

**COMPETENCY BASED CURRICULUM**

**FOR THE TRADE OF**

**ELECTRONICS MECHANIC**

**UNDER**

**CRAFTSMAN TRAINING SCHEME (CTS)**

**IN SEMESTER PATTERN**

**BY**



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

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## 1. INTRODUCTION

India is one of the youngest nations in the world. Our youth are our strength. However, a challenge facing the country is that of skilling our youth as per the demands of the industry. Recognizing the need for quickly coordinating the skill development and entrepreneurship efforts of all concerned stakeholders, the Government of India created the Ministry of Skill Development and Entrepreneurship on 9<sup>th</sup> November, 2014. To create further convergence between the Vocational Training System through Industrial Training Institutes (ITIs) and the new skill initiatives of the Government, the Training and Apprenticeship Training divisions from the Directorate General of Employment and Training (DGET) under the Ministry of Labour and Employment stand transferred to the Ministry of Skill Development and Entrepreneurship (MSDE) with effect from 16<sup>th</sup> April, 2015. This move brings over 11000 ITIs and scores of other institutions, and the Apprenticeship and Training divisions, under the Ministry.

The Ministry of Skill Development and Entrepreneurship is an apex organization for the development and coordination of the vocational training including Women's Vocational Training in our country. The Ministry conducts the vocational training programmes through the Craftsmen Training Scheme (CTS), Apprenticeship Training Scheme (ATS), Modular Employable Scheme (MES) under the Skill Development Initiative (SDI) Scheme, and Craftsmen Instructor Training Scheme (CITS) to cater the needs of different segments of the Labour market. The National Council for Vocational Training (NCVT) acts as a central agency to advise Government of India in framing the training policy and coordinating vocational training throughout India. The day-to-day administration of the ITIs rests with the State Governments/ Union Territories.

- Training courses under the CTS is being offered through a network of more than 11000 Government and Private Industrial Training Institutes (ITIs) located all over the country with a total seating capacity of more than 16 Lakhs with an objective to provide skilled workforce to the industry in 126 trades. Skill development courses exclusively for women are also being offered under CTS and other schemes through Government and Private ITIs and Regional Vocational Training Institutes (RVTIs) for Women.
- The Apprentices Act, 1961 was enacted with the objective of regulating the program of apprenticeship training in the industry by utilizing the facilities available within for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart on the job training for school leavers, and ITI passed outs to develop skilled manpower for the industry.
- The Ministry is implementing the Employable Scheme (MES) under the Skill Development Initiative Scheme to provide vocational training to people to develop skilled manpower for the industry through a network of Vocational Training Providers (VTPs) located across the country.

Central Staff Training and Research Institute (CSTARI), Kolkata is the nodal institute for the development/revision of curricula under all vocational training schemes of the Ministry.

National Instructional Media Institute (NIMI), Chennai is to make available instructional material in various trades for the use of trainees and trainers to ensure overall improvement in the standard of institutional training under the CTS and ATS schemes. The institute is actively involved in the development, production and dissemination of instructional media Packages (IMPs) comprising of books on Trade Theory, Trade Practical, Test/Assignment, and Instructor's Guide.

The National Skills Qualification Framework (NSQF), published in the Gazette of India on 27<sup>th</sup> December, 2013, is a national framework that aims to integrate general and vocational streams of education and training. The main goal of the NSQF is to focus on competency-based qualifications, which in turn facilitate and enhance transparency, both within and between general and vocational streams. The National Skill Development Agency (NSDA) under the Ministry is responsible for anchoring and implementation of the Framework, by bringing together the key stakeholders through the National Skill Qualifications Committee (NSQC).

The competency-based framework organizes qualifications into ten levels, with the entry level being 1, and the highest level being 10. Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are (1) Process, (2) Professional knowledge, (3) Professional skill, (4) core skill, and (5) Responsibility. The paradigm shift from learning focused on inputs to an outcome/competency-based education would help in the Recognition of Prior Learning (RPL), and simultaneously enable the alignment of the Indian qualifications with international ones. Government funding is expected to be on a preferential basis for NSQF compliant courses. The NSQF notification provides a Qualification Register, which is the official national database of all qualifications aligned to NSQF levels. Through this Register, learners can expect access to all NSQF compliant qualifications.

The Ministry has set up Mentor Councils to focus on courses under NCVT in various sectors with representation from thought leaders among different stakeholders viz., industries, innovative entrepreneurs who have proved to be game-changers, academic/professional institutions, and champion ITIs for each of the sectors. The Mentor Council for each sector reviews curriculum, admission criteria, course duration, and requirement of trainers and assessment/evaluation systems for the sector on a continuous basis and make recommendations regarding the same. Sector-wise Core Groups are formed to plan and prepare the documentation for the competency-based curricula for the courses under each sector.

## 1. JOB ROLES: Reference NOS & NCO

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

#### **Brief description of job roles:**

**Electronics Fitter, General** fits, assembles and repairs various kinds of electronic equipment in factory or workshop or at place of use. Examines drawings and wiring diagrams; checks parts for accuracy of fit and minor adjustments; assembles parts or mounts them on chassis or panels with aid of hand tools; installs and connects wiring, soldering joints equipment, diagnoses faults with aid of electronic testing equipment; dismantles equipment if required and replaces faulty parts or wiring.

**Electronics Fitter, other** include all other workers engaged in fitting, assembling, repairing and maintaining electronic equipment, machinery, appliances, etc., not elsewhere classified.

**Electronics Mechanic; Electronic Equipment Mechanic** repairs electronic equipment, such as computers, industrial controls, radar systems, transmitters and tele-metering control systems following blueprints and manufacturer's specifications and using hand tools and test instruments. Tests faulty equipment and applies knowledge of functional operation of electronic units and systems to diagnose cause of malfunction. Tests electronic components and circuits to locate defects, using instruments, such as oscilloscopes, signal generators, ammeters and voltmeters. Replaces defective components and wiring and adjusts mechanical parts, using hand tools and soldering iron. Aligns, adjusts and calibrates testing instruments. Maintains records of repairs, calibrations and test. May install equipment in industrial or military establishments and in aircraft.

**Television Installation Man** installs and adjusts television receivers and antennas, using hand tools. Selects antenna according to type of set and location of transmitting station. Bolts cross arms and dipole elements in position to assemble antenna. Secures antenna in place with bracket and guy wires, observing insurance codes and local ordinances to protect installation from lightning and other hazards. Drills and waterproofs holes in building to make passage for transmission line. Connects line between receiver and antenna and fastens it in place. Tunes receiver on all channels and adjusts screws to obtain desired density, linearity, focus and size of picture. Orients antenna and installs reflector to obtain strongest possible reception. May operate radio broadcasting unit.

**Cable Television Installer** installs cable television cables and equipment on customer's premises, using electrician's tools and test equipment. Measures television signal strength at utility pole, using electronic test equipment. Computes impedance of wire from pole to house to determine additional resistance needed for reducing signal to desired level. Installs terminal boxes and strings lead-in wires, using electrician's tools.

Connects television set to cable system and evaluates incoming signal. Adjusts and repairs cable system to ensure optimum reception. May collect installation fees and explain cable service operation to subscriber. May communicate with SUPERVISOR, using two-way radio or telephone, to receive instructions or technical advice and to report problems to be repaired. May report unauthorized use of cable system to SUPERVISOR. May clean and maintain tools, test equipment.

**Television Service and Repairman** repairs and adjusts radios and television receivers, using hand tools and electronic testing instruments. Tunes receiver on all channels and observes audio and video characteristics to locate source of trouble. Adjusts controls to obtain desired density, linearity, focus and size of picture. Examines

chassis for defects. Tests voltages and resistance of circuits to isolate defect following schematic diagram and using voltmeter, oscilloscope, signal generator and other electronic testing instruments. Tests and changes tubes, solders loose connections and repairs or replaces defective parts, using hand tools and soldering iron. Repair radios and other audio equipment. May install television sets.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Reference NCO & NOS:

1. **7242.10**
2. **7242.90**
3. **7243.10**
4. **7243.40**
5. **7243.45**
6. **7243.50**

Qualification Pack (QP) with no of NOS and NSQF Level:-

<ul style="list-style-type: none"> <li>ELE/Q0115 ELE/NO115, ELE/N9919, ELE/N9921</li> </ul>	<ul style="list-style-type: none"> <li>ELE/Q7201 ELE/N 0061, ELE/N 7201, ELE/N 7202, ELE/N 9962</li> </ul>
<ul style="list-style-type: none"> <li>ELE/Q 0105</li> </ul>	<ul style="list-style-type: none"> <li>ELE/Q4601 ELE/N 4601, ELE/N 4602, ELE/N 4603, ELE/N 0009</li> </ul>
<ul style="list-style-type: none"> <li>ELE/Q6301 ELE/N 6301, ELE/N 9971, ELE/N 9972</li> </ul>	<ul style="list-style-type: none"> <li>ELE/Q5101</li> </ul>
<ul style="list-style-type: none"> <li>ELE/Q4201</li> </ul>	<ul style="list-style-type: none"> <li>ELE/Q 8101</li> </ul>
<ul style="list-style-type: none"> <li>ELE/Q0105 ELE/N 0103, ELE/N 9919, ELE/N 9920</li> </ul>	<ul style="list-style-type: none"> <li>ELE/Q7303 ELE/N 7306, ELE/N 9962, ELE/N 9963</li> </ul>
<ul style="list-style-type: none"> <li>ELE/Q8104 ELE/N 8106, ELE/N 8107, ELE/N 9909, ELE/N 9910</li> </ul>	<ul style="list-style-type: none"> <li>ELE/Q5901 ELE/N 5901, ELE/N 5902, ELE/N 9952, ELE/N 9953</li> </ul>
<ul style="list-style-type: none"> <li>ELE / Q 3101 ELE/N 3101</li> </ul>	<ul style="list-style-type: none"> <li>ELE/Q3502 ELE/N 3308, ELE/N 3309, ELE/N 0002, ELE/N 0003</li> </ul>

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

#### **NSQF level for Electronics Mechanic 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 Electronics Mechanic 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 Electronics Mechanic 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 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 OUTCOME**

10. Perform basic mechanical workshop operations using suitable tools for fitting riveting, drilling etc observing suitable care & safety.
11. Identify, charge, discharge, connect, maintain different batteries used in electronic applications.
12. Identify, test various electrical components like Switches, Transformers, Relays, contactors, Solenoid valves
13. Identify, test various electronic components using proper measuring instruments and apply this knowledge to troubleshoot power supplies.
14. Configure, install, troubleshoot, upgrade, interconnect given computer system(s) and demonstrate & utilize application packages for different application.
15. Assemble, test and repair the various analog circuits and apply this knowledge to troubleshoot AF amplifier of PA system, fan regulator, light dimmer circuit
16. Assemble, test and repair the various digital circuits and apply this knowledge to troubleshoot various application circuits viz. display systems, digital clock, digital timer and event counter

17. Draw , simulate and analyze the analog and digital circuits using Electronic simulator software
18. Prepare, crimp, terminate and test various cables used in different electronics industries.
19. Identify , place, solder and desolder and test different SMD discrete components and IC's.
20. Identify, prepare /construct different electrical controls circuits, features and test for their proper functioning.
21. Construct/assemble/test and trouble shoot a commercial AM /FM receiver.
22. Identify different blocks of programmable system & test/troubleshoot the various components of it and apply the knowledge to service different domestic programmable systems
23. Understand the operation of different process sensors, identify, wire & apply the knowledge to test various sensors of different industrial processes by selecting appropriate test instruments
24. Select a project, understand the requirements to construct the project and install it for a domestic /commercial applications based on various analog and digital IC's
25. Prepare fibre optic setup to transmit and receive various analog and digital data using fibre optic cable by following proper care
26. Interface the LCD, LED DPM panels to various circuits for monitoring and testing
27. Identify the various components , connectors and trouble shoot the SMPS, UPS and inverter with due care and follow the safety norms
28. Install a solar panel and connect the panel to the inverter and test
29. Dismantle, identify the various parts of a cell phone, repair and assemble the cell phone/smart phone
30. Identify the various parts of a LED lights and stacks and troubleshoot
31. Identify, operate various controls, troubleshoot and replace modules of the LCD/LED TV & its remote.

***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 : **ELECTRONICS MECHANIC**
2. Ref. N.C.O. /NOS Code No. : 7242.10,7242.90,7243.10,7243.40,7243.45,  
7243.50/ELE/NO115, ELE/N9919, ELE/N9921,ELE/N 0061,  
ELE/N 7201, ELE/N 7202, ELE/N 7307, ELE/N 9963,ELE/N 4601,  
ELE/N 4602, ELE/N 4603, ELE/N 0009,ELE/N 6301, ELE/N 9971,  
ELE/N 9972,ELE/N 4612, ELE/N 4613, ELE/N 9909,ELE/N 3701,  
ELE/N 3702, ELE/N 9901, ELE/N 9903, ELE/N 9201, ELE/N  
9921,ELE/N 0103, ELE/N 9919, ELE/N 9920,ELE/N 7306, ELE/N  
9962, ELE/N 2101, ELE/N 0001,ELE/N 7404, ELE/N 7405,ELE/N  
8106, ELE/N 8107, ELE/N 9909, ELE/N 9910,ELE/N 5901, ELE/N  
5902, ELE/N 9952, ELE/N 9953,ELE/N 3101,ELE/N 6302
3. NSQC Level : Level - IV
4. Duration of Craftsmen Training : 2 Years (4 Semesters each of six months duration)
5. Entry Qualification : Passed 10<sup>th</sup> class under  
10+2 system of Education or its equivalent.
6. Trainees per unit : 20

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

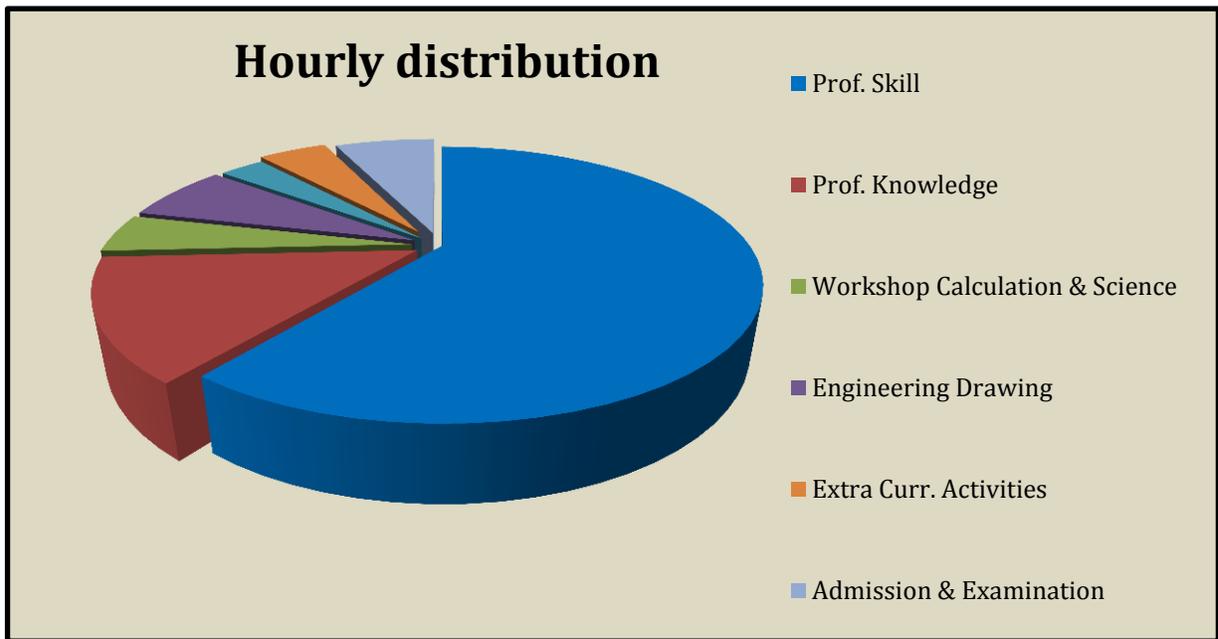
Total hours /week	Trade practical	Trade theory	Work shop Cal. & Sc.	Engg. Drawing	Employability skills	Extracurricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

## 6. COURSE STRUCTURE

1. Name of the Qualification :- ELECTRONICS MECHANIC
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 10 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 -10) 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 - 11

### **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 OUTCOMES**

### **Assessable outcomes after completion of two years Electronics Mechanic course**

#### **C. 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 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.

#### **SPCIFIC OUTCOME**

10. Perform basic mechanical workshop operations using suitable tools for fitting riveting, drilling etc observing suitable care & safety.
11. Identify, charge, discharge, connect, maintain different batteries used in electronic applications.
12. Identify, test various electrical components like Switches, Transformers, Relays, contactors, Solenoid valves
13. Identify, test various electronic components using proper measuring instruments and apply this knowledge to troubleshoot power supplies.
14. Configure, install, troubleshoot, upgrade, interconnect given computer system(s) and demonstrate & utilize application packages for different application.
15. Assemble, test and repair the various analog circuits and apply this knowledge to troubleshoot AF amplifier of PA system, fan regulator, light dimmer circuit
16. Assemble, test and repair the various digital circuits and apply this knowledge to troubleshoot various application circuits viz. display systems, digital clock, digital timer and event counter
17. Draw, simulate and analyze the analog and digital circuits using Electronic simulator software
18. Prepare, crimp, terminate and test various cables used in different electronics industries.
19. Identify, place, solder and desolder and test different SMD discrete components and IC's.

20. Identify, prepare /construct different electrical controls circuits, features and test for their proper functioning.
21. Construct/assemble/test and trouble shoot a commercial AM /FM receiver.
22. Identify different blocks of programmable system & test/troubleshoot the various components of it and apply the knowledge to service different domestic programmable systems
23. Understand the operation of different process sensors, identify, wire & apply the knowledge to test various sensors of different industrial processes by selecting appropriate test instruments
24. Select a project, understand the requirements to construct the project and install it for a domestic /commercial applications based on various analog and digital IC's
25. Prepare fibre optic setup to transmit and receive various analog and digital data using fibre optic cable by following proper care
26. Interface the LCD, LED DPM panels to various circuits for monitoring and testing
27. Identify the various components , connectors and trouble shoot the SMPS, UPS and inverter with due care and follow the safety norms
28. Install a solar panel and connect the panel to the inverter and test
29. Dismantle, identify the various parts of a cell phone and repair and assemble the cell phone/smart phone
30. Identify the various parts of a LED lights and stacks and troubleshoot
31. Identify, operate various controls, trouble shoot and replace modules of the LCD/LED TV & its remote.

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

**ASSESSABLE OUTCOME ALONGWITH ASSESSMENT CRITERIATO 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 site policy.
	1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.

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

	examination.
6. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	6.1 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
<p>10. Perform basic mechanical workshop operations using suitable tools for fitting, riveting, drilling etc observing suitable care &amp; safety.</p>	<p>10.1 Identify basic hand tools for fitting, riveting, drilling etc. with due care and safety.            10.2 Practice on fixing surface mounting type of accessories.            10.3 Demonstrate and apply the connection of electrical accessories.            10.4 Wire up of a test board and test it.</p>
<p>11. Identify, charge, discharge, connect, maintain different batteries used in electronic applications.</p>	<p>11.1 Identify Tools and instruments for testing of batteries.            11.2 Observe safety procedure during testing of batteries and work as per standard norms and company guidelines.            11.3 Identify the primary and secondary cells.            11.4 Measure and test the voltages of the given cells/battery using analog / digital multimeter.            11.5 Charging and discharging the battery.            11.6 Maintain the secondary battery.            11.7 Use a hydrometer to measure the specific gravity of the secondary battery</p>
<p>12. Identify, test various electrical components like Switches, Transformers, Relays, contactors, Solenoid valves</p>	<p>12.1 Plan work in compliance with standard safety norms.            12.2 Identify different types of mains transformers and test.            12.3 Identify the primary and secondary transformer windings and test the polarity.            12.4 Measure the primary and secondary voltage of different transformers.            12.5 Identify and test the variac.            12.6 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal</p>
<p>13. Identify, test various electronic components using proper measuring instruments and apply this knowledge to troubleshoot power supplies.</p>	<p>13.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner            13.2 Plan work in compliance with standard safety norms.            13.3 Identify the different types of resistors.            13.4 Measure the resistor values using colour code and verify the reading by measuring in multi meter.            13.5 Identify the power rating using size.            13.6 Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter.            13.7 Identify different inductors and measure the values using LCR meter.            13.8 Identify the different capacitors and measure capacitance of various capacitors using LCR meter.</p>

	13.9 Ascertain and select tools and materials for the job and make this available for use in
14. Configure, install, troubleshoot, upgrade, interconnect given computer system(s) and demonstrate & utilize application packages for different application	14.1 Plan, work in compliance with standard safety norms 14.2 Select hardware and software component 14.3 Install and configure operating systems and applications. 14.4 Integrate IT systems into networks. 14.5 Deploy tools and test programmes 14.6 Avoid e- waste and dispose the waste as per the procedure

## Semester-II

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
15. Assemble, test and repair the various analog circuits and apply this knowledge to troubleshoot AF amplifier of PA system, fan regulator, light dimmer circuit	15.1 Ascertain and select tools and instruments for carrying out the jobs 15.2 Plan and work in compliance with standard safety norms 15.3 Practice on soldering components on lug board with safety. 15.4 Identify the passive /active components by visual appearance, Code number and test for their condition. 15.5 Construct and test of Transistor and JFET amplifiers, oscillators and multivibrators. 15.6 Construct and test a UJT as relaxation oscillator 15.7 Construct and test lamp dimmer using TRIAC/DIAC with safety. 15.8 Construct and test MOSFET, IGBT test circuit and apply for suitable operation with proper safety 15.9 Construct and test the universal motor speed controller using SCR with safety 15.10 Construct and test a switching circuits using optical devices
16. Assemble, test and repair the various digital circuits and apply this knowledge to troubleshoot display systems, digital clock, digital timer and Event counter	16.1 Illustrate to practice the digital trainer kit with safety 16.2 Identify various digital ICs, test IC using digital IC tester and verify the truth table 16.3 Construct and verify the truth table of all gates using NOR and NAND gates 16.4 Construct a adder cum subtractor circuits and verify the truth table 16.5 Construct a decoder and encoder, multiplexer and de-multiplexer circuits and verify the truth table 16.6 Construct a multiplexer and de-multiplexer and verify the truth table 16.7 Construct and verify the truth table of various flip flop, counter and shift register circuits

17. Draw , simulate and analyze the analog and digital circuits using Electronic simulator software	17.1 Plan the work in compliance with standard procedure 17.2 Prepare simple analog and digital electronic circuits using the simulator software 17.3 Simulate and test the prepared analog and digital circuits 17.4 Convert the prepared circuit into layout diagram 17.5 Explore various trouble shooting and fault finding the resources provided in the simulation software
18. Prepare, crimp, terminate and test various cables used in different electronics industries	18.1 Plan and work in compliance with standard safety norms 18.2 Prepare, terminate and test various electronics cable using proper crimping tools.

### Semester-III

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
19. Identify , place, solder and desolder and test different SMD discrete components and IC's with due care and following safety norms using proper tools/setup	19.1 Identify the various crimping tools for various IC packages 19.2 Identify different types of soldering guns and choose the suitable tip for the application 19.3 Practice the soldering and de-soldering the different active and passive components, IC base on GPCBs using solder, flux, pump and wick 19.4 Make the necessary setting on SMD soldering station to solder and de-solder various IC's of different packages by following the safety norms 19.5 Identify SMD components, de-solder and solder the SMD components on the PCB 19.6 Check the cold continuity, identify loose/dry solder and broken track on printed wired assemblies and rectify the defects 19.7 Avoid waste, ascertain unused materials and components for safe disposal
20. Identify, prepare /construct different electrical controls circuits features and test for their proper functioning with due care and safety	20.1 Measure the coil winding of the given motor 20.2 Prepare the setup and control an induction motor using a DOL starter by following the safety norms 20.3 Construct a direction control circuit to change direction of an induction motor 20.4 Connect an overload relay and test for its proper functioning

<p>21. Construct/assemble/test and trouble shoot a commercial AM /FM receiver</p>	<p>21.1 Plan and select tools to assemble the receiver  21.2 Modulate and Demodulate various signals using AM and FM on the trainer kit and observe waveforms  21.3 Construct and test IC based AM Receiver  21.4 Construct and test IC based FM transmitter and receiver  21.5 Modulate and Demodulate a signal using PAM,PPM,PWM Techniques  21.6 Troubleshoot and replace the faulty components  21.7 Check the functionality of AM/FM receiver</p>
<p>22. Identify different blocks of programmable system &amp; test/troubleshoot the various components of it and apply the knowledge to service different domestic programmable systems</p>	<p>22.1 Understand and interpret the procedure as per manual of Micro controller  22.2 Identity various ICs &amp; their functions on the given Microcontroller Kit  22.3 Identify the address range of RAM &amp; ROM.  22.4 Write data into RAM &amp; observe its volatility  22.5 Identify the port pins of the controller &amp; configure the ports for Input &amp; Output operation  22.6 Demonstrate entering of simple programs, execute &amp; monitor the results</p>
<p>23. Understand the operation of different process sensors, identify, wire &amp; apply the knowledge to test various sensors of different industrial processes by selecting appropriate test instruments</p>	<p>23.1 Ascertain and select tools, material for the job and make this available for use in the timely manner  23.2 Plan work in compliance with safety norms  23.3 Demonstrate possible solution and agree task within the team  23.4 Identify sensors used in process industries such as RTDs, Temperature ICs, Thermocouples, proximity switches (inductive, capacitive and photo electric), load cells, strain gauge. LVDT by their appearance  23.5 Measure temperature of a lit fire using a Thermocouple and record the readings referring to data chart.  23.6 Measure temperature of a lit fire using RTD and record the readings referring to data chart.  23.7 Measure the DC voltage of a LVDT  23.8 Detect different objectives using capacitive, inductive and photoelectric proximity sensors</p>
<p>24. Select a project, understand the requirements to construct the project and install it for a domestic /commercial applications based on various analog and digital IC's</p>	<p>24.1 Plan, analyze and estimate the cost of the particular project  24.2 Identify the various tools required for the job  24.3 Prepare the simple digital/ analog electronic circuit  24.4 Simulate and test the prepared circuit  24.5 Assemble and test the circuit</p>

## Semester-IV

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
25. Prepare fibre optic setup to transmit and receive various analog and digital data using fibre optic cable by following proper care	25.1 Plan and select appropriate tools to complete the job safely 25.2 Identify the resources and their need on the given fiber optic trainer kit 25.3 Make optical fiber setup to transmit and receive analog and digital data 25.4 Demonstrate and apply FM modulation and demodulation using OFC trainer kit using audio signal and voice link 25.5 Demonstrate PWM modulation and demodulation using OFC trainer kit using audio signal and voice link 25.6 Demonstrate PPM modulation and demodulation using OFC trainer kit using audio signal and voice link
26. Interface the LCD, LED DPM panels to various circuits and test	26.1 Identify LCD/LED Display module and its decoder/driver ICs and display a word on a two line LCD/LED. 26.2 Measure/current flowing through a resistor and display it. Measure/current flowing through a sensor and display it on a LCD/LED module(DPM). 26.3 Avoid waste and dispose the waste as per the procedures
27. Identify the various components , connectors and trouble shoot the SMPS, UPS and inverter with due care and follow the safety norms	27.1 Identify the tools and equipments to perform the job with due care and safety. 27.2 Dismantle the given stabilizer and find major sections/ ICs components. 27.3 Identify various input and output sockets / connectors of the given SMPS. 27.4 Identify major sections/ ICs/components of SMPS 27.5 Identify and replace the faulty components and construct and test IC Based DC-DC converter for different voltages 27.6 Identify front panel control & indicators of UPS 27.7 Connect Battery & load to UPS & test on battery mode 27.8 Open Top cover of UPS & identify isolator transformer & UPS transformer & additional circuit other than inverter 27.9 Identify various circuit boards in UPS and monitor voltages at various test points 27.10 Test UPS under Fault condition & rectify fault

<p>28. Install a solar panel and connect the panel to the inverter and test</p>	<p>28.1 Select appropriate tools and equipment.  28.2 Install a solar panel to a roof.  28.3 Wire a solar panel to a solar controller.  28.4 Wire a solar controller to a battery storage station.  28.5 Connect storage batteries to a power inverter  28.6 Wire a power inverter to an electrical service panel.  28.7 Connect and test solar panel to the Inverter and run the load.  28.8 Installation of Solar Inverter.  28.9 Demonstrate the installation with team.</p>
<p>29. Dismantle, identify the various parts of a cell phone and repair and assemble the cell phone/smart phone</p>	<p>29.1 Understand and interpret repair procedure as per manual of cell phone and select appropriate tools &amp; equipment for undertaking job.  29.2 Plan to repair and assemble the components used as per circuit diagram.  29.3 Dismantle, identify the parts and assemble different types of smart phones.  29.4 Interface the cell phone/smart phone to the PC and transfer the data and browse internet.  29.5 Flash the various brands of cell phone/smart phone (at least 3) and upgrade the OS.  29.6 Format the cell phone/smart phone for virus (approach the mobile repair shop/service centre).  29.7 Identify the defective parts and rectify.</p>
<p>30. Identify the various parts of a LED lights and stacks and troubleshoot</p>	<p>30.1 Understand and interpret measuring procedure as per manual.  30.2 Conduct systematic trouble shooting  30.3 Dismantle the LED light, identify the connections of LEDs stacks, protection circuits, regulator  30.4 Measure the voltage across LED stacks  30.5 Identify the rectifier, controller part of LED lights  30.6 Test various subassemblies of the given LED light system  30.7 Comply with safety rules when performing the above operations.  30.8 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.</p>

<p>31. Identify, operate various controls, troubleshoot and replace modules of the LCD/LED TV &amp; its remote.</p>	<p>31.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.</p> <p>31.2 Plan to Dismantle and assemble modules as per circuit diagram.</p> <p>31.3 Identification and operate different Controls on LCD, LED TV.</p> <p>31.4 Dismantle, Identify the parts of the remote control.</p> <p>31.5 Trace and rectify the faults of a various remote controls.</p> <p>31.6 Identify various connectors and connect the cable operator's external decoder (set top box) to the TV.</p> <p>31.7 Comply with safety rules when performing the above operations.</p> <p>31.8 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.</p>
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## 10. SYLLABUS CONTENT WITH TIME STRUCTURE

### 10.1 SYLLABUS CONTENT FOR PROFESSIONAL SKILL & KNOWLEDGE

**First Semester**  
**(Semester Code no. ELM - 01)**

**Duration: Six Month**

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

1. Familiarize with basics of electricity, test the cable and measure the electrical parameter
2. Identify and Use different hand tools
3. Identify and test cells/batteries
4. Identify and test passive and active electronic components
5. Practice soldering and de-soldering of various types of electrical and electronic components
6. Assemble a computer system, install OS, Practice with MS office
7. Use the internet, browse, create mail IDs, download desired data from internet using search engines

<b>Week No.</b>	<b>Professional Skills</b>	<b>Professional Knowledge</b>
	<b>Trade Practical</b>	<b>Trade Theory</b>
1	<b><u>Trade and Orientation</u></b> <ul style="list-style-type: none"><li>• Visit to the institute and workshops.</li><li>• Introduction with the principal and other staffs.</li><li>• Care and safe working habits, safety precautions to be demonstrated to the trainees.</li><li>• Elementary first aid practice.</li><li>• Identify different types of fire extinguishers. Do's and Don'ts and standard practices to be followed in the institute</li></ul>	<p>Introduction to NCVT and certification mechanism.</p> <p>Semester system and its flexibility for the trainee and to the institute.</p> <p>EM trade and its applicability in industries.</p> <p>Expectations of the industry from trainees after the completion of the trade.</p> <p>The skills to be acquired to become part of industry.</p> <p>Introduction to safety, safety signs, and measures to be taken to maintain the standards of safety of personal working and the equipments.</p> <p>Different first aid mechanisms to rescue the affected by electric shocks or any physical</p>

		injuries.
2-3	<p><b><u>Hand Tools and their uses</u></b></p> <ul style="list-style-type: none"> <li>• Demonstration and uses of hand tools- screw drivers, pliers, tweezers, tester, wire stripper, electrician knife, steel rule, scribe, punches, hack saw, hammer, files, bench vice and drilling machine.</li> <li>• Simple mechanical fixtures</li> <li>• Identification of types of screws, bolts, nuts, washers, rivets, clamps, connectors</li> <li>• Fix screws of different sizes on wooden boards</li> <li>• Cutting of wooden blocks using hand/hack saw</li> <li>• Simple fitting practice and drilling practice</li> <li>• Simple sheet metal works</li> </ul>	<p>Identification, specifications, uses and maintenance of commonly used hand tools.</p> <p>Riveting of tags and lugs, cutting and bending of sheet metals, chassis and cabinets.</p>
4 - 5	<p>Basics of AC and Electrical Cables</p> <ul style="list-style-type: none"> <li>• Identify the Phase, Neutral and Earth on power Socket.</li> <li>• Construct a test lamp and use it to check mains healthiness.</li> <li>• Use a Tester to monitor AC power.</li> <li>• Measure the voltage between phase and ground and rectify earthing.</li> <li>• Identify and test different AC mains cables.</li> <li>• Skin the electrical wires /cables using the wire stripper and cutter.</li> <li>• Measure the gauge of the wire using SWG.</li> <li>• Prepare the mains cable for termination.</li> <li>• Crimp the lugs to wire end and Solder the lugs to wire end</li> <li>• Solder/crimp/terminate different types of electrical connectors</li> <li>• Measure AC and DC voltages using multi meter.</li> </ul>	<p>Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC &amp; DC. Terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, P-P, Instantaneous value. Single phase and Three phase supply. Terms like Line and Phase voltage/ currents. Insulators, conductors and semiconductor properties. Different type of electrical cables and their Specifications.</p> <p>Types of wires &amp; cables, standard wire gauge(SWG).</p> <p>Classification of cables according to gauge(core size), number of conductors, material, insulation strength, flexibility etc.</p>
6	<p><b><u>Cells &amp; Batteries</u></b></p> <ul style="list-style-type: none"> <li>• Identify the primary and secondary cells</li> <li>• Measure and test the voltages of the</li> </ul>	<p><b>Battery /Cells:</b> construction, types of</p>

	<p>given cells/battery using analog / digital multimeter.</p> <ul style="list-style-type: none"> <li>• Charging and discharging the battery.</li> <li>• Maintain the secondary battery.</li> <li>• Use a hydro meter to measure the specific gravity of the secondary battery.</li> </ul>	<p>primary and secondary cells, materials used, Specification of cells and batteries. Charging process, efficiency, life of cell/battery. Selection of cells / Batteries etc. Use of Hydrometer. Types of electrolytes used in cells and batteries. Series / parallel connection of batteries and purpose of such connections.</p>
7-9	<p><b><u>Passive Components</u></b></p> <ul style="list-style-type: none"> <li>• Identify the different types of resistors</li> <li>• Measure the resistor values using colour code and verify the reading by measuring in multi meter</li> <li>• Identify the power rating using size</li> <li>• Verify ohms law</li> <li>• Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter</li> <li>• Identify different inductors and measure the values using LCR meter</li> <li>• Identify the different capacitors and measure capacitance of various capacitors using LCR meter</li> <li>• Make an electro magnet.</li> <li>• Install a solenoid valve in a flow line.</li> <li>• Identify and test the circuit breaker and other protecting devices.</li> <li>• Dismantle and identify the different parts of a relay.</li> <li>• Connect a relay in a circuit and test for its working</li> <li>• Dismantle and identify the different parts of the electrical contactor</li> <li>• Connect a contactor in a circuit and test for its working</li> <li>• Construct and test RC time constant circuit</li> <li>• Construct a RC differentiator circuit and convert triangular wave into square wave</li> <li>• Construct and test series and parallel resonance circuit</li> </ul>	<p>Ohm's law and its variables. Resistor-definition, types of resistors, their construction &amp; specific use, color-coding, power rating. Equivalent Resistance of series parallel circuits. Distribution of V &amp; I in series parallel circuits. KVL&amp; KCL with applications.</p> <p>Principles of induction, inductive reactance, Types of inductors, construction, specifications and applications (energy storage concept). Self and Mutual induction. Behavior of inductor at low and high frequencies. series and parallel combination, Q factor.</p> <p>Capacitance and Capacitive Reactance, Impedance. Types of capacitors, construction, specifications and applications. Dielectric constant. Significance of Series parallel connection of capacitors. Capacitor behavior with AC and DC. Concept of Time constant of a RC circuit. Concept of Resonance and its application in RC, RL&amp; RLC series and parallel Types and circuit Properties of magnets and their materials, preparation of artificial magnets, significance of electro</p>

		<p>magnetism, types of cores.</p> <p>Electromagnetic Relays, types, construction, specifications- coil voltage and contact current capacity.</p>
10	<p><b><u>Transformers</u></b></p> <ul style="list-style-type: none"> <li>• Identify different types of mains transformers and test.</li> <li>• Identify the primary and secondary transformer windings and test the polarity.</li> <li>• Identify different sizes, shapes of cores used in low capacity transformers.</li> <li>• Measure the primary and secondary voltage of different transformers</li> <li>• Construct a low voltage night lamp</li> <li>• Identify and test the variac</li> </ul>	<p>Working principle of a Transformer,</p> <p>Transformer construction, Types of cores used. Specifications of a transformer, Step-up, Step down and isolation transformers with applications. Different type of losses in Transformers, Phase angle, phase relations, active and reactive power, power factor and its importance in the industry.</p>
11-12	<p><b><u>AC &amp; DC measurements</u></b></p> <ul style="list-style-type: none"> <li>• Identify the meter for measuring AC &amp; DC parameters</li> <li>• Use the multi meter to measure the various functions ( AC V, DC V, DC I, AC I, R)</li> <li>• Replace the fuse, battery for the given multimeter</li> <li>• Identify the different controls on the CRO front panel and observe the function of each controls</li> <li>• Measure DC voltage, AC voltage ,time period using CRO</li> <li>• Identify the different controls on the function generator front panel and observe the function of each controls</li> <li>• Connect the function generator to CRO and observe the different wave forms</li> </ul>	<p>Introduction to electrical measuring instruments, Importance of meter, classification of meters, forces necessary to work a meter. MC and MI meter, range extension, need of calibration, characteristics of meters and errors in meters. Multi meter, use of meters in different circuits. Care and maintenance of meters. Use of CRO, Function generator, LCR meter</p>
13	<p><b><u>Soldering &amp; De-soldering and switches</u></b></p> <ul style="list-style-type: none"> <li>• Identify different types of soldering guns and practice soldering of different electronic active and passive components and IC bases on lug boards and PCBs</li> <li>• Join the broken PCB track and test</li> <li>• Practice de-soldering using pump and wick</li> </ul>	<p>Different types of soldering guns, related to Temperature and wattages, types of tips.</p> <p>Solder materials and their grading. Use of flux and other materials. Selection of</p>

	<ul style="list-style-type: none"> <li>• Prepare component for soldering.</li> <li>• Demonstrate soldering and de-soldering using soldering and de-soldering stations</li> <li>• Identify and use SPST, SPDT, DPST, DPDT, tumbler, push button, toggle, piano switches used in electronic industries</li> <li>• Make a panel board using different types of switches for a given application</li> </ul>	<p>a soldering gun for specific requirement.</p> <p>Soldering and De-soldering stations and their specifications.</p> <p>Different switches and their specification, uses.</p>
14-15	<p><b><u>Rectifiers</u></b></p> <ul style="list-style-type: none"> <li>• Identify diodes, diode bridges</li> <li>• Record the specifications of different diodes using data book/ web site</li> <li>• Identify different packaging styles of diodes and heat sinks types</li> <li>• Test the given diode using multi meter</li> <li>• Construct and test Diode as a half wave, full wave and Bridge rectifier.</li> <li>• Construct a rectifier with capacitor filter circuit and measure the output voltage</li> <li>• Use CRO to observe the ripple from rectifiers for different load and filter capacitors</li> <li>• Identify and Test Zener diode.</li> <li>• Construct and test Zener based voltage regulator circuit.</li> </ul>	<p>Semiconductor component number coding for different electronic components such as Diodes, Zeners. PN Junction, Forward and Reverse biasing of diodes, Interpretation of diode specifications Forward current and Reverse voltage, packing styles of diodes. Diode Bridge Modules. Rectifier configurations, their efficiencies, Filter components and their role in reducing ripple. Working principles of Zener diode / specifications / applications, Varactor diode /Tunnel diode/ specifications with applications.</p>
16	<p><b><u>IC Regulators</u></b></p> <ul style="list-style-type: none"> <li>• Identify the different types of fixed +ve and -ve regulator ICs and the different current ratings (78/79 series)</li> <li>• Identify the pins</li> <li>• Construct a fixed voltage regulator as a variable one by floating the reference</li> <li>• Identify the different heat sinks for IC based regulators</li> <li>• Observe the output voltage of different IC regulators by varying the input voltage</li> <li>• Construct a dual power supply by using the fixed IC regulators with current limiting and short circuit protection features</li> </ul>	<p>Regulated Power supply using 78XX series,</p> <p>79XX series, Op-amp regulator, 723 regulator , (Transistorized &amp; IC based) voltage regulation, error correction and amplification etc.</p>

17-21	<p><b><u>Computer Hardware, OS, MS office</u></b></p> <p><b><u>Networking</u></b></p> <ul style="list-style-type: none"> <li>• Identification of various indicators, Connectors, ports on the computer cabinet</li> <li>• Identify drives and their capacity.</li> <li>• Identify various connectors and cables inside the cabinet &amp; Identify connections to rear side and front panel of the cabinet</li> <li>• Identify various parts of the system unit and motherboard</li> <li>• Disable certain functionality by disconnecting the concerned cables ( like USB, SERIAL, Flat)</li> <li>• Replace the CMOS battery</li> <li>• Replace/Extend a memory module</li> <li>• Test and Replace the SMPS</li> <li>• Replace the given HDD on the system</li> <li>• Replace the given DVD on the system</li> <li>• Configuring and troubleshooting display problems</li> <li>• Boot the system from different options</li> <li>• Practice various features of OS</li> <li>• Perform maintenance of the computer using standard tools provided in the OS</li> <li>• Install a Printer driver software and test for print outs</li> <li>• Install antivirus software and scan the system and Explore the configuration options in the antivirus software</li> <li>• Install MS office software</li> <li>• Use start menu, check available programs in computer, use search, settings, run and options. Creation of short cuts</li> <li>• Changing screen savers</li> <li>• Create folder and files, Drawing pictures using paint, using menus of paint</li> <li>• Explore different Menu/Tool/Format/status bars of MS word and practice the options: Editing the text, saving the text, changing the font and size of text.</li> <li>• Creation of brochures and taking the printouts</li> <li>• Practice the Mail merge and Hyperlink</li> </ul>	<p>Basic blocks of a computer, Hardware and software, I/O devices, keyboard, types of mouse and their working, Different types of printers, their function and inter-connection and their advantages HDD, CDD, DVD. Various ports in the computer.</p> <p>POST Booting concept.</p> <p>Windows O.S.</p> <p>MS widows: Starting windows and its operation, file management using explorer, Display &amp; sound properties, screen savers, font management, installation of program, setting and using of control panel., application of accessories, various IT tools and applications, Components of desk top</p> <p>Concept of word processing,: MS word</p> <p>– Menu bar, standard tool bar, saving, copying, deleting &amp; retrieving files, page setting, editing, formatting, advance features i.e. highlighting, cut &amp; paste, subscript &amp; superscript drawing features, mail merging, Hyperlink, tables and borders, printing of document etc.</p> <p>Excel – Worksheet basics, data entry and formulae. Moving data in worksheet using tool bars and menu bars, Formatting and calculations, printing worksheet, creating multiple work sheets, creating charts, changing chart types, Adding titles, legends and gridlines, colouring charts, printing charts, placing charts in a word file.</p> <p>Introduction to power point Basics of</p>
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	<p>options</p> <ul style="list-style-type: none"> <li>• Prepare a power point presentation on any three known topics with various design features</li> <li>• Prepare a power point presentation with different animation and visual effects.</li> <li>• Invoke excel sheet from MS WORD and vice versa</li> <li>• Convert the given PDF File into WORD File using suitable software. (<i>use free downloadable software</i> )</li> <li>• Use of search engines, Creation of email accounts, sending and receiving the mails configuration of email clients.</li> <li>• Identify the cables and network components.</li> <li>• Making UTP cross cables and testing, Making straight cables and testing, Making cable layout drawing</li> </ul>	<p>preparing slides, different design aspects of slides, animation with slides etc</p> <p>Concept of Internet, Browsers, Websites, search engines, email, chatting and messenger service. Downloading the Data and program files etc.</p> <p><b><u>Computer Networking:-</u></b></p> <p>Network features-Network topologies, protocols- TCP/IP, UDP, FTP, models, types, network components, network medias,</p> <p>Specification and standards, types of cables, UTP, STP, Coaxial cables. Network components like hub, Ethernet switch, router, NIC Cards, connectors, media and firewall. Difference between PC &amp; Server.</p> <p>Operating system -OS, NOS-features, types etc.</p> <p>Identify physical topology of a network and members of the network, Internet search engines and applications.</p>
22-23	<p>(i) <b>Project work</b></p> <p>(ii) <b>Industrial visit (optional)</b></p>	
24-25	<p><b>Examination</b></p>	
26	<p>Semester Gap</p>	

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

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

1. Construct and test amplifier, oscillator and wave shaping circuits
2. Identify and test power electronic components
3. Identify and test opto electronic devices
4. Practice SMD Soldering and De-soldering of Simple SMD components
5. Identify and verify the truth tables of various digital ICs using Data book
6. Practice circuit simulation software to simulate and test various the circuits
7. Identify and test various types of LEDs and LED displays
8. Construct and test various circuits using linear ICs 741 & 555

Week No.	Professional Skills	Professional Knowledge
	Trade Practical	Trade Theory
1	<p><b><u>Transistor</u></b></p> <ul style="list-style-type: none"> <li>• Identify PNP and NPN Transistors</li> <li>• Record the different specification of transistors using data book/web site</li> <li>• Identify different transistors with respect to different packaging styles, power, switching transistor, heat sinks</li> <li>• Measure E-B, C-B &amp; C-E terminal resistances and infer.</li> <li>• Construct and test a transistor based switching circuit to control a relay (use Relays of different coil voltages and Transistors of different <math>\beta</math> )</li> <li>• Construct a Transistorized amplifier vary the gain by changing the circuit components</li> </ul>	<p>Construction, Working of a PNP and NPN Transistors. Purpose of E, B &amp; C Terminals. Flow of currents into and out of terminals of PNP/ NPN Transistors and their relations. Significance of <math>\beta</math> of a Transistor Need for Biasing of Transistor junctions, Interpretation of main parameters of a Transistor. <math>V_{BE}</math>, <math>V_{CB}</math>, <math>V_{CE}</math>, <math>I_C</math>, <math>I_B</math>, Junction Temperature, junction capacitance, Frequency of operation, Discuss a Transistor application as a switch. Discuss a Transistor application as an amplifier. Define input impedance and output impedances</p> <p>Transistor power ratings &amp; packaging styles, use of different heat sinks.</p>
2-3	<p><b><u>Amplifier</u></b></p> <ul style="list-style-type: none"> <li>• Construct and test voltage divider bias</li> <li>• Construct and Test a common emitter amplifier with and without bypass capacitors</li> <li>• Construct and Test common base amplifier</li> <li>• Construct and Test common</li> </ul>	<p>Transistor (CB, CE &amp; CC) configurations and their characteristics and applications</p> <p>Transistor biasing circuits and stabilization Techniques.</p>

	<ul style="list-style-type: none"> <li>collector/emitter follower amplifier</li> <li>• Construct and Test Darlington amplifier</li> <li>• Construct and test a two stage RC Coupled amplifier</li> <li>• Construct and test a Class B complementary push pull amplifier</li> <li>• Construct and test class C Tuned amplifier</li> </ul>	<p>Classification of amplifiers according to frequency, mode of operation, methods of coupling, Voltage amplifiers- voltage gain, loading effect. Configuration of common emitter, common base, common collector transistor, their definition characteristics and applications. Single stage CE amplifier, (CC amplifier) emitter follower circuit and its advantages RC coupled amplifier, Distinguish between voltage and power amplifier, Push pull amplifier and class C tuned amplifier Alpha, beta, voltage gain, Concept of dB dBm. Feedback and its types.</p>
4	<ul style="list-style-type: none"> <li>• Demonstrate Colpitts oscillator, Hartley oscillator circuits</li> <li>• Construct and test a RC phase shift oscillator circuits</li> <li>• Construct and test a crystal oscillator circuits</li> <li>• Demonstrate Astable, monostable, bistable circuits using transistors.</li> </ul>	<p>Introduction to positive feedback and requisites of an oscillator, Study of Colpitts, Hartley, Crystal and RC oscillators.</p> <p>Types of multi vibrators and study of circuit diagrams</p>
5	<p><b><u>Wave shaping circuits</u></b></p> <ul style="list-style-type: none"> <li>• Construct and test shunt clipper</li> <li>• Construct and test series and dual clipper circuit using diodes</li> <li>• Construct and test clamper circuit using diodes</li> <li>• Construct and test Schmitt trigger circuit using transistors</li> </ul>	<p>Diode shunt clipper circuits and Clamping /limiting circuits and their applications.</p> <p>Schmitt trigger circuits</p>
6-7	<p><b><u>Power Electronic Components</u></b></p> <ul style="list-style-type: none"> <li>• Identify FET transistors and record main parameters from the Data book</li> <li>• Test the given FET using multi meter</li> <li>• Construct and test a FET Amplifier</li> <li>• Identify SCRs of different ratings and the packages</li> <li>• Test different SCRs using a Multi meter and component tester</li> <li>• Construct a test circuit to test SCRs</li> <li>• Construct a test circuit of SCR using UJT triggering</li> <li>• Identify different heat sinks used with SCRs.</li> <li>• Construct a snubber circuit for protecting SCR use freewheeling diode to reduce back emf.</li> <li>• Construct and test solid state relay.</li> </ul>	<p>Construction of FET, differentiate it with BJT. Purpose of Gate, Drain and source terminals and voltage / current relations between them,</p> <p>Impedances between various terminals. Interpret the main parameters of the FET. Suitability of FET amplifiers in measuring device applications. Working of power electronic components such as SCR, TRIAC, DIAC and UJT.</p>

	<ul style="list-style-type: none"> <li>• Construct a jig circuit to test DIAC</li> <li>• Identify and test a TRIAC using multi meter</li> <li>• Construct a simple dimmer circuit using TRIAC</li> <li>• Identify and Test a UJT using multi meter</li> <li>• Construct UJT based free running oscillator and change its frequency.</li> </ul>	
8	<p><b><u>MOSFET &amp; IGBT:</u></b></p> <ul style="list-style-type: none"> <li>• Identify MOSFET by its number</li> <li>• Identify different heat sinks used with various power MOSFET devices.</li> <li>• Construct MOSFET test circuit with a small load</li> <li>• Identify IGBT by its number</li> <li>• Construct IGBT test circuit with a small load</li> </ul>	Working of MOSFET, Power MOSFET and IGBT - their types, characteristics, switching speed, power ratings and protection. Differentiate FET with MOSFET, differentiate a Transistor with IGBT
9	<p><b><u>Opto Electronics:</u></b></p> <ul style="list-style-type: none"> <li>• Identify different types of LEDs</li> <li>• Test LEDs using DC supply and measure voltage drop and current using multimeter</li> <li>• Identify and test LDR, Identify photo voltaic cell</li> <li>• Construct a circuit to test a photo voltaic cell</li> <li>• Construct a circuit to switch a lamp load using photo diode</li> <li>• Construct a circuit to switch a lamp load using photo transistor.</li> <li>• Identify Opto coupler input and output terminals and measure the quantum of isolation between i/o terminals (Opto Transistor, TRIAC and SCR) and operate a Relay by connecting a switch</li> </ul>	Working and application of LED, IR LEDs, Photo diode ,photo transistor, its characteristics and application, optical sensor, opto-couplers, circuits with opto isolators, characteristics of LASER diodes
10	<p><b><u>Basic SMD (2,3,4 terminal components):</u></b></p> <ul style="list-style-type: none"> <li>• Identification of 2,3,4 terminal SMD components</li> <li>• De-solder the SMD components from the given PCB</li> <li>• Solder the SMD components in the same PCB</li> <li>• Check for cold continuity of PCB</li> <li>• Identification of loose /dry solder, broken tracks on printed wired assemblies</li> </ul>	<p>Introduction to SMD technology</p> <p>Identification of 2,3,4 terminal SMD components, advantages of SMD components over conventional lead components</p> <p>Introduction to solder paste and machine.</p> <p>Soldering of SM assemblies - Reflow soldering</p> <p>Tips for selection of hardware, Inspection of SM.</p>

11	<p><b><u>Basic Gates:</u></b></p> <ul style="list-style-type: none"> <li>• Identify different Logic Gates (AND, OR, NAND, NOR, X-OR, X-NOR, NOT ICs) by the number printed on them and draw I/O pin-out numbers.</li> <li>• Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs.</li> <li>• Construct and verify the truth table of all the gates using NAND and NOR gates</li> <li>• Use digital IC tester to test the various digital ICs (TTL and CMOS)</li> </ul>	<p>Introduction to Digital Electronics.</p> <p>Difference between analog and digital signals, Logic families and their comparison, Logic levels of TTL and CMOS. Number systems (Decimal, binary, octal, Hexadecimal) BCD code, ASCII code and code conversions.</p> <p>Logic Gates and their truth tables, propagation delay, power dissipation and noise immunity</p>
12	<p><b><u>Combinational Circuits:</u></b></p> <ul style="list-style-type: none"> <li>• Construct Half Adder circuit and verify the truth table.</li> <li>• Construct Full adder and verify the truth table.</li> <li>• Construct the Adder cum Subtractor and verify the result</li> <li>• Construct and Test a 2 to 4 Decoder</li> <li>• Construct and Test a 4 to 2 Encoder</li> <li>• Construct and Test a 4 to 1 Multiplexer</li> <li>• Construct and Test a 1 to 4 De Multiplexer</li> </ul>	<p>Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders, 2-bit and four bit full adders. Magnitude comparators. Half adder, full adder ICs and their applications for implementing arithmetic operations</p> <p>Basic Binary Decoder and four bit binary decoders.. Concept of encoder and decoder, Need for multiplexing of data. 1:4 line Multiplexer /De-multiplexer.</p>
13	<p><b><u>Flip Flops:</u></b></p> <ul style="list-style-type: none"> <li>• Identify different Flip-Flop (ICs) by the number printed on them</li> <li>• Construct and test four bit latch using 7475 .</li> <li>• Verify the truth tables of Flip-Flop ICs (RS, D, T, JK, MSJK) by connecting switches and LEDs</li> </ul>	<p>Introduction to Flip-Flop. S-R Latch, Gated S-R Latch, D- Latch. Flip-Flop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop, Master-Slave flip flops and Timing diagrams, Basic flip flop applications like data storage , data transfer and frequency division.</p>
14-15	<p><b><u>Electronic circuit simulation software</u></b></p> <ul style="list-style-type: none"> <li>• Prepare simple digital and electronic circuits using the software</li> <li>• Simulate and test the prepared digital and analog circuits</li> <li>• Convert the prepared circuit into a layout diagram.</li> <li>• Explore various troubleshooting and fault finding resources provided in the simulation software.</li> </ul>	<p>Study the library components available in the circuit simulation software. Various resources of the software.</p>
16-17	<p><b><u>Counter &amp; shift Registers:</u></b></p> <ul style="list-style-type: none"> <li>• Construct and test a four bit asynchronous binary counter using 7493.</li> </ul>	<p>Basics of Counters, types of counters, two bit</p>

	<ul style="list-style-type: none"> <li>• Construct and test 7493 as a modulus-12 counter.</li> <li>• Construct and test a four bit Synchronous binary counter using 74163.</li> <li>• Construct and test synchronous Decade counter.</li> <li>• Construct and test an up/down synchronous decade counter using 74190 and monitor the output on LEDs.</li> <li>• Identify and test common anode and common cathode seven segment LED display using multi meter</li> <li>• Display the two digit count value on seven segment display using decoder/driver ICs.</li> <li>• Construct a shift register using RS/D/JK flip flop and verify the result</li> <li>• Construct and test four bit SIPO register</li> <li>• Construct and test four bit PIPO register</li> <li>• Construct and test bidirectional shift registers</li> </ul>	<p>and three bit Asynchronous binary counters and decade counters with the timing diagrams.</p> <p>3-bit Synchronous counters and synchronous decade counters.</p> <p>Types of seven segment display, BCD display, BCD to decimal decoder. BCD to 7 segment display circuits,</p> <p>Basics of Register, types and application of Registers.</p>
18-21	<p><b><u>Op – Amp &amp; Timer 555 Applications:</u></b></p> <ul style="list-style-type: none"> <li>• Use analog IC tester to test the various analog ICs</li> <li>• Construction and testing of various Op-Amp circuits Inverting, Non-inverting and Summing Amplifiers</li> <li>• Construct and test Differentiator and Integrator</li> <li>• Construct and test a zero crossing detector</li> <li>• Construct and test Instrumentation amplifier</li> <li>• Construct and test a Binary weighted and R-2R Ladder type Digital-to-Analog Converters.</li> <li>• Construct and test Astable timer circuit using IC 555</li> <li>• Construct and test mono stable timer circuit using IC 555</li> <li>• Construct and test VCO (V to F Converter) using IC 555</li> <li>• Construct and test 555 timers as pulse width modulator</li> </ul>	<p>Block diagram and Working of Op-Amp, importance, Ideal characteristics, advantages and applications.</p> <p>Schematic diagram of 741, symbol, Non inverting voltage amplifier, inverting voltage amplifier, summing amplifier, Comparator, zero cross detector, differentiator, integrator and instrumentation amplifier, other popular Op-Amps.</p> <p>Block diagram of 555, functional description w.r.t. different configurations of 555 such as mono stable, Astable and VCO operations for various application</p>
22-23	Implant training / Project work (work in a team)	
24-25	Revision	
26	Examination	

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

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

1. Operate DSO to perform various functions
2. Practice SMD Soldering and De-soldering of various types of IC Packages
3. Identify defects and do rework of PCB Repairs.
4. Construct and test simple electrical control circuits and various electrical protective devices
5. Identify, prepare, terminate and test various types of electronic cables used in various systems
6. Identify various functional blocks of a microcontroller system and Identify various I/O Ports, Interface a model application with the Microcontroller kit and run the application
7. Construct and test various modulation/demodulation circuits
8. Identify and test various types of sensors used in electronic industries
9. Construct and test analog and digital IC based application circuits

Week No.	Professional Skills	Professional Knowledge
	Trade Practical	Trade Theory
1	<p><b><u>Digital Storage Oscilloscope:</u></b></p> <ul style="list-style-type: none"> <li>• Identify the different front panel control of a DSO.</li> <li>• Measure the Amplitude, Frequency and time period of typical electronic signals using DSO</li> <li>• Store a portion of signal waveform using DSO.</li> <li>• Take a print of a signal from DSO by connecting it to a printer</li> <li>• Construct and test function generator using IC 8038</li> </ul>	<p>Block diagram of DSO/CRO and applications of DSO/CRO application of digital CRO, block diagram of function generator. Differentiate a CRO with DSO. Advantages of DSO. Major features of DSO.</p>
2-3	<p><b><u>SMD Soldering and De-soldering:</u></b></p> <ul style="list-style-type: none"> <li>• Identify various connections and the setup required for SMD Soldering station</li> <li>• Identification of crimping tools for various IC packages.</li> <li>• Make the necessary settings on SMD soldering station to de-solder various ICs of different packages (at least four) by choosing proper crimping tools.</li> <li>• Make the necessary settings on SMD soldering station to solder various ICs of different packages (at least four) by</li> </ul>	<p>Soldering / de-soldering of above components</p> <p>Identification of Programmable Gate Array (PGA) packages</p> <p>Soldering / De-soldering of above PGA components</p> <p>Cold/Continuity check of PCBs</p> <p>Identification of loose /dry solders, broken tracks</p>

	choosing proper crimping tools.	on printed wiring assemblies
4	<p><b><u>PCB Rework:</u></b></p> <ul style="list-style-type: none"> <li>• Prevention of Static charges, Handling of static sensitive devices</li> <li>• Familiarizations of various crimping tools, wire wrapping, Conductive adhesives, Chip on Board, Tape Automated bonding.</li> <li>• Construction of Printed Circuit Boards (single, Double, multi-layer), Important tests for PCBs</li> <li>• Identify different types of soldering guns and practice soldering of different electronic active and passive components and IC bases on lug boards and PCBs</li> <li>• Join the broken PCB track and test</li> <li>• Practice the de-soldering using pump and wick</li> <li>• Prepare component for soldering</li> <li>• Demonstrate soldering and de soldering using soldering and de-soldering stations</li> <li>• Familiarizations of soldering technology, use of materials like solder, flux and cleaning solvents, Usage of correct tools, Component mounting, Solderability testing,</li> <li>• Practical's on soldering Inspection of solder joints, Defects of soldered joints</li> <li>• Familiarizations to rework and repair concepts</li> <li>• Practical on Types of conformal coating and its removal methods</li> <li>• Practical on Rework of through hole and surface mount soldered joints</li> <li>• Practical on Repair of damaged track</li> <li>• Practical on Repair of damaged pad</li> <li>• Practical on Repair of Plated through hole</li> <li>• Practical on Repair of solder mask</li> </ul>	<p><b>ESD Control in Electronics</b></p> <p>Introduction to Static charges, Prevention of Static charges, Handling of static sensitive devices, Various standards for ESD</p> <p><b>Introduction to non soldering interconnections</b></p> <p>Introduction to crimping, wire wrapping, Conductive adhesives, Chip on Board, Tape Automated bonding.</p> <p>Introduction to components, Printed Circuit Boards</p> <p>Introduction to components, Construction of Printed Circuit Boards(single, Double, multi-layer), Important tests for PCBs</p> <p><b>Soldering guns</b></p> <p>Different types of soldering guns, related to Temperature and wattages, types of tips.</p> <p>Solder materials and their grading. Selection of a soldering gun for specific requirement.</p> <p>Soldering and De-soldering stations and their specifications.</p> <p>Reliable Soldering Practices (Manual)</p> <p>Fundamentals of soldering technology, Materials selection like solder, flux and cleaning solvents, Usage of correct tools, Component mounting, Solderability testing, Process for soldering Inspection of solder joints, Defects of soldered joints</p> <p><b>Introduction to Surface Mount Technology (SMT)</b></p> <p>Introduction to surface mount technology – advantages Surface Mount components and packages, Introduction to solder paste (flux), Soldering of SM assemblies - Reflow soldering</p>

		<p>Tips for selection of hardware, Inspection of SM.</p> <p><b>Rework and Repair of Printed Circuit board assemblies</b></p> <p>Introduction to rework and repair concepts</p> <p>Types of conformal coating and its removal methods</p> <p>Rework of through hole and surface mount soldered joints</p> <p>Repair of damaged track</p> <p>Repair of damaged pad</p> <p>Repair of Plated through hole</p> <p>Repair of solder mask</p>
5	<p><b><u>Protection devices:</u></b></p> <ul style="list-style-type: none"> <li>Identify different types of fuses along with fuse holders.</li> <li>Wire an MCB to a motor and run it</li> <li>Test and rectify defects associated with MCBs.</li> <li>Connect an ELCB and test the leakage of an electrical motor control circuit.</li> </ul>	<p>Fuse ratings, types of Fuses, Fuse bases, single/three phase MCBs, single phase ELCBs.</p> <p>Types of Contactors, contactor coils and working voltages, contactor contact currents, protection to contactors and high current applications.</p>
6	<p><b><u>Electrical control circuits:</u></b></p> <ul style="list-style-type: none"> <li>Measure the coil winding resistance of the given motor</li> <li>Prepare the setup and Control an induction motor using a DOL Starter</li> <li>Construct a direction control circuit to change direction of an induction motor</li> <li>Connect an overload relay and test for its proper functioning.</li> </ul>	<p>Fundamentals of single phase Induction motors, synchronous speed, slip, rotor frequency, torque – speed characteristics, Starters used for Induction motors.</p>
7-8	<p><b><u>Electronic Cables &amp; Connectors</u></b></p> <ul style="list-style-type: none"> <li>Identify various types of cables used for various applications viz. insulation, gauge, current capacity, flexibility etc. used in various electronics products.</li> <li>Identify suitable connectors, solder/crimp /terminate &amp; test the cable sets.</li> </ul>	<p>Cable signal diagram conventions</p> <p>Classification of electronic cables as per the application w.r.t. insulation, gauge, current capacity, flexibility etc. different types of connector &amp; their terminations to the cables.</p>

	<ul style="list-style-type: none"> <li>Read &amp; follow markings on the connectors for testing the continuity of the prepared cable sets <u>The set of cables prepared should cover applications like computer, audio, video products, RF, DATA Transmission, IDE etc</u></li> </ul>	<p>Male / Female type DB connectors, Ethernet 10 Base cross over cables and pin out assignments, UTP and STP, SCTP Cables</p> <p>Cable trays.</p> <p>Different types of connectors Servo 0.1” connectors, FTP, RCA,BNC,HDMI</p> <p>Audio/video connectors like XLR,RCA(phono),6.3mm PHONO,3.5/2.5mm PHONO, BANTAM,SPEAKON, DIN, mini DIN, RF connectors, USB, Firewire, SATA Connectors, VGA,DVI connectors, MIDI etc</p>
9-10	<p><b><u>Communication electronics:</u></b></p> <ul style="list-style-type: none"> <li>Modulate and Demodulate various signals using AM and FM on the trainer kit and observe waveforms</li> <li>Construct and test IC based AM Receiver</li> <li>Construct and test IC based FM transmitter</li> <li>Construct and test IC based FM Receiver</li> <li>Dismantle the given FM receiver set and identify different stages ( AM section, audio amplifier section etc)</li> <li>Modulate and Demodulate a signal using PAM,PPM,PWM Techniques</li> </ul>	<p>Radio Wave Propagation – Principle, Fading, Need for Modulation, types of modulation. Demodulation techniques.</p> <p>Fundamentals of Antenna, various parameters, types of Antennas &amp; application.</p> <p>Introduction to AM, FM &amp; PM, SSB-SC &amp; DSB-SC,block diagram of AM and FM transmitter.</p> <p>FM Generation &amp; Detection</p> <p>Radio Receivers: Types, Super heterodyne receiver Blocks, Principle, characteristics, advantages and disadvantages, Block diagram of FM Receives, RF, IF &amp; AF Amplifier Sections, AM/FM RF Alignment.</p> <p>Digital modulation and demodulation techniques, sampling, quantization &amp; encoding.</p> <p>Concept of multiplexing and de multiplexing of AM/FM/PAM/ PPM /PWM signals.</p> <p><u>A simple block diagram approach to be adopted for explaining the above mod/demo. techniques.</u></p>
11-12	<p><b><u>Microcontroller (8051)</u></b></p> <ul style="list-style-type: none"> <li>Identify various ICs &amp; their functions on</li> </ul>	<p>Introduction to 8051 Microcontroller, architecture, pin details &amp; the bus system. Function of different ICs used in the</p>

	<p>the given Microcontroller Kit</p> <ul style="list-style-type: none"> <li>• Identify the address range of RAM &amp; ROM.</li> <li>• Write data into RAM &amp; observe its volatility</li> <li>• Measure the crystal frequency, connect it to the controller.</li> <li>• Identify the port pins of the controller &amp; configure the ports for Input &amp; Output operation</li> <li>• Connect an input switch &amp; control a lamp using necessary program</li> <li>• Demonstrate the initialization, load &amp; turn on a LED with delay using Timer.</li> <li>• Demonstrate the use of a Timer as an Event counter to count external events.</li> <li>• Demonstrate entering of simple programs, execute &amp; monitor the results</li> </ul>	<p>Microcontroller Kit. Differentiate microcontroller with microprocessor. Interfacing of memory to the microcontroller. Internal hardware resources of microcontroller. I/O port pin configuration. Different variants of 8051 &amp; their resources. Register banks &amp; their functioning. SFRs &amp; their configuration for different applications. Utilization of on chip resources such as ADC. Availability of assembly software &amp; compiler for 8051. Application of microcontroller in domestic, consumer &amp; industries.</p> <p>Comparative study of 8051 with 8052. Introduction to PIC Architecture.</p>
13-14	<p><b><u>Sensors ,Transducers and Applications</u></b></p> <ul style="list-style-type: none"> <li>• Identify sensors used in process industries such as RTDs, Temperature ICs, Thermocouples, proximity switches (inductive, capacitive and photo electric), load cells, strain gauge. LVDT by their appearance</li> <li>• Measure temperature of a lit fire using a Thermocouple and record the readings referring to data chart.</li> <li>• Measure temperature of a lit fire using RTD and record the readings referring to data chart.</li> <li>• Measure the strain of a given material using strain gauge</li> <li>• Measure the DC voltage of a LVDT</li> <li>• Detect different objectives using capacitive, inductive and photoelectric proximity sensors</li> </ul>	<p>Basics of passive and active transducers.</p> <p>Role, selection and characteristics.</p> <p>Working principles of RTD, PT-100 Thermocouple, Sensor voltage and current formats.</p> <p>Thermistors – salient features –operating range, composition, advantages and disadvantages.</p> <p>Thermocouples – basic principle – commonly used combinations, operating range, advantages and disadvantages.</p> <p>Strain gauges – principle, gauge factor, types of strain gauges.</p> <p>Load cell –definition, uses, working of strain gauge load cell</p> <p>Principle of operation of capacitive transducers,- advantages and disadvantages</p> <p>Principle of operation of inductive transducers,- advantages and disadvantages</p> <p>Principle of operation of LVDT-its advantages and disadvantages</p> <p>Proximity sensors – applications, working principles of eddy current , capacitive and</p>

		inductive proximity sensors
15-17	<p><b><u>Analog IC Applications</u></b></p> <p>Make simple projects/Applications using ICs 741, 723, 555, 7106, 7107</p> <p>Sample projects:</p> <ul style="list-style-type: none"> <li>• Laptop protector</li> <li>• Mobile cell phone charger</li> <li>• Battery monitor</li> <li>• Metal detector</li> <li>• Mains detector</li> <li>• Lead acid battery charger</li> <li>• Smoke detector</li> <li>• Solar charger</li> <li>• Emergency light</li> <li>• Water level controller</li> <li>• Door watcher</li> </ul> <p>(Instructor will pick up any five of the projects for implementation)</p>	Discussion on the identified projects with respect to data of the concerned ICs, components used in the project
20-21	<p><b><u>Digital IC Applications</u></b></p> <p>Make simple projects/Applications using various digital ICs ( digital display, event counter, stepper motor driver etc)</p> <ul style="list-style-type: none"> <li>• Duty cycle selector</li> <li>• Frequency Multiplier</li> <li>• Digital Mains Resumption Alarm</li> <li>• Digital Lucky Random number generator</li> <li>• Dancing LEDs</li> <li>• Count down timer</li> <li>• Clap switch</li> <li>• Stepper motor control</li> <li>• Digital clock</li> <li>• Event counter</li> <li>• Remote jammer</li> </ul> <p>(Instructor will pick up any five of the projects for implementation)</p>	Discussion on the identified projects with respect to data of the concerned ICs, components used in the project
22-23	Implant training/Project work/work in a team	
24-25	Revision	
26	Examination	

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

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

1. Work with DPM Modules to measure various electrical parameter
2. Practice various modulation techniques to acquaint with fiber optic trainer
3. Identify various functional blocks/major components/ICs in the given stabilizer. Rectify the faults
4. Identify various Input and output sockets/connectors of the given SMPS and UPS
5. Identify various functional blocks/major components/ICs in the given SMPS and UPS
6. Install and troubleshoot the given solar panel system
7. Dismantle and assemble various types of cell / smart phones and trouble shoot the cell/smart phone
8. Dismantle and assemble the given LED light stack
9. Dismantle, assemble, trouble shoot and rectify LED and LCD TV sets

Week No.	Professional Skills	Professional Knowledge
	Trade Practical	Trade Theory
1	<p><b><u>Fiber optic communication:</u></b></p> <ul style="list-style-type: none"> <li>• Identify the resources and their need on the given fiber optic trainer kit</li> <li>• Make optical fiber setup to transmit and receive analog and digital data</li> <li>• Demonstrate FM modulation and demodulation using OFC trainer kit using audio signal and voice link</li> <li>• Demonstrate PWM modulation and demodulation using OFC trainer kit using audio signal and voice link</li> <li>• Demonstrate PPM modulation and demodulation using OFC trainer kit using audio signal and voice link</li> </ul>	<p>Introduction to optical fiber as a transmission media, its advantages over other media, properties of optic fiber, testing, losses , types of fiber optic cables and specifications.</p> <p>Encoding of light.</p> <p>Fiber optic joints, splicing, testing and the related equipments/measuring tools, precautions to be taken laying of cables, safety aspects while handling optical cables.</p>
2-3	<p><b><u>Digital panel Meter:</u></b></p> <ul style="list-style-type: none"> <li>• Identify LED Display module and its decoder/driver ICs</li> <li>• Display a word on a two line LED</li> <li>• Measure/current flowing through a resistor and display it on LED Module</li> <li>• Measure/current flowing through a sensor and display it on a LED module(DPM)</li> <li>• Identify LCD Display module and its decoder/driver ICs</li> <li>• Display a word on a two line LCD</li> </ul>	<p>Different types of seven segment displays, decoders and driver IC s for them. Concept of multiplexing and its advantages.</p> <p>Block diagrams of 7106 and 7107 and their configuration for different measurements.</p> <p>Use of DPM (Digital Panel Meter) with seven segment displays to display different voltage &amp; current signals.</p>

	<ul style="list-style-type: none"> <li>Measure/current flowing through a resistor and display it. Measure/current flowing through a sensor and display it on a LCD module(DPM)</li> </ul>	<p>Principles of working of LCD. Different sizes of LCDs. Decoder/Driver ICs used with LCDs and their pin-out diagrams.</p> <p>Scrolling displays and its design.</p> <p>Use of DPM ( Digital Panel Meter) with LCD to display different voltage &amp; current signals</p>
4-7	<p><b><u>SMPS:</u></b></p> <ul style="list-style-type: none"> <li>Dismantle the given stabilizer and find major sections/ ICs components.</li> <li>Measure voltages at vital test points.</li> <li>Identify various input and output sockets / connectors of the given SMPS.</li> <li>Apply input and measure outputs using a multi meter.</li> <li>Test capacity of the given SMPS.</li> <li>Identify major sections/ ICs/components of SMPS.</li> <li>Measure / Monitor major test points of computer SMPS.</li> <li>Identify and replace the faulty components.</li> </ul> <p><i>Use SMPS used in TVs and PCs for Practice</i></p> <ul style="list-style-type: none"> <li>Construct and test IC Based DC-DC converter for different voltages</li> <li>Construct and test a switching step down regulator using LM2576</li> <li>Construct and test a switching step up regulator using MC 34063</li> </ul>	<p>Concept and block diagram of manual, automatic and servo voltage stabilizer, o/p voltage adjustment, voltage cutoff systems, study of different types of relays used in stabilizer. Block Diagram of Switch mode power supplies and their working principles</p> <p>Various types of chopper circuits step-up, step down, inverting types.</p> <p>Introduction to DC-DC Converters</p> <p>ICs used for converting DC- DC, block diagrams and their pin outs. Applications of DC-DC converters</p>
8-10	<p><b><u>UPS</u></b></p> <ul style="list-style-type: none"> <li>Make individual connections between batteries of battery stack and test for healthiness of batteries on stack.</li> <li>Connect battery stack to the UPS.</li> <li>Identify front panel control &amp; indicators of UPS</li> <li>Identify &amp; practice on the use of back panel sockets &amp; connections.</li> <li>Connect Battery &amp; load to UPS &amp; test on battery mode</li> <li>Measure battery current UPS is working on Battery Mode &amp; measure load current</li> <li>Open Top cover of UPS &amp; identify isolator transformer &amp; UPS</li> </ul>	<p>Concept of UPS,</p> <p>Difference between Inverters and UPS. Basic block diagram of UPS &amp; operating principle,-explanation of rectifier, battery, inverter, static transfer switch.</p> <p>Types of UPS : Off line UPS, On line UPS, Line interactive UPS &amp; their comparison</p> <p>UPS specifications. Load power factor &amp; types of indications &amp; protections</p> <p>UPS circuit description and working - controlling circuits, Micro controller circuits, power circuits, charging circuits, alarm circuits, Indicator circuits.</p>

	<p>transformer &amp; additional circuit other than inverter</p> <ul style="list-style-type: none"> <li>• Identify various circuit boards in UPS and monitor voltages at various test points</li> <li>• Perform load test to measure backup time.</li> <li>• Test UPS under Fault condition &amp; rectify fault</li> <li>• Perform all above experiment for three phase UPS</li> </ul>	<p>Three phase UPS Circuits.</p> <p>Installation of single phase &amp; three phase UPS</p> <p>Electrical wiring for Single phase and Three phase systems, Earthing and earth resistance measurement, calculation of load power and power factor of a power source.</p> <p>Protection circuits used in inverters– battery level, over load, over charging etc. Various faults and its rectification</p>
11-12	<p><b><u>Solar Power (Renewable Energy System)</u></b></p> <ul style="list-style-type: none"> <li>• Install a solar panel to a roof.</li> <li>• Wire a solar panel to a solar controller.</li> <li>• Wire a solar controller to a battery storage station.</li> <li>• Connect storage batteries to a power inverter</li> <li>• Wire a power inverter to an electrical service panel.</li> <li>• Connect and test solar panel to the Inverter and run the load.</li> <li>• Test circuits for voltages.</li> <li>• Installation of Solar Inverter.</li> <li>• Take the trainees to the nearest solar power installation and demonstrate various aspects to cover skills as specified above.</li> </ul>	<p>Need for renewable energy sources, Solar energy as a renewable resource. Materials used for solar cells. Principles of conversion of solar light into electricity. Basics of photovoltaic's cell. Types of solar cells. Mono crystalline and poly crystalline PV cells.</p> <p>Define Components like Solar cell, Module, panel and Arrays. Factors that influence the output of a PV module. SPV systems and the key benefits. Difference between SPV and conventional power. Define solar charge controller or regulator and its role.</p> <p>Safety precautions while working with solar systems.</p>
13-14	<p><b><u>Cell phones</u></b></p> <ul style="list-style-type: none"> <li>• Dismantle, identify the parts and assemble different types of smart phones</li> <li>• Dismantle the cell phone/smart phone replace the display</li> <li>• Dismantle the cell phone/smart phone remove the key pad and clean it, test for the continuity of the matrix/tracks</li> <li>• Interface the cell phone/smart phone to the PC and transfer the data</li> <li>• Enhance the memory capacity of the cell phone/smart phone</li> <li>• Connect internet on cell phone and</li> </ul>	<p>Introduction to mobile communication, concept cell site, hand off, frequency reuse, block diagram and working of cell phones, cell phone features, GSM and CDMA technology. Use IEMI number to trace lost/misplaced mobile phone.</p>

	<p>browse popular web sites</p> <ul style="list-style-type: none"> <li>• Flash the various brands of cell phone/smart phone ( at least 3)</li> <li>• Upgrade the OS</li> <li>• Format the cell phone/smart phone for virus( approach the mobile repair shop/service centre)</li> <li>• Unlock the handsets through codes and software</li> <li>• Identify the defective parts and rectify</li> <li>• Clean the water damage sets using CTC with vibrator tubs</li> <li>• Replace various faulty parts like mic, speaker, data/charging/audio jack etc.</li> </ul>	
15-16	<p><b><u>LED Lights</u></b></p> <p>Dismantle the LED light, identify the connections of LEDs stacks, protection circuits, regulator</p> <ul style="list-style-type: none"> <li>• Measure the voltage across LED stacks</li> <li>• Identify the rectifier, controller part of LED lights</li> <li>• Test various subassemblies of the given LED light system</li> </ul>	<p>Types of LED panels used in various lighting applications.</p> <p>Stacking of LEDs. Driving of LED stacks.</p>
17-21	<p><b><u>LCD and LED TV</u></b></p> <ul style="list-style-type: none"> <li>• Identification and operate different Controls on LCD, LED TV</li> <li>• Identify various connectors provided on a LCD TV and test the healthiness.</li> <li>• Identification of components and different sector of LCD and LED TV.</li> <li>• Dismantle, Identify the parts of the remote control</li> <li>• Trace and rectify the faults of a various remote controls</li> <li>• Identify various connectors and connect the cable operator's external decoder (set top box) to the TV.</li> </ul>	<p>Difference between a conventional CTV with LCD &amp; LED TVs,</p> <p>Principle of LCD and LED TV and function of its different section. Basic principle and working of 3D TV.</p> <p>IPS panels and their features</p> <p>Different types of interfaces like HDMI, USB, RGB etc with latest TVs.</p> <p>TV Remote Control –Types, parts and functions, IR Code transmitter and IR Code Receiver, Working principle, operation of remote control. Different adjustments, general faults in Remote Control.</p>
22-23	Implant training / Project work (work in a team)	
24-25	Revision	
26	Examination	

## 10.2 SYLLABUS CONTENT OF CORE SKILLS

### FirstSemester (Semester Code no. ELM - 01)

**Duration: Six Month**

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

1. Apply 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

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
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 calculator.	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, construction, Extension, Dimension, Section)</li> <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.	Drawing of Geometrical Figures: Definition, nomenclature and practice of <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> </ul>

		- Circle and its elements.
5.	<b>Percentage:</b> Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	Lettering and Numbering as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
6.	<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.	Dimensioning: - Definition, types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead - Leader Line with text
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.	Free hand drawing of - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches.
8.	<b>Speed and Velocity:</b> Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.	Sizes and Layout of Drawing Sheets - Basic principle of Sheet Size - Designation of sizes - Selection of sizes - Title Block, its position and content - Borders and Frames (Orientation marks and graduations) - Grid Reference - Item Reference on Drawing Sheet (Item List)
9.	<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.	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view
10.	-----	Symbolic Representation (as per BIS SP:46-2003) of : - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings

**Second Semester**  
**(Semester Code no. ELM - 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, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	Construction of Geometrical Drawing Figures: - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons. - 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. ELM - 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 electronic circuits, symbols and block diagram of CRO, Micro controller AM/FM receiver, function generator and front panel controls of electronic equipments

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>CRO: -</b> Block diagram of Cathode Ray Oscilloscope (CRO). Block diagram of Digital storage Oscilloscope (DSO). Front panel view of CRO & DSO.
2.	<b>Material:</b> Introduction, types and properties. Uses of Conducting, Semi-conducting and insulating materials.	<b>Surface Mounting devices (SMD):-</b> Front panel view of SMD station. IC package of SMD.
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>Electrical Protective Devices:-</b> Symbol of MCB (Miniature Circuit Breaker), ELCB (Earth Leakage Circuit Breaker), DOL starter, Relays.
4.	<b>Pressure:-</b> Pneumatic pressure, PSI, bar, atmospheric pressure, pressure gauge and absolute pressure, Heat treatment process.	<b>Microcontroller:-</b> Block diagram of 8051. Pin configuration of 8051.
5.	<b>Indices:</b> Laws of indices related problems. <b>Quadratic Equation:</b> Introduction, solution of simple Quadratic equation and related problems.	<b>Modulation: -</b> Block diagram of super Heterodyne Radio Receiver. Block diagram of AM and FM receiver.
6.	Solution of simple A.C. circuit with R.L.C. Calculation of power factor etc.	<b>Power supply:</b> Block diagram of SMPS. Block diagram of UPS-ONLINE, OFFLINE, LINE INTERACTING.
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.	-----

**Fourth Semester**  
**(Semester Code no. ELM - 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 symbols of electronic components, Block diagram of DTH, Cell phone, SMPS and circuit diagram of projects

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	<b>Power supply:</b> Calculation of SMPS, regulation, Calculation of load and wattage for selection of UPS, calculate of back up time of Battery related to UPS and Load, calculate of voltage regulation, firing angle calculation of ripple factor, voltage regulation of DC voltage. Calculate the regulation of solar power.	<b>Symbol of electronic component:-</b>  A. Thermocouple B. Strain Gauge C. LVDT(Linear variable differential transformer) D. Proximity Sensor
2.	<b>Motor parameters &amp; Calculation:</b> Speed and frequency calculation of A.C motors, D.C motors.	<b>DTH system:-</b> Block diagram connections of Home system. Direct To Home (DTH).
3.	<b>Modulation:</b> AM/FM modulation index calculation, calculation of Bandwidth, Percentage of modulation in FM/AM.	<b>Cell Phone:-</b> Block diagram of cell phone receiver system.
4.	<b>Number Systems:</b> Introduction, Decimal, Binary, Octal, Hexadecimal, BCD code, ASCII code, Bit, Byte, KB, MB, GB, Conversion, Addition, Subtraction, Multiplication, Division, 1 <sup>st</sup> and 2 <sup>s</sup> complement method, 9s and 10s complement method.	<b>Generator:-</b> Front panel control for function Generator.
5.	<b>Boolean Algebra:</b> Simplification of Boolean Algebra equations.	<b>Project related Drawings:-</b>  A. Dancing LED's B. Smoke detector C. Mobile charger D. Metal detector
6.	<b>Project costing:</b> Project selection, cost of project, Simple estimation, simple	

	problems on profit and loss , Balance sheet etc.	
7.	Power transmission by shaft, belts and ropes.	
8.	<b>Friction:</b> Law of friction, co-efficient of friction, angle of friction, advantage and disadvantage of friction.	
9.	<b>Force:</b> Resolution and Composition of forces. Representation of forces by vectors, simple problems on lifting tackles like Jib wall, crane solution of problems with the aid of vectors, General condition of equilibrium for series of forces on a body.	
10.	<b>Gravity:</b> Centre of Gravity, simple experiments stable, unstable and neutral equilibrium.	

# **11. EMPLOYABILITY SKILLS**

## **11.1 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.

## 11.2 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

## 11.3 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>	
<b>Marks Allotted: 09</b>	
<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>	
<b>Marks Allotted: 09</b>	
<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.
<b>3. Communication Skills</b>	
<b>Hour of Instruction: 15 Hrs.</b>	
<b>Marks Allotted: 07</b>	
<b>Topic</b>	<b>Contents</b>
<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.
<b>Motivational Training</b>	Characteristics Essential to Achieving Success
	The Power of Positive Attitude
	Self-awareness
	Importance of Commitment
	Ethics and Values
	Ways to Motivate Oneself
	Personal Goal setting and Employability Planning.
<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>Quality Consciousness :</b>	Meaning of quality, Quality Characteristic
<b>Quality Circles :</b>	Definition, Advantage of small group activity, objectives of Quality Circle, Roles and Functions of Quality Circles in organisation, Operation of Quality Circle, Approaches to Starting Quality Circles, Steps for Continuation Quality Circles
<b>Quality Management System:</b>	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
<b>House Keeping :</b>	Purpose of Housekeeping, Practice of good Housekeeping.5S Principles of Housekeeping: SEIRI – Segregation, SEITON – Arrangement, SEISO – Cleaning, SEIKETSU – maintenance of Standards, SHITSUKE - Discipline

## **12. INFRASTRUCTURE**

1. Instructors Qualification : Degree in Electronics / Electronics and telecommunication/ Electronics and communication Engineering from recognized Engineering College/ university with one year experience in the relevant field  
**OR**  
Diploma in Electronics / Electronics and telecommunication/ Electronics and communication from recognized board of technical education with two years experience in the relevant field  
**OR**  
10<sup>th</sup> class examination and NTC/NAC in the Trade With 3 years' post qualification experience in the relevant field.
2. Desirable qualification : Preference will be given to a candidate with CIC (Craft Instructor Certificate) in the trade.
3. Space norms : 56 Sq. metres.
4. Power norms :3.04 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.

## **13.ASSESSMENT STANDARD**

### **13.1 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 above 75%- 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

### 13.2 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.	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 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.	Perform basic mechanical workshop operations using suitable tools for fitting riveting, drilling etc observing suitable care & safety.	
11.	Identify, charge, discharge, connect, maintain different batteries used in electronic applications.	

12.	Identify, test various electrical components like Switches, Transformers, Relays, contactors, Solenoid valves	
13.	Identify, test various electronic components using proper measuring instruments and apply this knowledge to troubleshoot power supplies.	
14.	Configure, install, troubleshoot, upgrade, interconnect given computer system(s) and demonstrate & utilize application packages for different application	
	<b>Sub-Total of Internal assessment for Semester- I</b>	100
15.	Assemble, test and repair the various analog circuits and apply this knowledge to troubleshoot AF amplifier of PA system, fan regulator, light dimmer circuit	
16.	Assemble, test and repair the various digital circuits and apply this knowledge to troubleshoot various application circuits viz. display systems, digital clock, digital timer and event counter	
17.	Draw , simulate and analyze the analog and digital circuits using Electronic simulator software	
18.	Prepare, crimp, terminate and test various cables used in different electronic industries.	
	<b>Sub-Total of Internal assessment for Semester- II</b>	100
19.	Identify, place, solder and desolder and test different SMD discrete components and IC's.	
20.	Identify, prepare /construct different electrical controls circuits, features and test for their proper functioning.	
21.	Construct/assemble/test and trouble shoot a commercial AM /FM receiver.	
22.	Identify different blocks of programmable system & test/troubleshoot the various components of it and apply the knowledge to service different domestic programmable systems Understand the operation of different process sensors, identify, wire & apply the knowledge to test various sensors of different industrial processes by selecting appropriate test instruments	
23.	Understand the operation of different process sensors, identify, wire & apply the knowledge to test various sensors of different	

	industrial processes by selecting appropriate test instruments	
24.	Select a project, understand the requirements to construct the project and install it for a domestic /commercial applications based on various analog and digital IC's	
	<b>Sub-Total of Internal assessment for Semester- III</b>	<b>100</b>
25.	Prepare fibre optic setup to transmit and receive various analog and digital data using fibre optic cable by following proper care	
26.	Interface the LCD, LED DPM panels to various circuits for monitoring and testing	
27.	Identify the various components , connectors and trouble shoot the SMPS, UPS and inverter with due care and follow the safety norms	
28.	Install a solar panel and connect the panel to the inverter and test	
29.	Dismantle, identify the various parts of a cell phone and repair and assemble the cell phone/smart phone	
30.	Identify the various parts of a LED lights and stacks and troubleshoot	
31.	Identify, operate various controls, trouble shoot and replace modules of the LCD/LED TV & its remote.	
	<b>Sub-Total of Internal assessment for Semester- IV</b>	<b>100</b>
	<b>Total of Internal assessment</b>	<b>400</b>

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

There will be a single objective type Examination paper for the subjects Engineering drawing and Workshop Calculation & Science.

- a) There will be a single objective type Examination paper for the subjects Trade Theory and Employability Skills.
- b) 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>

## 14. LIST OF TRADE COMMITTEE MEMBERS

Sl. No.	Name & Designation	Organization	Remarks
1	M.R.K Naidu, Head (CR&D)	ECIL, Hyderabad	Chairman
2	PradeepDoshi , SVP	ESSCI, NewDelhi	Member
3	T. Venkataswamy, Assit. Engg.	BHEL, Hyderabad	Member
4	A Prasanna Lakshmi, Faculty	BHEL, Hyderabad	Member
5	T. Venkateswara Sharma, Sr. Officer HR	BEL, Hyderabad	Member
6	P. Chandrashekhar, MD	Techno Design Group, Hyderabad	Member
7	S.CH. Apparao, Managers(operations)	BEL, Hyderabad	Member
8	T. Ram Mohan Rao, Sr.Manager	BDL, Hyderabad	Member
9	B UdayaBhaskarRao, DGM Electronics	BDL, Hyderabad	Member
10	M Manoharan, MD	Automation Solutions, Hyderabad	Member
11	S K Sastry, MD	EPROSYS, Hyderabad	Member
12	KBR Siva Prasad	HAL, Hyderabad	Member
<b>Mentor</b>			
1.	R.L Singh, DDG(T)	DGET, MOLE, NewDelhi	Mentor
<b>Members of Core Group</b>			
2.	C.S Murthy, DDT	ATI-EPI, Hyderabad	TEAM LEADER
3.	C.H Ravi , DDT	ATI-EPI, Mumbai	Member
4.	L K Mukherjee, DDT	CSTARI, Kolkata	Member
5.	N.R Aravindan JDT	NIMI, Chennai	Member
6.	C. Ramasubramanian, DDT	AHI, Bangalore	Member
7.	H.C Goyal, DDT	ATI-EPI, Dehradun	Member
8.	Avinash Kishore, ADT	DGET, MOLE, NewDelhi	Member

9.	R. Malathi, TO	RVTI(W), Bangalore	Member
10.	D K Ojha, DDT	ATI-EPI, Dehradun	Member
11.	DM Basha, TO	ATI, Mumbai	Member
12.	AshwiniKoli, JTA	RVTI (W), Bangalore	Member
13.	H N Bargal, TO	ITI, Mumbai	Member
14.	R S Nemade, TO	ITI, Mumbai	Member
15.	Z A Gadyal, JTO	ITI, Belgaum	Member
16.	M V Pillai, GI	ITI, Thane	Member

**TRADE: ELECTRONICS MECHANIC****LIST OF TOOLS & EQUIPMENTS FOR 20 TRAINEES + 1****A. TRAINEES TOOL KIT FOR 20 TRAINEES +1 INSTRUCTOR ( common for all semesters )**

<b>SI No.</b>	<b>Names of the Items</b>	<b>Quantity</b>
1.	Connecting screwdriver 100 mm	10 Nos
2.	Neon tester 500 V.	6 Nos
3.	Screw driver set (set of 5 )	10 Nos
4.	Insulated combination pliers 150 mm	6 Nos
5.	Insulated side cutting pliers 150 mm	8 Nos
6.	Long nose pliers 150 mm	6 Nos
7.	Soldering iron 25 W. 240 V.	10 Nos
8.	Electrician knife	6 Nos
9.	Tweezers 100mm	10 Nos
10.	Digital Multimeter (3 ½ digit)	10 Nos
11.	Soldering Iron Changeable bits 10 W	6 Nos
12.	De- soldering pump	10 Nos

**B. General Machinery Shop outfit (common for all semesters )**

<b>SI.No</b>	<b>Name of the items</b>	<b>Quantity</b>
1.	Steel rule 300mm	4 Nos
2.	Steel measuring tape-3 m	4 Nos
3.	Tools makers vice 100mm (clamp)	1 Nos
4.	Tools maker vice 50mm (clamp)	1 Nos
5.	Crimping tool (pliers)	2 Nos
6.	Magneto spanner set	2 Nos
7.	File flat 200mm bastard	2 Nos
8.	File flat 200mm second cut	2 Nos
9.	File flat 200mm smooth	2Nos
10.	100mm flat pliers	4 Nos
11.	100mm round Nose pliers	4 Nos
12.	Scriber straight 150mm	2 Nos
13.	Hammer ball pen 0.5Kg	1 No
14.	Allen key set (set of 9)	1 No
15.	Tubular box spanner (set of 6Nos)	1 set
16.	Magnifying lenses 75mm	2 Nos
17.	Continuity tester	6 Nos
18.	Hacksaw frame adjustable	2 Nos
19.	Cold chisel 20mm	1 No
20.	Scissors 200mm	1 No

21.	Handsaw 450mm	1 No
22.	Hand Drill Machine	2 Nos
23.	First aid kit	1 No
24.	Fire Extinguisher	2 Nos
25.	Bench Vice	1 No

### C. Tools and equipment of semester I and II

1	Dual DC regulated power supply 30-0-30 V, 2 Amps	4 Nos
2	DC regulated variable power supply 0-24 V, 1Amp	2 Nos
3	LCR meter (Digital)	1 No
4	CRO Dual Trace 20 MHz (component testing facilities)	2 Nos
5	Signal Generator, 0-100 KHz	2 Nos
6	Battery Charger	1 No
7	Analogmultimeter	4 Nos
8	Function generator (Triangular, square and sine wave)	2 Nos
9	Or ELECTRONIC WORK BENCH Instead of sr no's ( 26,27,29,31,34 )	2 Nos
10	Dimmer start 3 Amps	2 Nos
11	Analog Component Trainer	4 Nos
12	Op Amp trainer	3 Nos
13	Digital IC Trainer	4 Nos
14	Digital IC Tester	1 No
15	Digital and Analog Bread Board Trainer	6 Nos
16	Rheostats various values and ratings	2 Nos
17	POWER ELECTRONICS TRAINER with at least 6 no's of onboard applications	4 No
18	Computers in the assembled form (including cabinet, motherboards, HDD, DVD, SMPS, Monitor, KB, Mouse, LAN card, Blu-Ray drive and player), MS Office education version.	4 Nos
19	Laptops latest configuration	1 No
20	Laser jet Printer	1 No
21	INTERNET BROADBAND CONNECTION	1 No
22	Electronic circuit simulation software with 6 user licenses	1 No
23	Different types of electronic and electrical cables, connectors, sockets, terminations.	As required
24	Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB	As required
25	Crimping tools as necessary for performing terminations mentioned week no 17-21 of SEMSTER-1	As required

### E. Tools and Equipments for III semester

SI No.	Names of the Items	Quantity
1	DSO ( colour)	1 No
2	Soldering & De soldering Station	1 No
3	SMD Soldering & De soldering Station with necessary accessories	2 Nos
4	DOL starter	1 No
5	AC motor ¼ HP	1 No
6	<b>OrELECTRICAL TRAINER FITTED WITH RESOURCES MENTIONED AT SI No ( DOL starter, contactors, relays, MCB, Motor suitable for electrical control circuit exercises)</b>	2 Nos
7	Frequency modulator and Demodulator trainer kit	2 Nos
8	PAM, PPM,PWM trainer kit	2 Nos
10	AM/FM Commercial radio receivers	2 Nos
11	Microcontroller kits (8051) along with programming software (Assembly level Programming)	4 Nos
12	Application kits for Microcontrollers 6 different applications	1 set
13	Sensor trainer kit ( containing Various sensors like Thermocouple, RTD, Thermocouple, load cell, strain gauge, LVDT, smoke sensors, speed sensor )	2 Nos
14	Various analog and digital ICs useful for doing project works mentioned in the digital and analog IC applications modules	As required
15	Different types of electronic and electrical cables, connectors, sockets, terminations.	As required

## F. Tools and equipments for IV semester

Sl.No.	Name of the items	Quantity
1.	Fiber optic communication trainer	2 Nos
2.	Seven segment DPM	6 Nos
3.	LCD based DPM	6 Nos
4.	SMPS of different make	4 Nos
5.	UPS trainer	1No
6.	UPS 3 KVA with backup time minimum 30 minutes	1 No
7.	Mobile phone (different models) at least one 3 G mobile	3 Nos
8.	Smart phones of different make (android/Windows)	4 Nos
9.	Precision set of screw drivers- T5, T6, T7	2 Nos
10.	Tweezers – Bend tip	2 Nos
11.	Cell phone power source with charger chords for different cell phones	1 No
12.	LCD TV (Trainer kit )	1 No
13.	LCD TV (21’')	2 No
14.	LED TV (Trainer kit )	1 No
15.	LED TV (21’')	2 No
16.	Home theatre system	1No
17.	Solar Power Inverter 500VA	1 No
18.	LED lighting system	2 sets

**F.WORKSHOP FURNITURE:**

<b>Sl.No</b>	<b>Name of the items</b>	<b>Quantity</b>
1	Instructor's table	1 No
2	Instructor's chair	2 Nos
3	Metal Rack, 100cm x 150cm x 45cm	4 Nos
4	Lockers with 16 drawers standard size	2 Nos
5	Steel Almirah, 2.5 m x 1.20 m x 0.5 m	2 Nos
6	Black board/white board	1 No

**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.