

Measurements & Metrology

Strength of Materials

- Mechanical properties of materials, simple stresses and strains
- Moment of inertia
- Torsion

Manufacturing Engineering

- Fundamentals of machining
- Lathe and drilling machines

-----

**Advt. No. 04/2018: Syllabus for Post Codes: AFLAD-2 & TCD - 1**  
**Post: Technician(1)**  
**Area: Fitter**

Safe working practices, environment regulation and housekeeping.

**Basic fitting operation** – marking, Hack sawing, Chiselling, Filing, Drilling, Taping and Grinding.

Producing components by different operations and checking of accuracy using appropriate measuring instruments. **Operations** - Drilling, Reaming, Taping; Appropriate Measuring Instrument –Vernier, Screw Gauge, Micrometer.

Making of different fit of components for assembling as per required tolerance as per the principle of interchangeability. **Different Fit** – Sliding, Angular, Step fit, 'T' fit, Square fit and Profile fit; Required tolerance:  $\pm 0.04$  mm, angular tolerance.

Producing components involving different operations on lathe observing standard procedure and checking for accuracy. **Different Operations** – facing, plain turning, step turning, parting, chamfering, shoulder turn, grooving, knurling, boring, taper turning, threading (external 'V' only).

Planning & performing simple repair, overhauling of different machines and checking functionality. **Different Machines** – Drill Machine, Bench Grinder and Lathe.

Making & assembling of components of different mating surfaces as per required tolerance by different surface finishing operations using different fastening components, tools and checking functionality. **Different Mating Surfaces** – Dovetail fitting, Combined fitting; Different surface finishing operations – Scraping, Lapping and Honing; Different fastening components – Dowel pins, screws, bolts, keys and cotters; Different fastening tools-hand operated & power tools, Required tolerance -  $\pm 0.02$ mm, angular tolerance  $\pm 10$  min.

Making different gauges by using standard tools & equipment and checking for specified accuracy. **Different Gauges** – Snap gauge, Gap gauge; Specified Accuracy -  $\pm 0.02$ mm.

Skills to execute pipe joints, dismantling and assembling valves & fittings with pipes and testing for leakages.

Cutting, Threading, Flaring, Bending and Joining.

Making drill jig & producing components on drill machine by using jigs and checking for correctness.

Planning, dismantling, repairing and assembling of different damaged mechanical components used for power transmission & checking functionality. **Different Damage Mechanical Components** – Pulley, Gear, Keys and Shafts.

Planning & performing basic day to day preventive maintenance, repairing and check functionality.

**Simple Machines** – Drill Machine and Lathe

Identifying, dismantling, replacing and assembling of different pneumatics and hydraulics components. **Different components** – Compressor, Pressure Gauge, Valves and Actuators.

Construction of circuit of pneumatics and hydraulics as per standard operating procedure & safety aspect.

Manufacturing of simple sheet metal items as per drawing and joining them by soldering, brazing and riveting.

**Advt. No. 04/2018: Syllabus for Post Code: AFLAD-3**  
**Post: Technical Assistant**  
**Area: Electronics & Instrumentation**

<b>S.No</b>	<b>Course Title/Topic</b>
1	Electronic Devices and Circuits
2	Analog Electronics and Digital Electronics
3	Electronic Measurements and Instrumentation
4	Electronic Circuits and Networks
5	Microcontroller and Applications
6	Consumer Electronics
7	Electronic Equipment Maintenance
8	Linear Integrated Circuits
9	Embedded Systems
10	Industrial Automation, Control Systems and PLC
11	Process control and Instrumentation
12	Industrial transducers
13	Electronic and Pneumatic Instrumentation
14	Digital switching and circuits
15	Introduction to Communication Engineering
16	Renewable Energy Technologies

**Advt. No. 04/2018: Syllabus for Post Code: AFLAD-4**  
**Post: Technician(1)**  
**Area: Diesel Mechanic**

- Safe working practices in an automotive workshop.
- Checking & performing the measurements & marking by using various Measuring & Marking tools: Vernier Calliper, Micrometer, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.
- Planning & performing basic fastening & fitting operation by using correct hand tools, machine tools & equipments.
- Tracing and testing of all electrical & electronic components & circuits and assembling of circuit to ensure functionality of system.
- Tracing & testing Hydraulic and Pneumatic components.
- Checking & Interpreting vehicle specification data and vehicle information number (VIN).
- Dismantling & assembling of diesel engine from vehicle (LMV/HMV) along with other accessories.
- Overhauling & servicing of diesel engine, its parts and checking functionality.
- Tracing, testing & repairing the cooling and lubrication system of engines.
- Tracing & testing Intake and Exhaust system of engine.
- Servicing Diesel Fuel System and checking proper functionality.
- Planning & overhauling the stationary engine and Governor and checking functionality.
- Monitoring emission of vehicle and executing different operation to obtain optimum pollution as per emission norms.
- Carrying out overhauling of alternator and starter motor.
- Diagnosis & rectification of the defects in LMV/HMV to ensure functionality of vehicle.

----

**Advt. No. 04/2018: Syllabus for Post Code: ESD-1**  
**Post: Technical Officer**  
**Area: Electronics / Instrumentation**

<b>S.No</b>	<b>Course Title/Topic</b>
<b>1</b>	Basic Electronics
<b>2</b>	Electrical Machines
<b>3</b>	Electromagnetic theory
<b>4</b>	Electronic Devices and Circuits
<b>5</b>	Transducers and Measurement Systems
<b>6</b>	Analog and Digital Electronics
<b>7</b>	VLSI Design
<b>8</b>	Power Electronics
<b>9</b>	Digital System Design
<b>10</b>	Microprocessors and Interfacing
<b>11</b>	Control Systems
<b>12</b>	Signals and systems
<b>13</b>	Microelectronic Circuits
<b>14</b>	Electronic Instrumentation
<b>15</b>	Industrial Instrumentation and control
<b>16</b>	Introduction to MEMS
<b>17</b>	Instrumentation Technology
<b>18</b>	Computer Architecture and Organisation
<b>19</b>	Introduction to Communication Engineering

----



**Advt. No. 04/2018: Syllabus for Post Code: ESD-3**  
**Post: Technical Assistant**  
**Area: Refrigeration & Air Conditioning**

1. Basic Mechanical Engineering

- Introduction to Thermodynamics
- Refrigeration and air conditioning
- Heat transfer
- Machine Tools and Machining Processes

2. Engineering drawing

3. Engineering workshop

4. Computer Fundamentals

5. Thermal Engineering

- Sources of Energy
- Air Compressors

6. Refrigeration and Air Conditioning

Refrigeration; Air Cycle; Vapour Compression Refrigeration System; Vapour Absorption Refrigeration; Refrigerants & lubricants; Introduction to Air conditioning; Factors affecting Air conditioning; Psychometric chart and its use; Faults in refrigeration and air conditioning system; Servicing procedure; Detection of refrigerants leakage; Tools used in refrigeration and Air conditioner installation; Installation procedure.

7. Refrigeration and Air Conditioning Equipments

Refrigeration Compressors; Evaporators; Condensers; Water Piping; Pumps; Humidifiers and Dehumidifiers; Domestic Refrigerators & Air Conditioners

8. Fluid Mechanics

- Properties of fluid
- Fluid Pressure & Pressure Measurement
- Flow Through Pipes

9. Measurements & Metrology

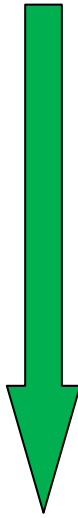
10. Strength of Materials

- Mechanical properties of materials, simple stresses and strains
- Moment of inertia
- Torsion

11. Manufacturing Engineering

- Fundamentals of machining
- Lathe and drilling machines

**Advt. No. 04/2018: Syllabus for Post Code: ESD-2**  
**Post: Technician(1)**  
**Area: Electrical**



**Next Page**

SYLLABUS FOR ELECTRICIAN TRADE			
FIRST YEAR			
Week No.	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
1	<ul style="list-style-type: none"> <li>Apply safe working practices</li> </ul>	<ol style="list-style-type: none"> <li>Visit various sections of the institutes and location of electrical installations. (05 hrs)</li> <li>Identify safety symbols and hazards. (05 Hrs)</li> <li>Preventive measures for electrical accidents and practice steps to be taken in such accidents. (05 hrs)</li> <li>Practice safe methods of fire fighting in case of electrical fire. (05 hrs)</li> <li>Use of fire extinguishers. (05 Hrs)</li> </ol>	Scope of the electrician trade. Safety rules and safety signs. Types and working of fire extinguishers.
2	<ul style="list-style-type: none"> <li>Apply safe working practices</li> <li>Comply environment regulation and housekeeping</li> </ul>	<ol style="list-style-type: none"> <li>Practice elementary first aid. (05 hrs)</li> <li>Rescue a person and practice artificial respiration. (05 Hrs)</li> <li>Disposal procedure of waste materials. (05 Hrs)</li> <li>Use of personal protective equipments. (05 hrs)</li> <li>Practice on cleanliness and procedure to maintain it. (05 hrs)</li> </ol>	First aid safety practice. Hazard identification and prevention. Personal safety and factory safety. Response to emergencies e.g. power failure, system failure and fire etc.
3	<ul style="list-style-type: none"> <li>Prepare profile with an appropriate accuracy as per drawing.</li> </ul>	<ol style="list-style-type: none"> <li>Identify trade tools and machineries. (10 Hrs)</li> <li>Practice safe methods of lifting and handling of tools &amp; equipment. (05 Hrs)</li> <li>Select proper tools for operation and precautions in operation. (05 Hrs)</li> <li>Care &amp; maintenance of trade</li> </ol>	Concept of Standards and advantages of BIS/ISI. Trade tools specifications. Introduction to National Electrical Code-2011.



		tools. (05 Hrs)	
4-5	<ul style="list-style-type: none"> <li>Prepare profile with an appropriate accuracy as per drawing.</li> </ul>	15. Operations of allied trade tools. (05 Hrs) 16. Workshop practice on filing and hacksawing. (10Hrs) 17. Prepare hand coil winding assembly. ( 5 Hrs) 18. Practice on preparing T-joint, straight joint and dovetail joint on wooden blocks. (15Hrs) 19. Practice sawing, planing, drilling and assembling for making a wooden switchboard. (15Hrs)	Allied trades: Introduction to fitting tools, safety precautions. Description of files, hammers, chisels hacksaw frames, blades, their specification and grades. Marking tools description and use. Types of drills, description & drilling machines. Various wooden joints.
6-7	<ul style="list-style-type: none"> <li>Prepare profile with an appropriate accuracy as per drawing.</li> </ul>	20. Practice in marking and cutting of straight and curved pieces in metal sheets, making holes, securing by screw and riveting. (10 Hrs) 21. Workshop practice on drilling, chipping, internal and external threading of different sizes. (20Hrs) 22. Practice of making square holes in crank handle. (5 Hrs) 23. Prepare an open box from metal sheet. (15 Hrs)	Marking tools; calipers Dividers, Surface plates, Angle plates, Scribes, punches, surface gauges Types, Uses, Care and maintenance. Sheet metal tools: Description of marking & cutting tools. Types of rivets and riveted joints. Use of thread gauge. Description of carpenter's tools Care and maintenance of tools.
8	<ul style="list-style-type: none"> <li>Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance of underground cable.</li> </ul>	24. Prepare terminations of cable ends (02 hrs) 25. Practice on skinning, twisting and crimping. (15 Hrs) 26. Identify various types of cables and measure conductor size using SWG and micrometer. (8 Hrs)	Fundamentals of electricity, definitions, units & effects of electric current. Conductors and insulators. Conducting materials and their comparison.
9-10	<ul style="list-style-type: none"> <li>Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance of underground cable.</li> </ul>	27. Make simple twist, married, Tee and western union joints. (18 Hrs) 28. Make britannia straight, britannia Tee and rat tail joints. (18 Hrs) 29. Practice in Soldering of joints / lugs. (14 Hrs)	Joints in electrical conductors. Techniques of soldering. Types of solders and flux.
11-12	<ul style="list-style-type: none"> <li>Prepare electrical</li> </ul>	30. Identify various parts, skinning	Underground cables:

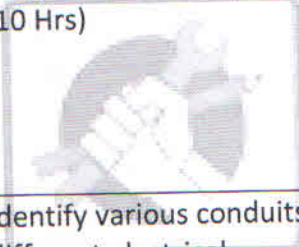


	wire joints, carry out soldering, crimping and measure insulation resistance of underground cable.	and dressing of underground cable. (15 Hrs) 31. Make straight joint of different types of underground cable. (15 Hrs) 32. Test insulation resistance of underground cable using megger. (05 hrs) 33. Test underground cables for faults and remove the fault. (15 Hrs)	Description, types, various joints and testing procedure. Cable insulation & voltage grades Precautions in using various types of cables.
13-14	• Verify characteristics of electrical and magnetic circuits.	34. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources and analyse by drawing graphs. (15 Hrs) 35. Measure current and voltage in electrical circuits to verify Kirchhoff's Law (10 Hrs) 36. Verify laws of series and parallel circuits with voltage source in different combinations. (05Hrs) 37. Measure voltage and current against individual resistance in electrical circuit (10 hrs) 38. Measure current and voltage and analyse the effects of shorts and opens in series circuit. (05 Hrs) 39. Measure current and voltage and analyse the effects of shorts and opens in parallel circuit. (05 Hrs)	Ohm's Law; Simple electrical circuits and problems. Kirchoff's Laws and applications. Series and parallel circuits. Open and short circuits in series and parallel networks.
15	• Verify characteristics of electrical and magnetic circuits.	40. Measure resistance using voltage drop method. (5 Hrs) 41. Measure resistance using wheatstone bridge. (5 Hrs) 42. Determine the thermal effect of electric current. (5 Hrs) 43. Determine the change in resistance due to temperature.	Laws of Resistance and various types of resistors. Wheatstone bridge; principle and its applications. Effect of variation of temperature on resistance. Different methods of measuring the values of

		(5 Hrs) 44. Verify the characteristics of series parallel combination of resistors. (5 Hrs)	resistance. Series and parallel combinations of resistors.
16-17	• Verify characteristics of electrical and magnetic circuits.	45. Determine the poles and plot the field of a magnet bar. (08 Hrs) 46. Wind a solenoid and determine the magnetic effect of electric current. (06 Hrs) 47. Measure induced emf due to change in magnetic field. (06 hrs) 48. Determine direction of induced emf and current. (06 hrs) 49. Practice on generation of mutually induced emf. (08 hrs) 50. Measure the resistance, impedance and determine inductance of choke coils in different combinations. (06 Hrs) 51. Identify various types of capacitors, charging / discharging and testing. (05 Hrs) 52. Group the given capacitors to get the required capacity and voltage rating. (05 Hrs)	Magnetic terms, magnetic materials and properties of magnet. Principles and laws of electro-magnetism. Self and mutually induced EMFs. Electrostatics: Capacitor- Different types, functions, grouping and uses.
18-19	• Verify characteristics of electrical and magnetic circuits.	53. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC series circuits. (08 Hrs) 54. Measure the resonance frequency in AC series circuit and determine its effect on the circuit. (07 hrs) 55. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC parallel circuits. (08 Hrs) 56. Measure the resonance frequency in AC parallel circuit	Inductive and capacitive reactance, their effect on AC circuit and related vector concepts. Comparison and Advantages of DC and AC systems. Related terms frequency, Instantaneous value, R.M.S. value Average value, Peak factor, form factor, power factor and Impedance etc. Sine wave, phase and phase difference. Active and Reactive power. Single Phase and three-phase system.



		<p>and determine its effects on the circuit. (07 hrs)</p> <p>57. Measure power, energy for lagging and leading power factors in single phase circuits and compare characteristic graphically. (08 Hrs)</p> <p>58. Measure Current, voltage, power, energy and power factor in three phase circuits. (07 hrs)</p> <p>59. Practice improvement of PF by use of capacitor in three phase circuit.(05 Hrs)</p>	Problems on A.C. circuits.
20-21	<ul style="list-style-type: none"> <li>Verify characteristics of electrical and magnetic circuits.</li> </ul>	<p>60. Ascertain use of neutral by identifying wires of a 3-phase 4 wire system and find the phase sequence using phase sequence meter. (10 Hrs)</p> <p>61. Determine effect of broken neutral wire in three phase four wire system.(05 hrs)</p> <p>62. Determine the relationship between Line and Phase values for star and delta connections. (10Hrs)</p> <p>63. Measure the Power of three phase circuit for balanced and unbalanced loads. (15 Hrs)</p> <p>64. Measure current and voltage of two phases in case of one phase is short-circuited in three phase four wire system and compare with healthy system.(10 hrs)</p>	<p>Advantages of AC poly-phase system.</p> <p>Concept of three-phase Star and Delta connection.</p> <p>Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load.</p> <p>Phase sequence meter.</p>
22-23	<p><b>Project work / Industrial visit</b></p> <p><b>Broad Areas:</b></p> <p>a) Prepare and assemble a test board with switches, plug socket, lamp holder etc.</p> <p>b) Temperature controlled system for switching 'ON' and 'OFF' of any circuit using bi-metallic strip.</p> <p>c) Series/ parallel combinational circuits</p>		
24-26	<b>Revision</b>		
27-28	<ul style="list-style-type: none"> <li>Install, test and maintenance of</li> </ul>	<p>65. Use of various types of cells. (08 Hrs)</p>	<p>Chemical effect of electric current and Laws of</p>

	batteries and solar cell.	<p>66. Practice on grouping of cells for specified voltage and current under different conditions and care. (12 Hrs)</p> <p>67. Prepare and practice on battery charging and details of charging circuit. (12 Hrs)</p> <p>68. Practice on routine, care/ maintenance and testing of batteries. (08 Hrs)</p> <p>69. Determine the number of solar cells in series / parallel for given power requirement. (10 Hrs)</p> 	<p>electrolysis. Explanation of Anodes and cathodes. Types of cells, advantages / disadvantages and their applications. Lead acid cell; Principle of operation and components. Types of battery charging, Safety precautions, test equipment and maintenance. Basic principles of Electroplating and cathodic protection Grouping of cells for specified voltage and current. Principle and operation of solar cell.</p>
29-30	<ul style="list-style-type: none"> <li>Estimate, Assemble, install and test wiring system.</li> </ul>	<p>70. Identify various conduits and different electrical accessories. (8 Hrs)</p> <p>71. Practice cutting, threading of different sizes &amp; laying Installations. (17 Hrs)</p> <p>72. Prepare test boards / extension boards and mount accessories like lamp holders, various switches, sockets, fuses, relays, MCB, ELCB, MCCB etc. (25 Hrs)</p>	<p>I.E. rules on electrical wiring. Types of domestic and industrial wirings. Study of wiring accessories e.g. switches, fuses, relays, MCB, ELCB, MCCB etc. Grading of cables and current ratings. Principle of laying out of domestic wiring. Voltage drop concept.</p>
31-32	<ul style="list-style-type: none"> <li>Estimate, Assemble, install and test wiring system.</li> </ul>	<p>73. Draw layouts and practice in PVC Casing-capping, Conduit wiring with minimum to more number of points of minimum 15 mtr length. (15 Hrs)</p> <p>74. Wire up PVC conduit wiring to control one lamp from two different places. (10 Hrs)</p> <p>75. Wire up PVC conduit wiring to control one lamp from three different places. (10 Hrs)</p> <p>76. Wire up PVC conduit wiring and practice control of sockets and lamps in different</p>	<p>PVC conduit and Casing-capping wiring system. Different types of wiring - Power, control, Communication and entertainment wiring. Wiring circuits planning, permissible load in sub-circuit and main circuit.</p>



		combinations using switching concepts. (15 Hrs)	
33-35	<ul style="list-style-type: none"> <li>Estimate, Assemble, install and test wiring system.</li> </ul>	77. Wire up the consumers main board with ICDP switch and distribution fuse box. (10 Hrs) 78. Prepare and mount the energy meter board. (10 Hrs) 79. Estimate the cost/bill of material for wiring of hostel/ residential building and workshop. (10 Hrs) 80. Practice wiring of hostel and residential building as per IE rules. (15 Hrs) 81. Practice wiring of institute and workshop as per IE rules. (15 Hrs) 82. Practice testing / fault detection of domestic and industrial wiring installation and repair. (15 Hrs)	Estimation of load, cable size, bill of material and cost. Inspection and testing of wiring installations. Special wiring circuit e.g. godown, tunnel and workshop etc.
36	<ul style="list-style-type: none"> <li>Plan and prepare Earthing installation.</li> </ul>	83. Prepare pipe earthing and measure earth resistance by earth tester / megger. (10 Hrs) 84. Prepare plate earthing and measure earth resistance by earth tester / megger. (10 Hrs) 85. Test earth leakage by ELCB and relay. (5 Hrs)	Importance of Earthing. Plate earthing and pipe earthing methods and IEE regulations. Earth resistance and earth leakage circuit breaker.
37-38	<ul style="list-style-type: none"> <li>Plan and execute electrical illumination system and test.</li> </ul>	86. Install light fitting with reflectors for direct and indirect lighting. (10 Hrs) 87. Group different wattage of lamps in series for specified voltage. (5 Hrs) 88. Practice installation of various lamps e.g. fluorescent tube, HP mercury vapour, LP mercury vapour, HP sodium vapour, LP sodium vapour, metal halide etc. (18 Hrs) 89. Prepare decorative lamp	Laws of Illuminations. Types of illumination system. Illumination factors, intensity of light. Type of lamps, advantages/ disadvantages and their applications. Calculations of lumens and efficiency.

		<p>circuit using drum switches. (5 Hrs)</p> <p>90. Prepare decorative lamp circuit to produce rotating light effect/running light effect. (6 Hrs)</p> <p>91. Install light fitting for show case lighting. (6 Hrs)</p>	
39-40	<ul style="list-style-type: none"> <li>Select and perform measurements using analog / digital instruments</li> </ul>	<p>92. Practice on various analog and digital measuring Instruments. (5 Hrs)</p> <p>93. Practice on measuring instruments in single and three phase circuits e.g. multi-meter, Wattmeter, Energy meter, Phase sequence meter and Frequency meter etc. (15 Hrs)</p> <p>94. Measure power in three phase circuit using two wattmeter methods. (8 Hrs)</p> <p>95. Measure power factor in three phase circuit by using power factor meter and verify the same with voltmeter, ammeter and wattmeter readings. (12 Hrs)</p> <p>96. Measure electrical parameters using tong tester in three phase circuits. (10 Hrs)</p>	<p>Classification of electrical instruments and essential forces required in indicating instruments.</p> <p>PMMC and Moving iron instruments.</p> <p>Measurement of various electrical parameters using different analog and digital instruments.</p> <p>Measurement of energy in three phase circuit.</p>
41	<ul style="list-style-type: none"> <li>Perform testing, verify errors and calibrate instruments.</li> </ul>	<p>97. Practice for range extension and calibration of various measuring instruments. (10 Hrs)</p> <p>98. Determine errors in resistance measurement by voltage drop method. (8 Hrs)</p> <p>99. Test single phase energy meter for its errors. (7 Hrs)</p>	<p>Errors and corrections in measurement.</p> <p>Loading effect of voltmeter and voltage drop effect of ammeter in circuits.</p> <p>Extension of range and calibration of measuring instruments.</p>
42-44	<ul style="list-style-type: none"> <li>Plan and carry out installation, fault detection and repairing of</li> </ul>	<p>100. Dismantle and assemble electrical parts of various electrical appliances e.g. cooking range, geyser,</p>	<p>Working principles and circuits of common domestic equipment and appliances.</p> <p>Concept of Neutral and Earth.</p>



	domestic appliances.	<p>washing machine and pump set. (25 Hrs)</p> <p>101. Service and repair of bell/buzzer. (5 Hrs)</p> <p>102. Service and repair of electric iron, electric kettle, cooking range and geyser. (12 Hrs)</p> <p>103. Service and repair of induction heater and oven. (10 Hrs)</p> <p>104. Service and repair of mixer and grinder. (10 Hrs)</p> <p>105. Service and repair of washing machine. (13Hrs)</p>	
45-46	<ul style="list-style-type: none"> <li>Execute testing, evaluate performance and maintenance of transformer.</li> </ul>	<p>106. Verify terminals, identify components and calculate transformation ratio of single phase transformers. (8 Hrs)</p> <p>107. Perform OC and SC test to determine and efficiency of single phase transformer. (12Hrs)</p> <p>108. Determine voltage regulation of single phase transformer at different loads and power factors. (12 Hrs)</p> <p>109. Perform series and parallel operation of two single phase transformers. (12 Hrs)</p> <p>110. Verify the terminals and accessories of three phase transformer HT and LT side. (6Hrs)</p>	<p>Working principle, construction and classification of transformer.</p> <p>Single phase and three phase transformers.</p> <p>Turn ratio and e.m.f. equation.</p> <p>Series and parallel operation of transformer.</p> <p>Voltage Regulation and efficiency.</p> <p>Auto Transformer and instrument transformers (CT &amp; PT).</p>
47	<ul style="list-style-type: none"> <li>Execute testing, evaluate performance and maintenance of transformer.</li> </ul>	<p>111. Perform 3 phase operation</p> <p>(i) delta-delta</p> <p>(ii) delta-star</p> <p>(iii) star-star</p> <p>(iv) star-delta</p> <p>by use of three single phase transformers. (6 Hrs)</p> <p>112. Perform testing of transformer oil. (6 Hrs)</p> <p>113. Practice on winding of small transformer. (8 Hrs)</p>	<p>Method of connecting three single phase transformers for three phase operation.</p> <p>Types of Cooling, protective devices, bushings and termination etc.</p> <p>Testing of transformer oil.</p> <p>Materials used for winding and winding wires in small transformer.</p>

		114. Practice of general maintenance of transformer. (5 Hrs)	
48-49	<b>Project work / Industrial visit</b> <b>Broad Areas:</b> <ol style="list-style-type: none"> <li>Overload protection of electrical equipment</li> <li>Automatic control of street light/night lamp</li> <li>Fuse and power failure indicator using relays</li> <li>Door alarm/indicator</li> <li>Decorative light with electrical flasher</li> </ol>		
50-51	<b>Revision</b>		
52	<b>Examination</b>		

**Note: -**

- Some of the sample project works (indicative only) are given at the mid and end of each year.
- Instructor may design their own projects and also inputs from local industry may be taken for designing such new projects.
- The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit a Project report after completion.
- If the instructor feels that for execution of specific project more time is required then he may plan accordingly in appropriate time during the execution of normal trade practical.

कौशल भारत - कुशल भारत



<b>SYLLABUS FOR ELECTRICIAN TRADE</b>			
<b>SECOND YEAR</b>			
<b>Week No.</b>	<b>Reference Learning Outcome</b>	<b>Professional Skills (Trade Practical) With Indicative Hours</b>	<b>Professional Knowledge (Trade Theory)</b>
53-54	<ul style="list-style-type: none"> <li>Plan, Execute commissioning and evaluate performance of DC machines.</li> </ul>	115. Identify terminals, parts and connections of different types of DC machines. (10 Hrs) 116. Measure field and armature resistance of DC machines. (10 Hrs) 117. Determine build up voltage of DC shunt generator with varying field excitation and performance analysis on load. (15 Hrs) 118. Test for continuity and insulation resistance of DC machine. (5 Hrs) 119. Start, run and reversedirection of rotation of DC series, shunt and compound motors. (10 Hrs)	General concept of rotating electrical machines. Principle of DC generator. Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring and Brushes, Laminated core etc. E.M.F. equation Separately excited and self excited generators. Series, shunt and compound generators.
55-56	<ul style="list-style-type: none"> <li>Plan, Execute commissioning and evaluate performance of DC machines.</li> <li>Execute testing, and maintenance of DC machines and motor starters.</li> </ul>	120. Perform no load and load test and determine characteristics of series and shunt generators. (12 Hrs) 121. Perform no load and load test and determine characteristics of compound generators (cumulative and differential). (13 Hrs) 122. Practice dismantling and assembling in DC shunt motor. (12 Hrs) 123. Practice dismantling and assembling in DC compound generator. (13 Hrs)	Armature reaction, Commutation, inter poles and connection of inter poles. Parallel Operation of DC Generators. Load characteristics of DC generators. Application, losses & efficiency of DC Generators. Routine & maintenance.



		Hrs)	
57-58	<ul style="list-style-type: none"> <li>Plan, Execute commissioning and evaluate performance of DC machines.</li> <li>Execute testing, and maintenance of DC machines and motor starters.</li> </ul>	124. Conduct performance analysis of DC series, shunt and compound motors. (15 Hrs) 125. Dismantle and identify parts of three point and four point DC motor starters. (10 Hrs) 126. Assemble, Service and repair three point and four point DC motor starters. (15 Hrs) 127. Practice maintenance of carbon brushes, brush holders, Commutator and slip-rings. (10 Hrs)	Principle and types of DC motor. Relation between applied voltage back e.m.f., armature voltage drop, speed and flux of DC motor. DC motor Starters, relation between torque, flux and armature current. Changing the direction of rotation. Characteristics, Losses & Efficiency of DC motors. Routine and maintenance.
59-60	<ul style="list-style-type: none"> <li>Execute testing, and maintenance of DC machines and motor starters.</li> <li>Distinguish, organise and perform motor winding.</li> </ul>	128. Perform speed control of DC motors - field and armature control method. (10 Hrs) 129. Carry out overhauling of DC machines. (15 Hrs) 130. Perform DC machine winding by developing connection diagram, test on growler and assemble. (25 Hrs)	Methods of speed control of DC motors. Lap and wave winding and related terms.
61-62	<ul style="list-style-type: none"> <li>Plan, Execute commissioning and evaluate performance of AC motors.</li> <li>Execute testing, and maintenance of AC motors and starters.</li> </ul>	131. Identify parts and terminals of three phase AC motors. (5 Hrs) 132. Make an internal connection of automatic star-delta starter with three contactors. (10 Hrs) 133. Connect, start and run three phase induction motors by using DOL, star-delta and auto-transformer starters. (20 Hrs) 134. Connect, start, run and reverse direction of rotation of slip-ring motor through rotor resistance	Working principle of three phase induction motor. Squirrel Cage Induction motor, Slip-ring induction motor; construction, characteristics, Slip and Torque. Different types of starters for three phase induction motors, its necessity, basic contactor circuit, parts and their functions.

		starter and determine performance characteristic. (15 Hrs)	
63-64	<ul style="list-style-type: none"> <li>Plan, Execute commissioning and evaluate performance of AC motors.</li> <li>Execute testing, and maintenance of AC motors and starters.</li> </ul>	<p>135. Determine the efficiency of squirrel cage induction motor by brake test. (8 Hrs)</p> <p>136. Determine the efficiency of three phase squirrel cage induction motor by no load test and blocked rotor test. (8 Hrs)</p> <p>137. Measure slip and power factor to draw speed-torque (slip/torque) characteristics. (14 Hrs)</p> <p>138. Test for continuity and insulation resistance of three phase induction motors. (5 Hrs)</p> <p>139. Perform speed control of three phase induction motors by various methods like rheostatic control, autotransformer etc. (15 Hrs)</p>	<p>Single phasing prevention.</p> <p>No load test and blocked rotor test of induction motor.</p> <p>Losses &amp; efficiency.</p> <p>Various methods of speed control.</p> <p>Braking system of motor.</p> <p>Maintenance and repair.</p>
65	<ul style="list-style-type: none"> <li>Distinguish, organise and perform motor winding.</li> </ul>	<p>140. Perform winding of three phase AC motor by developing connection diagram, test and assemble. (20 Hrs)</p> <p>141. Maintain, service and troubleshoot the AC motor starter. (05 Hrs)</p>	<p>Concentric/ distributed, single/ double layer winding and related terms.</p>
66-67	<ul style="list-style-type: none"> <li>Plan, Execute commissioning and evaluate performance of AC motors.</li> <li>Execute testing, and maintenance of AC motors and starters.</li> </ul>	<p>142. Identify parts and terminals of different types of single phase AC motors. (5 Hrs)</p> <p>143. Install, connect and determine performance of single phase AC motors. (15 Hrs)</p> <p>144. Start, run and reverse the direction of rotation of</p>	<p>Working principle, different method of starting and running of various single phase AC motors.</p> <p>Domestic and industrial applications of different single phase AC motors.</p> <p>Characteristics, losses and efficiency.</p>



		<p>single phase AC motors. (10 Hrs)</p> <p>145. Practice on speed control of single phase AC motors. (10 Hrs)</p> <p>146. Compare starting and running winding currents of a capacitor run motor at various loads and measure the speed. (10 Hrs)</p>	
68-69	<ul style="list-style-type: none"> <li>Distinguish, organise and perform motor winding.</li> </ul>	<p>147. Carry out maintenance, service and repair of single phase AC motors. (10 Hrs)</p> <p>148. Practice on single/double layer and concentric winding for AC motors, testing and assembling. (25 Hrs)</p> <p>149. Connect, start, run and reverse the direction of rotation of universal motor. (10 Hrs)</p> <p>150. Carry out maintenance and servicing of universal motor. (05 Hrs)</p>	<p>Concentric/ distributed, single/ double layer winding and related terms.</p> <p>Troubleshooting of single phase AC induction motors and universal motor.</p>
70-71	<ul style="list-style-type: none"> <li>Plan, execute testing, evaluate performance and carry out maintenance of Alternator / MG set.</li> <li>Execute parallel operation of alternators.</li> </ul>	<p>151. Install an alternator, identify parts and terminals of alternator. (10 Hrs)</p> <p>152. Test for continuity and insulation resistance of alternator. (5 Hrs)</p> <p>153. Connect, start and run an alternator and build up the voltage. (10 Hrs)</p> <p>154. Determine the load performance and voltage regulation of three phase alternator. (10 Hrs)</p> <p>155. Parallel operation and synchronization of three phase alternators. (15 Hrs)</p>	<p>Principle of alternator, e.m.f. equation, relation between poles, speed and frequency. Types and construction. Efficiency, characteristics, regulation, phase sequence and parallel operation. Effect of changing the field excitation and power factor correction.</p>
72	<ul style="list-style-type: none"> <li>Plan, execute testing, evaluate</li> </ul>	<p>156. Install a synchronous motor, identify its parts</p>	<p>Working principle of synchronous motor.</p>



	performance and carry out maintenance of Alternator / MG set.	and terminals. (10 Hrs) 157. Connect, start and plot V-curves for synchronous motor under different excitation and load conditions. (15 Hrs)	Effect of change of excitation and load. V and anti V curve. Power factor improvement.
73	• Plan, execute testing, evaluate performance and carry out maintenance of Alternator / MG set.	158. Identify parts and terminals of MG set. (5 Hrs) 159. Start and load MG set with 3 phase induction motor coupled to DC shunt generator. (20 Hrs)	Rotary Converter, MG Set description and Maintenance.
74-75	<b>Project work/Industrial visit (optional)</b> <b>Broad Areas:</b> a) Phase sequence checker for 3 phase supply b) Induction motor protection system c) Motor starters with protection d) Solar/wind power generation		
76-78	<b>Revision</b>		
79	• Assemble simple electronic circuits and test for functioning.	160. Determine the value of resistance by colour code and identify types. (10 Hrs) 161. Test active and passive electronic components and its applications. (15 Hrs)	Resistors – colour code, types and characteristics. Active and passive components. Atomic structure and semiconductor theory.
80-81	• Assemble simple electronic circuits and test for functioning.	162. Determine V-I characteristics of semiconductor diode. (10 Hrs) 163. Construct half wave, full wave and bridge rectifiers using semiconductor diode. (10 Hrs) 164. Check transistors for their functioning by identifying its type and terminals. (10 Hrs) 165. Bias the transistor and determine its characteristics. (10 Hrs) 166. Use transistor as an electronic switch and series voltage regulator. (10 Hrs)	P-N junction, classification, specifications, biasing and characteristics of diodes. Rectifier circuit - half wave, full wave, bridge rectifiers and filters. Principle of operation, types, characteristics and various configuration of transistor. Application of transistor as a switch, voltage regulator and amplifier.
82-83	• Assemble simple	167. Operate and set the required	Basic concept of power



	electronic circuits and test for functioning.	<p>frequency using function generator. (12 Hrs)</p> <p>168. Make a printed circuit board for power supply. (10 Hrs)</p> <p>169. Construct simple circuits containing UJT for triggering and FET as an amplifier. (12 Hrs)</p> <p>170. Troubleshoot defects in simple power supplies. (16 Hrs)</p>	<p>electronics devices.</p> <p>IC voltage regulators</p> <p>Digital Electronics - Binary numbers, logic gates and combinational circuits.</p>
84-85	<ul style="list-style-type: none"> <li>Assemble simple electronic circuits and test for functioning.</li> </ul>	<p>171. Construct power control circuit by SCR, Diac, Triac and IGBT. (15 Hrs)</p> <p>172. Construct variable DC stabilized power supply using IC. (10 Hrs)</p> <p>173. Practice on various logics by use of logic gates and circuits. (15 Hrs)</p> <p>174. Generate and demonstrate wave shapes for voltage and current of rectifier, single stage amplifier and oscillator using CRO. (10 Hrs)</p>	<p>Working principle and uses of oscilloscope.</p> <p>Construction and working of SCR, DIAC, TRIAC and IGBT.</p> <p>Principle, types and applications of various multivibrators.</p>
86-87	<ul style="list-style-type: none"> <li>Assemble accessories and carry out wiring of control cabinets and equipment.</li> </ul>	<p>175. Design layout of control cabinet, assemble control elements and wiring accessories for:</p> <p>(i) Local and remote control of induction motor. (15 Hrs)</p> <p>(ii) Forward and reverse operation of induction motor. (10 Hrs)</p> <p>(iii) Automatic star-delta starter with change of direction of rotation. (15 Hrs)</p> <p>(iv) Sequential control of three motors. (10 Hrs)</p>	<p>Study and understand Layout drawing of control cabinet, power and control circuits.</p> <p>Various control elements: Isolators, pushbuttons, switches, indicators, MCB, fuses, relays, timers and limit switches etc.</p>
88-89	<ul style="list-style-type: none"> <li>Assemble accessories and carry out wiring of control cabinets and equipment.</li> </ul>	<p>176. Carry out wiring of control cabinet as per wiring diagram, bunching of XLPE cables, channeling, tying and checking etc. (15 Hrs)</p>	<p>Wiring accessories: Race ways/ cable channel, DIN rail, terminal connectors, thimbles, lugs, ferrules, cable binding strap, buttons, cable ties,</p>

		<p>177. Mount various control elements e.g. circuit breakers, relays, contactors and timers etc. (10 Hrs)</p> <p>178. Identify and install required measuring instruments and sensors in control panel. (10 Hrs)</p> <p>179. Test the control panel for its performance. (15 Hrs)</p>	<p>sleeves, gromats and clips etc. Testing of various control elements and circuits.</p>
90-91	<ul style="list-style-type: none"> <li>Perform speed control of AC and DC motors by using solid state devices.</li> </ul>	<p>180. Perform speed control of DC motor using thyristors / DC drive. (18 Hrs)</p> <p>181. Perform speed control and reversing the direction of rotation of AC motors by using thyristors / AC drive. (18 Hrs)</p> <p>182. Construct and test a universal motor speed controller using SCR. (14 Hrs)</p>	<p>Working, parameters and applications of AC / DC drive. Speed control of 3 phase induction motor by using VVVF/AC Drive.</p>
92-94	<ul style="list-style-type: none"> <li>Detect the faults and troubleshoot inverter, stabilizer, battery charger, emergency light and UPS etc.</li> </ul>	<p>183. Assemble circuits of voltage stabilizer and UPS. (15Hrs)</p> <p>184. Prepare an emergency light. (10 Hrs)</p> <p>185. Assemble circuits of battery charger and inverter. (15 Hrs)</p> <p>186. Test, analyze defects and repair voltage stabilizer, emergency light and UPS. (15 Hrs)</p> <p>187. Maintain, service and troubleshoot battery charger and inverter. (10 Hrs)</p> <p>188. Install an Inverter with battery and connect it in domestic wiring for operation. (10 Hrs)</p>	<p>Basic concept, block diagram and working of voltage stabilizer, battery charger, emergency light, inverter and UPS. Preventive and breakdown maintenance.</p>
-95	<ul style="list-style-type: none"> <li>Erect overhead domestic service line and outline various power plant layout.</li> </ul>	<p>189. Draw layout of thermal power plant and identify function of different layout elements. (5 Hrs)</p> <p>190. Draw layout of hydel power</p>	<p>Conventional and non-conventional sources of energy and their comparison. Power generation by thermal and hydel power plants.</p>



		<p>plant and identify functions of different layout elements. (5 Hrs)</p> <p>191. Visit to transmission / distribution substation. (10 Hrs)</p> <p>192. Draw actual circuit diagram of substation visited and indicate various components. (5 Hrs)</p>	
96	<ul style="list-style-type: none"> <li>Plan, assemble and install solar panel.</li> <li>Erect overhead domestic service line and outline various power plant layout.</li> </ul>	<p>193. Prepare layout plan and Identify different elements of solar power system. (05 Hrs)</p> <p>194. Prepare layout plan and Identify different elements of wind power system. (05 Hrs)</p> <p>195. Assemble and connect solar panel for illumination. (15 Hrs)</p>	<p>Various ways of electrical power generation by non-conventional methods.</p> <p>Power generation by solar and wind energy.</p> <p>Principle and operation of solar panel.</p>
97	<ul style="list-style-type: none"> <li>Erect overhead domestic service line and outline various power plant layout.</li> </ul>	<p>196. Practice installation of insulators used in HT/LT line for a given voltage range. (5 hrs)</p> <p>197. Draw single line diagram of transmission and distribution system. (5 Hrs)</p> <p>198. Measure current carrying capacity of conductor for given power supply. (5 hrs)</p> <p>199. Fasten jumper in pin, shackle and suspension type insulators. (10 Hrs)</p>	<p>Transmission and distribution networks.</p> <p>Line insulators, overhead poles and method of joining aluminum conductors.</p>
98	<ul style="list-style-type: none"> <li>Erect overhead domestic service line and outline various power plant layout.</li> </ul>	<p>200. Erect an overhead service line pole for single phase 230V distribution system in open space. (10 Hrs)</p> <p>201. Practice on laying of domestic service line. (10 Hrs)</p> <p>202. Install bus bar and bus coupler on LT line. (5 Hrs)</p>	<p>Safety precautions and IE rules pertaining to domestic service connections.</p> <p>Various substations.</p> <p>Various terms like – maximum demand, average demand, load factor, diversity factor, plant utility factor etc.</p>
99	<ul style="list-style-type: none"> <li>Examine the faults</li> </ul>	<p>203. Identify various parts of relay</p>	<p>Types of relays and its</p>

	and carry out repairing of circuit breakers.	and ascertain the operation. (5 Hrs) 204. Practice setting of pick up current and time setting multiplier for relay operation. (5 hrs) 205. Identify the parts of circuit breaker, check its operation. (5Hrs) 206. Test tripping characteristic of circuit breaker for over current and short circuit current. (5 hrs) 207. Practice on repair and maintenance of circuit breaker. (5 hrs)	operation. Types of circuit breakers, their applications and functioning. Production of arc and quenching.
100-101	<b>Project work / Industrial visit</b> <b>Broad Areas:</b> a) Battery charger/Emergency light b) Control of motor pump with tank level c) DC voltage converter using SCRs d) Logic control circuits using relays e) Alarm/indicator circuits using sensors		
102-103	<b>Revision</b>		
104	<b>Examination</b>		

**Note: -**

1. Some of the sample project works (indicative only) are given at the mid and end of each year.
2. Instructor may design their own projects and also inputs from local industry may be taken for designing such new projects.
3. The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit a Project report after completion.
4. If the instructor feels that for execution of specific project more time is required then he may plan accordingly in appropriate time during the execution of normal trade practical.