Industrial Training Institute
Wireman

GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

WIREMAN

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4

SECTOR – POWER

Industrial Training Institute

Directorate General of Training

Skill India
कौशल भारत - कुशल भारत

Industrial Training Institute
Wireman

WIREMAN

(Engineering Trade)

(Revised in 2015)

Version: 1.1

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 5

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training
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List of member attended the meeting to finalize the course curricula of Wireman Trade			
S No.	**Name & Designation Shri./Mr./Ms.**	**Organization**	**Mentor Council Designation**
Members of Sector Mentor council			
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2.	Dr. P. Mahanto	Professor, IIT, Guwahati	Member
3.	K. K. Seth	Ex. Director, BHEL, Noida	Member
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10.	Bhim Singh	Professor, IIT Delhi	Member
Mentor			
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12.	R. Senthil Kumar	Director, ATI, Chennai	Member
13.	R.N. Bandopadhyay	Director, CSTARI, Kolkata	Member
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22.	C.C. Jose	Trg Officer, ATI, Chennai	Member
23.	L.M. Pharikal	Trg Officer, ATI, Kolkata	Member
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25.	Mohan Raj	Trg Officer, NIMI Chennai	Member

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33.	Surendu Adhikari	OTIS Elevator Co. India Ltd, Kolkata	Member

CONTENTS

1. COURSE INFORMATION

During the two-year duration of Wireman trade a candidate is trained on professional skill, professional knowledge, Engineering Drawing, Workshop Calculation & Science and Employability skill. In addition to this a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered under Professional Skill subject are as below:-

First Year: In this year, the trainee learns about safety and environment, use of fire extinguishers, artificial respiratory resuscitation to begin with. He gets the idea of planning & preparing good quality electrical wire joints for single and multi stand conductors suitable for applications with soldering and taking suitable care and safety. The trainee will be able to draw and set up DC and AC circuits including R-L-C circuits with accurate measurement of voltage, current, resistance, power, power factor and energy using ammeter, voltmeter, ohm-meter, watt-meter, energy meter, power factor meter and phase sequence tester with proper care and safety, plan, draw, estimate material, wire up and test different type of domestic wiring circuits as per Indian Electricity rules and taking care of quality, Construction and working of MCB & ELCB. Test a domestic wiring installation using Megger. The trainee will identify the type of batteries, construction, working and application of Ni-cadmium, lithium cell, lead acid cell etc. Demonstrate their charging and discharging, choosing appropriate method and carryout the installation and routine maintenance with due care and safety. He will plan & select to carry out basic jobs of marking out the components for filing, drilling, and riveting, fitting and assembled using different components independently, plan and install Pipe & Plate earthing. Measure earth resistance by earth tester, select and perform electrical/ electronic measurements with appropriate instrument. He should plan and execute electrical illumination system viz. FL tube, HPMV lamp, HPSV lamp, Halogen & metal halide lamp, CFL, LED lamp etc., plan, draw, estimate material, wire up and test different type of industrial wiring circuits as per Indian Electricity rules and taking care of quality. He will be able to plan, draw, estimate material, wire up and test different type of commercial and computer networking wiring circuits as per Indian Electricity rules and taking care of quality.

Second Year: In this year, the trainee will learn to construct and test Half–wave, full-wave, and bridge rectifiers with filter & without filter. He will be able to identify the constructional features, working principles of DC machine. Starting with suitable starter, running, forward and reverse operation and speed control of DC motors. Conduct the load performance test of DC machine with due care and safety. Maintain and troubleshoot of DC machines. He will recognise the constructional features, working principles of single phase and 3 phase AC motors. Starting with suitable starter, running, forward and reverse operation and speed control of AC motors with due care and safety. He should be able to identify the constructional

features, working principles of Alternator set. Test, Wire-up and run alternator. Synchronization of Alternator with due care and safety, identify the types, constructional features, working principles of transformer (single & three phase) Connect and test Transformer. He should be able to Prepare single line diagram and layout plan of electrical transmission & distribution systems and power plants with knowledge of principle applied. Make and test power connection to substation equipments with care and safety. He will select, assemble, test and wire-up control panel, plan, estimate and costing of different types of wiring system as per Indian Electricity rule.

2. TRAINING SYSTEM

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of Labour market. The vocational training programmes are running under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes under NCVT for propagating vocational training.

The Wireman trade under CTS is one of the most popular courses delivered nationwide through network of ITIs. The course is of two years duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core area (Workshop Calculation science, Engineering Drawing and Employability Skills) imparts requisite core skill & knowledge and life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by NCVT which is recognized worldwide.

Trainee broadly needs to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools;
- Perform tasks with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the job, and repair & maintenance work.
- Check the job/ assembly as per drawing for functioning identify and rectify errors in job/ assembly.
- Document the technical parameters in tabulation sheet related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS:

- Can appear in 10th examination through National Institute of Open Schooling (NIOS) for acquiring high school certificate and can go further for General/ Technical education.
- Can join Apprenticeship programs in different types of industries leading to a National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming an instructor in ITIs.

2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years: -

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	2131
2	Professional Knowledge (Trade Theory)	498
3	Workshop Calculation & Science	166
4	Engineering Drawing	249
5	Employability Skills	110
6	Library & Extracurricular Activities	166
7	Project Work/Industrial Visit	480
8	Revision & Examination	360
	Total	**4160**

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of the course and at the end of the training program as notified by the Government of India (GoI) from time to time. The employability skills will be tested in the first year itself.

a) The **Formative Assessment** during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute has to maintain an individual trainee portfolio as detailed in assessment guideline. The marks of Formative assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by NCVT as per the guideline of Government of India. The pattern and marking structure is being notified by Govt. of India from time to time. **The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The 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 REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects is 33%.

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. Due consideration should 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 the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences of Formative assessments are to be preserved until forthcoming 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 produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job.

	• A good level of neatness and consistency in the finish. • Little support in completing the project/job.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of job role:

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, sizes 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 three-way 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.

Reference NCO-2015: 7411.0301 – Wireman, Light and Power

4. GENERAL INFORMATION

Name of the Trade	**Wireman**
NCO - 2015	7411.0301
NSQF Level	Level-4
Duration of Craftsmen Training	Two Years
Entry Qualification	Passed 8th class examination
Unit Strength (No. Of Students)	20
Space Norms	88 Sq. m
Power Norms	5 KW
Instructors Qualification for:	
1. Wireman Trade	Degree in Electrical/ Electrical and Electronics Engineering from recognized Engineering College/ university with one year experience in the relevant field. **OR** Diploma in Electrical / Electrical and Electronics Engineering from recognized board of technical education with two years experience in the relevant field. **OR** NTC/NAC passed in the Trade of Electrician/ Wireman with three years' post qualification experience in the relevant field and one year Craftsman instructor training under CITS in 'Wireman' trade. **Essential Qualification:** Craft Instructor Certificate in relevant trade under NCVT. ***Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.***
2. Workshop Calculation & Science	Degree in Engineering with one year experience. **OR** Diploma in Engineering with two-year experience. **Essential Qualification:** Craft Instructor Certificate in RoD&A course under NCVT.
3. Engineering Drawing	Degree in Engineering with one year experience. **OR** Diploma in Engineering with two-year experience.

	OR NTC/ NAC passed in the Draughtsman (Mechanical/ Civil) with three-year experience. **<u>Essential Qualification</u>:** Craft Instructor Certificate in RoD & A course under NCVT.
4. Employability Skill	MBA OR BBA with two-year experience OR Graduate in Sociology/ Social Welfare/ Economics with two-year experience OR Graduate/ Diploma with two-year experience and trained in Employability Skills from DGT institutes. **AND** Must have studied English/ Communication Skills and Basic Computer at 12th/ Diploma level and above. **OR** **Existing Social Studies Instructors duly trained in Employability Skills from DGT institutes**
List of Tools and Equipment	As per Annexure – I

Distribution of training on hourly basis: (Indicative only)

Total Hours /Week	Trade Practical	Trade Theory	Workshop Cal. &Sc.	Engg. Drawing	Employability Skills	Extra-curricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

5. NSQF LEVEL COMPLIANCE

NSQF level for **'Wireman'** trade under CTS: **Level 4.**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

a. Process
b. Professional knowledge
c. Professional skill
d. Core skill
e. Responsibility

The Broad Learning outcome of **'Wireman'** trade under CTS mostly matches with the Level descriptor at Level-4.

The NSQF level-5 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 4	Work in familiar, predictable, routine, situation of clear choice	Factual knowledge of field of knowledge or study	Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts	Language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment	Responsibility for own work and learning

6. LEARNING OUTCOME

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

6.1 GENERIC LEARNING OUTCOME

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.
3. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric and apply knowledge of specific area to perform practical operations.
4. Understand and explain basic science in the field of study including friction, simple machine and heat and temperature.
5. Read and apply engineering drawing for different application in the field of work.
6. Understand and explain the concept in productivity, quality tools and labour welfare legislation and apply such in day to day work to improve productivity & quality.
7. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
8. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
9. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.

6.2 SPECIFIC LEARNING OUTCOME

FIRST YEAR

10. Make good quality electrical wire joints for single and multi strand conductors suitable for applications with soldering and taking suitable care and safety.
11. Draw and set up DC and AC circuits including R-L-C circuits with accurate measurement of voltage, current, resistance, power, power factor and energy using ammeter, voltmeter, ohm-meter, watt-meter, energy meter, power factor meter and phase sequence tester with proper care and safety.
12. Plan, draw, estimate material, wire up and test different type of domestic wiring circuits as per Indian Electricity rules and taking care of quality. Construction and working of MCB & ELCB. Test a domestic wiring installation using Megger.
13. Identify the type of batteries, construction, working and application of Ni-cadmium, lithium cell, lead acid cell etc. Demonstrate their charging and discharging, choosing appropriate method and carryout the installation and routine maintenance with due care and safety.
14. Make choices to carry out basic jobs of marking out the components for filing, drilling, and riveting, fitting and assembled using different components independently.

15. Plan and install Pipe & Plate earthing. Measure earth resistance by earth tester.
16. Select and perform electrical/ electronic measurements with appropriate instrument.
17. Plan and execute electrical illumination system viz. FL tube, HPMV lamp, HPSV lamp, Halogen & metal halide lamp, CFL, LED lamp etc.
18. Plan, draw, estimate material, wire up and test different type of industrial wiring circuits as per Indian Electricity rules and taking care of quality.
19. Plan, draw, estimate material, wire up and test different type of commercial and computer networking wiring circuits as per Indian Electricity rules and taking care of quality.

SECOND YEAR

20. Construct and test Half–wave, full-wave, and bridge rectifiers with filter & without filter. Troubleshoot and service of DC regulated power supply.
21. Understand the constructional features, working principles of DC machine. Starting with suitable starter, running, forward and reverse operation and speed control of DC motors. Conduct the load performance test of DC machine with due care and safety. Maintain and troubleshoot of DC machines.
22. Understand the constructional features, working principles of single phase and 3 phase AC motors. Starting with suitable starter, running, forward and reverse operation and speed control of AC motors with due care and safety.
23. Understand the constructional features, working principles of Alternator set. Test, Wire-up and run alternator. Synchronization of Alternator with due care and safety.
24. Understand the types, constructional features, working principles of transformer (single & three phase) Connect and test Transformer.
25. Prepare single line diagram and layout plan of electrical transmission & distribution systems and power plants with knowledge of principle applied. Make and test power connection to substation equipments with care and safety.
26. Select, assemble, test and wire-up control panel.
27. Plan, estimate and costing of different types of wiring system as per Indian Electricity rule.

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy.
	1.2 Recognize and report all unsafe situations according to site policy.
	1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1.4 Identify, handle and store / dispose off dangerous goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures in regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1.8 Identify and observe site evacuation procedures according to site policy.
	1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1.10 Identify basic first aid and use them under different circumstances.
	1.11 Identify different fire extinguisher and use the same as per requirement.
	1.12 Identify environmental pollution & contribute to the avoidance of instances of environmental pollution.
	1.13 Deploy environmental protection legislation & regulations
	1.14 Take opportunities to use energy and materials in an environmentally friendly manner
	1.15 Avoid waste and dispose waste as per procedure
	1.16 Recognize different components of 5S and apply the same in the working environment.
2. Interpret & use company and technical communication.	2.1 Obtain sources of information and recognize information.
	2.2 Use and draw up technical drawings and documents.
	2.3 Use documents and technical regulations and occupationally related provisions.
	2.4 Conduct appropriate and target oriented discussions with higher authority and within the team.

	2.5 Present facts and circumstances, possible solutions & use English special terminology.
	2.6 Resolve disputes within the team
	2.7 Conduct written communication.
3. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, and statistics and apply knowledge of specific area to perform practical operations.	3.1 Yearly examination to test basic skills on arithmetic, algebra, trigonometry and statistics.
	3.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
4. Understand and explain basic science in the field of study including friction, simple machine and heat and temperature.	4.1 Yearly examination to test basic skills on science in the field of study including friction, simple machine and heat and temperature.
	4.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
5. Read and apply engineering drawing for different application in the field of work.	5.1 Yearly examination to test basic skills on engineering drawing.
	5.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
6. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	6.1 Yearly examination to test the concept in productivity, quality tools and labour welfare legislation.
	6.2 Their applications will also be assessed during execution of assessable outcome.
7. Explain energy	7.1 Yearly examination to test knowledge on energy conservation, global warming and pollution.

conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	7.2 Their applications will also be assessed during execution of assessable outcome.
8. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	8.1 Yearly examination to test knowledge on personnel finance, entrepreneurship. 8.2 Their applications will also be assessed during execution of assessable outcome.
9. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.	9.1 Yearly examination to test knowledge on basic computer working, basic operating system and uses internet services. 9.2 Their applications will also be assessed during execution of assessable outcome.

SPECIFIC LEARNING OUTCOMES	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
FIRST YEAR	
10. Make good quality electrical wire joints for single and multi strand conductors suitable for applications with soldering and taking suitable care and safety.	10.1 Observe safety/ precaution during joints & soldering.
	10.2 Make simple straight twist and rat-tail joints in single strand conductors.
	10.3 Make married and 'T' (Tee) joint in stranded conductors.
	10.4 Prepare a Britannia straight and 'T' (Tee) joint in bare conductors.
	10.5 Prepare western union joint in bare conductor.
	10.6 Solder the finished copper conductor joints with precaution.
	10.7 Prepare termination of cable lugs by using crimping tool.
11. Draw and set up DC and AC circuits including R-L-C circuits with accurate measurement of voltage, current, resistance, power, power factor and energy using ammeter, voltmeter, ohm-meter, watt-meter, energy meter, power factor meter and phase sequence tester with proper care and safety.	11.1 Identify types of wires, cables and verify their specifications.
	11.2 Verify the characteristics of series, parallel and its combination circuit.
	11.3 Analyze the effect of the short and open in series and parallel circuits.
	11.4 Verify the relation of voltage components of R.L.C. series circuit in AC.
	11.5 Determine the power factor by direct and indirect methods in an AC single phase R, L, C parallel circuit.
	11.6 Identify the phase sequence of a 3 ø supply using a phase- sequence meter.
	11.7 Prepare / connect a lamp load in star and delta and determine relationship between line and phase values with precaution.
	11.8 Connect balanced and unbalanced loads in 3 phase star system and measure the power of 3 phase loads with safety/ precaution.
12. Plan, draw, estimate material, wire up, test different type of domestic wiring circuits as per Indian Electricity rules and taking care of quality. Construction and working of MCB & ELCB. Test a domestic wiring installation using Megger.	12.1 Comply with safety & IE rules when performing the domestic wiring.
	12.2 Identify the parts of MCB & ELCB and test its operation.
	12.3 Identify the types of fuses their ratings and applications.
	12.4 Prepare and mount the energy meter board with due care.
	12.5 Draw and wire up the consumers main board with ICDP switch and distribution fuse box.
	12.6 Draw and wire-up to control lamp controlled from 2 places (stair case wiring) on batten wiring as per IE rule.
	12.7 Draw and wire-up single phase domestic pump set in PVC conduit wiring as per IE rule.
	12.8 Draw and wire-up in casing capping one lamp controlled

	from 3 different places using intermediate switch as per IE rule.
	12.9 Wire –up in PVC conduit wiring for calling bell/buzzer & test them.
	12.10 Estimate the material for wiring in PVC casing & capping for two lamps, one fan and one 6A socket outlet & wire-up.
	12.11 Test a domestic wiring installation by using Megger.
13. Identify the type of batteries, construction, working and application of Ni-cadmium, lithium cell, lead acid cell etc. Demonstrate their charging and discharging, choosing appropriate method and carryout the installation and routine maintenance with due care and safety.	13.1 Assemble a DC source 6V/500 mA using 1.5V cells.
	13.2 Determine the Formative resistance of cell and make grouping of cells.
	13.3 Identify the parts of a battery charger and test for its operation.
	13.4 Practice on charging of battery and test for its condition with safety/ precaution.
	13.5 Installation and maintenance of batteries.
	13.6 Maintain, service and troubleshoot a battery charger.
14. Make choices to carry out basic jobs of marking out the components for filing, drilling, and riveting, fitting and assembled using different components independently.	14.1 Identify the trade hand tools; practice their uses with safety, care & maintenance.
	14.2 Prepare a simple half lap joint using firmer chisel with safety.
	14.3 Prepare tray using sheet metal with the safety
	14.4 Practice on fixing surface mounting type of accessories.
	14.5 Practice on connecting of electrical accessories.
	14.6 Make and wire up of a test board and test it.
15. Plan and install Pipe & Plate earthing. Measure earth resistance by earth tester.	15.1 Measure soil conductivity
	15.2 Install the pipe earthing and test it.
	15.3 Install the plate earthing and test it.
	15.4 Measure the earth electrode resistance using earth tester.
	15.5 Carry out earth resistance improvement.
16. Select and perform electrical/ electronic measurements with appropriate instrument.	16.1 Identify the type of electrical instruments.
	16.2 Determine the measurement errors while measuring resistance by voltage drop method.
	16.3 Extend the range of MC voltmeter and ammeter.
	16.4 Measure the power and energy in a single & three phase circuit using wattmeter and energy meter with CT and PT.
	16.5 Test single phase energy meter for its errors.
	16.6 Measure the value of resistance, voltage and current using digital multimeter.
	16.7 Measure the power factor in poly-phase circuit and verify the same with voltmeter, ammeter, wattmeter readings.

	16.8 Calibrate analog instruments.
	16.9 Measure frequency by frequency meter.
	16.10 Use meggar for insulation testing
17. Plan and execute electrical illumination system viz. FL tube, HPMV lamp, HPSV lamp, Halogen & metal halide lamp, CFL, LED lamp etc.	17.1 Install light fitting with reflectors for direct and indirect lighting.
	17.2 Assemble and connect a & single twin tube F.L.
	17.3 Connect, install and test the H.P.M.V, H.P.S.V, Halogen & metal hallide lamp with accessories.
	17.4 Prepare and test a decorative serial lamp set for 190 V using 6V bulb and flasher.
	17.5 Connect the neon sign with the accessories and test it.
	17.6 Assemble and install solar photo voltaic light.
	17.7 Install light fitting for show case window lighting.
	17.8 Install & test CFL & LED lamps.
	17.9 Measure intensity of light using LUX Meter.
18. Plan, draw, estimate material, wire up, test different type of industrial wiring circuits as per Indian Electricity rules and taking care of quality.	18.1 Comply with safety & IE rules when performing the Industrial wiring.
	18.2 Wire-up PVC Conduit wiring for lighting circuit & 3 phase motor circuit with due care and safety.
	18.3 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 IE rule.
	18.4 Make termination to the feeder cable in bus bar & to service cable through plug-in box with due care and safety.
	18.5 Erect a bus bar chamber on an angle iron board and wire-up for 3 phase induction motor with due care and safety.
	18.6 Determine the size of cable for main & distribution board of a workshop.
	18.7 Test an industrial wiring installation by using Megger.
19. Plan, draw, estimate material, wire up and test different type of commercialand computer networking wiring circuits as per Indian Electricity rules and taking care of quality.	19.1 Estimate the material for PVC channel wiring for telephone intercom having 5 instruments from main distribution frame (MDF) with due care.
	19.2 Estimate the material and wire-up PVC concealed conduit wiring of three phase installation of 3 stores office building having 4 lamps, 2 fans, one 5 A socket outlet and one buzzer in each room with ELCB protection as per IE rule.
	19.3 Draw and wire up a bank/hostel/hospital/commercial establishment in PVC conduit as per IE rule.
	19.4 Test a commercial wiring installation by using Megger.
	19.5 Wire up and test LAN wiring with due care.
	19.6 Install co axial cable from dish antenna to Television set.
	19.7 Prepare and connect batteries with UPS with due care and safety.

	19.8	Install and test UPS in the circuit with due care and safety.
SECOND YEAR		
20. Construct and test Half–wave, full-wave, and bridge rectifiers with filter & without filter. Trouble shoot and service of DC regulated power supply.	20.1	Practice soldering of components.
	20.2	Identify passive /active components by visual appearance, Code number and test for their condition.
	20.3	Construct and test a half wave, full wave and bridge rectifiers with and without filter circuits.
	20.4	Identify the control and functional switches in CRO and measure the D.C. / A.C. voltage, frequency and time period.
	20.5	Identify the parts, trouble shoot & service a DC regulated power supply.
21. Understand the constructional features, working principles of DC machine. Starting with suitable starter, running, forward and reverse operation and speed control of DC motors. Conduct the load performance test of DC machine with due care and safety. Maintain and troubleshoot of DC machines.	21.1	Plan work in compliance with standard safety norms related with DC machines.
	21.2	Identify the parts of DC machine and measure armature & field resistances and insulation resistance.
	21.3	Connect a DC generator, build up the voltage & load with proper safety.
	21.4	Disassemble, service and assemble a DC generator with due care.
	21.5	Connect the DC motor through 2/3/4 point starter, run, adjust the speed & change direction of rotation.
	21.6	Troubleshoot & maintain a DC machine.
22. Understand the constructional features, working principles of single phase and 3 phase AC motors. Starting with suitable starter, running, forward and reverse operation and speed control of AC motors with due care and safety.	22.1	Plan work in compliance with standard safety norms related with AC motors.
	22.2	Connect start, run and reverse the DOR of different type of single phase motors.
	22.3	Identify the terminals of 3 phase squirrel cage induction motor, wire up, run using different types of starters and change the direction of rotation.
	22.4	Determine the efficiency of 3 phase squirrel cage induction motor by no load test/ blocked rotor test and brake test.
	22.5	Wire up, start, run and adjust the speed of a slip-ring induction motor.
	22.6	Construct DOL, Forward/Reverse starter circuits using push button switches, contactors, overload relays etc.
	22.7	Practice power connections to motors.
23. Understand the constructional features, working principles of	23.1	Plan work in compliance with standard safety norms related with Alternator.
	23.2	Identify the parts of an Alternator, measure armature & field resistances and insulation resistance.

	Alternator set. Test, Wire-up and run alternator. Synchronization of Alternator with due care and safety.	23.3 Wire-up, start and run an alternator and build up the voltage.
		23.4 Load the Alternator & find out regulation at different loads.
		23.5 Synchronise the Alternators with mains.
24.	Understand the types, constructional features, working principles of transformer (single & three phase) Connect and test Transformer.	24.1 Plan work in compliance with standard safety norms related with transformer.
		24.2 Identify the types of transformers and their specifications.
		24.3 Measure winding resistance & Insulation resistance of single phase & 3 phase transformer.
		24.4 Identify the terminals; verify the transformation ratio of a single phase and 3 phase transformer.
		24.5 Connect and test a single phase auto- transformer.
		24.6 Determine the losses (iron loss and copper loss) efficiency and regulation of a single phase transformer at different loads.
		24.7 Connect transformers in parallel.
25.	Prepare single line diagram and layout plan of electrical transmission & distribution systems and power plants with knowledge of principle applied. Make and test power connection to substation equipments with care and safety.	25.1 Plan work in compliance with standard safety norms related with substation & over head lines.
		25.2 Prepare layout plan, single line diagram of different type of power plant and project report of all equipment's and machineries of the visited plant.
		25.3 Prepare single line diagram of the institute's electrical substation & distribution system.
		25.4 Demonstrate testing and use of line protecting devices as per IE rules.
		25.5 Make power connection to substation equipments.
		25.6 Identify the parts of substation equipments like circuit breakers and operate them.
		25.7 Practice crimping of lugs to underground cable and connect the cable to bus bars & equipments with due care.
		25.8 Start the generator, build up voltage and synchronise with mains by observing due care and safety.
26.	Select, assemble, test and wire-up control panel wiring.	26.1 Draw the layout diagram of 3 phase AC motor control cabinet.
		26.2 Mount the control elements and wiring accessories on the control panel.
		26.3 Practice wiring the control cabinet for local and remote control of induction motor.
		26.4 Draw and wire up the control panel for forward/ reverse operation of induction motor.
		26.5 Test the control panel for all the required logics.

27. Plan, estimate and costing of different types of wiring system as per Indian Electricity rule.	27.1 Prepare layout and wiring diagram of domestic, commercial and industrial installation using IER symbols.
	27.2 Record the various electrical wiring accessories available in market with price list and compare it.
	27.3 Plan, Estimate and Costing of Domestic wiring as per layout.
	27.4 Plan, Estimate and Costing of commercial wiring as per layout.
	27.5 Plan, Estimate and Costing of Industrial wiring as per layout.

SYLLABUS FOR WIREMAN TRADE			
FIRST YEAR			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
1	Recognize & comply safe working practices, environment regulation and housekeeping.	1. Implementation in the shop floor of the various safety measures. (2 hrs.) 2. Visit to the different sections of the Institute. (3 hrs.) 3. Demonstration on elementary first aid. Artificial Respiration. (2 hrs.) 4. Practice on use of fire extinguishers. (3 hrs.) 5. Occupational Safety & Health Importance of housekeeping & good shop floor practices. (3 hrs.) 6. Health, Safety and Environment guidelines, legislations & regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. (4 hrs.) 7. Basic safety introduction, Personal protective Equipment (PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. (3 hrs.) 8. Preventive measures for electrical accidents & steps to	**Occupational Safety & Health** Basic safety introduction, Personal protection:- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Use of Fire extinguishers. Visit & observation of sections. Various safety measures involved in the Industry. Concept of Standard **Soft Skills**: its importance and Job area after completion of training. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure.

		be taken in such accidents. (3 hrs.)	
2	Make good quality electrical wire joints for single and multi strand conductors suitable for applications with soldering and taking suitable care and safety.	9. Demonstration of Trade hand tools. (6 hrs.) 10. Identification of simple types-screws, nuts & bolts, chassis, clamps, rivets etc. (7 hrs.) 11. Use, care & maintenance of various hand tools. Familiarization with signs and symbols of Electrical accessories. (12 hrs.)	Identification of Trade-Hand tools-Specifications
3-4	-do-	12. Practice in using cutting pliers, screw drivers etc. skinning the cables, and joint practice on single strand. (20 hrs.) 13. Demonstration & Practice on bare conductors joints--such as rat tail, Britannia, straight, Tee, Western union Joints. (30 hrs.)	Fundamental of electricity. Electron theory- free electron, Fundamental terms, definitions, units & effects of electric current
5	-do-	14. Practice in **soldering** & brazing-measurement of Resistant and measurement of specific resistant. (15 hrs.) 15. Application of Wheatstone bridge in measurement of resistance. (10 hrs.)	Solders, flux and soldering technique. Resistors types of resistors & properties of resistors.
6	Draw and set up DC and AC circuits including R-L-C circuits with accurate measurement of voltage, current, resistance, power, power factor and energy using ammeter, voltmeter, ohm-meter, watt-meter, energy meter,	16. Demonstration and identification of types of cables. (6 hrs.) 17. Demonstration & practice on using standard wire gauge & micrometer. (6 hrs.) 18. Practice on crimping thimbles, Lugs. (5 hrs.) 19. Examination and checking of cables and conductors and verification of materials according to the span. (8 hrs.)	Introduction of National Electrical Code 2011 Explanation, Definition and properties of conductors, insulators and semi-conductors. Voltage grading of different types of Insulators, Temp. Rise permissible Types of wires & cables standard wire gauge Specification of wires & Cables-insulation & voltage grades -Low , medium & high voltage Precautions in using various types

	power factor meter and phase sequence tester with proper care and safety.		of cables / Ferrules
7	-do-	20. Verification of Ohm's Law. (2 hrs.) 21. Verification of Kirchhoff's Laws. (3 hrs.) 22. Verification of laws of series and parallel circuits. (4 hrs.) 23. Verification of open circuit and closed circuit network. (3 hrs.) 24. Measuring unknown resistance using Wheatstone bridge, voltage drop method. (6 hrs.) 25. Experiment to demonstrate the variation of resistance of a metal with the change in temperature. (7 hrs.)	**Ohm's Law -** Simple electrical circuits and problems. Reading of simple Electrical Layout. **Resistors -**Law of Resistance. Series and parallel circuits. **Kirchhoff's** Laws and applications. Wheatstone bridge principle and its applications. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance
8	Plan, draw, estimate material, wire up and test different type of domestic **wiring** circuits as per Indian Electricity rules and taking care of quality. Construction and working of MCB & ELCB. Test a domestic **wiring** installation using Megger.	26. Practice on installation and overhauling **common electrical accessories** as per simple Electrical circuit / Layout. (10 hrs.) 27. Fixing of switches, holder plugs etc. in T.W. boards. (8 hrs.) 28. Identification and use of **wiring** accessories concept of switching. (7 hrs.)	**Common Electrical Accessories**, their specifications in line with NEC 2011-Explanation of switches lamp holders, plugs and sockets. Developments of domestic circuits, Alarm & switches, with individual switches, Two way switch .Security surveillance, Fire alarm, MCB, ELCB, MCCB.
9	Identify the type of batteries, construction, working and application of Ni-cadmium, lithium cell, lead acid cell etc. Demonstrate their charging and	29. Assembly of Dry cell-Electrodes-Electrolytes. (4 hrs.) 30. Grouping of Dry cells for a specified voltage and current, Ni cadmium & Lithium cell. (4 hrs.) 31. Practice on Battery Charging, preparation of	**Chemical** effect of electric current-Principle of electrolysis. Faraday's Law of electrolysis. Basic principles of Electro-plating and Electro chemical equivalents. Explanation of Anodes and cathodes. Lead acid cell-description, methods of charging- Precautions

	discharging, choosing appropriate method and carryout the installation and routine maintenance with due care and safety.	battery charging. (4 hrs.) 32. Testing of cells, Installation of batteries, Charging of batteries by different methods. (8 hrs.) 33. Practice on Electroplating and anodizing, Cathodic protection. (5 hrs.)	to be taken & testing equipment, Ni-cadmium & Lithium cell, Cathodic protection. Electroplating, Anodizing. Different types of lead acid cells.
10	-do-	34. Routine care & maintenance of Batteries. (25 hrs.)	Rechargeable dry cell, description advantages and disadvantages. Care and maintenance of cells Grouping of cells of specified voltage & current, Sealed Maintenance free Batteries, Solar battery.
11	-do-	35. Charging of a Lead acid cell, filling of electrolytes- Testing of charging checking of discharged and fully charged battery. (25 hrs.)	Inverter, Battery Charger, UPS-Principle of working. Lead Acid cell, general defects & remedies. Nickel Alkali Cell-description charging. Power & capacity of cells. Efficiency of cells.
12-13	Make choices to carry out basic jobs of marking out the components for filing, drilling, and riveting, fitting and assembled using different components independently.	36. Marking use of chisels and hacksaw on flats, sheet metal filing practice, filing true to line. (26 hrs.) 37. Sawing and planning practice. Practice in using firmer chisel and preparing simple half lap joint. (24 hrs.)	**ALLIED TRADES:** Introduction of fitting trade. Safety precautions to be observed Description of files, hammers, chisels hacksaw frames & blades-their specification & grades. Care & maintenance of steel rule try square and files. Marking tools description & use. Description of carpenter's common hand tools such as saws planes, chisels mallet claw hammer, marking, dividing & holding tools-their care and maintenance.
14	-do-	38. Drilling practice in hand drilling & power drilling machines. Grinding of drill bits. (8 hrs.) 39. Practice in using taps & dies,	Types of drills description & drilling machines, proper use, care and maintenance. Description of taps & dies, types in

		threading hexagonal & square nuts etc. (8 hrs.) 40. Cutting external threads on stud and on pipes, riveting practice. (9 hrs.)	rivets & riveted joints. Use of thread gauge.
15	-do-	41. Practice in using snips, marking & cutting of straight & curved pieces in sheet metals. (6 hrs.) 42. Bending the edges of sheets metals. (6 hrs.) 43. Riveting practice in sheet metal. Practice in making different joints in sheet metal in **soldering** the joints. (13 hrs.)	Description of marking & cutting tools such as snubs shears punches & other tools like hammers, mallets etc. used by sheet metal workers. Types of **soldering** irons-their proper uses. Use of different bench tools used by sheet metal worker. Soldering materials, fluxes and process.
16-17	Draw and set up DC and AC circuits including R-L-C circuits with accurate measurement of voltage, current, resistance, power, power factor and energy using ammeter, voltmeter, ohm-meter, watt-meter, energy meter, power factor meter and phase sequence tester with proper care and safety.	44. Trace the magnetic field. (8 hrs.) 45. Assembly / winding of a simple electro magnet. (12 hrs.) 46. Use of magnetic compass. (6 hrs.) 47. Identification of different types of Capacitors. (10 hrs.) 48. Charging and discharging of capacitor. (8 hrs.) 49. Testing of Capacitors using DC voltage and lamp. (6 hrs.)	**Magnetism –** Classification of magnets, methods of magnetising, magnetic materials. Properties, care and maintenance. Para and Diamagnetism and Ferro magnetic materials. Principle of electro-magnetism, Maxwell's corkscrew rule, Fleming's left and right hand rules, Magnetic field of current carrying conductors, loop and solenoid. MMF, Flux density, reluctance. B.H. curve, Hysteresis, Eddy current. Principle of electro-magnetic Induction, Faraday's Law, Lenz's Law. Electrostatics: Capacitor- Different types, functions and uses.
18-19	-do-	50. Determine the characteristics of RL, RC and RLC in A.C. Circuits both in series and parallel. (13 hrs.)	**Alternating Current -**Comparison and Advantages D.C and A.C. Related terms frequency Instantaneous value, R.M.S. value

		51. Experiment on poly phase circuits. (8 hrs.) 52. Current, voltage, power and power factor measurement in single & poly- phase circuits. (15 hrs.) 53. Measurement of energy in single and poly-phase circuits. (8 hrs.) 54. Use of phase sequence meter. (6 hrs.)	Average value, Peak factor, form factor. Generation of sine wave, phase and phase difference. Inductive and Capacitive reactance Impedance (Z), power factor (p.f). Active and Reactive power, Simple problems on A.C. circuits, single Phase and three-phase system etc. Problems on A.C. circuits. Power consumption in series and parallel, P.F. etc. Concept three-phase Star and Delta connection. Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load.
20	Plan and install Pipe & Plate earthing. Measure earth resistance by earth tester.	55. **Practice on Earthing** – different methods of earthing.(13 hrs.) 56. Measurement of Earth resistance by earth tester.(6 hrs.) 57. Testing of Earth Leakage by ELCB and relay. (6 hrs.)	**Earthing**-Principle of different methods of earthing. i.e. Pipe, Plate, etc Importance of Earthing. Improving of earth resistance Earth Leakage circuit breaker (ELCB). In absence of latest revision in respective BIS provision for Earthing it is recommended to follow IEC guidelines.
21	Select and perform electrical/ electronic measurements with appropriate instrument.	58. Determine the resistance by Colour coding. (4 hrs.) 59. Identification of active/passive components. (5 hrs.) 60. **Diodes**-symbol - Tests - Construct & Test Half wave rectifier ckt. (8 hrs.) 61. Full wave rectifier ckt. Bridge rectifier ckt. (8 hrs.)	**Basic electronics**- Semiconductor energy level, atomic structure 'P' type and 'N' type. Type of materials –P-N-junction. Classification of Diodes – Reverse and Forward Bias, Heat sink. Specification of Diode PIV rating. Explanation and importance of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit.

			Filter circuits-passive filter.
22-23	**Project work/ Industrial visit**		
24-26	**Revision**		
27-28	-do-	**ELECTRICAL MEASURING INSTRUMENTS-** 62. Measurement of voltage, current & resistance in different circuits. (5 hrs.) 63. Direct & indirect measurement of electrical power & energy. (6 hrs.) 64. Calibration of energy meters. (6 hrs.) 65. Measurement of current and voltage using CT & PT, Measurement of 3 Phase energy using CT & PT. Phase sequence meter, measure current and voltage using Tong tester. (12 hrs.) 66. Power measurement by Two & Three watt meter method Insulation resistance test by Megger. (7 hrs.) 67. Measurement of earth resistance by earth tester. (4 hrs.) 68. Calibration of indicating type analogue instruments: voltmeter, ammeter, and wattmeter. Measurement of soil conductivity. Introduction of Digital meters. (10 hrs.)	Type of measuring instruments – MC & MI, Construction & working principles of Ammeter, Voltmeter, Ohm-meter ,Wattmeter, Energy meter, P.F. meter, frequency meter, multi meter, clamp meter, Megger & earth tester. Introduction of Digital meters. CT & PT. Tong tester / Clip on Meter.
29-30	Plan, draw, estimate material, wire up and test different type of domestic **wiring**	**DOMESTIC WIRING - METHODS, INSTALLATION & TESTING-** 69. Demonstration & Practice on connecting **common electrical accessories** in circuits and	Introduction and explanation of electrical **wiring** systems, cleat wiring, casing & Capping, CTS, Conduit and concealed etc., I. E. Rules. Related to **wiring**,

	circuits as per Indian Electricity rules and taking care of quality. Construction and working of MCB & ELCB. Test a domestic **wiring** installation using Megger.	testing them in series board. (8 hrs.) 70. Demonstration on Testing & replacement of different types of fuses. (6 hrs.) 71. Identification of different **wiring** materials and their specifications. (6 hrs.) 72. Removing of insulation from assorted wires and cables. (10 hrs.) 73. Demonstration and practice crimping thimbles/lugs of various sizes. (8 hrs.) 74. Jointing practice with single and multi-stranded conductors of different wires and cables. (12 hrs.)	National Building codes for house **wiring**, specification and types, rating & material.
31	-do-	75. Layout on **wiring** boards. (5 hrs.) 76. Practice in P.V.C. insulated cable **wiring** on wood buttons with distribution board and number of points. (20 hrs.)	Branching of circuits with respect to loads such as lighting and power. CTS/PVC Conduit-surface and concealed/metal conduit/PVC casing and capping. IE rules regarding clip distance. Fixing of screws, cable bending etc
32	-do-	77. Practice of **wiring**: A) One lamp controlled by one SP switch, (B) Two lamps controlled by two independent switches, (C) One lamp controlled by two 2way switches (Staircase **wiring**), (D)One lamp controlled by intermediate switch from three different locations, (E)Hospital wiring, (F)Tunnel/ Godown wiring, (G)Hostel wiring, (H)Bell Buzzer Indicator	Description of different electrical fittings and accessories such as lamp holders, switches, plugs brackets, ceiling rose, cut out etc. IS 732- 1863.Wiring materials used for P.V.C. cables I.E. rules, Indian standards regarding the above wiring such as-clip distance fixing of screws, cable bending etc.

		wiring, (I)Domestic wiring practice. (25 hrs.)	
33	-do-	78. Demonstration and practice of using Rowel tools. (8 hrs.) 79. Demonstration and practice of casing and capping wiring. (10 hrs.) 80. Testing of wiring installation by using Megger. (7 hrs.)	Description of Rowel tools and Rowel plugs, their sizes, plugging, compound, plugs- wall jumper and their sizes and uses. Introduction to estimation procedure, P.V.C. casing and capping materials, sizes and grades etc.
34	-do-	81. Demonstration and practice in cutting and threading conduit pipes. (6 hrs.) 82. Cold and hot bending of pipes. (6 hrs.) 83. Fitting of conduit accessories.(13 hrs.)	Conduit pipe wiring materials and accessories, types and sizes of conduit.
35	-do-	84. Preparation of conduit threads using different fittings and use of running threads wiring in conduit, using metal clad 3 pin plug, Earthing the conduit using earth clips and earth wire. (25 hrs.)	Layout of Light points, fan points etc. Layout of heating leads etc.- their controls, main switches, distribution boards as per **I.E. rules.** I. E. Rules for earthing conduits using earth clips and earth wire as per IS 732-1863.
36	Plan and execute electrical illumination system viz. FL tube, HPMV lamp, HPSV lamp, Halogen & metal halide lamp, CFL, LED lamp etc.	**ILLUMINATION:-** 85. Installation of - Neon Sign tube, Mercury vapour (H.P. & L.P.), Sodium vapour, Halogen Lamps, single tube, double tube, Metal halide lamps. Emergency light. (9 hrs.) 86. Practice on decoration lighting. (7 hrs.) 87. Practice on using LUX Meter. (4 hrs.) 88. Installation and testing of CFL Lamps and LED Lamps (5 hrs.)	Introduction of Illumination- Terms & definitions, laws of illumination, illumination factors, intensity of light –importance of light, colour available. Construction, working & applications of – Incandescent lamp, Fluorescent tube, CFL, Neon sign, Halogen, Mercury vapour and types, sodium vapour etc. Decoration lighting, Drum Switches etc.
37-39	Plan, draw, estimate material, wire up and test	**INDUSTRIAL WIRING-** 89. Tests on insulating materials. (10 hrs.)	Connections of different types of motors used in industry, their normal methods of wiring, Control

	different type of industrial wiring circuits as per Indian Electricity rules and taking care of quality.	90. Measurement of insulation resistance, of commercial and industrial installation Additional practice in conduit wiring. (20 hrs.) 91. Industrial power wiring involving single phase & 3phase motors with switches & starters. (20 hrs.)	, starting and protection devices-their connections, layouts and earthing Code practice for earthing of Industrial Wiring. Wiring methods & types in workshop & factories.
40	Plan, draw, estimate material, wire up and test different type of commercial and computer networking wiring circuits as per Indian Electricity rules and taking care of quality.	**COMMERCIAL WIRING-** 92. Inverter wiring./ Control panel wiring / multi-storeyed building wiring. (18 hrs.) 93. Introduction to LAN wiring. (7 hrs.)	Wiring in commercial building-their special precautions as per I.E. rules. Introduction to LAN wiring.
41-42	-do-	94. Installation of 1 ph. and 3 ph. on line / off line UPS wiring. (20 hrs.) 95. Testing of Industrial wiring and UPS wiring installation. (30 hrs.)	Power drives - Introduction, types, advantages & disadvantages. UPS- Introduction, types, Load calculation, Backup time calculation.
43	-do-	96. Straight and cross crimping of RJ-45 cable. (10 hrs.) 97. Crimping of co-axial cable, proper installation of co-axial cable from dish antenna to Television set. (15 hrs.)	Computer networking - Identification of network hardware / component. CAT-6 cable, RJ-45. DTH- Introduction of direct to home system, Music channel wiring/interconnecting couplers.
44	Plan, draw, estimate material, wire up and test different type of industrial wiring circuits as per Indian Electricity rules and taking care of quality.	98. Industrial wiring installations for mixed load, both light and power. (9 hrs.) 99. Layout of L.V. AC/DC machines and their panels. (3 hrs.) 100. Wiring of Low power A.C./ D.C. machines in metal conduit system as per I.E. Rules. (10 hrs.)	General idea of fixing meter boards & taking service connection. Sealing of I.C. cut out & meters as per I.E. Rules, General Electric Appliances using heating effect – their capacities, voltage ranges, Calculation of current

		101. Testing of wiring installation. (3 hrs.)	
45	-do-	102. Wiring of different circuit using Single core cable use for 2 ways, intermediate master switches etc. (20 hrs.) 103. Testing of wiring installation. (5 hrs.)	Explanation of inter connection wiring circuits in the main building and auxiliary blocks, meter boards and its locations. Study of layout symbols in the preparation of layout diagrams.
46-47	Plan, draw, estimate material, wire up and test different type of commercial and computer networking wiring circuits as per Indian Electricity rules and taking care of quality.	**COMPUTER AWARENESS:** 104. Identification of Computer Parts, Switching ON/OFF of PC, Safety Precautions. (5 hrs.) 105. Identifying and using Windows, like folders, files, Editing and saving. (12 hrs.) 106. Windows Explorer, Notepad, Paint and calculator. (12 hrs.) **OFFICE PACKAGE& INTERNET:** 107. Using /Practicing WORD, EXCEL, POWER POINT for communication. (16 hrs.) 108. Documentation. (2 hrs.) 109. Internet Practicing – Browsing/ Creating Email, Downloading. (3 hrs.)	Block diagram of computer, main parts inside the system unit, ports & connectors, of PC parts & peripherals associated with PC like-keyboard, Mouse, Printers, Scanners, Camera, Modem, External Storage Devices & UPS. Features of Operating System like M.S. Windows, Components of Windows- Calculator, Notepad, Paint, Windows Explorer. **INTERNET:** Websites, Browsing, Downloading Creating and Using E-mail ID's Using it for Communications.
48-51	**In plant training / Project work**		
52	**Examination**		

Note: -

1. *Instructor may design their own projects and also inputs from local industry may be taken for designing such new projects.*
2. *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.*

3. *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.*

SYLLABUS FOR WIREMAN TRADE			
SECOND YEAR			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
53	Construct and test Half–wave, full-wave, and bridge rectifiers with filter & without filter. Trouble shoot and service of DC regulated power supply.	110. Identify the terminals of LED, Diode, transistor, Zener diode, UJT, SCR, regulator ICs and test it. (25 hrs.)	LED , Diode, types of transistor, UJT, SCR, regulator ICs and Zener diode uses and its application
54	-do-	111. Construct and test variable DC power supply and trouble shoot the defects in a simple power supply. (25 hrs.)	IC - voltage regulator pin configurations and applications.
55-56	-do-	112. Construction & testing of various electrical circuits with different accessories. (15 hrs.) 113. Connection of Calling Bell, Buzzer, Electric Iron, Heater,	**Common Electrical Accessories**, their specifications-Explanation of switches, lamp holders, plugs and sockets etc. Development of domestic circuits using switches, fuse, MCB, sockets, lamp, fan,

		Light & Fan etc. (15 hrs.) 114. Practice in **soldering** and brazing by following Indian Electricity rules. (20 hrs.)	calling bell/buzzer, Two way switch, I.C.T.P, I.C.D.P, MCCB, ELCB, RCCB etc. Importance of Neutral, effect of opening of neutral wire **Soldering**- Solders, flux and soldering techniques. Types of soldering irons-their proper use.
57	Understand the constructional features, working principles of DC machine. Starting with suitable starter, running, forward and reverse operation and speed control of DC motors. Conduct the load performance test of DC machine with due care and safety. Maintain and troubleshoot of DC machines.	**D.C. GENERATORS,** 115. Identification of the parts of D.C. Generators. (5 hrs.) 116. Testing and measuring the field and Armature resistances. (5 hrs.) 117. Dismantle the D.C. Generator and Reassemble and test for its working. (15 hrs.)	Introduction to D.C Generators and working principle, parts of D.C. Generator. Classification of Generators- Self excited and separately excited- their application in practical field.
58-59	-do-	118. Identification of different parts of generators testing fields & Apparatus. (12 hrs.) 119. Insulation resistance measurements. (8 hrs.) 120. Building up of voltage and loading generators. (10 Hrs.) 121. Servicing of generators including replacing of carbon brushes. (20 hrs.)	Types and characteristics of D.C. Generators – Series, Shunt and compound, their applications. Explanation of Armature reaction, interlopes, commutation and EMF equation of DC generators. Parallel operation of Generators
60	-do-	**MOTORS & STARTER:** 122. Practice in connecting generators- Generators- Testing of D.C. Machines by Megger. (12 hrs.)	**I**ntroduction to D.C. Motor- Working principle, types of motors Explanation of terms used Torque, speed, Back E.M.F. etc. Characteristics, Speed control of

		123. General maintenance of D.C. machines. (13 hrs.)	DC motors
61-62	-do-	124. Testing of D.C. Motors - connect run and change direction of rotation. (12 hrs.) 125. Study of DC starters- 2 point 3 point and 4 point speed control of D.C. Motors and speed measurement. (13 hrs.) 126. Use Revolution counter. (6 hrs.) 127. Trouble shooting and fault rectification. Identify and test different types of D.C motors. (19 hrs.)	Necessity of starter- Types of starters, 2 point 3 point and 4 point starters, Protective devices used. Methods of speed control, advantages, disadvantages & Industrial applications. Trouble shooting and fault rectification.
63-64	Understand the constructional features, working principles of single phase and 3 phase AC motors. Starting with suitable starter, running, forward and reverse operation and speed control of AC motors with due care and safety.	128. Tests on 3 phase circuit. (10 hrs.) 129. Current and voltage measurement in star and delta connections. (12 hrs.) 130. Measurement A.C. 3 ph. power. (18 hrs.) 131. Determine the V and I relation in Star/Delta connections in a 3-Ph motor. (10 hrs.)	Introduction to A.C. Poly phase systems- advantages, 3 phase star delta. Terms used in 3Ø systems, connection and their relations w.r.t. current and voltage. Principle of measurement of A.C. 3 ph. Power. Simple calculation of A.C. 3 phase circuit parameter - I, V, Z & P.F. etc
65-66	Understand the constructional features, working principles of Alternator set. Test, Wire-up and run alternator. Synchronization of Alternator with due care and safety.	**A.C. GENERATORS, MOTORS & STARTERS** 132. Identification of Alternator of parts. (10 hrs.) 133. Running of Alternator by prime mover and loading it to find out regulation at different loads. Testing of alternators (IR tests). (28 hrs.) 134. Connect and test Parallel	Parts and construction of Alternators, principle of working, types of Alternators, EMF equation. Various applications and power rating of alternators. General idea of loading and regulation of Alternator. Parallel operation of Alternators, synchronising methods.

		operation of alternators. (12 hrs.)	
67	Understand the constructional features, working principles of single phase and 3 phase AC motors. Starting with suitable starter, running, forward and reverse operation and speed control of AC motors with due care and safety.	135. Demonstration and practice on A.C single phase motors starting and running for specific requirements. (25 hrs.)	Introduction to A.C single phase motors and types. Capacitors start/run- start and run. FHP motors and their uses. Various application of A.C single phase motors.
68-70		136. Constructional details of three phase squirrel cage induction motor and slip ring induction motor. (12 hrs.) 137. Determination of slip and efficiency. (8 hrs.) 138. Familiarization of DOL starter, Star- delta starter, Autotransformer starter and slip ring IM starter. (15 hrs.) 139. Phase sequence test on three phase IM motors, Single phasing preventer. (14 hrs.) 140. Identification of A.C and D.C motors (identify motors from the stock/scrap). (8 hrs.) 141. Construction of simple control circuits using push button and contactors. (18 hrs.)	**Three phase Induction motor: -** Construction, Principle of operation of Three phase induction motor. Squirrel cage induction motor and slip ring induction motor. Rotor slip, rotor frequency and rotor torque. Factors affecting torque. Effect of variation in applied voltage. Starting methods. Speed control methods. Importance of phase sequence in three phase induction motor. Single phasing preventer.
71	-do-	142. Connect and run the A.C single phase and 3-Ph motors by using starters. (25 hrs.)	Starters - DOL starter, Star – delta starter and Auto transformer starter.
72-73	-do-	143. A.C. motor panel wiring (slip ring Induction type) (12 hrs.)	Description of starter delta starter (manual, semi and Auto).

		POWER WIRING FOR DC & AC MOTORS 144. Practice power and control circuits on boards. (10 hrs.) 145. Assembly & testing of the frame for a panel – suitable for motor generator set. I.S. 3072 Part-II of 1861. (15 hrs.) 146. Erection of panel board, fixing of controlling and starting equipment, necessary meters. (12 hrs.)	Formative arrangement of a motor resistance starter for slip ring induction motor. Motor control circuit and starting devices. Power and control wiring circuits of AC motors.
74-75	**In plant training/ Project work**		
76-78	**Revision**		
79-82	Understand the types, constructional features, working principles of transformer (single & three phase) Connect and test Transformer.	147. Identification of types of transformers. (18 hrs.) 148. Test / check the polarity of single phase transformer. (15 hrs.) 149. Insulation testing of single phase and Three Phase. (15 hrs.) 150. Conducting No-load/O.C. & short circuit tests. (15 hrs.) 151. Connection of transformers, efficiencies of transformers, parallel operation of transformer. (25 hrs.) 152. Ratio test and voltage regulation. (12 hrs.)	**TRANSFORMERS –** Power Transformer – Its construction, working, performance, parallel operation of transformer, their connections. Cooling of transformer, S.C. & O.C. tests. Regulation and efficiency, Specifications, problems on e.m.f. Equation, transformation ratio. Characteristics of ideal transformer. Construction of core, winding shielding, auxiliary parts breather, conservator. Buchholz's relay, other protective devices. Transformer oil testing and Tap changing off load and on load. Transformer bushings and termination. Auto transformer- Its construction, working, performance & uses.
83-85	Prepare single line diagram and layout	153. Familiarize and practice operation of OH line	**GENERATION, TRANSMISSION AND DISTRIBUTION OF**

	plan of electrical transmission & distribution systems and power plants with knowledge of principle applied. Make and test power connection to substation equipments with care and safety.	components. (20 hrs.) 154. Visit to generating station (Thermal/ Hydro/Nuclear) Visit to a sub-station to familiarize OH line components. (35 hrs.) 155. Prepare a line diagram of the institute/ ITI supply system. (20 hrs.)	**ELECTRICAL POWER** Generation of Electricity and their types. General idea about overhead transmission, distribution (LV,MV& HV) and their types of accessories used. General arrangement and maintenance of outdoor type of substation. Explanation of overhead bus bar, side by bar. Bus trunking and rising mains. I.E. rules regarding panel erection, bus bar, spacing bus bar chamber, danger boards. Connection of high voltage metering equipment used with bus bar.
86	-do-	156. Demonstration, testing and use of line protecting devices as per I.E. Rules. (10 hrs.) 157. Visit to Distribution - station. (15 hrs.)	Types of Distribution, Explanation of line protecting devices and their general principle. Brief description of connection of places of use.
87-88	-do-	158. Familiarization and operation of various CBs ACB, VCB, SF6, OCB etc. (12 hrs.) 159. Visit to sub-station. (18 hrs.) 160. Demonstration and Tests on Multi range switches, Rotary switches. (10 hrs.) 161. Cooker control Panel, Power circuit switches Thermostats. Mercury switches, visit/in plant training in a industry. (10 hrs.)	**SUBSTATION EQUIPMENTS** Switchgear-CBs – ACB,VCB, SF6, OCB etc. protection schemes, CT/PT-Protective relays, lightning arrestors, Explanation of different types of switches and switches gears multi Range switches, rotary switches, cooker control panels, power circuit switches, thermostat, mercury switches etc.
89	-do-	162. Familiarize the parts of substations low and high voltages. (25 hrs.)	**TYPES OF SUBSTATIONS - INDOOR, OUTDOOR & POLE MOUNTING** Substation construction: i. Outdoor and Indoor

			substation. ii. E.H.T. substation iii. H.T. substation iv. Medium & low voltage substation (Pole mounting type)
90-91	-do-	163. Demonstration and practice in terminating an U.G. cable to a bus bar chamber. (25 hrs.) 164. Crimping lugs to the conductors of U.G. cable and connection to bus bar Loop connection for other circuit. (25 hrs.)	**U.G. CABLE** Construction of cable, Types , Application & methods of jointing UG cable & testing General idea of laying method and jointing precautions to be observed and different accessories used for medium voltage termination.
92	Understand the constructional features, working principles of Alternator set. Test, Wire-up and run alternator. Synchronization of Alternator with due care and safety.	**Synchronizing** 165. Building up the alternator output voltage, synchronizing of bus bar voltage with generated voltage. (25 hrs.)	Need of Synchronizing, various methods, precautions to be observed while Synchronizing
93-94	Select, assemble, test and wire-up control panel.	**Control panel wiring** 166. Preparation of control panel board and its layout fixing of indicating meters /Instruments, Control devices, Protection devices. (35 hrs.) 167. Fixing of cable entry and exit points (15 hrs.)	Control Panel elements, types and specifications. Layout and installation of panel board, Panel board wiring methods, colour coding of cables for its easy identification. Grouping and numbering of cables by using ferrules.
95	-do-	168. Preventive maintenance and routine tests. (8 hrs.) 169. Fault location and remedy practice both in domestic and industrial wirings. (10 hrs.)	Importance and advantages of maintenance. Points to be observed to maintain the installation, preventive maintenance and routine tests.

		170. Practice in fixing conduit along with the girder, steel structures station etc. (7 hrs.)	Common faults, causes and remedies in domestic and industrial wiring installation, Methods of Locating faults.
96-98	Plan, estimate and costing of different types of wiring system as per Indian Electricity rule.	**Planning, Estimation and Costing of Wiring-** 171. Planning and Preparation of layout for domestic, commercial, Multi storied building wiring and workshop electrical wiring. (50 hrs.) 172. Estimation and costing of Labour, materials and accessories as per layout. (25 hrs.)	Concept and Principle of plan, estimation and cost. Preparation of complete house wiring layout, industrial wiring, commercial wiring for office Lodge, Hospital, Bank, Hotels etc. I.E. rules for Multi-storied buildings.
99-100	**Project Work** (work in a team) (i) Over hauling and Testing of 3 phase Induction motor (ii) Over hauling and testing of Ceiling / Table Fan. (iii) Preparation of series test board with indicating digital metres. (iv) Construction and test regulated power supply of 6-12 Volt DC. (v) Construct and Test Decorative running LED lamp assembly. (vi) Installation of Pump set.		
101-102	**Project work/ Industrial visit**		
103-104	**Examination**		

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.*

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

S No.	Workshop Calculation and Science	Engineering Drawing
	FIRST YEAR	
1.	**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	Engineering Drawing: Introduction and its importance Relationship to other technical drawing types Conventions Viewing of engineering drawing sheets. Method of Folding of printed Drawing Sheet as

		per BIS SP:46-2003
2.	**Fractions**: Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator.	Drawing Instruments : their Standard and uses Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.
3.	**Square Root**: Square and Square Root, method of finding out square roots, Simple problem using calculator.	Lines : Definition, types and applications in Drawing as per BIS SP:46-2003 Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) Drawing lines of given length (Straight, curved) Drawing of parallel lines, perpendicular line Methods of Division of line segment
4.	**Ratio & Proportion**: Simple calculation on related problems.	Drawing of Geometrical Figures: Definition, nomenclature and practice of Angle: Measurement and its types, method of bisecting. Triangle -different types Rectangle, Square, Rhombus, Parallelogram. Circle and its elements.
5.	**Percentage**: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	Lettering and Numbering as per BIS SP46-2003: Single Stroke, Double Stroke, inclined, Upper case and Lower case.
6.	**Material Science** : properties - Physical & Mechanical, Types – Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.	Dimensioning: Definition, types and methods of dimensioning (functional, non-functional and auxiliary) Types of arrowhead Leader Line with text
7.	**Mass, Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.	Free hand drawing of Lines, polygons, ellipse, etc. geometrical figures and blocks with dimension Transferring measurement from the given object to the free hand sketches.
8.	**Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration,	Sizes and Layout of Drawing Sheets Basic principle of Sheet Size Designation of sizes Selection of sizes

	retardation, equations of motions, simple related problems.	Title Block, its position and content Borders and Frames (Orientation marks and graduations) Grid Reference Item Reference on Drawing Sheet (Item List)
9.	**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	Method of presentation of Engineering Drawing Pictorial View Orthogonal View Isometric view
10.	-----	Symbolic Representation (as per BIS SP:46-2003) of : Fastener (Rivets, Bolts and Nuts) Bars and profile sections Weld, brazed and soldered joints. Electrical and electronics element Piping joints and fittings
11.	**Algebra**: Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Construction of Scales and diagonal scale
12.	**Mensuration :** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids – cube, cuboid, cylinder and Sphere.	Practice of Lettering and Title Block
13.	**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables	Dimensioning practice: - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance. - Text of dimension of repeated features, equidistance elements, circumferential objects.
14.	**Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat,	Construction of Geometrical Drawing Figures: - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons. - Conic Sections (Ellipse & Parabola)

	conduction, convection, radiation.	
15.	**Basic Electricity**: Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.
16.	**Levers and Simple Machines:** levers and its types. Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.	Free Hand sketch of hand tools and measuring tools used in respective trades.
17.	-----	Projections: - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification
18.	-----	Drawing of Orthographic projection from isometric/3D view of blocks
19.	-----	Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
20.	-----	Drawing details of two simple mating blocks and assembled view.
SECOND YEAR		
1.	**Elasticity:** Stress, strain, Modulus of elasticity, elastic limit, Hooks law, young's modulus.	**<u>Sign & Symbol Trade related</u> Alternating Current** Drawing of simple electrical circuit using electrical symbols. Drawing of sine square & triangular waves. Diagram of battery charging circuit. Practice in reading typical example of circuit containing R, L & C. Reading of electrical drawing.

2.	**Material:** Introduction, types and properties. Uses of Conducting, Semi-conducting and insulating materials.	**Electronic components** Symbols for electronic components. Diode, Transistor, Zener diode, S.C.R., UJT, FET, I.C. Diac, Triac, Mosfet I.G.B.T etc. Drawing of half wave, Full wave and Bridge rectifier circuit. Drawing circuit for a single stage Amplifiers and Multi stage Amplifies and types of signals. Drawing of circuit containing UJT, FET & Simple power control circuits. Free hand drawing of Logic gates and circuits.
3.	**Magnetism:** Magnetic material, magnetic field, flux density, magnetic moment, m.m.f. Reluctance, permeability, susceptibility, electromagnet, solenoid and its practical applications.	**Electric wirings & Earthing** Detailed diagram of calling bell, & Buzzers etc Free hand sketching of Staircase wiring. Drawing the schematic diagram of plate and pipe earthing. Diagram for electroplating from A.C and D.C source.
4.	**Pressure:-** Pneumatic pressure, PSI, bar, atmospheric pressure, pressure gauge and absolute pressure, Heat treatment process.	**DC machines** Graphic symbols for Rotating machines. Sketching of brush and brush gear of D.C. machines. Sketching of D.C. 3-point and 4-point starter. Layout arrangement of D.C. Generators & motors, control panel. Exercises on connection to motors through Ammeter, voltmeter & K.W. meters of electrical wiring diagram. Drawing the schematic diagram of D.C. motor speed control by Thyristor / DC Drive.
5.	**Indices:** Laws of indices related problems. **Quadratic Equation:** Introduction, solution of simple Quadratic equation and related problems.	**Transformer** Graphic symbols for Transformers. Free hand sketching of transformer and auxiliary parts and sectional views. Sketching a breather. Drawing the diagram of typical marking plate of a distribution transformer.
6.	Solution of simple A.C. circuit with R.L.C. Calculation of power factor etc.	**Illumination** Free hand sketching of Mercury vapour lamp, sodium vapour lamp, Fluorescent tube (Single & Twine), MHL lamp and their connection.
7.	**A.C Waveform Calculation:** Calculation of r.m.s, average, instantaneous value, peak value. Peak to peak value, Frequency and	-----

	wavelength calculation and their relationship	
8.	**Series And Parallel Connection of Electrical and Electronic components:** 1. Calculation Series and parallel connection of Resistors. 2. Calculation Series and parallel connection of Capacitors. 3. Calculation Series and parallel connection of Inductors. 4. Calculation Series and parallel connection of Batteries. Conversion of power flow to H.P. 5. Calculation of KVA.	-----
9.	**Friction: -** Laws of friction, co- efficient of friction, angle of friction, simple problems related to friction. Lubrication Concept on terms like pressure, atoms-pheric pressure, gauge pressure. Heat treatment necessity difference methods.	**Three phase Induction motor** Free hand sketching of Slip-ring and Squirrel cage Induction motor. Typical wiring diagram for drum controller operation of A.C. wound rotor motor. Drawing the schematic diagram of Autotransformer starter, DOL starter and Star Delta Starter. Drawing the schematic diagram of A.C. motor speed control by SCR /AC Drive.
10.	**Forces: -** Resolution and composition of forces. Representation of force by vectors, simple problems on lifting tackles like jib wall, crane-Solution of problems with the aid of vectors. General condition of equilibriums for series of forces on a body. Law of parallelogram, Triangle Law, Lami's theorem.	**Alternator** Tracing of panel wiring diagram of an alternator. Drawing the schematic diagram of automatic voltage regulators of A.C. generators.
11.	**Centre of gravity:-** Centre of gravity concept and C.G. of different lamina. Equilibrium different kinds stable, unstable and neutral. Law of parallelogram force. Triangle law, Lami's theorem stable, unstable and neutral equilibrium.	**Winding** Drawing the development diagram for D.C. Simplex Lap & Wave winding with brush position. Drawing the development diagram of A.C 3 – Phase, 4 Pole 24 slots single layer winding.
12.	**Number system:-** decimal and binary, Octal Hexa decimal. BCD code, conversion from decimal to binary and vice-versa, all other conversions.	**Control Panel** Practice in reading panel diagram. Local & Remote control of Induction motor with inching.

	Practice on conversions.	Forward & Reverse operation of Induction motor Automatic Star Delta Starter Automatic star delta starter with change of direction of rotation Sequential control of three motors.
13.	**Estimation & costing:-**Simple estimation of the requirement of materials etc. as applicable to the trade. Problems on estimation and costing. **Further Mensuration**:- Volumes of frustums including conical frustums. **Graph-** Basics, abscissa, co-ordinate etc. Y = mx and Y= mx + c graph	**Distribution of Power** Types of insulator used in over head line. (Half sectional views) Different type of distribution systems and methods of connections. Layout diagram of a substation. Single line diagram of substation feeders.
14.	Simple Problems on Profit & Loss. Simple and compound interest.	-----

9.2 EMPLOYABILITY SKILLS

Duration: 110 Hrs.		
1. English Literacy		**Duration : 20 hrs** **Marks : 09**
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.	

Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking/ Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on known people, picture reading, gain confidence through role-playing and discussions on current happening, job description, asking about someone's job, habitual actions. Cardinal (fundamental) numbers, ordinal numbers. Taking messages, passing on messages and filling in message forms, Greeting and introductions, office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. IT Literacy	**Duration : 20 hrs** **Marks : 09**
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of the computer.
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc. Use of Common applications.
Word Processing and Worksheet	Basic operating of Word Processing, Creating, Opening and Closing Documents, Use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion &Creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.
Computer Networking and Internet	Basic of Computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, WebsSite, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.

3. Communication Skills	**Duration : 15 hrs** **Marks : 07**
Introduction to Communication Skills	Communication and its importance Principles of effective communication Types of communication - verbal, non-verbal, written, email, talking on phone. Non-verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening, guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active listening skills.
Motivational Training	Characteristics essential to achieving success. The power of positive attitude. Self awareness Importance of commitment Ethics and values Ways to motivate oneself Personal goal setting and employability planning.
Facing Interviews	Manners, etiquettes, dress code for an interview Do's &don'ts for an interview
Behavioral Skills	Problem solving Confidence building Attitude
4. Entrepreneurship Skills	**Duration : 15 hrs** **Marks : 06**
Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises: Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance &record, Role &function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.
Project Preparation & Marketing Analysis	Qualities of a good entrepreneur, SWOT and risk analysis. Concept &Application of PLC, Sales &Distribution management. Difference between small scale &large scale business, Market survey, Method of marketing, Publicity and advertisement, Marketing mix.

Institution's Support	Preparation of project. Role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the policies / programmes, procedure & the available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop act, Estimation &costing, Investment procedure - Loan procurement - Banking processes.
5. Productivity	**Duration : 10 hrs** **Marks : 05**
Benefits	Personal/ Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working aids, Automation, Environment, Motivation - How it improves or slows down productivity.
Comparison with Developed Countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in select industries, e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and insurance.
6. Occupational Safety, Health and Environment Education	**Duration : 15 hrs** **Marks : 06**
Safety & Health	Introduction to occupational safety and health Importance of safety and health at workplace.
Occupational Hazards	Basic hazards, chemical hazards, vibroacoustic hazards, mechanical hazards, electrical hazards, thermal hazards. occupational health, occupational hygiene, occupational diseases/ disorders & its prevention.
Accident &Safety	Basic principles for protective equipment. Accident prevention techniques - control of accidents and safety measures.
First Aid	Care of injured &sick at the workplaces, First-aid &transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. Safety, health, welfare under legislative of India.
Ecosystem	Introduction to environment. The relationship between society and environment, ecosystem and factors causing imbalance.

Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of energy, re-use and recycle.
Global Warming	Global warming, climate change and ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and harvesting of water.
Environment	Right attitude towards environment, Maintenance of in-house environment.
7. Labour Welfare Legislation	**Duration : 05 hrs** **Marks : 03**
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's Compensation Act.
8. Quality Tools	**Duration : 10 hrs** **Marks : 05**
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality circle, Roles and function of quality circles in organization, Operation of quality circle. Approaches to starting quality circles, Steps for continuation quality circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of housekeeping, Practice of good housekeeping.
Quality Tools	Basic quality tools with a few examples.

ANNEXURE-I

LIST OF TOOLS & EQUIPMENT			
WIREMAN (For batch of 20 Candidates)			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1.	Steel rule	300 mm	*21 Nos.
2.	Screw Driver	200 mm	*21 Nos.
3.	Screw Driver	100 mm	*21 Nos.
4.	Terminal screw Driver	75 mm (Connector)	*21 Nos.
5.	Knife Electrician	D.B.	*21 Nos.
6.	Hammer Ball peen.	0.25 Kg	*21 Nos.
7.	Plumb bob	115 grams	*21 Nos.
8.	Combination pliers insulated	200 mm	*21 Nos.
9.	Neon tester pencil bit type	500 volt	*21 Nos.
10.	Try square	200 mm	*21 Nos.
11.	Small crimping tools (assorted)	10 – 100 mm (5 nos)	*21 Nos.
12.	Spanner set DE	Set of 6 from 6x7 to 16x7	*21 Nos.
13.	Screw driver set (set of 5)	100-300 mm	*21 Nos.
14.	File half round 2nd cut	250 mm	*21 Nos.
15.	File round 2nd cut	150 mm	*21 Nos.
16.	Soldering iron	60 w/230 v	*21 Nos.
17.	Neon tester	230 v	*21 Nos.
B. EQUIPMENT, MACHINERY & METERS			
18.	Conduit pipe cutting and threading machines adjustable	for 15mm to 30mm.	1 No.

19.	Conduit pipe bending machine, suitable	for 15mm,18mm, 25mm and 30mm pipe	1 No.
20.	Bar magnet		1 No.
21.	Drill bit	6mm, 8mm & 10 mm	1 No. each
22.	Horse shoe magnet		1 No.
23.	Crimping tool	25mm	1 No.
24.	Crimping tool for telephone/LAN cable		1 No.
25.	Rubber matting	2 meter x 1 meter x 9mm	2 nos.
26.	Wiring board on stand	3 meter x1 meter with 0.5 meter projection on the top	*20 Nos.
27.	Fire extinguishers	Dry chemical 5 Kg	2 Nos.
28.	Set of Wall jumper octagonal	37mm X 450mm and 37 X 600mm	4 sets
29.	Center punch	100mm	2 Nos.
30.	Rule four fold wood	600 mm	*20 Nos.
31.	Bradawl	150 mm X 6mm square pointed	*20 Nos.
32.	Set of Rowel punch	8,10mm	*20 Nos.
33.	Wooden mallet	1 kg (75mm x15mm)	*20 Nos.
34.	Pliers side cutting insulated	200mm	5 Nos.
35.	Pliers flat nose insulated	150mm	5 Nos.
36.	Pliers round nose insulated	200mm	5 Nos.
37.	Pliers long nose insulated	200mm	5 Nos.
38.	Screw driver heavy duty	200mm	2 Nos.
39.	Screw driver heavy duty	300 mm	5 Nos.
40.	Firmer chisel	1”	10 Nos.
41.	Firmer chisel	½ ”	10 Nos.
42.	Hammer Ball Peen	0.50 kg.	5 Nos.
43.	Wire stripper	150 mm	5 Nos.
44.	Hammer Ball Peen	1.00 kg	5 Nos.
45.	Hammer cross Peen	0.50 kg.	5 Nos.
46.	Rawal tool holder & Bit	No.8, 10, 14, & 16	2 set
47.	Set of Wall jumper octagonal	37mm X 450mm and 37 X 600mm	4 sets
48.	Scriber	150mm	2 Nos.
49.	File flat	300mm rough	5 Nos.
50.	File flat round	150mm smooth	5 Nos.
51.	File round	300mm 2nd cut	5 Nos.
52.	File triangular	150mm 2nd cut	5 Nos.

53.	Spanner set of 6 18X18, 20X22, 21X23, 24 X27, 25X27, 30X32,	Double ended	2 sets
54.	Adjustable spanner	300mm	1 No.
55.	Foot print Grip	250mm	2 Nos.
56.	Allen keys	Set 5 to 11	1 set
57.	Spirit level	300mm	1 No.
58.	Electric soldering iron	125 watts 230-250 V	2 Nos.
59.	Blow lamp	1 liter capacity	2 Nos.
60.	Forge with hand blower		1 No.
61.	Bench vice	150mm	5 Nos.
62.	Hand vice	50mm jaw	5 Nos.
63.	Rubber gloves	5000volts	2 pairs
64.	Safety belt with provision for keeping tools		10 Nos.
65.	Tower ladder on type wheels	Min 10ft-Max 30ft	2 Nos.
66.	Portable extension ladder	Aluminum 6 to 9 meters	1 No.
67.	Trowel	150mm	2 Nos.
68.	All types C.F.L. lamp sets	5watt,15watt,2 5watt	3each
69.	Multi meter	0-5, 100, 200, 500 milli amperes 0-100- 1000, 10000 ohms. 0-150, 300, 600 V AC/DC	4 Nos.
70.	Hot wire Ammeter	0-15 Amps.	1 No.
71.	Wheatstone Bridge		1 No.
72.	Electrical power drilling machine	12mm, capacity 250 volts universal type	1 No.
73.	Megger (Insulation tester)	500 volts	2 Nos.
74.	Voltmeter M.C.	O.-300 volts	1 No.
75.	Voltmeter M.C/ Multi range	0.70, 150,300 & 600 V	1 No.
76.	Voltmeter M.C. Multi range	0-15,30,50 & 75 V	1 No.
77.	Voltmeter centre zero	15-0-15 volts	1 No.
78.	Voltmeter M.I. multi- range	0-150, 300, 600 V	2 Nos.
79.	Voltmeter M.I. multi- range	0-50, 75, 150 V	1 No.
80.	Ammeter M.I.	0-30 Amp, panel board type	2 Nos.
81.	Ammeter M.I.	0-5Amp. Panel board type	2 Nos.
82.	Ammeter M.I	0 - 10 Amp. panel board mounting type	1 No.
83.	Ammeter M.C. Centre zero	5-0-5Amp	1 No.
84.	Ammeter MC	0 – 1 Amp	1 No.
85.	Field regulator	0 – 1000 ohmic, 2 Amps	1 No.
86.	Single phase K.W.H meter digital	5A, 250 V A. C	4 Nos.
87.	Single phase K.W.H meter analog	5A, 250 V A. C	4 Nos.
88.	3 Phase KW meter	15A 440 v	1 No.
89.	Watt meter Dynamo meter type	5 Amps. And 250 v, 1.25 kw	1 No.

90.	Personal computer system with printer		1 No.
91.	LCD projector		1 No.
92.	Clamp on ammeter	0-25A,0-200A	2 Nos.
93.	Three phase K.W.H meter analog	25A,415 V A. C	4 Nos.
94.	Three phase K.W.H meter digital	25A,415 V A. C	4 Nos.
95.	UPS 500VA with battery	230V	1 No.
96.	D.C. compound motor	3 H.P 250 V with 4 point starter and field regulator (Laboratory type)	1 No.
97.	D.C. shunt motor	3 H.P 250 v with 3 point starter and speed regulator (Laboratory type)	1 No.
98.	D. C. series motor with 2 point starter	3 H.P 250 v with 3 point starter and speed regulator (Laboratory type)	1 No.
99.	DC Power supply	250v DC , 25 Amp	1 No.
100.	Capacitor motor	1/2 H.P. single phase 250 V	1 No.
101.	Split phase motor	1/2 H.P. single phase 250 V	1 No.
102.	Universal motor	1/2 H.P.AC/DC 250 V	1 No.
103.	M.G. Set consisting of squirrel cage induction motor 5 H.P. 400 V cycle with directly coupled compound generator 3K.W. 250 V with built in panel board consisting of :	3 phase air circuit breakers	1set
		Star Delta starter (contact type 8 point) & Automatic type	1 No.
		D.C circuit breaker	1 No.
		Suitable voltmeter on A.C. & D.C. side	1 No.
		Sunk field regulators	1 No.
		Suitable line ammeters on A.C. and D.C. side	1 No.
		Field circuit ammeter	1 No.
		Indicating lamps on both the sides (AC &DC)	1 No.
104.	Squirrel cage induction motor 3 H.P. 400 V with D.O.L. starter		1 No.
105.	Squirrel cage induction motor 5 H.P. 400 V with star delta starter		1 No.
106.	Manual star Delta starter		1 No.
107.	Semi-automatic star Delta starter		1 No.
108.	Automatic star Delta starter		1 No.
109.	Automatic Reverse Forward starter		1 No.
110.	Single phasing preventer	415V	3 Nos.
111.	D.O.L starter		1 No.
112.	Two point starter for DC series		1 No.

	motor		
113.	Soft starter 1ph		1 No.
114.	Tachometer digital type	Non contact type 0-6000 RPM	1 No.
115.	Flux meter		1 No.
116.	2KVA Alternator with 3 ph induction motor		1 No.
117.	5 HP Slip ring induction motor with rotor resistance starter		1 No.
118.	Lux meter		1 No.
119.	Lead Acid battery 75Ah	12V	1 No.
120.	Battery Charger	15V,Current controlled	1 No.
121.	Solar street light lamp set	12v , 18 / 24 watts	4 no
122.	Hydraulic crimping tool for UG cable crimping with bits	20 sq mm to 250sq mm	1 No.
123.	Transformer single phase	1 K.V.A. 250/100v	2 Nos.
124.	Transformer Three phase (oil cooled)	5 K.V.A. 440/220 v	2 Nos.
125.	Transformer oil testing kit	Automatic 60kv	1 No.
126.	Autotransformer	Single phase 0- 300V 1kVA	2 Nos.
127.	Autotransformer	Three phase 0- 500V 1kVA	2 Nos.
128.	Current transformer	10/1, 20/1,30/1,50/5, 100/5 and 300/5A	1 each
129.	Potential transformer	220/110, 300/110, 440/110, 600/110	1 each
130.	Miniature circuit breaker(MCB)	220V/ 6 Amps	2 Nos.
131.	Earth leakage circuit breaker (ELCB)	220V/25mA	2 Nos.
132.	Metal clad circuit breaker (MCCB)	220V/1A	2 Nos.
C. WORKSHOP FURNITURE'S			
133.	Instructors table (Junior Executive)		1 No.
134.	Instructors chair – Full Arm, Caned Back & Seat		2 Nos.
135.	Metal rack	100x150x45 cm	4 Nos.
136.	Lockers with 16 drawers standard size with key		1 No.
137.	Steel almirah	2.5x1.20x0.50 m	2 Nos.
138.	White board		1 No.
139.	Computer table		1 No.
140.	Computer chair - Revolving		2 Nos.
141.	Printer and computer table		1 No.
142.	Work bench	2.5x1.20x0.75meters	2 Nos.
143.	Steel locket standard size with 8 Drawers in each		2 Nos.

144.	Almirah	1.8 x 1.2 x 0.45meters	2 Nos.
145.	Demonstration table	2.5 x 1.25 x 0.75 meter	2 Nos.
146.	Blackboard with easel	3’ x 6’	1 No.
147.	Stools	1’ x 1’x 1.5’	*20 Nos.
148.	Metal rack	180 x 150 x 45cm	1 No.

Note: -

1. *All the tools and equipment are to be procured as per BIS specification.*
2. *Quantity marked with * has been increased as per the batch size.*
3. *Internet facility is desired to be provided in the class room.*

Tools & Equipment for Employability Skills		
S No.	**Name of the Equipment**	**Quantity**
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 Nos.

2.	UPS – 500 VA	10 Nos.
3.	Scanner cum Printer	1 No.
4.	Computer Tables	10 Nos.
5.	Computer Chairs	20 Nos.
6.	LCD Projector	1 No.
7.	White Board 1200 mm x 900 mm	1 No.
Note: Above Tools & Equipment not required, if Computer LAB is available in the institute.		

ANNEXURE-II

FORMAT FOR FORMATIVE ASSESSMENT

Name & Address of the Assessor:		**Year of Enrollment:**
Name & Address of ITI (Govt./Pvt.):		**Date of Assessment:**
Name & Address of the Industry:		**Assessment location: Industry / ITI**
Trade Name:	**Examination:**	**Duration of the Trade/course:**
Learning Outcome:		

S No.	**Candidate Name**	**Father's/Mother's Name**	Safety Consciousness (15)	Workplace Hygiene & Economical use of materials (5)	Attendance/ Punctuality (10)	Ability to follow Manuals/ Written instructions (5)	Application of Knowledge (10)	Skills to Handle Tools/ Equipment/ Instruments/ Devices (10)	Economical use of Materials (5)	Working Strategy (10)	Quality in Workmanship/ Performance (15)	VIVA (15)	**Total Internal Assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														