

**COMPETENCY BASED CURRICULUM**

**FOR THE TRADE OF**

**WIREMAN**

**UNDER**

**CRAFTSMAN TRAINING SCHEME (CTS)**

**IN SEMESTER PATTERN**

**BY**



**GOVERNMENT OF INDIA  
MINISTRY OF SKILL DEVELOPMENT AND ENTREPRENEURSHIP  
DIRECTORATE GENERAL TRAINING**

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# **1. INTRODUCTION**

The Ministry of Skill Development & Entrepreneurship is the apex organization for development and coordination at National level for the programmes relating to vocational training including Women's Vocational Training and Employment Services. Employment service is operated through a countrywide network of Employment Exchanges. Industrial Training Institutes are under the administrative and financial control of State Governments or Union Territory Administrations. The Ministry also operates Vocational Training Schemes in some of the specialized areas through field institutes under its direct control. Development of these programmes at national level, particularly in the area concerning common policies, common standards and procedures, training of instructors and trade testing are the responsibility of the Ministry. But, day-to-day administration of employment Exchanges and Industrial Training Institutes rests with the State Governments/ Union Territories Administrations.

CSTARI one of the field institute of the Ministry is mandated to develop curricula for various courses under different schemes viz., CTS, ATS, MES, CoE& CITS. All the courses are certificate level and run on pan India basis under the aegis of NCVT. The curricula developed so far by this institute are skill based which catered the need of the industry manpower there by contributing significantly in the development of technical manpower. Hence vocational training provides country wide manpower and this trained manpower actually builds the wealth for the nation.

The broad concept of industry competency concerns the ability to perform particular tasks and duties to the standard of performance expected in the workplace. Competency requires the application of specified skills, knowledge and attitudes relevant to effective participation in an industry, industry sector or enterprise.

Competency covers all aspects of workplace performance and involves performing individual tasks; managing a range of different tasks; responding to contingencies or breakdowns; and dealing with the responsibilities of the workplace, including working with others. Workplace competency requires the ability to apply relevant skills, knowledge and attitudes consistently over time and in the required workplace situations and environments.

In line with this concept of competency based curriculum focus on what is expected of a competent individual in the workplace as an outcome of learning, rather than focusing on the learning process itself.

“The Competency Based Training” establishes a direct link between the things which trainees must learn in institutions and knowledge and skills expected from them for employability “The Competency Based Training” is a means of instruction which :

- i) Identifies the competencies required for work performance,
- ii) Prepares the trainees through precise learning objectives,
- iii) Is based on the realities of the world of work

When learning deals with performance type activities, it is necessary to analyse each job performed under a particular vocation. Skills required for doing a job may be manipulative and may require sequential and chronological order of performance. Therefore, teaching and learning content shall be presented in a psychological and methodological manner. Hence, identification of competencies becomes an essential exercise for planning and design a curriculum for vocational courses.

The elements of competency are the basic building blocks of the unit of competency. They describe in terms of outcomes the significant functions and tasks that make up the competency.

The performance criteria specify the required performance in relevant tasks, roles, skills and in the applied knowledge that enables competent performance. They are usually written in passive voice. Critical terms or phrases may be written in bold italics and then defined in range statement, in the order of their appearance in the performance criteria.

The essential skills and knowledge are either identified separately or combined. Knowledge identifies what a person needs to know to perform the work in an informed and effective manner. Skills describe the application of knowledge to situations where understanding is converted into a workplace outcome.

The procedure followed for this purpose is as follows:

- I) listing of job opportunities,
- II) identification of duties for each job,
- III) analyzing the elements of competencies and setting Performance criteria against each elements of competencies,
- IV) determining courses objectives,
- V) Preparing course content by projecting elements of competencies, Performance criteria, skills and knowledge and personality traits.

## **2. JOB ROLES: Reference NOS & NCO**

### **Brief description of Job roles:**

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 :**

- i) NCO-2004: 7137.20 ( 855.10)**

### **3. NSQF COMPLIANCE BLOCK**

#### **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 and
- e. Responsibility.

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

The NSQF level-4 descriptor is given below:

<b>LEVEL</b>	<b>Process required</b>	<b>Professional knowledge</b>	<b>Professional skill</b>	<b>Core skill</b>	<b>Responsibility</b>
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.

#### **4. Learning outcome**

The following are minimum broad general learning outcome after completion of the Wireman course of 02 years duration:

##### **A. GENERIC 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.

##### **B. SPECIFIC OUTCOME**

10. Make good quality electrical wire joints for single and multistrand 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. Make choices to carry out basic jobs of marking out the components for filing, drilling, and riveting, fitting and assembled using different components independently.
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. Plan and install Pipe & Plate earthing. Measure earth resistance by earth tester.
15. Select and perform electrical/ electronic measurements with appropriate instrument.
16. 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.
17. Plan, draw, estimate material, wire up and test different type of industrial wiring circuits as per Indian Electricity rules and taking care of quality.
18. 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.
19. Plan and execute electrical illumination system viz. FL tube, HPMV lamp, HPSV lamp, Halogen & metal halide lamp, CFL, LED lamp etc.
20. Construct and test Half-wave, full-wave, and bridge rectifiers with filter & without filter. Trouble shoot 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 Alternator set. Test, Wire-up and run alternator. Synchronization of Alternator with due care and safety.
23. 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.
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.

***NOTE: Learning outcomes are reflection of total competencies of a trainee. Each learning outcome may include multiple assessment components. However assessment will be carried out as per assessable outcome and assessment criteria.***



## 5. GENERAL INFORMATION

1. Qualification : **WIREMAN**
2. Ref. N.C.O. /NOS Code No. : 7137.20 ( 855.10)
3. NSQC Level : Level - IV
4. Duration of Craftsmen Training : 2 Years (4 Semesters each of six months duration)
5. Entry Qualification : Passed 8<sup>th</sup> class
6. Trainees per unit : 16 ( Max. supernumeraries seats : 5)

### **Distribution of training on Hourly basis:**

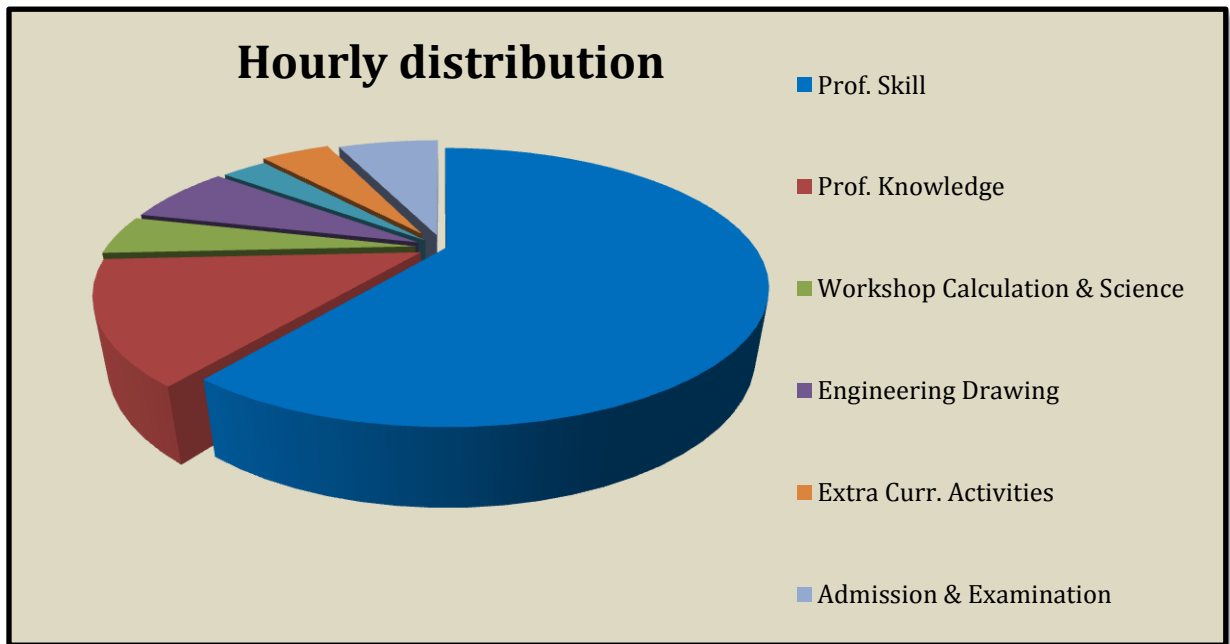
Total hours /week	Trade practical	Trade theory	Work shop Cal. & Sc.	Engg. Drawing	Employability skills	Extracurricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

## 6. COURSE STRUCTURE

1. Name of the Qualification :- WIREMAN
2. Total duration of the course: - 24 Months
3. Training duration details :-

	COURSE ELEMENTS	HOURLY DISTRIBUTION
A	PROFESSIONAL SKILL	2200 HRS
B	PROFESSIONAL KNOWLEDGE	530 HRS
C	WORKSHOP CALCULATION & SCIENCE	180 HRS
D	ENGINEERING DRAWING	265 HRS
E	EMPLOYABILITY SKILLS	110 HRS
F	EXTRA CURRICULAR ACTIVITIES/LIB.	180 HRS
G	INPLANT TRG./PROJECT WORK	240 HRS
H	ADMISSION & EXAMINATION	160 HRS

### PIE-CHART



## **7. General Training Plan, Examination & Pass regulation**

### **General Training Plan**

The skills stated in Learning outcome are to be imparted in accordance with the instructions contained within Section 9 in respect of the content and time structure of the vocational education and training (General Training Plan).

### **Examination**

Each Semester examination is to take place after the end of the six months of training. The each semester examination encompasses such skills as are listed for that period of training (Detail in Section -9) and also includes theoretical knowledge, Core skills & E/S. The E/S will be covered in first two semesters only.

### **Candidates are to demonstrate that they are able to:**

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

The details of the examination and assessment standard are as per section - 12

### **Pass regulation**

For the purposes of determining the overall result, weighting of 25 percent is applied to each semester examination. The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%.

## **8. ASSESSABLE OUTCOME WITH ASSESSMENT CRITERIA**

### ASSESSABLE OUTCOME ALONGWITH ASSESSMENT CRITERIA TO BE ACHIEVED AFTER EACH SEMESTER & COMPLETION OF QUALIFICATION

- i) The training shall be conducted as per syllabus defined in reference no: Section 10.
- ii) The trainee shall demonstrate the competencies which are defined below in assessable outcome and assessment criteria.
- iii) All the assessable outcomes are to be tested during formative assessment, Theory & Practical examinations, various observation and viva-voce.
- iv) Assessable outcome of Employability Skills, Workshop Calculation & Science and Engineering Drawing shall be tested separately and also be applied in Theory and Practical examinations.
- v) These assessable outcomes and assessment criteria will serve as guide lines for Trainers, Paper setters, Moderators and Assessors.

### **GENERIC ASSESSABLE OUTCOME:**

<b>ASSESSABLE OUTCOMES</b>	<b>ASSESSMENT CRITERIA</b>
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

	<p>site policy.</p> <p>1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.</p> <p>1.10 Identify basic first aid and use them under different circumstances.</p> <p>1.11 Identify different fire extinguisher and use the same as per requirement.</p> <p>1.12 Identify environmental pollution &amp; contribute to the avoidance of instances of environmental pollution.</p> <p>1.13 Deploy environmental protection legislation &amp; regulations</p> <p>1.14 Take opportunities to use energy and materials in an environmentally friendly manner</p> <p>1.15 Avoid waste and dispose waste as per procedure</p> <p>1.16 Recognize different components of 5S and apply the same in the working environment.</p>
2. Interpret & use company and technical communication	<p>2.1 Obtain sources of information and recognize information.</p> <p>2.2 Use and draw up technical drawings and documents.</p> <p>2.3 Use documents and technical regulations and occupationally related provisions.</p> <p>2.4 Conduct appropriate and target oriented discussions with higher authority and within the team.</p> <p>2.5 Present facts and circumstances, possible solutions &amp; use English special terminology.</p> <p>2.6 Resolve disputes within the team</p> <p>2.7 Conduct written communication.</p>
3. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, and statistics and apply knowledge of specific area to perform practical operations.	<p>3.1 Semester examination to test basic skills on arithmetic, algebra, trigonometry and statistics.</p> <p>3.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.</p>
4. Understand and explain basic science in the field of study including friction, simple machine and heat and temperature	<p>4.1 Semester examination to test basic skills on science in the field of study including friction, simple machine and heat and temperature.</p> <p>4.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.</p>
5. Read and apply engineering drawing for	<p>5.1 Semester examination to test basic skills on engineering drawing.</p>

different application in the field of work.	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 Semester 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 conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	7.1 Semester examination to test knowledge on energy conservation, global warming and pollution. 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 Semester 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 Semester 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 ASSESSABLE OUTCOME:

### Semester-I

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
10. Make good quality electrical wire joints for single and multistrand 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 $\phi$ 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. Make choices to carry out basic jobs of marking out the components for filing, drilling, riveting, fitting and assembled using different components independently.	12.1 Identify the trade hand tools; practice their uses with safety, care & maintenance.
	12.2 Prepare a simple half lap joint using firmer chisel with safety.
	12.3 Prepare tray using sheet metal with the safety
	12.4 Practice on fixing surface mounting type of accessories.
	12.5 Practice on connecting of electrical accessories.
	12.6 Make and wire up of a test board and test it.
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	13.1 Assemble a DC source 6V/500 mA using 1.5V cells.
	13.2 Determine the internal 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.
	14. 6 Maintain, service and trouble shoot a battery charger.

installation and routine maintenance with due care and safety.	
14. Plan and install Pipe & Plate earthing. Measure earth resistance by earth tester.	14.1 Measure soil conductivity
	14.2 Install the pipe earthing and test it.
	14.3 Install the plate earthing and test it.
	14.4 Measure the earth electrode resistance using earth tester.
	14.5 Carry out earth resistance improvement.

## Semester-II

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
15. Select and perform electrical/ electronic measurements with appropriate instrument.	15.1 Identify the type of electrical instruments.
	15.2 Determine the measurement errors while measuring resistance by voltage drop method.
	15.3 Extend the range of MC voltmeter and ammeter.
	15.4 Measure the power and energy in a single & three phase circuit using wattmeter and energy meter with CT and PT.
	15.5 Test single phase energy meter for its errors.
	15.6 Measure the value of resistance, voltage and current using digital multimeter.
	15.7 Measure the power factor in poly-phase circuit and verify the same with voltmeter, ammeter, wattmeter readings.
	15.8 Calibrate analog instruments.
	15.9 Measure frequency by frequency meter.
	15.10 Use meggar for insulation testing
16. 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.	16.1 Comply with safety & IE rules when performing the domestic wiring.
	16.2 Identify the parts of MCB & ELCB and test its operation.
	16.3 Identify the types of fuses their ratings and applications.
	16.4 Prepare and mount the energy meter board with due care.
	16.5 Draw and wire up the consumers main board with ICDP switch and distribution fuse box.
	16.6 Draw and wire-up to control lamp controlled from 2 places (stair case wiring) on batten wiring as per IE rule.
	16.7 Draw and wire-up single phase domestic pump set in PVC conduit wiring as per IE rule.
	16.8 Draw and wire-up in casing capping one lamp controlled from 3 different places using intermediate switch as per IE rule.



	16.9 Wire –up in PVC conduit wiring for calling bell/buzzer & test them.
	16.10 Estimate the material for wiring in PVC casing & capping for two lamps, one fan and one 6A socket outlet & wire-up.
	16.11 Test a domestic wiring installation by using Megger.
17. Plan, draw, estimate material, wire up, test different type of industrial wiring circuits as per Indian Electricity rules and taking care of quality.	17.1 Comply with safety & IE rules when performing the Industrial wiring.
	17.2 Wire-up PVC Conduit wiring for lighting circuit & 3 phase motor circuit with due care and safety.
	17.3 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.
	17.4 Make termination to the feeder cable in bus bar & to service cable through plug-in box with due care and safety.
	17.5 Erect a bus bar chamber on an angle iron board and wire-up for 3 phase induction motor with due care and safety.
	17.6 Determine the size of cable for main & distribution board of a workshop.
	17.7 Test an industrial wiring installation by using Megger.
18. 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.	18.1 Estimate the material for PVC channel wiring for telephone intercom having 5 instruments from main distribution frame (MDF) with due care.
	18.2 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.
	18.3 Draw and wire up a bank/hostel/hospital/commercial establishment in PVC conduit as per IE rule.
	18.4 Test a commercial wiring installation by using Megger.
	18.5 Wire up and test LAN wiring with due care.
	18.6 Install co axial cable from dish antenna to Television set.
	18.6 Prepare and connect batteries with UPS with due care and safety.
18.7 Install and test UPS in the circuit with due care and safety.	
19. Plan and execute electrical illumination system viz. FL tube, HPMV lamp, HPSV lamp, Halogen & metal halide	19.1 Install light fitting with reflectors for direct and indirect lighting.
	19.2 Assemble and connect a & single twin tube F.L.
	19.3 Connect, install and test the H.P.M.V, H.P.S.V, Halogen & metal hallide lamp with accessories.

lamp, CFL, LED lamp etc.	19.4 Prepare and test a decorative serial lamp set for 190 V using 6V bulb and flasher.
	19.5 Connect the neon sign with the accessories and test it.
	19.6 Assemble and install solar photo voltaic light.
	19.7 Install light fitting for show case window lighting.
	19.8 Install & test CFL & LED lamps.
	19.9 Measure intensity of light using LUX Meter.

### Semester-III

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
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 Trouble shoot & maintain a DC machine.
22. Understand the constructional features,	22.1 Plan work in compliance with standard safety norms related with Alternator.

working principles of Alternator set. Test, Wire-up and run alternator. Synchronization of Alternator with due care and safety.	22.2 Identify the parts of an Alternator, measure armature & field resistances and insulation resistance
	22.3 Wire-up, start and run an alternator and build up the voltage.
	22.4 Load the Alternator & find out regulation at different loads.
	22.5 Synchronise the Alternators with mains.
23. 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.	23.1 Plan work in compliance with standard safety norms related with AC motors.
	23.2 Connect start, run and reverse the DOR of different type of single phase motors.
	23.3 Identify the terminals of 3 phase squirrel cage induction motor, wire up, run using different types of starters and change the direction of rotation.
	23.4 Determine the efficiency of 3 phase squirrel cage induction motor by no load test/ blocked rotor test and brake test.
	23.5 Wire up, start, run and adjust the speed of a slip-ring induction motor.
	23.6 Construct DOL, Forward/Reverse starter circuits using push button switches, contactors, overload relays etc.
	23.7 Practice power connections to motors.

## Semester-IV

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
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	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

transmission & distribution systems and power plants with knowledge of principle applied. Make and test power connection to substation equipments with care and safety.	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.
	25.4. Make power connection to substation equipments.
	25.5 Identify the parts of substation equipments like circuit breakers and operate them.
	25.6 Practice crimping of lugs to underground cable and connect the cable to bus bars & equipments with due care.
	25.7 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.

## 9. SYLLABUS CONTENT WITH TIME STRUCTURE

### 9.1 SYLLABUS CONTENT FOR PROFESSIONAL SKILL & KNOWLEDGE

**First Semester**  
**(Semester Code no. WM - 01)**  
**Duration: Six Month**

#### **LEARNING OBJECTIVES OF 1<sup>ST</sup> SEMESTER**

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Interpret & use Company terminology and technical communication
4. To make simple wiring circuit with common electrical accessories with domestic electrical appliances for a specified voltage and current.
5. To carry out the necessary test for charging secondary battery individually, installation and grouping of batteries, care and maintenance of batteries.
6. To make a job profile according to the drawing.
7. Able to carry out earthing installation.

Week No.	Professional Skills	Professional Knowledge
	Trade Practical	Trade Theory
1	<p>Implementation in the shop floor of the various safety measures. Visit to the different sections of the Institute Demonstration on elementary first aid. Artificial Respiration. Practice on use of fire extinguishers.</p> <p><b>Occupational Safety &amp; Health Importance of housekeeping &amp; good shop floor practices.</b></p> <p>Health, Safety and Environment guidelines, legislations &amp; regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction,</p>	<p><b>Occupational Safety &amp; Health</b></p> <p>Basic safety introduction, Personal protection:-</p> <p>Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution &amp; personal safety message.</p> <p>Use of Fire extinguishers.</p> <p>Visit &amp; observation of sections.</p> <p>Various safety measures involved in the Industry. Elementary first Aid. Concept of Standard</p> <p><b>Soft Skills:</b> its importance and Job area after completion of training. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept &amp; its application. Response to emergencies eg; power failure, fire, and system failure.</p>

	<p>Personal protective Equipment(PPE):-  Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution &amp; personal safety message.  Preventive measures for electrical accidents &amp; steps to be taken in such accidents.  Use of Fire extinguishers.</p>	
2	<p>Demonstration of Trade hand tools. Identification of simple types- screws, nuts &amp; bolts, chassis, clamps, rivets etc. Use, care &amp; maintenance of various hand tools. Familiarization with signs and symbols of Electrical accessories</p>	<p>Identification of Trade-Hand tools-Specifications</p>
3 - 4	<p>Practice in using cutting pliers, screw drivers etc. skinning the cables, and joint practice on single strand.  Demonstration &amp; Practice on bare conductors joints--such as rat tail, Britannia, straight, Tee, Western union. Joints</p>	<p>Fundamental of electricity. Electron theory- free electron, Fundamental terms, definitions, units &amp; effects of electric current</p>
5	<p>Practice in soldering &amp; brazing- Measurement of Resistant and Measurement of specific Resistant. Application of Wheatstone bridge in measurement of Resistance</p>	<p>Solders, flux and soldering technique. Resistors types of resistors &amp; properties of resistors.</p>
6	<p>Demonstration and identification of types of cables. Demonstration &amp; practice on using standard wire gauge &amp; micrometer. Practice on crimping thimbles, Lugs.  Examination and checking of cables and conductors and verification of materials according to the span.</p>	<p>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 &amp; cables standard wire gauge  Specification of wires &amp; Cables-insulation &amp; voltage grades  -Low , medium &amp; high voltage  Precautions in using various types of cables / Ferrules</p>

7	<p>Verification of Ohm's Law, Verification of Kirchoff's Laws.</p> <p>Verification of laws of series and parallel circuits.</p> <p>Verification of open circuit and closed circuit network.</p> <p><b>Measuring unknown resistance using Wheatstone bridge, voltage drop method.</b></p> <p>Experiment to demonstrate the variation of resistance of A metal with the change in temperature.</p>	<p>Ohm's Law - Simple electrical circuits and problems. Reading of simple Electrical Layout.</p> <p><b>Resistors</b> -Law of Resistance. Series and parallel circuits.</p> <p><b>Kirchoff's</b> Laws and applications. Wheatstone bridge principle And its applications. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance</p>
8.	<p>Practice on installation and overhauling common electrical accessories as per simple Electrical circuit / Layout.</p> <p>Fixing of switches, holder plugs etc. in T.W. boards.</p> <p>-Identification and use of wiring accessories concept of switching.</p>	<p>Common Electrical Accessories, their specifications in line with NEC 2011-Explanation of switches lamp holders, plugs and sockets. Developments of domestic circuits, Alarm &amp; switches, with individual switches, Two way switch .Security surveillance, Fire alarm, MCB, ELCB, MCCB.</p>
9	<p>Assembly of a Dry cell- Electrodes-Electrolytes.</p> <p>Grouping of Dry cells for a specified voltage and current, Ni cadmium &amp; Lithium cell.</p> <p>Practice on Battery Charging, Preparation of battery charging,</p> <p>Testing of cells, Installation of batteries, Charging of batteries by different methods.</p> <p>Practice on Electroplating and anodising, Cathodic protection.</p>	<p><b>Chemical</b> 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.</p> <p>Lead acid cell-description, methods of charging-Precautions to be taken &amp; testing equipment, Ni-cadmium &amp; Lithium cell, Cathodic protection.</p> <p>Electroplating, Anodising.</p> <p>Different types of lead acid cells.</p>
10	<p>Routine care &amp; maintenance of Batteries</p>	<p>Rechargeable dry cell, description advantages and disadvantages.</p> <p>Care and maintenance of cells</p> <p>Grouping of cells of specified voltage &amp; current, Sealed Maintenance free Batteries, Solar battery.</p>
11	<p>Charging of a Lead acid cell, filling of electrolytes- Testing of charging checking of discharged and fully charged</p>	<p>Inverter, Battery Charger, UPS-Principle of working.</p> <p>Lead Acid cell, general defects &amp; remedies.</p> <p>Nickel Alkali Cell-description charging. Power &amp; capacity of cells. Efficiency of cells.</p>

	battery	
12-13	<p>Marking use of chisels and hacksaw on flats, sheet metal filing practice, filing true to line.</p> <p>Sawing and planning practice. Practice in using firmer chisel and preparing simple half lap joint.</p>	<p><u>ALLIED TRADES:</u></p> <p>Introduction of fitting trade. Safety precautions to be observed Description of files, hammers, chisels hacksaw frames &amp; blades-their specification &amp; grades. Care &amp; maintenance of steel rule try square and files.</p> <p>Marking tools description &amp; use. Description of carpenter's common hand tools such as saws planes, chisels mallet claw hammer, marking, dividing &amp; holding tools-their care and maintenance.</p>
14	<p>Drilling practice in hand drilling &amp; power drilling machines. Grinding of drill bits. Practice in using taps &amp; dies, threading hexagonal &amp; square nuts etc. cutting external threads on stud and on pipes, riveting practice.</p>	<p>Types of drills description &amp; drilling machines, proper use, care and maintenance.</p> <p>Description of taps &amp; dies, types in rivets &amp; riveted joints.</p> <p>Use of thread gauge.</p>
15	<p>Practice in using snips, marking &amp; cutting of straight &amp; curved pieces in sheet metals. Bending the edges of sheets metals. Riveting practice in sheet metal. Practice in making different joints in sheet metal in soldering the joints.</p>	<p>Description of marking &amp; cutting tools such as snubs shears punches &amp; other tools like hammers, mallets etc. used by sheet metal workers. Types of soldering irons-their proper uses.</p> <p>Use of different bench tools used by sheet metal worker. Soldering materials, fluxes and process.</p>
16-17	<p>Trace the magnetic field.</p> <p>Assembly / winding of a simple electro magnet.</p> <p>Use of magnetic compass.</p> <p>Identification of different types of Capacitors. Charging and discharging of capacitor, Testing of Capacitors using DC voltage and lamp.</p>	<p><b>Magnetism -</b></p> <p>Classification of magnets, methods of magnetising, magnetic materials. Properties, care and maintenance.</p> <p>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.</p>



18-18	Determine the characteristics of RL, RC and RLC in A.C. Circuits both in series and parallel. Experiment on poly phase circuits. Current, voltage, power and power factor measurement in single & poly- phase circuits. Measurement of energy in single and poly-phase circuits. - Use of phase sequence meter.	<b>Alternating Current</b> -Comparison and Advantages D.C and A.C. Related terms frequency Instantaneous value, R.M.S. value 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	<b>Practice on Earthing</b> - different methods of earthing. Measurement of Earth resistance by earth tester. Testing of Earth Leakage by ELCB and relay.	<b>Earthing</b> - 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	Determine the resistance by Colour coding Identification of active/passive components. <b>Diodes</b> -symbol - Tests - Construct & Test Half wave rectifier ckt. Full wave rectifier ckt. Bridge rectifier ckt.	<b>Basic electronics</b> - 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	(i) <b>Project work</b> (ii) <b>Industrial visit (optional)</b>	
24-25	<b>Examination</b>	
26	Semester Gap	

**Second Semester**  
**(Semester Code no. WM - 02)**  
**Duration: Six Month**

**LEARNING OBJECTIVES OF 2<sup>nd</sup> SEMESTER**

1. Apply safe working practices.
2. Comply environment regulation and housekeeping.
3. Interpret & use Company terminology and technical communication
4. Able to select and perform electrical/ electronic measurements.
5. Able to plan, Execute and test domestic wiring system.
6. Able to execute and test electrical illumination (lighting) system.
7. Able to plan, Execute and test Industrial wiring system.
8. Able to plan, Execute and test commercial wiring system.
9. Able to execute and test wiring for computer network.

<b>Week No.</b>	<b>Professional Skills</b>	<b>Professional Knowledge</b>
	<b>Trade Practical</b>	<b>Trade Theory</b>
1-2	<p><b>ELECTRICAL MEASURING INSTRUMENTS-</b> Measurement of voltage, current &amp; resistance in different circuits. Direct &amp; indirect measurement of electrical power &amp; energy. Calibration of energy meters. Measurement of current and voltage using CT &amp; PT, Measurement of 3 Phase energy using CT &amp; PT. Phase sequence meter, measure current and voltage using Tong tester. Power measurement by Two &amp; Three watt meter method Insulation resistance test by Megger. Measurement of earth resistance by earth tester. Calibration of indicating type analogue instruments: voltmeter, ammeter, and wattmeter. Measurement of soil conductivity. Introduction of</p>	<p>Type of measuring instruments – MC &amp; MI, Construction &amp; working principles of Ammeter, Voltmeter, Ohm-meter ,Wattmeter, Energy meter, P.F. meter, frequency meter, multi meter, clamp meter, Megger &amp; earth tester. Introduction of Digital meters. CT &amp; PT. Tong tester / Clip on Meter.</p>

	Digital meters.	
3-4	<p><b>DOMESTIC WIRING - METHODS, INSTALLATION &amp; TESTING-</b></p> <p>Demonstration &amp; Practice on connecting common electrical accessories in circuits and testing them in series board. Demonstration on Testing &amp; replacement of different types of fuses.</p> <p>Identification of different wiring materials and their specifications.</p> <p>Removing of insulation from assorted wires and cables.</p> <p>Demonstration and practice crimping thimbles/lugs of various sizes. Jointing practice with single and multi-stranded conductors of different wires and cables.</p>	<p>Introduction and explanation of electrical wiring systems, cleat wiring, casing &amp; Capping, CTS, Conduit and concealed etc.,</p> <p>I. E. Rules. Related to wiring, National Building codes for house wiring, specification and types, rating &amp; material.</p>
5	<p>Layout on wiring boards.</p> <p>Practice in P.V.C. insulated cable wiring on wood buttons with distribution board and number of points.</p>	<p>Branching of circuits with respect to loads such as lighting and power.</p> <p>CTS/PVC Conduit-surface and concealed/metal conduit/PVC casing and capping.</p> <p>IE rules regarding clip distance. Fixing of screws, cable bending etc</p>
6	<p>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 wiring (I)Domestic wiring practice</p>	<p>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.</p>
7	<p>Demonstration and practice of using Rowel tools,</p> <p>Demonstration and practice of</p>	<p>Description of Rowel tools and Rowel plugs, their sizes, plugging, compound, plugs- wall jumper and their sizes and uses.</p>

	casing and capping wiring. Testing of wiring installation by using Megger.	Introduction to estimation procedure, P.V.C. casing and capping materials, sizes and grades etc.
8	Demonstration and practice in cutting and threading conduit pipes. Cold and hot bending of pipes. Fitting of conduit accessories.	Conduit pipe wiring materials and accessories, types and sizes of conduit.
9	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.	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.
10	<b>ILLUMINATION:-</b> Installation of - Neon Sign tube, Mercury vapour (H.P. & L.P.), Sodium vapour, Halogen Lamps, single tube, double tube, Metal halide lamps. Emergency light. Practice on decoration lighting . Practice on using LUX Meter. Installation and testing of CFL Lamps and LED Lamps	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.
11-13	<b>INDUSTRIAL WIRING-</b> Tests on insulating materials. Measurement of insulation resistance, of commercial and industrial installation Additional practice in conduit wiring. Industrial power wiring involving single phase & 3phase motors with switches & starters.	Connections of different types of motors used in industry, their normal methods of wiring, Control , starting and protection devices-their connections, layouts and earthing Code practice for earthing of Industrial Wiring. Wiring methods & types in workshop & factories.
14	<b>COMMERCIAL WIRING-</b> Inverter wiring./ Control panel wiring / multi-storeyed building wiring. Introduction to LAN wiring.	Wiring in commercial building- their special precautions as per I.E. rules. Introduction to LAN wiring.

15-16	Installation of 1 ph. and 3 ph. on line / off line UPS wiring. Testing of Industrial wiring and UPS wiring installation.	Power drives - Introduction, types, advantages & disadvantages. UPS- Introduction, types, Load calculation, Backup time calculation.
17	Straight and cross crimping of RJ-45 cable. crimping of co-axial cable, proper installation of co-axial cable from dish antenna to Television set.	Computer networking - Identification of network hardware / component. CAT-6 cable, RJ-45. DTH- Introduction of direct to home system, Music channel wiring/interconnecting couplers.
18	<b>Industrial wiring installations</b> for mixed load, both light and power. Layout of L.V. AC/DC machines and their panels. Wiring of Low power A.C./ D.C. machines in metal conduit system as per I.E. Rules. Testing of wiring installation	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
18	Wiring of different circuit using Single core cable use for 2 ways, intermediate master switches etc. Testing of wiring installation	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
20-21	<b>COMPUTER AWARENESS:</b> Identification of Computer Parts, Switching ON/OFF of PC, Safety Precautions. Identifying and using Windows, like folders, files, Editing and saving. Windows Explorer, Notepad, Paint and calculator. <b>OFFICE PACKAGE&amp; INTERNET:</b> Using /Practicing WORD, EXCEL, POWER POINT for communication. Documentation. Internet Practicing – Browsing/ Creating Email, Downloading.	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.
22-23	Implant training / Project work/work in a team	
24-25	NCVT Examination	
26	Semester Gap	

**Third Semester**  
**(Semester Code no. WM - 03)**  
**Duration: Six Month**

**LEARNING OBJECTIVES OF 3<sup>rd</sup> SEMESTER**

1. Apply safe working practices.
2. Comply environment regulation and housekeeping.
3. Interpret and use Company terminology and technical communication
4. Able to construct, test and trouble shoot DC power supplies.
5. Able to connect, test and run DC machine.
6. Able to connect, test and run alternator.
7. Able to connect, test and run AC motor.

Week No.	Professional Skills	Professional Knowledge
	Trade Practical	Trade Theory
1	Identify the terminals of LED, Diode , transistor, Zener diode, UJT, SCR , regulator ICs and test it.	LED , Diode, types of transistor, UJT, SCR, regulator ICs and Zener diode uses and its application
2	Construct and test variable DC power supply and trouble shoot the defects in a simple power supply.	IC - voltage regulator pin configurations and applications.
3-4	Construction & testing of various electrical circuits with different accessories. Connection of Calling Bell, Buzzer, Electric Iron, Heater, Light & Fan etc. Practice in soldering and brazing by following Indian Electricity rules.	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, 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 <b>Soldering</b> - Solders, flux and soldering techniques. Types of soldering irons-their proper use.
5	<b>D.C. GENERATORS,</b> Identification of the parts of D.C. Generators. Testing and measuring the field and	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

	Armature resistances. Dismantle the D.C. Generator and Reassemble and test for its working.	field.
6-7	Identification of different parts of generators testing fields & Apparatus. Insulation resistance measurements. Building up of voltage and loading generators. Servicing of generators including replacing of carbon brushes.	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
8	<b>MOTORS &amp; STARTER:</b> Practice in connecting generators- Generators- Testing of D.C. Machines by Megger. General maintenance of D.C. machines.	Introduction to D.C. Motor-Working principle, types of motors Explanation of terms used Torque, speed, Back E.M.F. etc. Characteristics, Speed control of DC motors
9-10	Testing of D.C. Motors - connect run and change direction of rotation. Study of DC starters- 2 point 3 point and 4 point speed control of D.C. Motors and speed measurement. Use Revolution counter. Trouble shooting and fault rectification. Identify and test different types of D.C motors.	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.
11-12	Tests on 3 phase circuit. – Current and voltage measurement in star and delta connections. Measurement A.C. 3 ph. power. Determine the V and I relation in Star/Delta connections in a 3-Ph motor.	Introduction to A.C. Poly phase systems- advantages, 3 phase star delta. Terms used in $3\phi$ 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
13-14	<b>A.C. GENERATORS, MOTORS &amp; STARTERS</b> Identification of Alternator of parts. Running of Alternator by prime mover and loading it to find out regulation at different loads. Testing of alternators (IR	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.

	tests). Connect and test Parallel operation of alternators.	
15	Demonstration and practice on A.C single phase motors starting and running for specific requirements.	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.
16-18	Constructional details of three phase squirrel cage induction motor and slip ring induction motor. Determination of slip and efficiency. Familiarisation of DOL starter, Star- delta starter, Autotransformer starter and slip ring IM starter. Phase sequence test on three phase IM motors, Single phasing preventer. Identification of A.C and D.C motors (identify motors from the stock/scrap). Construction of simple control circuits using push button and contactors.	<b>Three phase Induction motor:</b> - 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.
18	Connect and run the A.C single phase and 3-Ph motors by using starters.	Starters - DOL starter, Star – delta starter and Auto transformer starter.
20-21	A.C. motor panel wiring (slip ring Induction type) <b>POWER WIRING FOR DC &amp; AC MOTORS</b> Practice power and control circuits on boards. Assembly & testing of the frame for a panel – suitable for motor generator set. I.S. 3072 Part-II of 1861. Erection of panel board, fixing of controlling and starting equipment, necessary meters.	Description of starter delta starter (manual, semi and Auto). Internal 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.
22-23	Implant training/Project work/work in a team	
24-25	NCVT EXAMINATION	
26	Semester Gap	



**Fourth Semester**  
**(Semester Code no. WM - 04)**  
**Duration: Six Month**

**LEARNING OBJECTIVES OF 4<sup>th</sup> SEMESTER**

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Interpret & use Company terminology and technical communication
4. Able to connect and test transformers.
5. Able to connect and operate Electrical substation equipments
6. Able to perform control panel wiring and test.
7. Able to plan, estimate & costing of wiring system.

Week No.	Professional Skills	Professional Knowledge
	Trade Practical	Trade Theory
1-4	<p>Identification of types of transformers.            To test / check the polarity of single phase transformer.            Insulation Testing of single phase and Three Phase.            Conducting No-load/O.C. &amp; short circuit tests.            Connection of transformers, efficiencies of transformers, parallel operation of transformer. Ratio test and voltage regulation.</p>	<p><b>TRANSFORMERS –</b>            Power Transformer – Its construction, working, performance, parallel operation of transformer, their connections. Cooling of transformer, S.C. &amp; 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 &amp; uses.</p>
5-7	<p>Familiarize and practice operation of OH line components. Visit to generating station (Thermal/ Hydro/Nuclear)            Visit to a sub-station to familiarize OH line components.            Prepare a line diagram of the</p>	<p><b>GENERATION, TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER</b>            Generation of Electricity and their types.            General idea about overhead transmission, distribution (LV,MV&amp; 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</p>

	institute/ ITI supply system.	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.
8	Demonstration, testing and use of line protecting devices as per I.E. Rules. Visit to Distribution - station.	Types of Distribution, Explanation of line protecting devices and their general principle. Brief description of connection of places of use.
9-10	Familiarization and operation of various CBs ACB, VCB, SF6, OCB etc. visit to sub-station. Demonstration and Tests on Multi range switches, Rotary switches. Cooker control Panel, Power circuit switches Thermostats. Mercury switches, visit/in plant training in a industry.	<b>SUBSTATION EQUIPMENTS</b> 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.
11	Familiarize the parts of substations low and high voltages	<b>TYPES OF SUBSTATIONS - INDOOR, OUTDOOR &amp; POLE MOUNTING</b> Substation construction: i. Outdoor and Indoor substation. ii. E.H.T. substation iii. H.T. substation iv. Medium & low voltage substation (Pole mounting type)
12-13	Demonstration and practice in terminating an U.G. cable to a bus bar chamber. Crimping lugs to the conductors of U.G. cable and connection to bus bar Loop connection for other circuit.	<b>U.G. CABLE</b> 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.
14	<b>Synchronizing</b> Building up the alternator output voltage, Synchronizing of bus bar voltage with generated voltage	Need of Synchronizing, various methods, precautions to be observed while Synchronizing
15-16	<b>Control panel wiring</b> Preparation of control panel board and its layout	Control Panel elements, types and specifications. Layout and installation of panel board , Panel board wiring methods, colour coding of cables for

	Fixing of indicating meters /Instruments, Control devices, Protection devices. Fixing of cable entry and exit points	its easy identification. Grouping and numbering of cables by using ferrules.
17	Preventive maintenance and routine tests. Fault location and remedy practice both in domestic and industrial wirings. Practice in fixing conduit along with the girder, steel structures station etc.	Importance and advantages of maintenance. Points to be observed to maintain the installation, preventive maintenance and routine tests. Common faults, causes and remedies in domestic and industrial wiring installation, Methods of Locating faults.
18-20	<b>Planning , Estimation and Costing of Wiring-</b> Planning and Preparation of layout for domestic, commercial, Multi storied building wiring and workshop electrical wiring. Estimation and costing of Labour, materials and accessories as per layout.	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.
21-22	<b>Project Work (work in a team)</b>	
	<ol style="list-style-type: none"> <li>1. Over hauling and Testing of 3 phase Induction motor</li> <li>2. Over hauling and testing of Ceiling / Table Fan.</li> <li>3. Preparation of series test board with indicating digital metres.</li> <li>4. Construction and test regulated power supply of 6-12 Volt DC.</li> <li>5. Construct and Test Decorative running LED lamp assembly.</li> <li>6. Installation of Pumpset.</li> </ol>	
22-23	Industrial visit	
24-25	NCVT EXAMINATION	
26	Semester Gap	

## 9.2 SYLLABUS CONTENT OF CORE SKILLS

**First Semester**  
**(Semester Code no. WM - 01)**  
**Duration: Six Month**

### **LEARNING OBJECTIVES OF 1<sup>ST</sup> SEMESTER**

1. Demonstrate basic arithmetic to derive value of unknown quantity / variable.
2. Understand & apply engineering material, their classification, properties and applications in the day to day technical application.
3. Explain & apply speed, velocity, work, power & energy for application in field of work.
4. Understand & explain importance of engineering drawing, drawing instruments, their standard & uses.
5. Draw lines, geometrical figures, free hand sketches.
6. Understand and apply sizes & layout of drawing sheet, method of presentation of engineering drawing & symbolic representation as per BIS standards

<b>Sl. No.</b>	<b>Professional Knowledge</b>	<b>Professional Knowledge &amp; Skills</b>
	<b>Workshop Calculation and Science</b>	<b>Engineering Drawing</b>
1.	<b>Unit:</b> Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	Engineering Drawing: Introduction and its importance <ul style="list-style-type: none"> <li>- Relationship to other technical drawing types</li> <li>- Conventions</li> <li>- Viewing of engineering drawing sheets.</li> <li>- Method of Folding of printed Drawing Sheet as per BIS SP:46-2003</li> </ul>
2.	<b>Fractions</b> : 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 <ul style="list-style-type: none"> <li>- 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.</li> </ul>
3.	<b>Square Root</b> : Square and Square Root, method of finding out square roots, Simple problem using	Lines : <ul style="list-style-type: none"> <li>- Definition, types and applications in Drawing as per BIS SP:46-2003</li> <li>- Classification of lines (Hidden, centre,</li> </ul>

	calculator.	<p>construction, Extension, Dimension, Section)</p> <ul style="list-style-type: none"> <li>- Drawing lines of given length (Straight, curved)</li> <li>- Drawing of parallel lines, perpendicular line</li> <li>- Methods of Division of line segment</li> </ul>
4.	<b>Ratio &amp; Proportion</b> : Simple calculation on related problems.	<p>Drawing of Geometrical Figures: Definition, nomenclature and practice of</p> <ul style="list-style-type: none"> <li>- Angle: Measurement and its types, method of bisecting.</li> <li>- Triangle -different types</li> <li>- Rectangle, Square, Rhombus, Parallelogram.</li> <li>- Circle and its elements.</li> </ul>
5.	<b>Percentage</b> : Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	<p>Lettering and Numbering as per BIS SP46-2003:</p> <ul style="list-style-type: none"> <li>- Single Stroke, Double Stroke, inclined, Upper case and Lower case.</li> </ul>
6.	<b>Material Science</b> : 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.	<p>Dimensioning:</p> <ul style="list-style-type: none"> <li>- Definition, types and methods of dimensioning (functional, non-functional and auxiliary)</li> <li>- Types of arrowhead</li> <li>- Leader Line with text</li> </ul>
7.	<b>Mass, Weight and Density</b> : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.	<p>Free hand drawing of</p> <ul style="list-style-type: none"> <li>- Lines, polygons, ellipse, etc.</li> <li>- geometrical figures and blocks with dimension</li> <li>- Transferring measurement from the given object to the free hand sketches.</li> </ul>
8.	<b>Speed and Velocity</b> : Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.	<p>Sizes and Layout of Drawing Sheets</p> <ul style="list-style-type: none"> <li>- Basic principle of Sheet Size</li> <li>- Designation of sizes</li> <li>- Selection of sizes</li> <li>- Title Block, its position and content</li> <li>- Borders and Frames (Orientation marks and graduations)</li> <li>- Grid Reference</li> <li>- Item Reference on Drawing Sheet (Item List)</li> </ul>

9.	<p><b>Work, Power and Energy:</b> 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.</p>	<p>Method of presentation of Engineering Drawing</p> <ul style="list-style-type: none"> <li>- Pictorial View</li> <li>- Orthogonal View</li> <li>- Isometric view</li> </ul>
10.	<p>-----</p>	<p>Symbolic Representation (as per BIS SP:46-2003) of :</p> <ul style="list-style-type: none"> <li>- Fastener (Rivets, Bolts and Nuts)</li> <li>- Bars and profile sections</li> <li>- Weld, brazed and soldered joints.</li> <li>- Electrical and electronics element</li> <li>- Piping joints and fittings</li> </ul>

**Second Semester**  
**(Semester Code no. WM - 02)**

**Duration: Six Month**

**LEARNING OBJECTIVES OF 2<sup>ND</sup> SEMESTER**

1. Demonstrate basic algebraic, mensuration, trigonometric facts and formulas to derive value of unknown quantity / variable.
2. Apply the factual knowledge of basic heat & temperature, basic electricity for day to day practical application.
3. Explain & apply principles of simple machine & levers for mechanical advantage, efficiency for practical application.
4. Draw & practice dimensioning, construction of solid figures and projections as per IS specifications.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	<b>Algebra</b> : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Construction of Scales and diagonal scale
2.	<b>Mensuration</b> : 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
3.	<b>Trigonometry</b> : 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.
4.	<b>Heat &amp; Temperature</b> : Heat and temperature, their units, difference between heat and temperature,	Construction of Geometrical Drawing Figures: - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons.

	boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	- Conic Sections (Ellipse & Parabola)
5.	<b>Basic Electricity:</b> 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.
6.	<b>Levers and Simple Machines:</b> 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.
7.	-----	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
8.	-----	Drawing of Orthographic projection from isometric/3D view of blocks
9.	-----	Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
10.	-----	Drawing details of two simple mating blocks and assembled view.



**Third Semester**  
**(Semester Code no. WM - 03)**  
**Duration: Six Month**

**LEARNING OBJECTIVES OF 3<sup>rd</sup> SEMESTER**

1. The trainee will acquire the knowledge, explain and apply the basic terms and law related with elasticity & materials, magnetism, pressure and heat treatment process.
2. The trainee will able to explain and solve the problem related to Laws of indices & Quadratic Equation.
3. The trainee will acquire knowledge of electrical circuit of capacitors, resistors and inductors for series and parallel operation and apply in the practical field of operation of electrical circuit in routine and repetitive in various range of applications.
4. The trainee will acquire knowledge about fundamental of AC waveforms for calculation of r.m.s, average, instantaneous value and peak value etc.
5. Able to draw & understand freehand sketch/ diagram of Alternating current, electronic component, wiring, earthing, DC machine, transformer and illumination and apply in routine work of electrical field.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	<b>Elasticity:</b> Stress, strain, Modulus of elasticity, elastic limit, Hooks law, young's modulus.	<b><u>Sign &amp; Symbol Trade related</u></b> <b>Alternating Current</b> 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.	<b>Material:</b> Introduction, types and properties. Uses of Conducting, Semi-conducting and insulating materials.	<b>Electronic components</b> 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.	<b>Magnetism:</b> Magnetic material, magnetic field, flux density, magnetic moment, m.m.f. Reluctance, permeability, susceptibility, electromagnet, solenoid and its practical applications.	<b>Electric wirings &amp; Earthing</b> 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.	<b>Pressure:-</b> Pneumatic pressure, PSI, bar, atmospheric pressure, pressure gauge and absolute pressure, Heat treatment process.	<b>DC machines</b> 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.	<b>Indices:</b> Laws of indices related problems.  <b>Quadratic Equation:</b> Introduction, solution of simple Quadratic equation and related problems.	<b>Transformer</b> 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.	<b>Illumination</b> Free hand sketching of Mercury vapour lamp, sodium vapour lamp, Fluorescent tube (Single & Twine), MHL lamp and their connection.
7.	<b>A.C Waveform Calculation:</b> Calculation of r.m.s, average, instantaneous value, peak value. Peak to peak value, Frequency and wavelength calculation and their relationship	-----
8.	<b>Series And Parallel Connection of Electrical and Electronic components:</b> 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. Calculation of KVA.	
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**Fourth Semester**  
**(Semester Code no. WM - 04)**  
**Duration: Six Month**

**LEARNING OBJECTIVES OF 4<sup>th</sup> SEMESTER**

1. The trainee will acquire the knowledge friction, force and centre of gravity and their related terms for application in the practical field.
2. Able to explain and apply different types of Number system & conversions.
3. The trainee will acquire the knowledge of calculation on estimation and costing for requirement of materials in the field.
4. The trainee will acquire the knowledge of personnel finance by learning simple problems solution on Profit & Loss, simple and compound interest.
5. Able to draw freehand sketch/ diagram of 1 & 3 phase AC motors, alternators, synchronous motors, winding, control panel & distribution of power and apply in the routine work of electrical field.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	<b>Friction:</b> - Laws of friction, coefficient of friction, angle of friction, simple problems related to friction. Lubrication  Concept on terms like pressure, atmospheric pressure, gauge pressure. Heat treatment necessity difference methods.	<b>Three phase Induction motor</b> 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.

2.	<p><b>Forces:</b> - 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.</p>	<p><b>Alternator</b></p> <p>Tracing of panel wiring diagram of an alternator. Drawing the schematic diagram of automatic voltage regulators of A.C. generators.</p>
3.	<p><b>Centre of gravity:-</b> 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.</p>	<p><b>Winding</b></p> <p>Drawing the development diagram for D.C. Simplex Lap &amp; Wave winding with brush position. Drawing the development diagram of A.C 3 – Phase, 4 Pole 24 slots single layer winding.</p>
4.	<p><b>Number system:-</b> decimal and binary, Octal Hexa decimal. BCD code, conversion from decimal to binary and vice-versa, all other conversions. Practice on conversions.</p>	<p><b>Control Panel</b></p> <p>Practice in reading panel diagram. Local &amp; Remote control of Induction motor with inching. Forward &amp; Reverse operation of Induction motor Automatic Star Delta Starter Automatic star delta starter with change of direction of rotation Sequential control of three motors.</p>
5.	<p><b>Estimation &amp; costing:-</b> Simple estimation of the requirement of materials etc. as applicable to the trade. Problems on estimation and costing.</p> <p><b>Further Mensuration:-</b></p> <p>Volumes of frustums including conical frustums.</p> <p><b>Graph-</b> Basics, abscissa, co-ordinate etc.</p> <p><math>Y = mx</math> and <math>Y = mx + c</math> graph</p>	<p><b>Distribution of Power</b></p> <p>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.</p>
6.	<p>Simple Problems on Profit &amp; Loss.</p> <p>Simple and compound interest.</p>	<p>-----</p>

# **10. EMPLOYABILITY SKILLS**

## **10.1 GENERAL INFORMATION**

1. **Name of the subject** : EMPLOYABILITY SKILLS
2. **Applicability** :  
  - CTS- Mandatory for all trades
  - ATS- Mandatory for fresher only
3. **Hours of Instruction** : 110 Hrs.
4. **Examination** : The examination will be held at the  
end of semesters.
5. **Instructor Qualification** :

**MBA OR BBA with two years experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years experience OR Graduate/ Diploma with Two years experience and trained in Employability Skills from DGET institutes  
AND  
Must have studied English/ Communication Skills and Basic Computer at 12<sup>th</sup> / Diploma level and above**

**OR**

Existing Social Studies Instructors duly trained in Employability Skills from DGET institutes

6. **Instructor** :
- One full time instructor is required for 1000 seats and above
  - For seats less than 1000, the instructor may be out sourced/ hired on contract basis.

## 10.2 DISTRIBUTION OF TOPICS BETWEEN SEMESTERS FOR EMPLOYABILITY SKILL

Course Duration	Semester1	Semester2	Examination
	Topics	Topics	
01 Year (Two semesters)	1. English Literacy 2. I.T. Literacy 3. Communication Skills	4. Entrepreneurship Skills 5. Productivity 6. Occupational safety , Health and Environment Education 7. Labour Welfare Legislation 8. Quality Tools	Final examination at the end of second semester
02 Years (Four Semesters)	1. English Literacy 2. I.T. Literacy 3. Communication Skills	4. Entrepreneurship Skills 5. Productivity 6. Occupational safety , Health and Environment Education 7. Labour Welfare Legislation 8. Quality Tools	Final examination at the end of second semester

## 10.3 SYLLABUS CONTENT OF EMPLOYABILITY SKILL

### SEMESTER – I

#### LEARNING OBJECTIVES OF 1<sup>ST</sup> SEMESTER

1. Read, write and communicate in English language for day to day work.
2. Communicate in written and oral and with required clarity ensuring that the information communicated is clear, concise and accurate.
3. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.

<b>1. English Literacy</b> <b>Hours of Instruction: 20 Hrs.</b> <span style="float: right;"><b>Marks Allotted: 09</b></span>	
<b>Pronunciation</b>	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
<b>Functional Grammar</b>	Transformation of sentences, Voice change, Change of tense, Spellings.
<b>Reading</b>	Reading and understanding simple sentences about self, work and environment
<b>Writing</b>	Construction of simple sentences Writing simple English
<b>Speaking / Spoken English</b>	Speaking with preparation on self, on family, on friends/ classmates, on know, 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 messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
<b>2. I.T. Literacy</b> <b>Hours of Instruction: 20 Hrs.</b> <span style="float: right;"><b>Marks Allotted: 09</b></span>	
<b>Basics of Computer</b>	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
<b>Computer Operating System</b>	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.
<b>Word processing and Worksheet</b>	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
<b>Computer Networking and INTERNET</b>	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, Web Site, 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

**Hour of Instruction: 15 Hrs.**

**Marks Allotted: 07**

Topic	Contents
<b>Introduction to Communication Skills</b>	Communication and its importance
	Principles of Effective communication
	Types of communication – verbal, nonverbal, written, email, talking on phone.
	Nonverbal communication –characteristics, components-Para-language
	Body – language
	Barriers to communication and dealing with barriers.
	Handling nervousness/ discomfort.
<b>Listening Skills</b>	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.
	Triple- A Listening – Attitude, Attention & Adjustment.
	Active Listening Skills.
	Characteristics Essential to Achieving Success
	The Power of Positive Attitude



<b>Motivational Training</b>	Self-awareness
	Importance of Commitment
	Ethics and Values
	Ways to Motivate Oneself
	Personal Goal setting and Employability Planning.
<b>Facing Interviews</b>	Manners, Etiquettes, Dress code for an interview
	Do's & Don'ts for an interview
<b>Behavioral Skills</b>	Problem Solving
	Confidence Building
	Attitude

## **SEMESTER-II**

### **LEARNING OBJECTIVES OF 2<sup>ND</sup> SEMESTER**

1. Knowledge of business activities, ability to interact with consumers for development of businesses.
2. Understand and apply productivity, its benefits and factors affecting the productivity.
3. Follow and maintain procedures to achieve a safe working environment in line with occupational health, safety, environment regulations and Labour welfare legislation and requirements.
4. Understand and apply quality concepts as per ISO and BIS system and its importance.
5. Recognize different components of 5S and apply the same in the working environment.

<b>4. Entrepreneurship skill</b>	
<b>Hour of Instruction: 15 Hrs.</b>	<b>Marks Allotted: 06</b>
<b>Topic</b>	<b>Content</b>
<b>Business &amp; Consumer:</b>	Types of business in different trades and the importance of skill, Understanding the consumer, market through consumer behavior, market survey, Methods of Marketing, publicity and advertisement
<b>Self Employment:</b>	Need and scope for self-employment, Qualities of a good Entrepreneur (values attitude, motive, etc.), SWOT and Risk Analysis

<b>Govt. Institutions :</b>	Role of various Schemes and Institutes for self-employment i.e. DIC, SIDBI, MSME, NSIC, Financial institutions and banks
<b>Initiation Formalities :</b>	Project Formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment Procedure - Loan Procurement - Agencies - banking Process
<b>5. Productivity</b>	
<b>Hour of Instruction: 10 Hrs.</b>	
<b>Marks Allotted: 05</b>	
<b>Productivity</b>	Definition, Necessity, Meaning of GDP.
<b>Benefits</b>	Personal / Workman – Incentive, Production linked Bonus, Improvement in living standard. Industry Nation.
<b>Affecting Factors</b>	Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.
<b>Comparison with developed countries</b>	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
<b>Personal Finance Management</b>	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
<b>6. Occupational Safety, Health &amp; Environment</b>	
<b>Hour of Instruction: 15 Hrs.</b>	
<b>Marks Allotted: 06</b>	
<b>Safety &amp; Health :</b>	Introduction to Occupational Safety and Health and its importance at workplace
<b>Occupational Hazards :</b>	Occupational health, Occupational hygiene, Occupational Diseases/ Disorders & its prevention
<b>Accident &amp; safety :</b>	Accident prevention techniques- control of accidents and safety measures
<b>First Aid :</b>	Care of injured & Sick at the workplaces, First-aid & Transportation



## **11. INFRASTRUCTURE**

1. Instructors Qualification : 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 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'.
2. Desirable qualification : Preference will be given to a candidate with CIC (Craft Instructor Certificate) in wireman trade.
3. Space norms : 88 Sq. metres. ( 11 X 8 Meters)
4. Power norms : 5 KW
5. Tools, Equipment & Machinery : ( As per Annexure – I )

### **Note:**

- (i) Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma in the field.
- (ii) Instructor qualification for WCS and E.D, as per the training manual.
- (iii) The list of Tools, Equipment & General Machinery listed in Annexure – I are for a particular trade (Electrician) comprising of four semesters and not for single semester.

## **12. ASSESSMENT STANDARD**

### **12.1 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 assessment. Due consideration to be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitive to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude to be considered while assessing competency.

Assessment will be evidence based comprising the following:

- i) Job carried out in labs/workshop
- ii) Record book/ daily diary
- iii) Answer sheet of assessment
- iv) Viva-voce
- v) Progress chart
- vi) Attendance and punctuality
- vii) Assignment
- viii) Project work

Evidence of internal assessment to be preserved until forthcoming semester examination for audit and verification by examination body.

The following marking pattern to be adopted while assessing:

**a)** Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- many tolerances while undertaking different work are in line 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 above75%- 90% to be allotted during assessment under following performance level:

For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- the majority of tolerances while undertaking different work are in line 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 above 90% to be allotted during assessment under following performance level:

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.

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- tolerances while undertaking different work being substantially in line 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

## 12.2 INTERNAL ASSESSMENTS (FORMATIVE ASSESSMENT)

ASSESSABLE OUTCOME NO.	ASSESSABLE OUTCOME	Internal Assessment Marks
<b>GENERIC</b>		
1.	Recognize & comply safe working practices, environment regulation and housekeeping.	
2.	Interpret & use company and technical 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.	
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.	
<b>SPECIFIC</b>		
10.	Make good quality electrical wire joints for single and multistrand 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.	Make choices to carry out basic jobs of marking out the components for filing, drilling, riveting, fitting and assembled using different components independently..	
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.	Plan and install Pipe & Plate earthing. Measure earth resistance by earth tester.	
	<b>Sub-Total of Internal assessment for Semester- I</b>	100
15.	Select and perform electrical/ electronic measurements with appropriate instrument.	
16.	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.	
17.	Plan, draw, estimate material, wire up and test different type of industrial wiring circuits as per Indian Electricity rules and taking care of quality.	
18.	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.	
19.	Plan and execute electrical illumination system viz. FL tube, HPMV lamp, HPSV lamp, Halogen & metal halide lamp, CFL, LED lamp etc.	
	<b>Sub-Total of Internal assessment for Semester- II</b>	100
20.	Construct and test Half-wave, full-wave, and bridge rectifiers with filter & without filter. Trouble shoot 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 Alternator set. Test, Wire-up and run alternator. Synchronization of Alternator with due care and safety.	
23.	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.	
	<b>Sub-Total of Internal assessment for Semester- III</b>	<b>100</b>
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.	
	<b>Sub-Total of Internal assessment for Semester- IV</b>	<b>100</b>
	<b>Total of Internal assessment</b>	<b>400</b>

## 12.3 FINAL ASSESSMENT- ALL INDIA TRADE TEST (SUMMATIVE ASSESSMENT)

- a) There will be a single objective type Examination paper for the subjects Engineering drawing and Workshop Calculation & Science.
- b) There will be a single objective type Examination paper for the subjects Trade Theory and Employability Skills.
- c) The two objective type Examination papers as mentioned above will be conducted by National Council for Vocational Training (NCVT), whereas examination for the subject Trade Practical will be conducted by the State Government. NCVT shall supply the Question Paper for the subject Trade Practical.

<b>Marking Pattern</b>		
<b>Sl. No.</b>	<b>Subject for the trade test</b>	<b>Maximum marks for the each subject</b>
<b>a)</b>	Practical	<b>300</b>
<b>b)</b>	Trade Theory	<b>200</b> Objective type Written test of 200 marks (Trade Theory 150 marks & Employability Skills 50 marks)
<b>c)</b>	Employability Skills	
<b>d)</b>	Work shop Calculation and Science.	<b>100</b> Objective Type Written test of 100 marks (Engineering Drawing 50 marks & Work shop Calculation and Science 50 marks)
<b>e)</b>	Engineering Drawing	
<b>f)</b>	Internal assessment	<b>100</b>
<b>TOTAL:</b>		<b>700</b>

### 13. LIST OF TRADE COMMITTEE MEMBERS

Sl. No.	Name	Organization	Mentor Council Designation
<b>Members of Sector Mentor council</b>			
1.	Dr. S.P. Gupta	Professor, IIT Roorkee,	Chairman
2.	Dr. P. Mahanto	Professor, IIT, Guwahati	Member
3.	K. K. Seth	Ex. Director, BHEL, Noida	Member
4.	N. Chattopadhyay	Sr. DGM, BHEL, Kolkatta	Member
5.	A K Gohshal	Professor, IIT, Guwahati	Member
6.	Dr. Bharat Singh Rajpurohit	Asst. Professor, IIT, Himachal Pradesh	Member
7.	Sunand Sharma	Chairman ALSTOM Projects India Ltd.	Member
8.	Dinesh Singhal	Rithani, Delhi road, Meerut	Member
9.	J S S Rao	Principal Director, NTPC, Faridabad	Member
10.	Bhim Singh	Professor, IIT Delhi	Member
<b>Mentor</b>			
11.	Amrit Pal Singh	Dy. Director, DGET, New Delhi	Mentor
<b>Member of Core Group</b>			
12.	R. Senthil Kumar	Director, ATI, Chennai	Member
13.	R.N. Bandopadhyay	Director, CSTARI, Kolkata	Member
14.	S. Mathivanan	Dy. Director, ATI, Chennai,	Team Leader
15.	L K Mukherjee	Dy. Director, CSTARI, Kolkata	Member
16.	B.N. Sridhar	Dy Director, FTI, Bangalore	Member
17.	Ketan Patel	Dy Director, RDAT, Mumbai	Member
18.	B. Ravi	Dy Director, CTI, Chennai	Member
18.	A.S. Parihar	Dy Director, RDAT, Kolkata	Member
20.	Nirmalya Nath	Asst Director, CSTARI, Kolkata	Member
21.	Parveen Kumar	Asst Director, ATI-EPI, Hyderabad	Member
22.	C.C. Jose	Trg Officer, ATI, Chennai	Member
23.	L.M. Pharikal	Trg Officer, ATI, Kolkata	Member
24.	C.M. Diggewadi	Trg Officer, RDAT, Mumbai	Member
25.	Mohan Raj	Trg Officer, NIMI Chennai	Member
26.	M. Asokan	Trg Officer, CTI, Chennai	Member
27.	U.K. Mishra	Trg Officer, ATI, Mumbai	Member
28.	Prasad U.M.	Voc Instructor, MITI, Calicut	Member
29.	D. Viswanathan	ATO. Govt ITI, North Chennai	Member
30.	B. Navaneedhan	ATO, ITI. North Chennai	Member
31.	R. Rajasekar	ATO, ITI, Ambattur, Chennai	Member
32.	K. Amaresan	ATO, Govt ITI, Guindy, Chennai	Member
<b>Other industry representatives</b>			
33.	Surendu Adhikari	OTIS Elevator Co. India Ltd, Kolkata	Member

34.	K. Raju	Consultant- Energy Area, ASCI, Hyderabad	Member
35.	Ravi G Deshmukh	Certified Energy Auditor, PPS Energy solutions,	Member
36.	R. Thiruppathi	JTS, IIT, Madras, Chennai	Member
37.	M.N. Krishnamurthy	Retd. Ex Engineer, TNEB, Chennai	Member
38.	S. Kirubanandam	Asst. Ex Engineer, TANTRANSCO, Chennai	Member
39.	R. Kasi,	Asst. Ex Engineer, TANTRANSCO, Chennai	Member
40.	L.R. Sundarajan	Jr. Works Manager, Heavy vehicles factory	Member
41.	B.S. Sudheendara	Consultant, VI micro systems pvt ltd, Chennai.	Member
42.	S. Ganesh	Manager, L&T , Chennai	Member
43.	G. Neethimani	Vice principal, Rane engine valves ltd, Chennai.	Member

**Annexure - I****TRADE: WIREMAN****LIST OF TOOLS AND EQUIPMENTS  
TRAINEES TOOL KIT FOR 16 TRAINEES + 1 INSTRUCTOR****(COMMON FOR ALL SEMSTERS)**

<b>Sl. No</b>	<b>Description</b>	<b>Broad Specification</b>	<b>Qty</b>	<b>Expected life</b>	<b>Approx. cost in Rs/one Unit</b>
1	Steel rule	300mm	17 Nos	5 years	78.00
2	Screw Driver	200mm	17 Nos	5 years	36.00
3	Screw Driver	100mm	17 Nos	5 years	30.00
4	Terminal screw Driver	75 mm (Connector)	17 Nos	5 years	20.00
5	Knife Electrician	D.B.	17 Nos	5 years	15.00
6	Hammer Ball peen.	0.25 Kg	17 Nos	5 years	115.00
7	Plumb bob	115grams	17 Nos	5 years	110.00
8	Combination pliers insulated	200 mm	17Nos	5 years	150.00
9	Neon tester pencil bit type	500 volt	17 Nos	2 years	120.00
10	Try square	200 mm	17 Nos	5 years	60.00
11	Small crimping tools (assorted)	10 – 100 mm (5nos)	17 Sets	5 years	250.00
12	Spanner set DE	Set of 6 from 6x7 to 16x7	17 Sets	5 years	500.00
13	Screw driver set (set of 5)	100-300 mm	17 Sets	5 years	250.00
14	File half round 2 <sup>nd</sup> cut	250 mm	17 Nos	5 years	200.00
15	File round 2 <sup>nd</sup> cut	150 mm	17 Nos	5 years	200.00
16	Soldering iron	60 w/230 v	17 Nos	2 years	300.00
17	Neon tester	230 v	17 Nos	1 year	50.00

**Tools common for all semesters and**  
**EQUIPMENT & MACHINERY IS COMMON FOR**  
**SEMESTER I**

Sl. No	Description	Broad Specification	Qty	Expected life	Approx. cost in Rs/one Unit
1.	Forge with hand blower		1	5 years	200
2.	Conduit pipe cutting and threading machines adjustable	for 15mm to 30mm.	1	5 years	3500
3.	Conduit pipe bending machine, suitable	for 15mm,18mm, 25mm and 30mm pipe	1	5 years	2000
4.	Bar magnet		1	5 years	25
5.	Drill bit	6mm, 8mm & 10 mm	1 each	2 years	50
6.	Horse shoe magnet		1	5 years	25
7.	Crimping tool	25mm	1no	5 years	175
8.	Crimping tool for telephone/LAN cable		1no	5 years	100
9.	Rubber matting	2 meter x 1 meter x 9mm	2 nos.	5 years	180
10.	Wiring board on stand	3 meter x1 meter with 0.5 meter projection on the top	16	5 years	675
11.	Fire extinguishers	Dry chemical 5 Kg	2	5 years	2600
12.	Set of Rowel punch	8,10mm	16	1year	100.00
13.	Rawal tool holder & Bit	No.8, 10, 14, & 16	2 set	2 years	175.00
14.	Set of Wall jumper octagonal	37mm X 450mm and 37 X 600mm	4 sets	2 years	250.00
15.	Center punch	100mm	2	2 years	35.00
16.	Combination pliers insulated	200 mm insulated	16	5 years	175.00
17.	Rule four fold wood	600 mm	16	5 years	35.00
18.	Spanner set DE 6X7,8X9,10X11,12X13,14X15,16X17	Set of 6	16	5 years	180.00

19.	Bradawl	150 mm X 6mm square pointed	16	5 years	200.00
20.	Set of Rowel punch	8,10mm	16	1 year	100.00
21.	wooden mallet	1kg.(75mm x15mm)	16	1 year	45.00
22.	Pliers side cutting insulated	200mm	5	5 years	150.00
23.	Pliers flat nose insulated	150mm	5	5 years	85.00
24.	Pliers round nose insulated	200mm	5	5 years	135.00
25.	Pliers long nose insulated	200mm	5	5 years	135.00
26.	Screw driver heavy duty	200mm	2	5 years	125.00
27.	Screw driver heavy duty	300 mm	5	5 years	65.00
28.	Firmer chisel	1"	10	2 years	100.00
29.	Firmer chisel	½ "	10	2 years	75.00
30.	Hammer Ball Peen	0.50 kg.	5	2 years	85.00
31.	Wire stripper	150mm	5	2 years	85.00
32.	Hammer Ball Peen	1.00 kg	5	2 years	135.00
33.	Hammer cross Peen	0.50 kg.	5	2 years	135.00
34.	Rawal tool holder & Bit	No.8, 10, 14, & 16	2 set	2 years	175.00
35.	Set of Wall jumper octagonal	37mm X 450mm and 37 X 600mm	4 sets	2 years	250.00
36.	Scriber	150mm	2	2 years	35.00
37.	File flat	300mm rough	5	2 years	225.00
38.	File flat round	150mm smooth	5	2 years	85.00
39.	File round	300mm 2nd cut	5	2 years	165.00
40.	File triangular	150mm 2nd cut	5	2 years	95.00
41.	Spanner set of 6 18X18,20X22,21X23,24 X27,25X27,30X32,	Double ended	2 sets	5 years	300.00
42.	Adjustable spanner	300mm	1	5 years	180
43.	Foot print Grip	250mm	2	5 years	65
44.	Allen keys	Set 5 to 11	1 set	5 years	225
45.	Spirit level	300mm	1	2 years	240
46.	Electric soldering iron	125 watts 230-250 V	2	2 years	125
47.	Blow lamp	1 liter capacity	2	5 years	275
48.	Forge with hand blower		1	5 years	200
49.	Bench vice	150mm	5	5 years	1300.00
50.	Hand vice	50mm jaw	5	5 years	225.00

51.	Rubber gloves	5000volts	2 pairs	1 year	225.00
52.	Safety belt with provision for keeping tools		10	2 years	350.00
53.	Tower ladder on type wheels	Min 10ft-Max 30ft	2	10 years	3500.00
54.	Portable extension ladder	Aluminum 6 to 9 meters	1	10 years	5500.00
55.	Trowel	150mm	2		45.00
56.	All types C.F.L. lamp sets	5watt,15watt,25watt	3each	5 years	150 each

## **EQUIPMENT & MACHINERY**

### **LIST OF METERS & EQUIPMENTS FOR SEMESTER - II**

<b>Sl. No</b>	<b>Description</b>	<b>Broad Specification</b>	<b>Qty</b>	<b>Expected life</b>	<b>Approx. cost in Rs/one Unit</b>
1.	Multi meter	0-5, 100, 200, 500 milli amperes 0-100-1000, 10000 ohms. 0-150, 300, 600 V AC/DC	4	5 years	1650
2.	Hot wire Ammeter	0-15 Amps.	1	5 years	375
3.	Wheatstone Bridge		1	5 years	3500
4.	Electrical power drilling machine	12mm, capacity 250 volts universal type	1	5 years	3500
5.	Megger (Insulation tester )	500 volts	2	5 years	750
6.	Voltmeter M.C.	0.-300 volts	1	5 years	75
7.	Voltmeter M.C/ Multi range	0.70, 150,300 & 600 V	1	5 years	1050
8.	Voltmeter M.C. Multi range	0-15,30,50 & 75 V	1	5 years	1050
9.	Voltmeter centre zero	15-0-15 volts	1	5 years	130
10.	Voltmeter M.I. multi-range	0-150, 300, 600 V	2	5 years	750
11.	Voltmeter M.I. multi-range	0-50, 75, 150 V	1	5 years	750
12.	Ammeter M.I.	0-30 Amp, panel board	2	5 years	75



		type			
13.	Ammeter M.I.	0-5Amp. Panel board type	2	5 years	75
14.	Ammeter M.I	0 - 10 Amp. panel board mounting type	1	5 years	75
15.	Ammeter M.C. Centre zero	5-0-5Amp	1	5 years	75
16.	Ammeter MC	0 – 1 Amp	1	5 years	75
17.	Field regulator	0 – 1000 ohmic, 2 Amps	1	5 years	100
18.	Single phase K.W.H meter digital	5A, 250 V A. C	4	5 years	450
19.	Single phase K.W.H meter analog	5A, 250 V A. C	4	5 years	450
20.	3 Phase KW meter	15A 440 v	1	5 years	750
21.	Watt meter Dynamo meter type	5 Amps. and 250 v, 1.25 kw	1	5 years	750
22.	Personal computer system with printer		1	4 years	35000
23.	LCD projector		1	4 years	80000
24.	Clamp on ammeter	0-25A,0-200A	2	5 years	800
25.	Three phase K.W.H meter analog	25A,415 V A. C	4	5 years	700
26.	Three phase K.W.H meter digital	25A,415 V A. C	4	5 years	750
27.	UPS 500VA with battery	230V	1	5 years	10000

### **EQUIPMENTS FOR SEMESTER III**

#### **Sl. No. 1-17 of Semester – II to be utilized**

28.	D.C. compound motor	3 H.P 250 V with 4 point starter and field regulator (Laboratory type)	1	10 years	45000
29.	D.C. shunt motor	3 H.P 250 v with 3 point starter and speed regulator (Laboratory type)	1	10 years	40000
30.	D. C. series motor with 2 point starter	3 H.P 250 v with 3 point starter and speed regulator (Laboratory type)	1	10 years	30000
31.	DC Power supply	250v DC , 25 Amp	1	5 years	5000
32.	Capacitor motor	1/2 H.P. single phase 250 V	1	10 years	3500

33.	Split phase motor	1/2 H.P. single phase 250 V	1	10 years	3000
34.	Universal motor	1/2 H.P.AC/DC 250 V	1	10 years	4500
35.	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 :				60000
		1. 3 phase air circuit breakers	1 set		
		2. Star Delta starter (contact type 8 point) & Automatic type	1 no		
		3. D.C circuit breaker	1		
		4. Suitable voltmeter on A.C. & D.C. side	1		
		5. Sunk field regulators	1		
		6. Suitable line ammeters on A.C. and D.C. side	1		
		7. Field circuit ammeter	1		
	8. Indicating lamps on both the sides (AC &DC)	1			
36.	Squirrel cage induction motor 3 H.P. 400 V with D.O.L. starter		1	10 years	12000
37.	Squirrel cage induction motor 5 H.P. 400 V with star delta starter		1	10 years	12000
38.	Manual star Delta starter		1	5 years	2500
39.	Semi-automatic star Delta starter		1	5 years	3000
40.	Automatic star Delta starter		1	5 years	3500
41.	Automatic Reverse Forward starter		1	5 years	3500
42.	Single phasing preventer	415V	3	5 years	1500
43.	D.O.L starter		1	5 years	2500
44.	Two point starter for DC series motor		1	5 years	3000
45.	Soft starter 1ph		1	5 years	1600

46.	Tachometer digital type	Non contact type 0-6000 RPM	1 no	5 years	3000
47.	Flux meter		1no	5 years	3000
48.	2KVA Alternator with 3 ph induction motor		1 no	10 years	30,000
49.	5 HP Slip ring induction motor with rotor resistance starter		1 no	10 years	30,000
50.	Lux meter		1 no	5 years	2500
51.	Lead Acid battery 75Ah	12V	1No	4 years	2500
52.	Battery Charger	15V,Current controlled	1No	4 years	3500
53.	Solar street light lamp set	12v , 18 / 24 watts	4 no	5 years	12000
54.	Hydraulic crimping tool for UG cable crimping with bits	20 sq mm to 250sq mm	1no	5 years	10000

**EQUIPMENTS FOR SEMESTER IV**  
**Sl. No. 1-18 of Semester – II to be utilized**

55.	Transformer single phase	1 K.V.A. 250/100 v	2	5 years	5000.00 each
56.	Transformer Three phase (oil cooled)	5 K.V.A. 440/220 v	2	5 years	8000.00 each
57.	Transformer oil testing kit	Automatic 60kv	1	5 years	10000
58.	Autotransformer	Single phase 0-300V 1kVA	2	5 years	8000
59.	Autotransformer	Three phase 0-500V 1kVA	2	5 years	10000
60.	Current transformer	10/1, 20/1,30/1,50/5, 100/5 and 300/5A	1each	5 years	800
61.	Potential transformer	220/110, 300/110, 440/110, 600/110	1 each	5 years	1000
62.	Miniature circuit breaker(MCB)	220V/ 6 Amps	2	5 years	500
63.	Earth leakage circuit breaker (ELCB)	220V/25mA	2	5 years	1000
64.	Metal clad circuit breaker (MCCB)	220V/1A	2	5 years	2000

## : WORKSHOP FURNITURES :

Sl.no	Name of the items	Quantity
1	Instructors table (Junior Executive)	1
2	Instructors chair – Full Arm, Caned Back & Seat	2
3	Metal rack 100x150x45 cm	4
4	Lockers with 16 drawers standard size with key	1
5	Steel almirah 2.5x1.20x0.50 m	2
6	White board	1
7	Computer table	1
8	Computer chair - Revolving	2
9	Printer and computer table	1
10	Work bench , 2.5x1.20x0.75meters	2
11	Steel locket standard size with 8 Drawers in each	2
12	Almirah , 1.8 x 1.2 x 0.45meters	2
13	Demonstration table , 2.5 x 1.25 x 0.75 meter	2
14	Blackboard with easel, 3' x 6'	1
15	Stools, 1' x 1'x 1.5'	16
16	Metal rack , 180 x 150 x 45cm	1

## ANNEXURE-II

### **GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS**

1. All the questions of theory paper for the trade will be in objective type format.
2. Due care to be taken for proper & inclusive delivery among the batch. The following some method of delivery may be adopted:
  - A) LECTURE
  - B) LESSON
  - C) DEMONSTRATION
  - D) PRACTICE
  - E) GROUP DISCUSSION
  - F) DISCUSSION WITH PEER GROUP
  - G) PROJECT WORK
  - H) INDUSTRIAL VISIT
3. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. may be adopted.
4. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.
5. Questions may be set based on following instructions:-

Sl. No.	Question on different aspect	Weightage in %age	Key Words may be like
1	Information received	25	What, Who, When
2	Knowledge	50	Define, Identify, Recall, State, Write, List & Name
3	Understanding	15	Describe, Distinguish, Explain, Interpret & Summarize
4	Application	10	Apply, Compare, Demonstrate, Examine, Solve & Use

6. Due weightage to be given to all the topics under the syllabus while setting the question paper.