

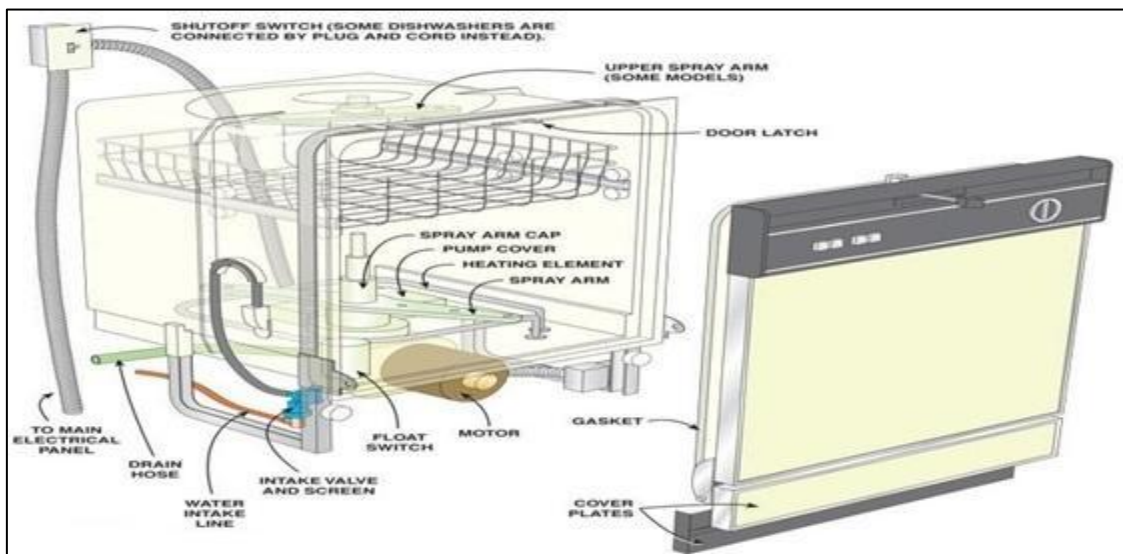


GOVERNMENT OF INDIA  
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP  
DIRECTORATE GENERAL OF TRAINING

**COMPETENCY BASED CURRICULUM**  
**MECHANIC CONSUMER ELECTRONIC**  
**APPLIANCES**

(Duration: Two Years)

**CRAFTSMEN TRAINING SCHEME (CTS)**  
**NSQF LEVEL- 4**



**SECTOR – ELECTRONICS & HARDWARE**

**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**  
Kolkata-700091

# MECHANIC CONSUMER ELECTRONIC APPLIANCES

(Engineering Trade)

(Revised in August 2025)

Version: 3.0

**CRAFTSMEN TRAINING SCHEME (CTS)**

**NSQF LEVEL: 4**



Directorate General of Training

Developed By

**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**

Directorate General of Training

Ministry of Skill Development and Entrepreneurship

EN-81, Sector-V, Salt Lake City,

Kolkata – 700 091

[www.cstaricalcutta.gov.in](http://www.cstaricalcutta.gov.in)

## CONTENTS

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S no.	Topics	Page No.
1.	Course Information	1
2.	Training System	2
3.	Job Role	6
4.	General Information	9
5.	Learning Outcome	11
6.	Assessment Criteria	15
7.	Trade Syllabus	26
8.	Annexure I (List of Trade Tools & Equipment)	60
9.	Annexure II (List of Contributors)	73
10.	Annexure III (Abbreviations)	77

## 1. COURSE INFORMATION

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During the two years duration of Electronics Mechanic trade, a candidate is trained on Professional Skill, Professional Knowledge and Employability Skill related to job roles. In addition to this, a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered under Professional skill subject are as below: -

**FIRST YEAR:** In the first year, students will gain foundational hands-on experience in workshop operations, including fitting, riveting, and drilling, while adhering to standard safety practices. They will learn to perform electrical and electronic measurements, calibrate single-range meters, and test various batteries to estimate repair costs. Training includes the use of Digital Storage Oscilloscopes (DSO) and other measuring instruments to analyze and compare component parameters. Learners will develop skills in PCB design and printing, as well as in soldering, de-soldering, and assembling basic electronic circuits such as power supplies and control systems. They will install and configure computer systems and apply software tools for circuit simulation and analysis. The course also emphasizes construction and testing of analog, digital, and power electronic circuits, working with sensors, opto-electronic components, and ICs like 741 and 555. Additionally, students will apply basic mathematics, science, and engineering drawing concepts relevant to their technical field, culminating in the planning and execution of a practical project for domestic or commercial applications.

**SECOND YEAR:** In the second year, students will advance their technical expertise by identifying, soldering, desoldering, and testing various SMD components and IC packages using proper tools and safety protocols. They will prepare, crimp, and test industry-relevant cables, and assemble commercial AM/FM receivers to assess performance. The course covers servicing and troubleshooting of programmable systems, SMPS, UPS, inverters, and various modules of Smart and LED TVs. Students will install and configure LCD/LED projectors, DTH systems, CCTV setups, and troubleshoot home theatre systems. Emphasis is given to understanding and maintaining modern appliances like dishwashers, smart locks, and automated home systems. Learners will also explore integration of AI, smart devices, fuzzy logic, and mobile phone technology (4G/5G) in home automation and communication systems. Throughout the year, they will work on selecting, assembling, and evaluating domestic/commercial projects, while continuing to apply engineering drawing, basic mathematics, and science principles in real-world applications.

## **2. TRAINING SYSTEM**

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### **2.1 GENERAL**

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

The Mechanic Consumer Electronic Appliances trade under CTS is one of the popular newly designed courses. The earlier course was Mechanic Consumer Electronics. The course is of two years duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skill, knowledge and life skills. After passing out the training program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

#### **Trainee broadly needs to demonstrate that they are able to:**

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

### **2.2 PROGRESSION PATHWAYS:**

- Can join industry as Technician and will progress further as Senior Technician, Supervisor and can rise to the level of Manager.
- Can become Entrepreneur in the related field.
- Can appear in 10+2 examination through National Institute of Open Schooling (NIOS) for acquiring higher secondary certificate and can go further for General/ Technical education.
- Can take admission in the diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programs in different types of industries leading to a National Apprenticeship certificate (NAC).

## Mechanic Consumer Electronic Appliances

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming an instructor in ITIs.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

### 2.3 COURSE STRUCTURE:

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

S No.	Course Element	Notional Training Hours	
		1 <sup>st</sup> Year	2 <sup>nd</sup> Year
1	Professional Skill (Trade Practical)	840	840
2	Professional Knowledge (Trade Theory)	240	300
3	Employability Skills	120	60
<b>Total</b>		<b>1200</b>	<b>1200</b>
On the Job Training (OJT)/ Group Project *		150	150
Optional Courses**		240	240
<b>Grand Total</b>		<b>1590</b>	<b>1590</b>

\* The trainee has to undergo 150 hours of mandatory OJT (On the Job Training) at nearby industry or wherever industry not available then group project has to be done with the supervision of the trade instructor for every year.

\*\* Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for obtaining 10th/ 12th class certificate from NIOS along with ITI certification, or, short term courses for extra skills/knowledge.

### 2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his/her skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute has to maintain an individual trainee portfolio as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on [www.cstaricalcutta.gov.in](http://www.cstaricalcutta.gov.in) or [www.bharatskills.gov.in](http://www.bharatskills.gov.in)

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

**Mechanic Consumer Electronic Appliances**

**examiner during final examination will also check** the individual trainee’s profile as detailed in assessment guideline before giving marks for practical examination.

**2.4.1 PASS REGULATION**

For the purposes of determining the overall result, weightage of 100% is applied for six months and one-year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percentage for Trade Practical and Formative assessment are 60% & for all other subjects are 33%.

**2.4.2 ASSESSMENT GUIDELINE**

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking 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 Occupational, Safety, Health and Environment (OSHE) and self-learning attitude to be considered while assessing competency.

Assessment will be evidence based comprising some of the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work
- Computer based multiple choice question examination
- Practical Examination

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

Marks Allotted during Assessment	Performance Level	Evidence
Marks between 60% to 75%	For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship	<ul style="list-style-type: none"> <li>• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment.</li> <li>• 60-70% accuracy achieved while</li> </ul>

### **Mechanic Consumer Electronic Appliances**

	with occasional guidance, and due regard for safety procedures and practices.	<p>undertaking different work with those demanded by the component/job.</p> <ul style="list-style-type: none"> <li>• A fairly good level of neatness and consistency in the finish.</li> <li>• Occasional support in completing the project/job.</li> </ul>
Marks above 75% to 90%	For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices.	<ul style="list-style-type: none"> <li>• Good skill levels in the use of hand tools, machine tools and workshop equipment.</li> <li>• 70-80% accuracy achieved while undertaking different work with those demanded by the component/job.</li> <li>• A good level of neatness and consistency in the finish.</li> <li>• Little support in completing the project/job.</li> </ul>
Marks Above 90%	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.	<ul style="list-style-type: none"> <li>• High skill levels in the use of hand tools, machine tools and workshop equipment.</li> <li>• Above 80% accuracy achieved while undertaking different work with those demanded by the component/job.</li> <li>• A high level of neatness and consistency in the finish.</li> <li>• Minimal or no support in completing the project.</li> </ul>

## 3. JOB ROLE

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### **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, transmitters, and telemetering 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.

**Solar Panel Installation Technician;** is also known as 'Panel Installer', the Solar Panel Installation Technician is responsible for installing solar panels at the customers' premises. The individual at work checks the installation site, understands the layout requirement as per design, assesses precautionary measures to be taken, installs the solar panel as per customer's requirement and ensures effective functioning of the system post installation.

**Optical Fibre Technician;** is responsible for maintaining uptime and quality of the network segment (both optical media and equipment) assigned to him by undertaking periodic preventive maintenance activities and ensuring effective fault management in case of fault occurrence. He is also required to coordinate activities for installation and commissioning of Optical Fibre Cable (OF) as per the route plan.

**Field Technician: UPS and Inverter;** is also called, 'UPS Repair Technician', this is an after-sales service job for installing and providing support to customers of different types of UPS and inverters. The individual at work installs the newly purchased UPS or inverter. The individual also and interacts with customers to diagnose problems in them, assesses possible causes, rectifies faults or replaces faulty modules or recommends factory repairs for bigger faults as per the route plan. Installation, service, repair and overhaul radio sets service centre. May install television sets.

## **Mechanic Consumer Electronic Appliances**

**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 clean and maintain tools, test equipment.

**Television Repair Technician;** job role is applicable to both Television manufacturing facilities as well as electronics service centres. This role pertains to rectifying faults identified during testing of TV on in manufacturing process and providing after sales assistance and ensuring appropriate functioning of television sets. A TV repair technician identifies the section in the TV that is not functioning. If the problem identified is in the Printed Circuit Board (PCB), the technician identifies the specific fault in the PCB and corrects it. Replaces the dysfunctional PCB with a new one, if the damage identified requires fixing at the service centre.

**DTH Set-Top Box Installer and Service Technician;** installs set-top boxes and provides after sales service for Direct to Home (DTH) system. The individual at work installs the set-top box at customers' premises; addresses the field serviceable complaints and co-ordinates with the technical team for activation of new connections.

**Field Technician, Washing Machine** is also, called 'Washing Machine Repair Technician'. This job is about providing after sales service to customers. The individual at work installs the washing machine, interacts with customers to diagnose the problem and assesses possible causes of fault reported. Once the problem and causes have been identified, the individual rectifies minor problems or replaces faulty modules for failed parts or recommends factory repairs for bigger faults.

**Field Technician, Other Home Appliances;** is also called, 'Home Appliance Repair Technician', this is an after-sales service job for installing and providing support to the water purifier, mixer/grinder buyers. The individual at work installs the appliance and interacts with customers to diagnose the problem and possible causes. Once the problem and causes have been identified, the individual rectifies minor problems or replaces faulty modules for failed parts or recommends factory repairs for bigger faults.

**Access Controls Installation Technician;** Also called 'Access Control Device Installer', the Access Control Installation Technician provides after sale support services for access control devices and systems such as point of sale scanners, fingerprint or iris scan. The individual at work is responsible for installing the access control system at the customer's premises. The individual undertakes site assessment, installs the hardware and integrates the system to meet customer's requirement.

## **Mechanic Consumer Electronic Appliances**

**Field Engineer TV** is also called, 'Service Engineer – TV', the TV Field Engineer provides installation and after sales service to buyers of TV and other consumer electronic products such as home theatre system, DVD and Blue-ray players, audio systems, headphones etc. The individual at work interacts with customers to install the entertainment system and diagnose any problems to assess possible causes of malfunction. Once the problem and causes have been identified, the individual rectifies minor problems or replaces faulty modules for failed parts or recommends factory repairs for bigger faults.

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-2015:**

- (i) 7421.0100 - Electronics Fitter, General
- (ii) 7421.0200 - Electronics Fitters, Other
- (iii) 7421.0300 - Electronic Mechanic
- (iv) 7421.1401 - Solar Panel Installation Technician
- (v) 7422.0801 - Optical Fibre Technician
- (vi) 7421.0801 - Field Technician: UPS and Inverter
- (vii) 7422.1200 - Cable Television Installer
- (viii) 7422.1302 - Television Repair Technician
- (ix) 7422.1202 - DTH Set-Top Box Installer and Service Technician
- (x) 7421.0601 - Field Technician: Washing Machine
- (xi) 7421.0701 - Field Technician: Other Home Appliances
- (xii) 7411.0102 - CCTV Installation Technician
- (xiii) 7421.1302 - Field Engineer TV

### **Reference NOS:**

- |                  |                    |
|------------------|--------------------|
| (i) ELE/N9470    | (xviii) PSS/N9401  |
| (ii) ELE/N9471   | (xix) PSS/N9402    |
| (iii) ELE/N9472  | (xx) ELE/N9521     |
| (iv) ELE/N9440   | (xxi) ELE/N9520    |
| (v) ELE/N9517    | (xxii) ELE/N9442   |
| (vi) ELE/N9530   | (xxiii) ELE/N9443  |
| (vii) ELE/N9516  | (xxiv) ELE/N9534   |
| (viii) ELE/N9441 | (xxv) ELE/N9525    |
| (ix) SSC/N9408   | (xxvi) ELE/N9528   |
| (x) ELE/N9523    | (xxvii) ELE/N9529  |
| (xi) ELE/N9436   | (xxviii) ELE/N9535 |
| (xii) ELE/N9437  | (xxix) ELE/N9536   |
| (xiii) ELE/N9444 | (xxx) ELE/N9537    |
| (xiv) ELE/N9438  | (xxxi) ELE/N9446   |
| (xv) ELE/N9518   | (xxxii) ELE/N9538  |
| (xvi) ELE/N9519  | (xxxiii) ELE/N9539 |
| (xvii) ELE/N9439 | (xxxiv) ELE/N9540  |

## 4. GENERAL INFORMATION

<b>Name of the Trade</b>	<b>MECHANIC CONSUMER ELECTRONIC APPLIANCES</b>
<b>Trade Code</b>	DGT/1066
<b>NCO – 2015</b>	7421.0100, 7421.0200, 7421.0300, 7421.1401, 7422.0801, 7421.0801, 7422.1200, 7422.1302, 7422.1202, 7421.0601, 7421.0701, 7411.0102, 7421.1302
<b>NOS Covered</b>	ELE/N9470, ELE/N9471, ELE/N9472, ELE/N9440, ELE/N9517, ELE/N9530, ELE/N9516, ELE/N9441, SSC/N9408, ELE/N9523, ELE/N9436, ELE/N9437, ELE/N9444, ELE/N9438, ELE/N9518, ELE/N9519, ELE/N9439, PSS/N9401, PSS/N9402, ELE/N9521, ELE/N9520, ELE/N9442, ELE/N9443, ELE/N9534, ELE/N9525, ELE/N9528, ELE/N9529, ELE/N9535, ELE/N9536, ELE/N9537, ELE/N9446, ELE/N9538, ELE/N9539, ELE/N9540
<b>NSQF Level</b>	Level-4
<b>Duration of the Trade</b>	Two Years
<b>Entry Qualification</b>	Passed 10th class examination with Science and Mathematics or with vocational subject in same sector or its equivalent.
<b>Minimum Age</b>	14 years as on first day of academic session.
<b>Eligibility for PwD</b>	LD, LC, DW, AA, LV, DEAF, AUTISM, SLD
<b>Unit Strength (No. Of Students)</b>	24 (There is no separate provision of supernumerary seats)
<b>Space Norms</b>	56 Sq m
<b>Power Norms</b>	3.04 KW
<b>Instructors Qualification for:</b>	
<b>1. Mechanic Consumer Electronic Appliances Trade</b>	<p>B.Voc/Degree in Electronics / Electronics and Telecommunication/ Electronics and communication Engineering from AICTE/UGC recognized Engineering College/ university with <b>one year of teaching or industry experience</b> in the Electronics field.</p> <p style="text-align: center;"><b>OR</b></p> <p>03 years Diploma in Electronics / Electronics and telecommunication/ Electronics and communication from AICTE /recognized board of technical education <b>two years of teaching or industry experience</b> in the Electronics field.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/NAC passed in the Trade of "Mechanic Consumer Electronics Appliances" with <b>three years of teaching or industry experience</b> in the Electronics field.</p> <p><b>Essential Qualification:</b> Regular/ RPL variants of National Craft Instructor Certificate (NCIC) in "Mechanic Consumer Electronics Appliances" trade under DGT.</p> <p><b>NOTE: Out of two Instructors required for the unit of 2 (1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.</b></p>

	<b>However, both of them must possess NCIC in any of its variants.</b>
<b>2. Workshop Calculation &amp; Science</b>	<p>B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with <b>one-year of teaching or industry experience.</b></p> <p style="text-align: center;"><b>OR</b></p> <p>03 years Diploma in Engineering from AICTE / recognized board of technical education with <b>two years' of teaching or industry experience.</b></p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/ NAC in any one of the engineering trades with <b>three years' of teaching or industry experience.</b></p> <p><b><u>Essential Qualification:</u></b> Regular / RPL variants of National Craft Instructor Certificate (NCIC) in any one of the engineering trades or RoDA.</p>
<b>3. Engineering Drawing</b>	<p>B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with <b>one-year of teaching or industry experience.</b></p> <p style="text-align: center;"><b>OR</b></p> <p>03 years Diploma in Engineering from AICTE / recognized board of technical education with <b>two years' teaching or industry experience.</b></p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/ NAC in any one of the engineering/ Draughtsman group of trades with <b>three years' of teaching or industry experience.</b></p> <p><b><u>Essential Qualification:</u></b> Regular / RPL variants of National Craft Instructor Certificate (NCIC) in any one of the engineering trades or RoDA.</p>
<b>4. Employability Skill</b>	<p>MBA/ BBA / Any Graduate/ Diploma in any discipline with <b>Two years' of teaching or industry experience with short term ToT Course</b> in Employability Skills conducted by DGT institutions. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above)</p> <p style="text-align: center;"><b>OR</b></p> <p>Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills conducted by DGT institutions.</p>
<b>5. Minimum Age for Instructor</b>	21 Years
<b>List of Tools and Equipment</b>	As per Annexure – I

## 5. LEARNING OUTCOME

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

### 5.1 LEARNING OUTCOMES

Sl. No.	NOS CODE	Learning Outcome	Duration		
			Practical	Theory	Total
<b>FIRST YEAR</b>					
1.	ELE/N9470	Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety following safety precautions.	40	05	45
2.	ELE/N9471	Select and perform electrical/electronic measurement of single range meters and calibrate the instrument under given conditions.	22	08	30
3.	ELE/N9472	Test & service different batteries used in electronic applications and record the data to estimate repair cost.	22	08	30
4.	ELE/N9440	Measure the various parameters by DSO and execute the result with standard one.	24	06	30
5.	ELE/N9517	Test various electronic components using proper measuring instruments and compare the data using standard parameter.	74	16	90
6.	ELE/N9530	Design PCB & Print using PCB printing machine.	25	05	30
7.	ELE/N9516	Plan and execute soldering & de- soldering of various electrical components like Switches, PCB & Transformers for electronic circuits.	09	06	15
8.	ELE/N9517	Assemble simple electronic power supply circuit and test for functioning.	37	08	45
9.	ELE/N9441	Construct different electrical control circuits and test for their proper functioning with due care and safety.	36	09	45
10.	SSC/N9408	Install, configure and interconnect given computer system(s) and Laptop. Use application packages for different application.	75	15	90

11.	ELE/N9523	Plan and carry out the selection of a project, assemble the project and evaluate performance for a domestic/ commercial application.	52	08	60
12.	ELE/N9436	Construct, test and verify the input/ output characteristics of various analog circuits.	75	15	90
13.	ELE/N9437	Plan and construct different power electronic circuits and analyse the circuit functioning.	63	12	75
14.	ELE/N9444	Execute the operation of different process sensors, identify, wire & test various sensors of different industrial processes by selecting appropriate test instruments.	50	10	60
15.	ELE/N9438	Select the appropriate opto- electronics components and verify the characteristics in different circuit.	20	10	30
16.	ELE/N9518	Assemble, test and troubleshoot various digital circuits.	118	17	135
17.	ELE/N9519	Simulate and analyze the analog and digital circuits using electronic simulator software.	48	12	60
18.	ELE/N9439	Construct and test different circuits using ICs 741 operational amplifiers & ICs 555 linear integrated circuits and execute the result.	50	10	60
19.	PSS/N9401	Read and apply engineering drawing for different application in the field of work.	-	30	30
20.	PSS/N9402	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	-	30	30
<b>Employability Skills</b>			-	<b>120</b>	<b>120</b>
<b>Total</b>			<b>840</b>	<b>360</b>	<b>1200</b>
<b>Second Year</b>					
21.	ELE/N9521	Identify, place, solder and desolder and test different SMD discrete components and ICs package with due care and following safety norms using proper tools/setup.	35	10	45
22.	ELE/N9520	Prepare, crimp, terminate and test various cables used in different electronics industries.	31	14	45
23.	ELE/N9442	Assemble and test a commercial AM/ FM receiver and evaluate performance.	46	14	60

24.	ELE/N9443	Test, service and troubleshoot the various components of different domestic/ industrial programmable systems.	60	15	75
25.	ELE/N9523	Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications.	100	20	120
26.	ELE/N9534	Demonstrate applications, and integration of AI, SMART devices, and fuzzy logic in modern home appliances for enhanced functionality and automation.	24	06	30
27.	ELE/N9525	Detect the faults and troubleshoot SMPS, UPS and inverter.	90	30	120
28.	ELE/N9528	Identify, operate various controls, trouble shoot and replace modules of the Smart Hd TV & LED TV & its remote.	90	30	120
29.	ELE/N9529	Install /configure, various control adjustment of the display, troubleshoot and secure LCD/LED projector.	25	05	30
30.	ELE/N9535	Install a DTH system by proper selection of site, assembling of different parts/ accessories and troubleshoot the system.	25	05	30
31.	ELE/N9536	Dismantle, identify the parts, control circuits, sensors of a various domestic appliances. Estimate and troubleshoot.	50	10	60
32.	ELE/N9537	Install a CCTV system and configure the system for surveillance function.	50	10	60
33.	ELE/N9446	Identify, operate various controls play switches, troubleshoot and replace faulty boards of a home theatre and its remote.	45	15	60
34.	ELE/N9538	Interpret the construction, working principle, and electronic control systems of a dishwasher used in modern home appliances.	40	05	45
35.	ELE/N9539	Interpret the operation, components, and installation of smart locks and doors with electronic access control systems for enhanced home security.	40	05	45
36.	ELE/N9534	Interpret the concept, components and functioning of home automation systems for controlling and monitoring household electronic appliances.	40	05	45

**Mechanic Consumer Electronic Appliances**

37.	ELE/N9540	Demonstrate 4G/5G mobile phones and their components provides practical insights into modern communication technology, showcasing key parts like the motherboard, antenna, SIM module, and display unit.	49	11	60
38.	PSS/N9401	Read and apply engineering drawing for different application in the field of work.	-	45	45
39.	PSS/N9402	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	-	45	45
<b>Employability Skills</b>			-	<b>60</b>	<b>60</b>
<b>Total</b>			<b>840</b>	<b>360</b>	<b>1200</b>
<b>Grand Total</b>			<b>1680</b>	<b>720</b>	<b>2400</b>

## 6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
<b>FIRST YEAR</b>	
<p>1. Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care &amp; safety following safety precautions. (NOS: ELE/N9470)</p>	<ul style="list-style-type: none"> <li>• Identify basic hand tools for fitting, riveting, drilling etc. with due care and safety.</li> <li>• Fix surface mounting type of accessories in a panel board.</li> <li>• Connect electrical accessories.</li> <li>• Make and wire up of a test board and test it.</li> </ul>
<p>2. Select and perform electrical/electronic measurement of single range meters and calibrate the instrument under given conditions. (NOS: ELE/N9471)</p>	<ul style="list-style-type: none"> <li>• Plan work in compliance with standard safety norms.</li> <li>• Identify the type of electronic instruments.</li> <li>• Determine the measurement errors while measuring resistance by voltage drop method.</li> <li>• Extend the range of MC voltmeter and ammeter.</li> <li>• Measure the value of resistance, voltage and current using digital multimeter.</li> <li>• Calibrate analog multimeter.</li> </ul>
<p>3. Test &amp; service different batteries used in electronic applications and record the data to estimate repair cost. (NOS: ELE/N9472)</p>	<ul style="list-style-type: none"> <li>• Identify tools and instruments for testing of batteries.</li> <li>• Observe safety procedure during testing of batteries and work as per standard norms and company guidelines.</li> <li>• Identify the primary and secondary cells.</li> <li>• Measure and test the voltages of the given cells/battery using analog/ digital multimeter.</li> <li>• Charging and discharging the battery.</li> <li>• Maintain and estimate the repair cost of secondary battery.</li> <li>• Use a hydrometer to measure the specific gravity of the secondary battery.</li> </ul>
<p>4. Measure the various parameters by DSO and execute the result with standard one. (NOS: ELE/N9440)</p>	<ul style="list-style-type: none"> <li>• Identify and demonstrate various control elements on front panel of a DSO.</li> <li>• Measure different parameters of electronic signals using DSO.</li> <li>• Store the waveform of a signal in DSO.</li> <li>• Connect DSO with a printer and take printout of signal waveforms.</li> </ul>

<p>5. Test various electronic components using proper measuring instruments and compare the data using standard parameter. (NOS: ELE/N9517)</p>	<ul style="list-style-type: none"> <li>• Ascertain and select tools and materials for the job and make this available for use in a timely manner.</li> <li>• Plan work in compliance with standard safety norms.</li> <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>• 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> </ul>
<p>6. Design PCB &amp; Print using PCB printing machine. (NOS: ELE/N9530)</p>	<ul style="list-style-type: none"> <li>• Convert schematics into PCB layouts, apply design rules, and generate Gerber files and understand the conversion of Gerber file to G-code.</li> <li>• Set up and run a PCB printing machine, including material loading, alignment, and basic troubleshooting.</li> <li>• Inspect for defects and perform continuity and functionality tests on completed PCBs.</li> <li>• Develop accurate circuit diagrams using PCB design software.</li> </ul>
<p>7. Plan and execute soldering &amp; de- soldering of various electrical components like Switches, PCB &amp; Transformers for electronic circuits. (NOS: ELE/N9516)</p>	<ul style="list-style-type: none"> <li>• Perform soldering on different electronic components, small transformer and lugs.</li> <li>• Demonstrate soldering on IC bases and PCBs.</li> <li>• Perform de-soldering using pump and wick.</li> <li>• Join the broken PCB track and test.</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>8. Assemble simple electronic power supply circuit and test for functioning. (NOS: ELE/N9517)</p>	<ul style="list-style-type: none"> <li>• Practice soldering on components, lug and board with safety.</li> <li>• Identify the passive/active components by visual appearance, Code number and test for their condition.</li> <li>• Identify the control and functional switches in CRO and measure the D.C. &amp; A.C. voltage, frequency and time period.</li> <li>• Construct and test a half &amp; full wave rectifier with and without filter circuits.</li> <li>• Construct and test a bridge rectifier with and without filter</li> </ul>

	<p>circuits.</p> <ul style="list-style-type: none"> <li>• Construct and test a Zener based voltage regulator circuit.</li> </ul>
<p>9. Construct different electrical control circuits and test for their proper functioning with due care and safety. (NOS: ELE/N9441)</p>	<ul style="list-style-type: none"> <li>• Identify different types of fuses along with fuse holders, overload (no volt coil), current adjust (Biometric strips to set the current).</li> <li>• Test the given MCBs.</li> <li>• Connect an ELCB and test the leakage of an electrical motor control circuit.</li> <li>• Measure the coil winding resistance of the given motor.</li> <li>• Prepare the setup of DOL starter and control an induction motor.</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>10. Install, configure and interconnect given computer system(s) and Laptop. Use application packages for different application. (NOS: SSC/N9408)</p>	<ul style="list-style-type: none"> <li>• Plan, work in compliance with standard safety norms.</li> <li>• Select hardware and software component.</li> <li>• Install and configure operating systems and applications.</li> <li>• Integrate IT systems into networks.</li> <li>• Deploy tools and test programmes.</li> <li>• Avoid e-waste and dispose the waste as per the procedure.</li> </ul>
<p>11. Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications. (NOS: ELE/N9523)</p>	<ul style="list-style-type: none"> <li>• Plan, analyze and estimate the cost of the particular project.</li> <li>• Identify the various tools required for the job.</li> <li>• Prepare the simple digital/analog electronic circuit.</li> <li>• Simulate and test the prepared circuit.</li> <li>• Assemble and test the circuit.</li> </ul>
<p>12. Construct, test and verify the input/ output characteristics of various analog circuits. (NOS: ELE/N9436)</p>	<ul style="list-style-type: none"> <li>• Ascertain and select tools and instruments for carrying out the jobs.</li> <li>• Plan and work in compliance with standard safety norms.</li> <li>• Practice on soldering components on lug board with safety.</li> <li>• Identify the passive/active components by visual appearance, code number and test for their condition.</li> <li>• Construct and test the transistor-based switching circuit.</li> <li>• Construct and test CB, CE &amp; CC amplifier circuit.</li> <li>• Ascertain the performance of different oscillator circuits.</li> <li>• Construct and test clipper, clamper and Schmitt trigger circuit.</li> </ul>

<p>13. Plan and construct different power electronic circuits and analyze the circuit functioning. (NOS: ELE/N9437)</p>	<ul style="list-style-type: none"> <li>• Construct and test of Transistor and JFET amplifiers, oscillators and multi-vibrators.</li> <li>• Construct and test a UJT as relaxation oscillator.</li> <li>• Construct and test lamp dimmer using TRIAC/DIAC with safety.</li> <li>• Construct and test MOSFET, IGBT test circuit and apply for suitable operation with proper safety.</li> <li>• Construct and test the universal motor speed controller using SCR with safety.</li> <li>• Construct and test a switching circuit using optical devices.</li> </ul>
<p>14. Execute the operation of different process sensors, identify, wire &amp; test various sensors of different industrial processes by selecting appropriate test instruments. (NOS: ELE/N9444)</p>	<ul style="list-style-type: none"> <li>• Ascertain and select tools, material for the job and make this available for use in the timely manner.</li> <li>• Plan work in compliance with safety norms.</li> <li>• Demonstrate possible solution and agree task within the team.</li> <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 DC voltage of a LVDT.</li> <li>• Detect different objectives using capacitive, inductive and photoelectric proximity sensors.</li> </ul>
<p>15. Select the appropriate opto-electronics components and verify the characteristics in different circuit. (NOS: ELE/N9438)</p>	<ul style="list-style-type: none"> <li>• Plan work in compliance with standard safety norms.</li> <li>• Identify the different types of LEDs and IR LEDs.</li> <li>• Measure the resistance, voltage, current through electronic circuit using multimeter.</li> <li>• Construct and test a circuit using photo transistor and verify its characteristics.</li> <li>• Identify photo coupler/ optical sensor input/output terminals and measure the quantum of isolation between the terminals.</li> </ul>
<p>16. Assemble, test and troubleshoot various digital circuits. (NOS: ELE/N9518)</p>	<ul style="list-style-type: none"> <li>• Illustrate to practice the digital trainer kit with safety.</li> <li>• Identify various digital ICs, test IC using digital IC tester and verify the truth table.</li> </ul>

	<ul style="list-style-type: none"> <li>• Construct and verify the truth table of all gates using NOR and NAND gates.</li> <li>• Construct an adder cum subtractor circuits and verify the truth table.</li> <li>• Construct a decoder and encoder, multiplexer and de-multiplexer circuits and verify the truth table.</li> <li>• Construct a multiplexer and de-multiplexer and verify the truth table.</li> <li>• Construct and verify the truth table of various flip flop, counter and shift register circuits.</li> </ul>
<p>17. Simulate and analyze the analog and digital circuits using electronic simulator software. (NOS: ELE/N9519)</p>	<ul style="list-style-type: none"> <li>• Plan the work in compliance with standard procedure.</li> <li>• Prepare simple analog and digital electronic circuits using the simulator software.</li> <li>• Simulate and test the prepared analog and digital circuits.</li> <li>• Convert the prepared circuit into layout diagram.</li> <li>• Explore various trouble shooting and fault finding the resources provided in the simulation software.</li> </ul>
<p>18. Construct and test different circuits using ICs 741 operational amplifiers &amp; ICs 555 linear integrated circuits and execute the result. (NOS: ELE/N9439)</p>	<ul style="list-style-type: none"> <li>• Demonstrate analog trainer kit with safety precautions.</li> <li>• Identify various ICs, differentiate by code No. and test for their condition.</li> <li>• Construct and test various OPAMP circuits.</li> <li>• Construct and test R-2R ladder type digital to analog converter circuit.</li> <li>• Construct and test different configurations of 555 IC e.g. astable, monostable, bi-astable and VCO circuits.</li> </ul>
<p>19. Read and apply engineering drawing for different application in the field of work. (NOS: PSS/N9401)</p>	<ul style="list-style-type: none"> <li>• Read &amp; interpret the information on drawings and apply in executing practical work.</li> <li>• Read &amp; analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.</li> <li>• Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.</li> </ul>
<p>20. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of</p>	<ul style="list-style-type: none"> <li>• Solve different mathematical problems</li> <li>• Explain concept of basic science related to the field of study</li> </ul>

study. (NOS: PSS/N9402)	
<b>SECOND YEAR</b>	
<p>21. Identify, place, solder and desolder and test different SMD discrete components and ICs package with due care and following safety norms using proper tools/setup. (NOS: ELE/N9521)</p>	<ul style="list-style-type: none"> <li>• Identify the various crimping tools for various IC packages.</li> <li>• Identify different types of soldering guns and choose the suitable tip for the application.</li> <li>• Practice the soldering and de-soldering the different active and passive components, IC base on GPCBs using solder, flux, pump and wick.</li> <li>• Make the necessary setting on SMD soldering station to solder and de-solder various IC's of different packages by following the safety norms.</li> <li>• Identify SMD components, de-solder and solder the SMD components on the PCB.</li> <li>• Check the cold continuity, identify loose/dry solder and broken track on printed wired assemblies and rectify the defects.</li> <li>• Avoid waste, ascertain unused materials and components for safe disposal.</li> </ul>
<p>22. Prepare, crimp, terminate and test various cables used in different electronics industries. (NOS: ELE/N9520)</p>	<ul style="list-style-type: none"> <li>• Plan and work in compliance with standard safety norms.</li> <li>• Identify various types of cables viz. RF coaxial feeder, screened cable, ribbon cable, RCA connector cable, digital optical audio, video cable, RJ45, RJ11, Ethernet cable, fiber optic cable splicing, fiber optic cable mechanical splices, insulation, gauge, current capacity, flexibility etc. used in various electronics products, different input output sockets.</li> <li>• Identify suitable connectors, solder/ crimp/ terminate &amp; test the cable sets.</li> <li>• Check the continuity as per the marking on the connector for preparing the cable set.</li> <li>• Identify and select various connectors and cables inside the CPU cabinet of PC.</li> <li>• Identify the suitable connector and cable to connect a computer with a network switch and prepare a cross over cable to connect two networks computers.</li> </ul>
<p>23. Assemble and test a commercial AM/ FM receiver and evaluate performance. (NOS: ELE/N9442)</p>	<ul style="list-style-type: none"> <li>• Plan and select tools to assemble the receiver.</li> <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 and receiver.</li> </ul>

	<ul style="list-style-type: none"> <li>• Modulate and demodulate a signal using PAM, PPM, PWM Techniques.</li> <li>• Troubleshoot and replace the faulty components.</li> <li>• Check the functionality of AM/ FM receiver.</li> </ul>
<p>24. Test, service and troubleshoot the various components of different domestic/ industrial programmable systems. (NOS: ELE/N9443)</p>	<ul style="list-style-type: none"> <li>• Interpret the procedure as per manual of Micro controller.</li> <li>• Identity various ICs &amp; their functions on the given Microcontroller Kit.</li> <li>• Identify the address range of RAM &amp; ROM.</li> <li>• Write data into RAM &amp; observe its volatility.</li> <li>• Identify the port pins of the controller &amp; configure the ports for Input &amp; Output operation.</li> <li>• Demonstrate entering of simple programs, execute &amp; monitor the results.</li> </ul>
<p>25. Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications. (NOS: ELE/N9523)</p>	<ul style="list-style-type: none"> <li>• Plan, analyze and estimate the cost of the particular project.</li> <li>• Identify the various tools required for the job.</li> <li>• Prepare the simple digital/ analog electronic circuit.</li> <li>• Simulate and test the prepared circuit.</li> <li>• Assemble and test the circuit.</li> </ul>
<p>26. Demonstrate applications, and integration of AI, SMART devices, and fuzzy logic in modern home appliances for enhanced functionality and automation. (NOS: ELE/N9534)</p>	<ul style="list-style-type: none"> <li>• Identify various SMART appliances and their features.</li> <li>• Interpret how fuzzy logic is used to improve appliance performance and decision-making.</li> <li>• Describe how AI enhances automation and user interaction in modern electronic devices.</li> <li>• Integrate networked devices for remote control and monitoring.</li> </ul>
<p>27. Detect the faults and troubleshoot SMPS, UPS and Inverter. (NOS: ELE/N9525)</p>	<ul style="list-style-type: none"> <li>• Identify the tools and equipments to perform the job with due care and safety.</li> <li>• Dismantle the given stabilizer and find major sections/ ICs components.</li> <li>• Identify various input and output sockets/ connectors of the given SMPS.</li> <li>• Identify major sections/ ICs/components of SMPS.</li> <li>• Identify and replace the faulty components and construct and test IC Based DC-DC converter for different voltages.</li> <li>• Identify front panel control &amp; indicators of UPS.</li> </ul>

	<ul style="list-style-type: none"> <li>• Identify various circuit boards in UPS and monitor voltages at various test points.</li> <li>• Test UPS under Fault condition &amp; rectify fault.</li> <li>• Interpret the function of Inverter.</li> </ul>
<p>28. Identify, operate various controls, trouble shoot and replace modules of the Smart Hd TV &amp; LED TV &amp; its remote. (NOS: ELE/N9528)</p>	<ul style="list-style-type: none"> <li>• Ascertain and select tools and materials for the job and make this available for use in a timely manner.</li> <li>• Select measuring procedure and measuring devices, assess measurement errors and set up Smart TV /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>• Measured and checked various connectors and connect the cable operator's external decoder (set top box) to the TV.</li> <li>• Comply with safety rules when performing the above operations.</li> <li>• Monitor, evaluated and check own work and work done by others.</li> </ul>
<p>29. Install/ configure, various control adjustment of the display, troubleshoot and secure LCD/LED projector. (NOS: ELE/N9529)</p>	<ul style="list-style-type: none"> <li>• Ascertain &amp; select tools and equipment an order-related in a timely manner.</li> <li>• Identify and operate different control on LCD/ LED projector.</li> <li>• Select the proper parts use suitable cable to interface to the desktop computer, make necessary adjustment and operate.</li> <li>• Dismantle the projector and identify all major functional modules, test the power supply, exhaust fan etc.</li> <li>• Comply with safety rules when performing the above operations.</li> </ul>
<p>30. Install a DTH system by proper selection of site, assembling of different parts/ accessories and troubleshoot the system. (NOS: ELE/N9535)</p>	<ul style="list-style-type: none"> <li>• Plan &amp; setup the workplace different tools and equipment used in DTH installation procedure &amp; cabling procedure and take due care using the tools.</li> <li>• Monitor form of a surface areas a DTH system, select the site accordance with technical requirements and track for azimuth and elevation angles using SAT meter.</li> <li>• Set up the connection to STB by selecting the suitable port and cable.</li> <li>• Identify the faults in DTH system &amp; rectify.</li> <li>• Document materials, spare parts, work time and technical checks.</li> <li>• Monitor, evaluate and check own work.</li> </ul>

<p>31. Dismantle, identify the parts, control circuits, sensors of a various domestic appliances. Estimate and troubleshoot. (NOS: ELE/N9536)</p>	<ul style="list-style-type: none"> <li>• Systematically seek causes of errors and qualify defects, rectify and document such errors and defects.</li> <li>• Identify, use the controls on touch keypad of Microwave oven, dismantle, wire the Microwave oven and rectify the faults.</li> <li>• Identify the faults in the given Microwave oven &amp; rectify.</li> <li>• Dismantle and identify of various parts, sensors, wire, trace of various controls, electronic circuits, in various types of washing M/C and rectify the faults.</li> <li>• Dismantle and identify various parts, electric circuits in various types of Vacuum cleaners and rectify the faults.</li> <li>• Assemble and identify of various parts, electric circuits in various types of mixer/grinder and rectify the faults.</li> <li>• Dismantle and identify various parts of steam iron and rectify the faults.</li> <li>• Dismantle and identify the various parts, electronic circuits in of rice cooker and rectify the faults.</li> <li>• Select test methods and test equipment for various component of water purifier, dismantle, clean and replace the worn-out consumable parts following the troubleshooting manual and assemble the water purifier and install.</li> <li>• Dismantle and identify the various parts, wire and electrical and electronics circuit in Induction cook-top, replace the Induction tube (coil) in Induction cook-top.</li> <li>• Identify the different component of PA System.</li> </ul>
<p>32. Install a CCTV system and configure the system for surveillance function. (NOS: ELE/N9537)</p>	<ul style="list-style-type: none"> <li>• Identify &amp; use different tools and equipment used for installation of CCTV, handle the tools with due care and safety.</li> <li>• Identify the different CCTV components, Trace or follow the CCTV setup for any commercial installation.</li> <li>• Identify the strategic locations for the installation of cameras.</li> <li>• Plan and setup the procedure for switching the cameras to have different views.</li> <li>• Identify the connectors and sockets used on DVRs, connect CCTV Cameras to DVR, Record and Replay.</li> <li>• Dismantle DVR and identify major functional blocks and test for the healthiness.</li> <li>• Make tools, machine tools, taste measure equipment and technical equipment ready for operational use, check and maintain such tools and equipment and initiate measures for the rectify of errors.</li> </ul>

	<ul style="list-style-type: none"> <li>• Monitor, evaluate and check own work.</li> </ul>
<p>33. Identify, operate various controls, play switches, troubleshoot and replace faulty boards of a home theatre and its remote. (NOS: ELE/N9446)</p>	<ul style="list-style-type: none"> <li>• Select test methods and test use of different parts of home theatre, test the speakers, woofers &amp; tweeters.</li> <li>• Contribute to continuous improvement troubleshoot of work process in home theatre front panel.</li> <li>• Install/setup of home theatre using specific devices.</li> <li>• Identify different parts of AV receiver and rectify the faults.</li> <li>• Dismantle, identify the parts of the remote control, trace and rectify the faults of a various remote controls as home theatre.</li> <li>• Document materials, spare parts, work time and technical checks.</li> </ul>
<p>34. Interpret the construction, working principle, and electronic control systems of a dishwasher used in modern home appliances. (NOS: ELE/N9538)</p>	<ul style="list-style-type: none"> <li>• Identify the main parts and components of a dishwasher.</li> <li>• Describe the function of sensors used in dishwashers for automation and safety.</li> <li>• Interpret the step-by-step working process of a dishwasher.</li> <li>• Interpret the role of electronic control systems in managing dishwasher functions.</li> <li>• Perform basic troubleshooting and identify common faults in dishwashers.</li> <li>• Demonstrate safe handling, installation, and maintenance procedures for dishwashers.</li> </ul>
<p>35. Interpret the operation, components, and installation of smart locks and doors with electronic access control systems for enhanced home security. (NOS: ELE/N9539)</p>	<ul style="list-style-type: none"> <li>• Identify various types of smart locks and their applications.</li> <li>• Identify various components of smart locking systems.</li> <li>• Demonstrate the steps involved in installing and configuring smart locks.</li> <li>• Recognize the use of different technologies (RFID, biometrics, apps) in access control.</li> <li>• Perform troubleshooting and maintenance of smart locks.</li> <li>• Emphasize safety, privacy, and battery management in smart door systems.</li> </ul>
<p>36. Interpret the concept, components, and functioning of home automation systems for controlling and monitoring household electronic appliances. (NOS:</p>	<ul style="list-style-type: none"> <li>• Identify the sensors, actuators, and controllers in automation.</li> <li>• Describe common communication protocols and their roles in device connectivity.</li> <li>• Recognize typical applications of home automation for lighting, security, and energy control.</li> <li>• Set up and operate a basic home automation system.</li> <li>• Demonstrate security considerations and best practices for</li> </ul>

ELE/N9534)	protecting automated systems.
<p>37. The demonstration of 4G/5G mobile phones and their components provides practical insights into modern communication technology, showcasing key parts like the motherboard, antenna, SIM module, and display unit. (NOS: ELE/N9540)</p>	<ul style="list-style-type: none"> <li>• Real-Time Operation and Hardware Identification.</li> <li>• Identification and understanding of key smartphone hardware components Dual SIM interface section, Battery charging circuit, Touch screen display section, Power Management Unit, (PMU).</li> <li>• Functionality and testing of various user interface elements: Buzzer, Vibrator, Microphone (MIC) / Speaker, Hands-free module.</li> <li>• Observation of RF signals using RF Spectrum Analyzer Module.</li> <li>• Examination of power distribution and fault protection through the Power Management Unit.</li> </ul>
<p>38. Read and apply engineering drawing for different application in the field of work. (NOS: PSS/N9401)</p>	<ul style="list-style-type: none"> <li>• Read &amp; interpret the information on drawings and apply in</li> <li>• executing practical work.</li> <li>• Read &amp; analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.</li> <li>• Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.</li> </ul>
<p>39. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: PSS/N9402)</p>	<ul style="list-style-type: none"> <li>• Solve different mathematical problems.</li> <li>• Explain concept of basic science related to the field of study</li> </ul>

<b>SYLLABUS FOR MECHANIC CONSUMER ELECTRONIC APPLIANCES TRADE</b>			
<b>FIRST YEAR</b>			
<b>Duration</b>	<b>Reference Learning Outcome</b>	<b>Professional Skills (Trade Practical)</b>	<b>Professional Knowledge (Trade Theory)</b>
Professional Skill 40 Hrs.; Professional Knowledge 05 Hrs.	1. Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety following safety precautions.	<b>Trade and Orientation</b> 1. Visit to various sections of the institute and identify location of various installations. 2. Identify safety signs for danger, warning, caution & personal safety message. 3. Use of personal protective equipment (PPE). 4. Practice elementary first aid. 5. Preventive measures for electrical accidents & steps to be taken in such accidents. 6. Use of Fire extinguishers.	Familiarization with the working of Industrial Training Institute system. Importance of safety and precautions to be taken in the industry/shop floor. Introduction to PPEs. Introduction to First Aid. Response to emergencies e.g. power failure, fire, and system failure. Importance of housekeeping & good shop floor practices. Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable.
		<b>Hand tools and their uses</b> 7. Identify the different hand tools. 8. Selection of proper tools for operation and precautions in operation. 9. Care & maintenance of trade tools. 10. Practice safety precautions while working in fitting jobs. 11. Workshop practice on filing and hacks swing.	Identification, specifications, uses and maintenance of commonly used hand tools. State the correct shape of files for filing different profiles. Riveting of tags and lugs. Introduction to Electro Magnetic Interference (EMI) and Electro Magnetic Compatibility (EMC).
Professional Skill 22 Hrs.; Professional Knowledge	2. Select and perform electrical/electronic measurement of single range	<b>Basics of AC and Electrical Cables</b> 12. Identify the Phase, Neutral and Earth on power socket, use testers to monitor AC power.	Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC.

<p>08 Hrs.</p>	<p>meters and calibrate the instrument under given conditions.</p>	<p>13. Construct a test lamp and use it to check mains healthiness.            14. Measure the voltage between phase and ground and rectify earthing.            15. Identify and test different AC mains cables.            16. Prepare terminations, skin the electrical wires/cables using wire stripper and cutter.            17. Measure the gauge of the wire using SWG/AWG and outside micro-meter.            18. Refer table and find current carrying capacity of wires.            19. Crimp the lugs to wire end.            20. Measure AC and DC voltages using multi-meter.</p>	<p>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. Types of wires &amp; cables, standard wire gauge (SWG).            Classification of cables according to gauge (core size), number of conductors, material, insulation strength, flexibility etc.            Earthing and Grounding for electronics</p>
		<p><b>Single range meters</b>            21. Identify the type of meters by dial and scale marking/ symbols.            22. Demonstrate various analog/digital measuring instruments.            23. Find the minimum and maximum measurable range of the meter.            24. Carryout mechanical zero setting of a meter.            25. Check the continuity of wires, meter probes and fuse etc.            26. Measure voltage and current using clamp meter.</p>	<p>Introduction to electrical and electronic measuring instruments.            Basic principle and parts of simple meters.            Specifications, symbols used in dial and their meaning.</p>
<p>Professional Skill 22 Hrs.;             Professional Knowledge 08 Hrs.</p>	<p>3. Test &amp; service different batteries used in electronic applications and record the data to estimate repair cost.</p>	<p><b>Cells &amp; Batteries</b>            27. Identify the +ve and -ve terminals of the battery.            28. Identify the rated output voltage and Ah capacity of given battery.            29. Measure the voltages of the</p>	<p><b>Cells &amp; Batteries</b>            Construction, types of primary and secondary cells. Materials used, specification of cells and batteries. Charging process, efficiency, life of cell/ battery, estimate</p>

		<p>given cells/battery using analog/ digital multimeter.</p> <p>30. Charge and discharge the battery through load resistor.</p> <p>31. Maintain the secondary cells.</p> <p>32. Measure the specific gravity of the electrolyte using hydrometer.</p> <p>33. Test a battery and verify whether the battery is ready for use of needs recharging.</p>	<p>cost and repair of battery. Selection of cells/ batteries etc.</p> <p>Use of Hydrometer.</p> <p>Types of electrolytes used in cells and batteries.</p> <p>Series/ parallel connection of batteries and purpose of such connections.</p> <p>Introduction to Lithium-Ion battery Lead Acid Battery Nickel–cadmium battery.</p>
<p>Professional Skill 24 Hrs.;</p> <p>Professional Knowledge 06 Hrs.</p>	<p>4. Measure the various parameters by DSO and execute the result with standard one.</p>	<p><b>Digital Storage Oscilloscope</b></p> <p>34. Identify the different front panel control of a DSO.</p> <p>35. Measure the Amplitude, Frequency and time period of typical electronic signals using DSO.</p> <p>36. Connect USB to DSO and save the waveform in USB and open it in computer and take print.</p>	<p>Advantages and features of DSO.</p> <p>Block diagram of Digital storage oscilloscope (DSO)/ and applications.</p> <p>Applications of DSO.</p>
<p>Professional Skill 24 Hrs.;</p> <p>Professional Knowledge 06 Hrs.</p>	<p>5. Test various electronic components using proper measuring instruments and compare the data using standard parameter.</p>	<p><b>AC &amp; DC measurements</b></p> <p>37. Use the multi-meter to measure the various functions (AC V, DC V, DC I, AC I, R).</p> <p>38. Identify the different types of meter for measuring AC &amp; DC parameters.</p> <p>39. Identify the different controls on the CRO/ DSO front panel and observe the function of each control.</p> <p>40. Measure DC voltage, AC voltage, time period using CRO/DSO sine wave parameters.</p> <p>41. Identify the different controls on the function generator front panel and observe the</p>	<p>Introduction to electrical measuring instruments.</p> <p>Importance and classification of meters.</p> <p>Forces necessary to work a meter.</p> <p>MC and MI meters. Range extension, need of calibration.</p> <p>Characteristics of meters and errors in meters.</p> <p>Various terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, Instantaneous value.</p> <p>Multi meter, use of meters in different circuits.</p> <p>Care and maintenance of meters. Use of CRO, Function generator, LCR meter.</p>

		function of each control.	
<p>Professional Skill 25 Hrs.;</p> <p>Professional Knowledge 05 Hrs.</p>	<p>6. Design PCB &amp; Print using PCB printing machine.</p>	<p>42. Convert schematics into PCB layouts, apply design rules, and generate Gerber files and understand the conversion of Gerber file to G-code.</p> <p>43. Set up and run a PCB printing machine, including material loading, alignment, and basic troubleshooting.</p> <p>44. Use tools to inspect for defects and perform continuity and functionality tests on completed PCBs.</p> <p>45. Develop accurate circuit diagrams using PCB design software.</p>	<p>Fundamentals of PCB types, electronic components, and circuit schematic design. Students learn to use PCB design software for layout and Gerber file and G-Code generation. It explains PCB fabrication methods and the operation of PCB printing machines, including setup, alignment, and maintenance. Safety measures, ESD precautions, and environmental considerations are emphasized. Quality control techniques like inspection and testing are included, enabling learners to design, print, and troubleshoot PCBs effectively in a technical environment.</p>
<p>Professional Skill 09 Hrs.;</p> <p>Professional Knowledge 06 Hrs.</p>	<p>7. Plan and execute soldering &amp; de-soldering of various electrical components like Switches, PCB &amp; Transformers for electronic circuits.</p>	<p><b>Soldering/ De-soldering and Various Switches</b></p> <p>46. Practice soldering on different electronic components, small transformer and lugs.</p> <p>47. Practice soldering on IC bases and PCBs.</p> <p>48. Practice de-soldering using pump and wick.</p> <p>49. Join the broken PCB track and test.</p> <p>50. Identify and use SPST, SPDT, DPST, DPDT, tumbler, push button, toggle, piano switches used in electronic industries.</p> <p>51. Make a panel board using different types of switches for a given application.</p>	<p>Different types of soldering guns, related to temperature and wattages, types of tips. Solder materials and their grading. Use of flux and other materials. Selection of soldering gun for specific requirement. Soldering and de-soldering stations and their specifications. Different switches, their specification and usage.</p>

<p>Professional Skill 50 Hrs.;</p> <p>Professional Knowledge 10 Hrs.</p>	<p>5 (a). Test various electronic components using proper measuring instruments and compare the data using standard parameter.</p>	<p><b>Active and Passive Components</b></p> <p>52. Identify the different types of active electronic components.</p> <p>53. Measure the resistor value by colour code and verify the same by measuring with multimeter.</p> <p>54. Identify resistors by their appearance and check physical defects.</p> <p>55. Identify the power rating of carbon resistors by their size.</p> <p>56. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources.</p> <p>57. Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law.</p> <p>58. Verify laws of series and parallel circuits with voltage source in different combinations.</p> <p>59. Measure the resistance, Voltage, Current through series and parallel connected networks using multi-meter.</p> <p>60. Identify different inductors and measure the values using LCR meter.</p> <p>61. Identify the different capacitors and measure capacitance of various capacitors using LCR meter.</p> <p>62. Identify and test the circuit breaker and other protecting devices.</p> <p>63. Dismantle and identify the different parts of a relay.</p> <p>64. Connect a timer relay in a</p>	<p>Ohm's law and Kirchhoff's Law. Resistors; types of resistors, their construction &amp; specific use, color-coding, power rating.</p> <p>Equivalent resistance of series parallel circuits.</p> <p>Distribution of V &amp; I in series parallel circuits.</p> <p>Principles of induction, inductive reactance.</p> <p>Types of inductors, construction, specifications, applications and energy storage concept.</p> <p>Behaviour of inductor at low and high frequencies.</p> <p>Series and parallel combination.</p> <p>Capacitance and capacitive Reactance, Impedance.</p> <p>Types of capacitors, construction, specifications and applications. Dielectric constant.</p> <p>Significance of Series parallel connection of capacitors.</p> <p>Capacitor behaviour with AC and DC.</p> <p>Concept of resonance and its application in RC, RL &amp; RLC series and parallel circuit.</p> <p>Relays, types, construction and specifications etc.</p> <p>Real time application of RC filters, High Pass and low pass.</p>
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		<p>circuit and test for its working.</p> <p>65. Connect a contactor in a circuit and test for its working.</p> <p>66. Use RC filters and make High pass and low pass filters.</p>	
<p>Professional Skill 37 Hrs.;</p> <p>Professional Knowledge 08 Hrs.</p>	<p>8. Assemble simple electronic power supply circuit and test for functioning.</p>	<p><b>Power Supply Circuits</b></p> <p>67. Identify different types of diodes, diode modules and their specifications.</p> <p>68. Test the given diode using multi-meter and determine forward to reverse resistance ratio.</p> <p>69. Measure the voltage and current through a diode in a circuit and verify its forward characteristic.</p> <p>70. Identify different types of transformers and test.</p> <p>71. Identify the primary and secondary transformer windings and test the polarity.</p> <p>72. Construct and test a half wave, full wave and Bridge rectifier circuit.</p> <p>73. Measure ripple voltage, ripple frequency and ripple factor of rectifiers for different load and filter capacitors.</p> <p>74. Identify and test Zener diode.</p> <p>75. Construct and test Zener based voltage regulator circuit.</p> <p>76. Calculate the percentage regulation of regulated power supply.</p> <p><b>IC Regulators</b></p> <p>77. Construct and test a +12V</p>	<p>Semiconductor materials, components, number coding for different electronic components such as Diodes and Zeners etc.</p> <p>PN Junction, forward and reverse biasing of diodes. Interpretation of diode specifications.</p> <p>Forward current and reverse voltage.</p> <p>Packing styles of diodes.</p> <p>Different diodes, Rectifier configurations, their efficiencies,</p> <p>Filter components and their role in reducing ripple.</p> <p>Working principles of Zener diode, varactor diode, their specifications and applications.</p> <p>Working principle of a transformer, construction, Specifications and types of cores used.</p> <p>Step-up Step down and isolation transformers with applications. Losses in Transformers.</p> <p>Regulated Power supply using 78XX series, 79XX series.</p> <p>Op-amp regulator, 723 regulators, (Transistorized &amp; IC based).</p> <p>Voltage regulation, error</p>

		<p>fixed voltage regulator.</p> <p>78. Identify the different types of fixed +ve and –ve regulator ICs and the different current ratings (78/79 series).</p> <p>79. Identify different heat sinks for IC based regulators.</p> <p>80. Observe the output voltage of different IC 723 metal/ plastic type and IC 78540 regulators by varying the input voltage with fixed load.</p> <p>81. Construct and test a 1.2V – 30V variable output regulated power supply using IC LM317T.</p>	<p>correction and amplification etc.</p>
<p>Professional Skill 36 Hrs.;</p> <p>Professional Knowledge 09 Hrs.</p>	<p>9. Construct different electrical control circuits and test for their proper functioning with due care and safety.</p>	<p><b>Protection devices</b></p> <p>82. Identify different types of fuses along with fuse holders, overload (no volt coil), current adjust (Biometric strips to set the current).</p> <p>83. Test the given MCBs.</p> <p>84. Connect an ELCB and test the leakage of an electrical motor control circuit.</p>	<p>Necessity of fuse, fuse ratings, types of fuses, fuse bases.</p> <p>Single/ three phase MCBs, single phase ELCBs.</p> <p>Types of contactors, relays and working voltages.</p> <p>Contact currents, protection to contactors and high current applications.</p>
		<p><b>Electrical control circuits</b></p> <p>85. Measure the coil winding resistance of the given motor.</p> <p>86. Prepare the setup of DOL starter and control an induction motor.</p> <p>87. Construct a direction control circuit to change direction of an induction motor.</p> <p>88. Connect an overload relay and test for its proper functioning.</p>	<p>Fundamentals of single-phase Induction motors, synchronous speed, slip, rotor frequency.</p> <p>Torque-speed characteristics, Starters used for Induction motors.</p>
<p>Professional Skill 75 Hrs.;</p>	<p>10. Install, configure and interconnect given computer</p>	<p><b>Computer Hardware, OS, MS office and Networking</b></p> <p>89. Identify various indicators,</p>	<p>Basic blocks of a computer, Components of desktop and motherboard.</p>

<p>Professional Knowledge 15 Hrs.</p>	<p>system(s) and Laptop. Use application packages for different application.</p>	<p>cables, connectors and ports on the computer cabinet.</p> <p>90. Demonstrate various parts of the system unit and motherboard components.</p> <p>91. Identify various computer peripherals and connect it to the system.</p> <p>92. Disable certain functionality by disconnecting the concerned cables SATA/ PATA.</p> <p>93. Replace the CMOS battery and extend a memory module.</p> <p>94. Test and Replace the SMPS.</p> <p>95. Replace the given DVD and HDD on the system.</p> <p>96. Dismantle and assemble the desktop computer system.</p> <p>97. Boot the system from different options.</p> <p>98. Install OS in a desktop computer.</p> <p>99. Install a printer driver software and test for print outs.</p> <p>100. Install antivirus software, scan the system and explore the options in the antivirus software.</p> <p>101. Install MS office software.</p> <p>102. Create folder and files, draw pictures using paint.</p> <p>103. Explore different menu/ tool/ format/ status bars of MS word and practice the options.</p> <p>104. Explore different menu/ tool/ format/ status bars of MS excel and practice the</p>	<p>Hardware and software, I/O devices, and their working. Different types of printers, HDD, DVD.</p> <p>Various ports in the computer. Windows OS 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.</p> <p>Concept of word processing: MS word – Menu bar, standard tool bar, editing, formatting, printing of document etc. 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.</p> <p>Introduction to power-point Basics of 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</p>
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		<p>options.</p> <p>105. Prepare PowerPoint presentation on any three known topics with various design, animation and visual effects.</p> <p>106. Convert the given PDF File into Word file using suitable software.</p> <p>107. Browse search engines, create email accounts, practice sending and receiving of mails and configuration of email clients.</p> <p>108. Identify different types of cables and network components e.g. Hub, switch, router, modem etc.</p> <p>109. Prepare terminations, make UTP and STP cable connectors and test.</p> <p>110. Connect network connectivity hardware and check for its functioning.</p> <p>111. Configure a wireless Wi-Fi Network.</p> <p>112. Disassemble and assemble hardware system of a laptop.</p>	<p>and program files etc.</p> <p><b>Computer Networking:</b>            Network features - Network media Network topologies, protocols- TCP/IP, UDP, FTP, models and types.            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.            Understanding the Laptop Hardware.            Comparison between laptops and desktop computers.            Fault Diagnosis and Troubleshooting of Laptop.</p>
<p>Professional Skill 11 Hrs.;</p> <p>Professional Knowledge 04 Hrs.</p>	<p>11. Plan and carry out the selection of a project, assemble the project and evaluate performance for a domestic/ commercial application.</p>	<p>113. Make simple project applications using ICs, Zener diode, transformer and other discrete components.</p> <ol style="list-style-type: none"> <li>Modular Rectifiers.</li> <li>Transformer less 12V dual power supply.</li> <li>AC/DC voltage tester.</li> </ol> <p>(Instructor will pick up any five of the projects for implementation)</p>	<p>Discussion on the identified projects with respect to data of the concerned ICs, components used in the project.</p>
<p>Professional Skill 75 Hrs.;</p>	<p>12. Construct, test and verify the input/ output</p>	<p><b>Transistor</b></p> <p>114. Identify different transistors with respect to different</p>	<p>Construction, working of a PNP and NPN transistors,</p>

Professional Knowledge 15 Hrs.	characteristics of various analog circuits.	package type, B-E-C pins, power, switching transistor, heat sinks etc. 115. Test the condition of a given transistor using ohm- meter. 116. Measure and plot input and output characteristics of a CE amplifier. 117. Construct and test a transistor based switching circuit to control a relay (use Relays of different coil voltages and Transistors of different $\beta$ ).	purpose of E, B & C terminals. Significance of $\alpha$ , $\beta$ and relationship of a transistor. Need for biasing of transistor. $V_{BE}$ , $V_{CB}$ , $V_{CE}$ , $I_C$ , $I_B$ , Junction Temperature, junction capacitance, frequency of operation. Transistor applications as switch and amplifier. Transistor input and output characteristics. Transistor power ratings & packaging styles and use of different heat sinks.
		<b>Amplifier</b> 118. Construct and test fixed-bias, emitter-bias and voltage divider-bias transistor amplifier. 119. Construct and test a common emitter amplifier with and without bypass capacitors. 120. Construct and test common base amplifier. 121. Construct and test common collector/emitter follower amplifier. 122. Construct and test Darlington amplifier. 123. Construct and test a two stage RC Coupled amplifier.	Different types of biasing, various configurations of transistor (C-B, C-E & C-C), their characteristics and applications. Transistor biasing circuits and stabilization techniques. Classification of amplifiers according to frequency, mode of operation and methods of coupling. Voltage amplifiers- voltage gain, loading effect. Single stage CE amplifier and 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.
		<b>Oscillators</b>	

		<p>124. Demonstrate Colpitts oscillator, Hartley oscillator circuits and compare the output frequency of the oscillator by DSO CRO.</p> <p>125. Construct and test a RC phase shift oscillator circuit.</p> <p>126. Construct and test a crystal oscillator circuit.</p> <p>127. Demonstrate Astable, monostable, bistable circuits using transistors.</p>	<p>Introduction to positive feedback and requisites of an oscillator.</p> <p>Study of Colpitts, Hartley, Crystal and RC oscillators.</p> <p>Types of multi-vibrators and study of circuit diagrams.</p>
		<p><b>Wave shaping circuits</b></p> <p>128. Construct and test shunt clipper.</p> <p>129. Construct and test series and dual clipper circuit using diodes.</p> <p>130. Construct and test clamper circuit using diodes.</p>	<p>Diode shunt clipper circuits, Clamping/limiting circuits and Zener diode as peak clipper, uses their applications.</p>
<p>Professional Skill 63 Hrs.;</p> <p>Professional Knowledge 12 Hrs.</p>	<p>13. Plan and construct different power electronic circuits and analyse the circuit functioning.</p>	<p><b>Power Electronic Components</b></p> <p>131. Identify different power electronic components, their specification and terminals.</p> <p>132. Construct and test a FET Amplifier.</p> <p>133. Construct a test circuit of SCR using UJT triggering.</p> <p>134. Identify different heat sinks used in SCRs.</p> <p>135. Construct a snubber circuit for protecting SCR use freewheeling diode to reduce back emf.</p> <p>136. Construct a jig circuit to test DIAC.</p> <p>137. Construct a simple dimmer circuit using TRIAC.</p> <p>138. Construct UJT based free running oscillator and change its frequency.</p>	<p>Construction of FET&amp; JFET, difference with BJT.</p> <p>Purpose of Gate Drain and source terminals and voltage/ current relations between them and Impedances between various terminals.</p> <p>Heat Sink-uses &amp;purpose. Suitability of FET amplifiers in measuring device applications. Working of different power electronic components such as SCR, TRIAC, DIAC and UJT.</p>

		<p><b>MOSFET &amp; IGBT</b></p> <p>139. Identify various Power MOSFET by its number and test by using multimeter.</p> <p>140. Identify different heat sinks used with various power MOSFET devices.</p> <p>141. Construct MOSFET test circuit with a small load drivers. (Cloud Based Simulator)</p> <p>142. Identify IGBTs by their numbers and test by using multimeter.</p> <p>143. Construct IGBT test circuit with a small load.</p> <p>144. Interpret running and reversing phenomenon of BLDC Motor.</p> <p>145. Perform speed control of BLDC Motor using PWM technique.</p> <p>146. Interpret load characteristics of BLDC Motor.</p> <p>147. Interpret speed-torque characteristics of BLDC Motor.</p>	<p>MOSFET, Power MOSFET and IGBT, their types, characteristics, switching speed, power ratings and protection.</p> <p>Differentiate FET with MOSFET.</p> <p>Differentiate Transistor with IGBT.</p> <p>Study of running and reversing phenomenon of BLDC Motor.</p> <p>Study of speed control of BLDC Motor using PWM technique.</p> <p>Study of load characteristics of BLDC Motor.</p> <p>Study of speed-torque characteristics of BLDC</p>
<p>Professional Skill 50 Hrs.;</p> <p>Professional Knowledge 10 Hrs.</p>	<p>14. Execute the operation of different process sensors, identify, wire &amp; test various sensors of different industrial processes by selecting appropriate test instruments.</p>	<p><b>Sensors, Transducers and Applications</b></p> <p>148. Identify sensors used in process industries such as RTDs, Temperature ICs, Thermocouples, proximity switches (inductive, capacitive and photo electric), load cells, strain gauge. LVDT PT 100 (platinum resistance sensor), water level sensor, thermostat float switch, float valve by their appearance.</p>	<p>Basics of passive and active transducers.</p> <p>Role, selection and characteristics.</p> <p>Sensor voltage and current formats.</p> <p>Thermistors/ Thermocouples - Basic principle, salient features, operating range, composition, advantages and disadvantages.</p> <p>Strain gauges/ Load cell – principle, gauge factor, types</p>

		<p>149. Measure temperature of a lit fire using a Thermocouple and record the readings referring to data chart.</p> <p>150. Measure temperature of a lit fire using RTD and record the readings referring to data chart.</p> <p>151. Measure the DC voltage of a LVDT.</p> <p>152. Detect different objectives using capacitive, inductive and photoelectric proximity sensors.</p>	<p>of strain gauges.</p> <p>Inductive/ capacitive transducers - Principle of operation, advantages and disadvantages.</p> <p>Principle of operation of LVDT, advantages and disadvantages.</p> <p>Proximity sensors – applications, working principles of eddy current, capacitive and inductive proximity sensors.</p>
<p>Professional Skill 20 Hrs.;</p> <p>Professional Knowledge 10 Hrs.</p>	<p>15. Select the appropriate opto-electronics components and verify the characteristics in different circuit.</p>	<p><b>Opto-Electronics</b></p> <p>153. Test LEDs with DC supply and measure voltage drop and current using multimeter.</p> <p>154. Construct a circuit to switch a lamp load using photo diode.</p> <p>155. Construct a circuit to switch a lamp load using photo transistor.</p> <p>156. Identify opto-coupler input and output terminals and measure the quantum of isolation between input/output terminals and operate a relay by connecting a switch.</p>	<p>Working and application of LED, IR LEDs, Photo diode, photo transistor, their characteristics and applications.</p> <p>Optical sensor, opto-couplers, circuits with opto-isolators.</p> <p>Characteristics of LASER diodes.</p>
<p>Professional Skill 118 Hrs.;</p> <p>Professional Knowledge 17 Hrs.</p>	<p>16. Assemble, test and troubleshoot various digital circuits.</p>	<p><b>Basic Gates</b></p> <p>157. Identify different Logic Gates (AND, OR, NAND, NOR, EX-OR, EX-NOR, NOT ICs) by the number printed on them.</p> <p>158. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs.</p> <p>159. Construct and verify the truth table of all the gates</p>	<p>Introduction to Digital Electronics.</p> <p>Difference between analog and digital signals.</p> <p>Logic families and their comparison, logic levels of TTL and CMOS.</p> <p>Number systems (Decimal, binary, octal, Hexadecimal). BCD code, ASCII code and</p>

		<p>using NAND and NOR gates.</p> <p>160. Pc based universal IC tester cum programmer Use digital IC tester to test the various digital ICs (TTL and CMOS).</p>	<p>code conversions.</p> <p>Various Logic Gates and their truth tables.</p>
		<p><b>Combinational Circuits</b></p> <p>161. Construct Half Adder circuit using ICs and verify the truth table.</p> <p>162. Construct Full adder with two Half adder circuit using ICs and verify the truth table.</p> <p>163. Construct the adder cum subtractor circuit and verify the result.</p> <p>164. Construct and test a 2 to 4 Decoder.</p> <p>165. Construct and test a 4 to 2 Encoder.</p> <p>166. Construct and test a 4 to 1 multiplexer.</p> <p>167. Construct and test a 1 to 4 De multiplexer.</p>	<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>Concept of encoder and decoder. Basic Binary Decoder and four-bit binary decoders.</p> <p>Need for multiplexing of data.</p> <p>1: 4-line Multiplexer/De-multiplexer.</p>
		<p><b>Flip Flops</b></p> <p>168. Identify different Flip-Flop (ICs) by the number printed on them.</p> <p>169. Verify the truth tables of Flip-Flop ICs (RS, D, T, JK, MSJK) by connecting switches and LEDs.</p> <p>170. Construct and test four-bit latch using 7475.</p> <p>171. Construct and test R-S flip-flop using IC7400 with clock and without clock pulse.</p> <p>172. Verify the truth tables of Flip-Flop ICs (RS, D, T, JK, MSJK) by connecting switches and LEDs.</p>	<p>Introduction to Flip-Flop. S-R Latch, Gated S-R Latch, D-Latch.</p> <p>Flip-Flop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop.</p> <p>Master-Slave flip flops and Timing diagrams.</p> <p>Basic flip flop applications like data storage, data transfer and frequency division.</p>
		<p><b>Counter &amp; shift registers</b></p>	<p>Basics of Counters, types,</p>

		<p>173. Construct and test a four-bit asynchronous binary counter using 7493.</p> <p>174. Construct and test 7493 as a modulus-12 counter.</p> <p>175. Construct and test a four-bit Synchronous binary counter using 74163.</p> <p>176. Construct and test synchronous Decade counter.</p> <p>177. Construct and test an up/down synchronous decade counter using 74190 and monitor the output on LEDs.</p> <p>178. Identify and test common anode and common cathode seven segment LED display using multi meter.</p> <p>179. Display the two-digit count value on seven segment display using decoder/driver ICs.</p> <p>180. Construct a shift register using RS/D/JK flip flop and verify the result.</p> <p>181. Construct and test four-bit SIPO register.</p> <p>182. Construct and test four-bit PIPO register.</p> <p>183. Construct and test bidirectional shift registers.</p>	<p>two bit 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.</p> <p>BCD display and BCD to decimal decoder.</p> <p>BCD to 7 segment display circuits.</p> <p>Basics of Register, types and application of Registers.</p>
<p>Professional Skill 48 Hrs.;</p> <p>Professional Knowledge 12 Hrs.</p>	<p>17. Simulate and analyze the analog and digital circuits using electronic simulator software.</p>	<p><b>Electronic circuit simulator</b></p> <p>184. Prepare simple digital and electronic circuits using the software.</p> <p>185. Simulate and test the prepared digital and analog circuits.</p> <p>186. Convert the prepared circuit into a layout diagram.</p>	<p>Study the library components available in the circuit simulation software.</p> <p>Various resources of the software.</p>

		187. Prepare simple, power electronic and domestic electronic circuit using simulation software.	
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	18. Construct and test different circuits using ICs 741 operational amplifiers & ICs 555 linear integrated circuits and execute the result.	<p><b>Op – Amp &amp; Timer 555 Applications</b></p> <p>188. Construct and test various Op-Amp circuits Inverting, Non-inverting and Summing Amplifiers.</p> <p>189. Construct and test Differentiator and Integrator.</p> <p>190. Construct and test a zero-crossing detector.</p> <p>191. Construct and test Instrumentation amplifier.</p> <p>192. Construct and test a Binary weighted and R-2R Ladder type Digital-to-Analog Converters.</p> <p>193. Construct and test Astable timer circuit using IC 555.</p> <p>194. Construct and test mono stable timer circuit using IC555.</p> <p>195. Construct and test 555 timers as pulse width modulator.</p>	<p>Block diagram and working of Op-Amp, importance, ideal characteristics, advantages and applications.</p> <p>Schematic diagram of 741, symbol.</p> <p>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 monostable, astable.</p> <p>Duty cycle part.</p>
Professional Skill 41 Hrs.; Professional Knowledge 04 Hrs.	11 (a). Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications.	<p>196. Make simple project applications using ICs, transformer and other discrete components.</p> <p>a) Pencil charger indicator.</p> <p>b) Delayed automatic power on circuit.</p> <p>c) Neon flasher circuit using IC741.</p> <p>d) UJT act as a relaxation oscillator.</p> <p>e) Dimmer circuit of Light &amp; Fan using DIAC &amp; TRIAC.</p>	<p>Discussion on the identified projects with respect to data of the concerned ICs, components used in the project.</p>

		<p>f) Timer Circuit using IC-555.</p> <p>(Instructor will pick up any five of the projects for implementation)</p>	
<b>ENGINEERING DRAWING</b>			
<p>Professional Knowledge</p> <p>ED-30 Hrs.</p>	<p>19. Read and apply engineering drawing for different application in the field of work.</p>	<p>Introduction to Engineering Drawing and Drawing Instrument–</p> <ul style="list-style-type: none"> <li>• Conventions</li> <li>• Sizes and layout of drawing sheets</li> <li>• Title Block, its position and content</li> <li>• Drawing Instrument Freehand drawing of–</li> <li>• Geometrical figures and blocks with dimension</li> <li>• Transferring measurement from the given object to the free hand sketches.</li> <li>• Free hand drawing of hand tools. Drawing of Geometrical figures:-</li> <li>• Angle, Triangle, Circle, Rectangle, Square, Parallelogram.</li> <li>• Lettering &amp; Numbering – Single Stroke</li> </ul> <p>Symbolic representation</p> <ul style="list-style-type: none"> <li>• Different Electronic symbols used in the related trades</li> </ul> <p>Reading of Electronic Circuit Diagram.</p> <p>Reading of Electronic Layout drawing.</p>	
<b>WORKSHOP CALCULATION &amp; SCIENCE</b>			
<p>WCS- 30 Hrs.</p>	<p>20. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.</p>	<p><b>Unit, Fractions</b></p> <p>Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion. Factors, HCF, LCM and problems. Fractions - Addition, subtraction, multiplication &amp; division. Decimal fractions - Addition, subtraction, multiplication &amp; division. Solving problems by using calculator.</p> <p><b>Square root, Ratio and Proportions, Percentage</b> Square and square root. Simple problems using calculator. Applications of Pythagoras theorem and related problems. Ratio and proportion. Ratio and proportion - Direct and indirect proportions Percentage Percentage - Changing percentage to decimal and fraction.</p> <p><b>Material Science</b></p> <p>Types metals, types of ferrous and non ferrous metals. Introduction of iron and cast iron.</p> <p><b>Mass, Weight, Volume and Density</b></p> <p>Specific gravity.</p> <p>Potential energy, kinetic energy and related problems with assignment.</p> <p><b>Heat &amp; Temperature and Pressure</b></p>	

		<p>Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point &amp; melting point of different metals and non-metals.</p> <p>Scales of temperature, celsius, fahrenheit, kelvin and conversion between scales of temperature.</p> <p><b>Basic Electricity</b></p> <p>Introduction and uses of electricity, molecule, atom, how electricity is produced, electric current AC, DC their comparison, voltage, resistance and their units Conductor, insulator, types of connections - series and parallel. Ohm's law, relation between V.I.R &amp; related problems. Electrical power, energy and their units, calculation with assignments. Magnetic induction, self and mutual inductance and EMF generation Electrical power, HP, energy and units of electrical energy.</p> <p><b>Trigonometry</b></p> <p>Measurement of angles Trigonometrical ratios Trigonometrical tables.</p>

SYLLABUS FOR MECHANIC CONSUMER ELECTRONIC APPLIANCES TRADE			
SECOND YEAR			
Duration	Reference Learning Outcome	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
Professional Skill 35 Hrs.;  Professional Knowledge 10 Hrs.	21. Identify, place, solder and desolder and test different SMD discrete components and ICs package with due care and following safety norms using proper tools/setup.	<b>Basic SMD (2, 3, 4 terminal components)</b> 197. Identification of 2, 3, 4 terminal SMD components. 198. Identify different types of packages. 199. Prepare Bill Off Material (BOM). 200. De-solder the SMD components from the given PCB. 201. Solder the SMD components in the same PCB. 202. Identification of loose/dry solder, broken tracks on PCB, Cold continuity test on printed wired assemblies.	Introduction to SMD technology Identification of 2, 3, 4 terminal SMD components. Advantages of SMD components over conventional lead components. Soldering of SM assemblies - Reflow soldering. Tips for selection of hardware, Inspection of SM.
Professional Skill 31 Hrs.;  Professional Knowledge 14 Hrs.	22. Prepare, crimp, terminate and test various cables used in different electronics industries.	<b>Electronic Cables &amp; Connectors</b> 203. Identify various types of cables viz. RF coaxial feeder, screened cable, ribbon cable, RCA connector cable, digital optical audio, video cable, RJ45, RJ11, Ethernet cable, fiber optic cable splicing, fiber optic cable mechanical splices, insulation, gauge, current capacity, flexibility etc. used in various electronics products, different input output sockets. 204. Identify suitable	Cable signal diagram conventions Classification of electronic cables as per the application w.r.t. insulation, gauge, current capacity, flexibility etc. Different types of connector & their terminations to the cables. Male/ Female type DB connectors. Ethernet 10 Base cross over cables and pin out assignments, UTP and STP, SCTP, TPC, coaxial, types of

		<p>connectors, solder/ crimp/ terminate &amp; test the cable sets.</p> <p>205. Check the continuity as per the marking on the connector for preparing the cable set.</p> <p>206. Identify and select various connectors and cables inside the CPU cabinet of PC.</p> <p>207. Identify the suitable connector and cable to connect a computer with a network switch and prepare a cross over cable to connect two networks computers.</p>	<p>fibre optical Cables and 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), 6.3 mm PHONO, 3.5/ 2.5 mm PHONO, BANTAM, SPEAKON, DIN, mini DIN, RF connectors, USB, Fire wire, SATA Connectors, VGA, DVI connectors, MIDI and RJ45, RJ11 etc.</p>
<p>Professional Skill 46 Hrs.;</p> <p>Professional Knowledge 14 Hrs.</p>	<p>23. Assemble and test a commercial AM/ FM receiver and evaluate performance.</p>	<p><b>Communication electronics</b></p> <p>208. Modulate and demodulate various signals using AM and FM on the trainer kit and observe waveforms.</p> <p>209. Construct and test IC based AM Receiver.</p> <p>210. Construct and test IC based FM transmitter.</p> <p>211. Construct and test IC based AM transmitter and test the transmitter power. Calculate the modulation index.</p> <p>212. Dismantle the given FM receiver set and identify different stages (AM section, audio amplifier section etc.)</p> <p>213. Modulate two signals using AM kit draw the way from and calculate percentage (%) of modulation.</p> <p>214. Modulate and demodulate</p>	<p>Radio Wave Propagation – principle, fading.</p> <p>Need for Modulation, types of modulation and demodulation.</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.</p> <p>Block diagram of AM and FM transmitter.</p> <p>FM Generation &amp; Detection.</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><i>A simple block diagram approach to be adopted for</i></p>

		a signal using PAM, PPM, PWM Techniques.	<i>explaining the above mod/demod techniques.</i>
Professional Skill 60 Hrs.;	24. Test, service and troubleshoot the various components of different domestic/ industrial programmable systems.	<b>Microcontroller (8051) &amp; Microcontroller ATMEGA 328</b> 215. Identify various ICs & their functions on the given Microcontroller Kit. 216. Identify various ICs, Pins, Ports and & their functions on the given Microcontroller Atmega 328 Arduini Uno Board. 217. Identify the address range of RAM & ROM. 218. Identify memory concept, boot loader of Atmega 328 microcontroller. 219. Measure the crystal frequency, connect it to the controller. 220. Identify the port pins of the controller & configure the ports for Input & Output operation. 221. Use 8051 microcontroller, connect 8 LED to the port, blink the LED with a switch. 222. Installation of Arduino IDE on computer. 223. Use Atmega 328 microcontroller, connect LED to the port, blink the LED by writing a program. 224. Perform the initialization, load & turn on a LED with delay using Timer. 225. Perform the initialization, & blink LED with delay in program. 226. Perform the use of a Timer as an Event counter to	Introduction Microprocessor & ATMEGA 328 Microcontroller Arduino Uno Board, architecture, pin details & the bus system. Function of different ICs used in the Microcontroller Kit. Differentiate microcontroller with microprocessor. Interfacing of memory to the microcontroller.  Boot loading concept of Atmega 328 controller  Installation of Arduino IDE on computer  Understanding the compete menu and its functions of Arduino IDE Tool.  How to connect and select Arduinio Board from Library.  How to download different Libraray updates Internal hardware resources of microcontroller. I/O port pin configuration. Different variants of 8051 & their resources. Register banks & their functioning. SFRs & their configuration for different applications. Comparative study of 8051 with 8052. Introduction to PIC Architecture.
Professional Knowledge 15 Hrs.			

		<p>count external events.</p> <p>227. Demonstrate entering of simple programs, execute &amp; monitor the results.</p> <p>228. Perform with 8051 microcontroller assembling language program, check the reading of an input port and sending the received bytes to the output port of the microcontroller, used switches and LCD for the input and output.</p> <p>229. Construct a digital clock using seven segment display and connect to I/O PORTS.</p>	
<p>Professional Skill 50 Hrs.;</p> <p>Professional Knowledge 10 Hrs.</p>	<p>25. Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications.</p>	<p>230. Make simple project applications using ICs, transformer and other discrete components.</p> <ol style="list-style-type: none"> <li>a) Electronic code lock.</li> <li>b) Temperature control circuit using a thermostat in an electric circuit.</li> <li>c) AM/FM transmitter circuit.</li> <li>d) Smoke detector.</li> <li>e) Water level sensor.</li> <li>f) Programmable musical bell.</li> <li>g) Laptop Protector.</li> <li>h) Mobile phone charged with Battery Monitor.</li> <li>i) Lead Acid Battery Charger/ Auto Turn-off Battery Charger with Indicator.</li> <li>j) Emergency Light.</li> <li>k) Dancing LEDs. (Instructor</li> </ol>	<p>Discussion on the identified projects with respect to data of the concerned ICs, components used in the project.</p>

		will pick up any five of the project for implementation)	
Professional Skill 24 Hrs.;  Professional Knowledge 06 Hrs.	26. Demonstrate applications, and integration of AI, SMART devices, and fuzzy logic in modern home appliances for enhanced functionality and automation.	<p>231. Understand the working principles of AI, SMART technology, and fuzzy logic in home appliances.</p> <p>232. Identify various SMART appliances and their features.</p> <p>233. Explain how fuzzy logic is used to improve appliance performance and decision-making.</p> <p>234. Describe how AI enhances automation and user interaction in modern electronic devices.</p> <p>235. Understand the integration of networked devices for remote control and monitoring.</p>	<p>Knowledge of AI , Smart Device and Fuzzy logic.</p> <p>Type of Communication Wi-Fi, Bluetooth, or Zigbee to form an interconnected smart home network.</p> <p>Introduction to optical fiber, optical connection and various types optical amplifier, its advantages, properties of optic fiber, testing, losses, types of fiber optic cables and specifications. Encoding of light. Fiber optic joints, splicing, testing and the related equipment/ measuring tools. Precautions and safety aspects while handling optical cables.</p>
Professional Skill 90 Hrs.;  Professional Knowledge 30 Hrs.	27. Detect the faults and troubleshoot SMPS, UPS and inverter.	<p><b>SMPS and Inverter</b></p> <p>236. Identify the components/ devices and draw their corresponding symbols.</p> <p>237. Dismantle the given stabilizer and find major sections/ ICs components.</p> <p>238. List the defect and symptom in the faulty SMPS.</p> <p>239. Measure/ Monitor major test points of computer SMPS.</p> <p>240. Troubleshoot the fault in the given SMPS unit.</p> <p>241. Rectify the defect and verify the output with load.</p> <p>242. Record your procedure followed for trouble shooting the defects.</p>	<p>Concept and block diagram of manual, automatic and servo voltage stabilizer, o/p voltage adjustment.</p> <p>Voltage cut-off systems, relays used in stabilizer. Block Diagram of different types of Switch mode power supplies and their working principles.</p> <p>Various types of chopper circuits.</p> <p>Inverter; principle of operation, block diagram, power rating, change over period.</p> <p>Installation of inverters, protection circuits used in inverters.</p> <p>Battery level, overload, over charging etc.</p>

		<p>243. Use SMPS used in TVs and PCs for Practice.</p> <p>244. Install and test the SMPS in PC.</p> <p>245. Install and test an inverter.</p> <p>246. Troubleshoot the fault in the given inverter unit.</p> <p>247. Rectify the defects and verify the output with load.</p> <p>248. Construct and test IC Based DC-DC converter for different voltages.</p> <p>249. Construct and test a switching step down regulator using LM2576.</p> <p>250. Construct and test a switching step up regulator using MC 34063.</p> <p>251. Understand the function of Inverter Trainer, understand the charging of battery, Inverter circuit, different faults and there troubleshooting in Inverter circuit.</p> <p>252. Study of Primary rectifier and Filter section, Switching, Transformer, Optocoupler, Regulation, SMPS with Variac input (Variable AC) Regulation Test, Various faults and procedure of their trouble shooting.</p>	<p>Various faults and its rectification in inverter. Block diagram of DC-DC converters and their working principles. Study of Inverter Circuit.</p>
		<p><b>UPS</b></p> <p>253. Connect battery stack to the UPS.</p> <p>254. Identify front panel control &amp; indicators of UPS.</p> <p>255. Connect Battery &amp; load to UPS &amp; test on battery</p>	<p>Concept of uninterrupted power supply.</p> <p>Difference between Inverters and UPS.</p> <p>Basic block diagram of UPS &amp; operating principle.</p> <p>Types of UPS: Offline UPS,</p>

		<p>mode.</p> <p>256. Open top cover of a UPS; identify its isolator transformers, the UPS transformer and various circuit boards in UPS.</p> <p>257. Identify the various test point and verify the voltages on these.</p> <p>258. Identify various circuit boards in UPS and monitor voltages at various test points.</p> <p>259. Perform load test to measure backup time.</p> <p>260. Perform all above experiment for three phase UPS.</p>	<p>Online UPS, Line interactive UPS &amp; their comparison 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>Installation of single phase &amp; three phase UPS.</p>
<p>Professional Skill 90 Hrs.;</p> <p>Professional Knowledge 30 Hrs.</p>	<p>28. Identify, operate various controls, trouble shoot and replace modules of the Smart Hd TV &amp; LED TV &amp; its remote.</p>	<p><b>LED TV</b></p> <p>261. Identify and operate different Controls on LED TV and Smart TV.</p> <p>262. Identify components and different sectors of LED TV and Smart TV.</p> <p>263. Dismantle; identify the parts of the remote control.</p> <p>264. Dismantle the given LED/ Smart TV to find faults with input stages through connectors.</p> <p>265. Detect the defect in a LED/ Smart TV receiver given to you. Rectify the fault.</p> <p>266. Troubleshoot the faults in the given LED/ Smart TV receiver. Locate and rectify the faults.</p> <p>267. Test LED /Smart TV after troubleshooting the</p>	<p>Difference between a conventional CTV with LED TVs.</p> <p>Principle of LCD and LED TV and function of its different section.</p> <p>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.</p> <p>TV Remote Control–Types, parts and functions, IR Code transmitter and IR Code receiver.</p> <p>Working principle, operation of remote control.</p> <p>Different adjustments, general faults in remote control.</p> <p>Difference between LED TV and Smart TV.</p>

		<p>defects.</p> <p>268. Identify various connectors and connect the cable operator's external decoder (set top box) to the TV.</p> <p>269. Configure Wi-Fi and Bluetooth adaptor to connect to the wireless high-speed internet connection.</p>	
<p>Professional Skill 25 Hrs.;</p> <p>Professional Knowledge 05 Hrs.</p>	<p>29. Install /configure, various control adjustment of the display, troubleshoot and secure LCD/LED projector.</p>	<p><b>LCD/ LED Projector/ Interactive panels/ Smart boards</b></p> <p>270. Identify various front panel controls on the given LCD/LED Projector and operate the projector using them.</p> <p>271. Identify rear connectors and terminate them using proper cables to the desktop computer.</p> <p>272. Make necessary adjustments of the display using remote.</p> <p>273. Dismantle the projector and identify all major functional modules.</p> <p>274. Test the healthiness of power supply, exhaust fan etc.</p> <p>275. Identify the LCD/LED lamp stack and monitor the necessary voltages.</p>	<p>Differentiate LCD and LED projectors.</p> <p>Specifications of LED Projector</p> <p>Working principle of LED Projector.</p> <p>Most frequently occurring faults in a LED projector and their remedies.</p>
<p>Professional Skill 25 Hrs.;</p> <p>Professional Knowledge 05 Hrs.</p>	<p>30. Install a DTH system by proper selection of site, assembling of different parts/ accessories and troubleshoot the system.</p>	<p><b>DTH System</b></p> <p>276. Identification &amp; use of DTH system assembly.</p> <p>277. Identification &amp; use of different tools and equipments used in DTH installation procedure &amp; cabling procedure.</p>	<p>Basic satellite communication, Merits &amp; Demerits of satellite communication, applications, types of satellite &amp; its orbits, Satellite Frequency Bands.</p> <p>Basic components of DTH system: PDA, LNBC, Satellite</p>

		<p>278. Identify various types of connectors and cables Connection procedure.</p> <p>279. Install a DTH system &amp; get a TV station.</p> <p>280. Site selection, installation mounting tracking for azimuth and elevation angles using SAT meter.</p> <p>281. Identify the faults in DTH system &amp; rectify.</p> <p>282. Identify &amp; use of various I/O ports of STB.</p> <p>283. STB connection and first installation.</p> <p>284. Identify the faults in STB &amp; rectify.</p>	<p>receiver terminal, dish installation aspects, Azimuth &amp; elevation settings of dish/ DTH receiver. Types of cables used in DZTH system, impedance and specification Multi-dwelling unit design, headed amplifier, line amplifier, cascaded in/out multi-switch, tap, and splitter. Set top box features, block diagram of set top box, I/O ports, Cable modem termination system, software &amp; customer premises equipments.</p>
<p>Professional Skill 50 Hrs.;</p> <p>Professional Knowledge 10 Hrs.</p>	<p>31. Dismantle, identify the parts, control circuits, sensors of a various domestic appliances. Estimate and troubleshoot.</p>	<p><b><u>Domestic Appliances</u></b></p> <p>285. Identification &amp; use of controls on touch keypad of Microwave oven.</p> <p>286. Dismantle and identification of various parts, wiring, tracing of various controls of Microwave oven.</p> <p>287. Identify the faults in the given Microwave oven &amp; rectify.</p> <p>288. Dismantle and identification of various parts, sensors, wiring, tracing of various controls, electronic circuits, in various types of washing M/C.</p> <p>289. Identify the faults in the given washing M/C and rectify.</p> <p>290. Dismantle and identification of various</p>	<p>Microwave oven: Different types of oven, study the various functions of Oven, Block diagram of microwave oven, Electrical wiring diagram of microwave oven, Microwave generation system-circuit, description &amp; working, working of Power supply.</p> <p>Washing M/c: different types of machines, washing techniques, (Block diagram) parts of manual, semi-automatic and fully automatic machines, basic working principle of manual, semi- automatic and fully automatic machines, study the working of motors, different types of timers, power supply circuits. Vacuum cleaner (Block</p>

		<p>parts, wiring, tracing of various controls, electronic circuits in various types of Vacuum cleaners.</p> <p>291. Identify the faults in various types of Vacuum cleaners &amp; rectify.</p> <p>292. Dismantle and identification of various parts, wiring, tracing of various controls, electronic circuits in various types of Mixers/grinders.</p> <p>293. Identify the faults in various types of Mixers/grinders &amp; rectify.</p> <p>294. Dismantle and identification of various parts, wiring, tracing of various controls, electronic circuits in steam Iron.</p> <p>295. Identify the faults in steam iron &amp; rectify.</p> <p>296. Identify various components of Electric rice cooker, controls and trace the circuit and rectify the simulated faults.</p> <p>297. Identify various components of Water purifier, mantling and dismantling of water purifier, connection between different parts of water purifier.</p> <p>298. Clean and replace the worn-out consumable parts following the troubleshooting manual.</p> <p>299. Simulate and rectify the faults.</p> <p>300. Repeat the above exercise</p>	<p>diagram) working principle, main parts of Vacuum cleaner, study of different features of the machine, study &amp; working of motor used, Electronic circuit, power supply.</p> <p>Various parts &amp; functions of Mixer/Grinder, speed control circuit &amp; auto overload protector.</p> <p>Principle of electric iron, parts of steam iron, thermostat heat controls.</p> <p>Working principal of RO and UV type of water purifiers, Different components of water purifier, consumables required, Most frequently occurring faults and their remedial procedures referring to the manual.</p> <p>Principal of Immersion heater, part of immersion heater, Insulation in Immersion heater.</p> <p>Working principle of Induction cook top, study of different features of machine. Types of induction tubes, study of different component of induction cooktop,</p> <p>Fault identification, Heat sinking in induction cooktop.</p> <p>Introduction to Air Conditioning.</p> <p>Components of a AC System. Block diagram and operating principle of Public Address</p>
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		<p>for UV type water purifier.</p> <p>301. Dismantle and identify various parts, wiring and connections of immersion heater.</p> <p>302. Replace coil and fixing insulation failure problems. Remove scale formation from heating element.</p> <p>303. Identify the faults in Induction cooktop and rectify.</p> <p>304. Dismantle and identify various parts, wiring and tracing of various controls, Electrical and electronics circuit in Induction cooktop.</p> <p>305. Replace the Induction tube (coil) in Induction cook top.</p> <p>306. Identify the faults in the given AC and rectify.</p> <p>307. Circuit description and functions of different sections of PA System, Observation of waveforms/ signals of different sections of PA System.</p>	<p>System.</p> <p>Functions of front panel controls/ keys of Public Address System.</p>
<p>Professional Skill 50 Hrs.;</p> <p>Professional Knowledge 10 Hrs.</p>	<p>32. Install a CCTV system and configure the system for surveillance function.</p>	<p><b>CCTV</b></p> <p>308. Identification of different CCTV components.</p> <p>309. Draw, trace or follow the CCTV setup of any commercial installation.</p> <p>310. Identify the strategic locations for the installation of cameras.</p> <p>311. Operate and learn the procedure for switching cameras to have different views.</p>	<p>Types of cameras and their specifications used in CCTV systems.</p> <p>CCTV setup and its components</p> <p>Working of Digital Video Recorders and types of DVRs.</p>

		<p>312. Identify connectors and sockets used on DVRs.</p> <p>313. Test the healthiness cables and connectors.</p> <p>314. Connect CCTV Cameras to DVR, Record and Replay.</p> <p>315. Dismantle DVR and identify major functional blocks and test for the healthiness.</p> <p>316. Install and Configure IP based CCTV system.</p> <p><b>Take the students to any nearby commercial CCTV installation to carry out the above tasks.</b></p>	
<p>Professional Skill 45 Hrs.;</p> <p>Professional Knowledge 15 Hrs.</p>	<p>33. Identify, operate various controls play switches, troubleshoot and replace faulty boards of a home theatre and its remote.</p>	<p><b>Home theatre</b></p> <p>317. Identify different parts of home theatre.</p> <p>318. Test speakers, woofers &amp; tweeters.</p> <p>319. Set up home theatre using specific devices.</p> <p>320. Identify different parts of AV receiver.</p> <p>321. Identify the faults in AV receiver &amp; rectify.</p>	<p>Introduction to home theatre, surround sound system, basic components, block diagram of home theatre &amp; working.</p>
<p>Professional Skill 50 Hrs.;</p> <p>Professional Knowledge 10 Hrs.</p>	<p>25 (a). Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications.</p>	<p>322. Make simple project applications (any three) using ICs, transformer and other discrete components.</p> <ul style="list-style-type: none"> <li>a) Solar power inverter</li> <li>b) Remote control for home appliances</li> <li>c) Metal Detector</li> <li>d) Digital video recorder Door Watcher</li> <li>e) Remote Control jammer</li> <li>f) Clap Switch</li> <li>h) Digital Lucky random</li> </ul>	<p>Discussion on the identified projects with respect to data of the concerned ICs, components used in the project.</p>

		<p>Number Generator</p> <p>i) Count Down Timer</p> <p>j) Digital Clock</p> <p>k) Even Counter</p> <p>l) Seven Segment LED</p> <p>g) Display Decoder Drive Circuit</p>	
<p>Professional Skill 40 Hrs.;</p> <p>Professional Knowledge 05 Hrs.</p>	<p>34. Interpret the construction, working principle, and electronic control systems of a dishwasher used in modern home appliances.</p>	<p>323. Understand the step-by-step working process of a dishwasher.</p> <p>324. Explain the role of electronic control systems in managing dishwasher functions.</p> <p>325. Perform basic troubleshooting and identify common faults in dishwashers.</p> <p>326. Demonstrate safe handling, installation, and maintenance procedures for dishwashers.</p>	<p>Identify and describe the main components and structure of a dishwasher. Understand the working principle and sequence of operations in a dishwasher. Explain the function of electronic control systems used in dishwashers. Describe the function of sensors used in dishwashers for automation and safety.</p>
<p>Professional Skill 40 Hrs.;</p> <p>Professional Knowledge 05 Hrs.</p>	<p>35. Interpret the operation, components, and installation of smart locks and doors with electronic access control systems for enhanced home security.</p>	<p>327. Identify various types of smart locks and their applications.</p> <p>328. Understand the working principles and components of smart locking systems.</p> <p>329. Explain the role of electronic access control in home and office security.</p> <p>330. Demonstrate the steps involved in installing and configuring smart locks.</p> <p>331. Recognize the use of different technologies (RFID, biometrics, apps) in access control.</p> <p>332. Understand basic troubleshooting and maintenance of smart</p>	<p>Definition of Smart Locks and Doors. Identify the main component of Smart lock and Door. Understanding then Access control system.</p>

		locks. 333. Emphasize safety, privacy, and battery management in smart door systems.	
Professional Skill 40 Hrs.;  Professional Knowledge 05 Hrs.	36. Interpret the concept, components, and functioning of home automation systems for controlling and monitoring household electronic appliances.	334. Understand the working principle of sensors, actuators, and controllers in automation.  335. Describe common communication protocols and their roles in device connectivity.  336. Recognize typical applications of home automation for lighting, security, and energy control.  337. Explain the process of setting up and operating a basic home automation system.  338. Understand security considerations and best practices for protecting automated systems.	Define home automation and explain its importance in modern households.  Identify key components and devices used in home automation systems.
Professional Skill 49 Hrs.;  Professional Knowledge 11 Hrs.	37. Demonstrate 4G/5G mobile phones and their components provides practical insights into modern communication technology, showcasing key parts like the motherboard, antenna, SIM module, and display unit.	339. Real-Time Operation and Hardware Identification.  340. Identification and understanding of key smartphone hardware components Dual SIM interface section, Battery charging circuit, Touch screen display section, Power Management Unit, (PMU).  341. Functionality and testing of various user interface elements: Buzzer, Vibrator, Microphone (MIC) / Speaker, Hands-free module.	Introduction to Mobile Communication.  Differences between 4G and 5G in terms of speed, latency, and frequency usage.  Block diagram of a smartphone.  Concept of User Interface and Peripheral Devices.  Understanding SIM card detection and interface section.  Linear to dB and dB to Linear Conversion.

		<p>342. Observation of RF signals using RF Spectrum Analyzer Module.</p> <p>343. Examination of power distribution and fault protection through the Power Management Unit.</p>	
<b>ENGINEERING DRAWING</b>			
<p>Professional Knowledge</p> <p>ED-45 Hrs.</p>	<p>38. Read and apply engineering drawing for different application in the field of work.</p>	<ul style="list-style-type: none"> <li>• Reading of Electronics Sign and Symbols.</li> <li>• Sketches of Electronics components.</li> <li>• Reading of Electronics wiring diagram and Layout diagram.</li> <li>• Drawing of Electronics circuit diagram</li> <li>• Drawing of Block diagram of Instruments &amp; equipment of trade.</li> </ul>	
<b>WORKSHOP CALCULATION &amp; SCIENCE</b>			
<p>Professional Knowledge</p> <p>WCS- 45 Hrs.</p>	<p>39. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.</p>	<p><b>Algebra</b></p> <p>Addition, Subtraction, Multiplication &amp; Divisions. Algebra– Theory of indices, Algebraic formula, related problems.</p> <p><b>Estimation and Costing</b></p> <p>Simple estimation of the requirement of material etc., as applicable to the trade.</p> <p>Problems on estimation and costing.</p>	

### **SYLLABUS FOR CORE SKILLS**

1. Employability Skills (Common for all CTS trades) (120 Hrs. for 1st year + 60 Hrs. for 2nd year)

Learning outcomes, assessment criteria, syllabus and Tool List of Employability Skills is provided separately in [www.cstaricalcutta.gov.in](http://www.cstaricalcutta.gov.in) / [www.bharatskills.gov.in](http://www.bharatskills.gov.in) / [www.dgt.gov.in](http://www.dgt.gov.in).

<b>List of Tools &amp; Equipment</b>			
<b>MECHANIC CONSUMER ELECTRONIC APPLIANCES (For batch of 24 candidates)</b>			
<b>S No.</b>	<b>Name of the Tools and Equipment</b>	<b>Specification</b>	<b>Quantity</b>
<b>A. TRAINEES TOOL KIT (For each additional unit trainees tool kit s no. 1-12 is required additionally)</b>			
1.	Connecting screwdriver	100 mm	12 Nos.
2.	Neon tester 500 V.	500 V	6 Nos.
3.	Screwdriver set	Set of 7	10 Nos.
4.	Insulated combination pliers	150 mm	6 Nos.
5.	Insulated side cutting pliers	150mm	8 Nos.
6.	Long nose pliers	150mm	6 Nos.
7.	Soldering iron	25-Watt, 240 Volt	12 Nos.
8.	Electrician knife	100 mm	6 Nos.
9.	Tweezers	150 mm	12 Nos.
10.	Digital Multi-meter	(3 ½ digit)	12 Nos.
11.	Soldering Iron Changeable bits	15-Watt, 240 Volt	6 Nos.
12.	De-soldering pump electrical heated, manual operators	230 V, 40 W	12 Nos.
<b>B. SHOP TOOLS, INSTRUMENTS– For 2 (1+1) units no additional items are required</b>			
<b>Lists of Tools:</b>			
13.	Steel rule graduated both in Metric and English Unit	300 mm	4 Nos.
14.	Precision set of screw drivers	T5, T6, T7	2 Nos.
15.	Tweezers – Bend tip		2 Nos.
16.	Steel measuring tape	3 meters	4 Nos.
17.	Tools makers vice	100mm (clamp)	1 No.
18.	Tools maker vice	50mm (clamp)	1 No.
19.	Crimping tool (pliers)	7 in 1	2 Nos.
20.	Magneto spanner set	8 Spanners	2 Nos.
21.	File flat bastard	200 mm	2 Nos.
22.	File flat second cut	200 mm	2 Nos.
23.	File flat smooth	200 mm	2 Nos.
24.	Plier - Flat Nose	150 mm	4 Nos.
25.	Round Nose pliers	100 mm	4 Nos.
26.	Scriber straight	150 mm	2 Nos.
27.	Hammer ball pen	500 grams	1 No.

### Mechanic Consumer Electronic Appliances

28.	Allen key set (Hexagonal set of 9)	1 - 12 mm, set of 24 Keys	1 No.
29.	Tubular box spanner	Set - 6 - 32 mm	1 set.
30.	Magnifying lenses	75 mm	2 Nos.
31.	Continuity tester		6 Nos.
32.	Hacksaw frame adjustable	300 mm	2 Nos.
33.	Chisel - Cold - Flat	10 mm X 150 mm	1 No.
34.	Scissors	200mm	1 No.
35.	Handsaw 450mm	Hand Saw - 450 mm	1 No.
36.	Hand Drill Machine Electric with Hammer Action	13 mm	2 Nos.
37.	First aid kit		1 No.
38.	Bench Vice	Bench Vice - 125 mm	1 No. each
		Bench Vice - 100 mm	
		Bench Vice - 50 mm	
<b>List of Equipment</b>			
39.	Electrical Safety Trainer	Real time appearance of MCB to help the students to understand its mechanical arrangement. Demonstration of Fuse in very easy way. Provided with a manual containing colored graphical representation of many safety standards and with very interesting activities which are to be performed by students. Performing different electrical activities to avoid electrical hazards.	1 No.
40.	Dual DC regulated power supply	30-0-30 V, 2 Amps	4 Nos.
41.	DC Regulated Variable Programmable DC Power Supply	0-30V/3A	2 Nos.
42.	LCR meter (Digital) Handheld		1 No.
43.	Battery Charger	0 - 6 - 9 - 12 – 24 V, 10 Amp	1 No.
44.	Analog multi-meter		4 Nos.
45.	Clamp meter	0 - 100 A	2 Nos.
46.	Function generator (Sine, Square, Triangle, Ramp, Pulse, and Modulation.)	1 mHz -10 MHz Function-Modulation Generator with Built- in 40MHz Frequency Counter	2 Nos.
47.	Dimmer starter	3 Amps	2 Nos.
48.	Autotransformer	15 Amps	2 Nos.
49.	Analog Component Trainer	DC power supply: +5V,1A (Fixed);	4 Nos.

		<p>+12V, 500mA (Fixed); ±12V, 500mA (Variable) AC power Supply: 9V-0V-9V, 500mA            Function Generator: Sine, Square, Triangle Modulating Signal            Generator: Sine, Square, Triangle.            Modules</p> <ul style="list-style-type: none"> <li>• Diode Characteristics (Si, Zener, LED)</li> <li>• Rectifier Circuits</li> <li>• Diode as Clipper Circuit</li> <li>• Diode as Clamping Circuit</li> <li>• Zener as voltage regulator.</li> <li>• Transistor Type NPN &amp; PNP and CE Characteristics</li> <li>• Transistor as a switch</li> </ul>	
50.	Milli Ammeter (AC)	0 – 200 mA	2 Nos.
51.	Milli Ammeter (DC)	0 – 500 mA	2 Nos.
52.	Op-Amp trainer	<p>Fixed DC power supply: +12V Regulated; -12V Regulated; +5V Regulated; -5V Regulated            Variable DC power supply: +1.5V to +10V Regulated using LM317; -1.5V to -10V Regulated using LM337            Function Generator: Sine Wave, Square Wave, Triangular Wave (1KHz to 100KHz; 0-5Vpp)            Op Amp IC: IC uA741 (2 Nos.)- All pins terminated by 2mm Banana            Resistor Bank: SMD Resistance 1KV 1% 1/4W (5 Nos.), SMD Resistance 10KV 1% 1/4W (5 Nos.), SMD Resistance 100KV 1% 1/4W (5 Nos.)            Diode: Diode 1N 4007            Capacitor Bank: Electrolyte Cap. 1mf/63V, Disc cap. 1nf/63V, Disc cap. 10nf/63V, Disc cap. 100nf/63V            Variable Resistance bank: 1KΩ Single turn Potentiometer (2 Nos.), 10KΩ Single turn Potentiometer (2 Nos.), 100KΩ Single turn Potentiometer (2</p>	2 Nos.

		Nos.), 1M $\Omega$ Single turn Potentiometer (2 Nos.)	
53.	Digital IC Trainer	Breadboard for Circuit design with necessary DC Power Supply 5 V/1 A +12V/1A, Clock Frequency 4 different steps, Data Switches: 8 Nos, LED Display: 8 Nos. (TTL), Seven Segment Display Clock Frequency in steps 1Hz – 100KHz	4 Nos.
54.	Universal IC Tester	Handheld Digital IC Tester Specification: Tests variety of Digital ICs such as 74 series, 40/45 series of CMOS IC's, Auto search facility of IC's 28 pin DIP ZIF socket, 16 keys keypad, 16x2 LCD Display, 9V input voltage	1 No. each
55.	Rheostats various values and ratings		2 Nos. each
56.	POWER ELECTRONICS TRAINER with at least 6 Nos. of application board MOSFET Characteristics SCR Characteristics SCR Lamp Flasher SCR Alarm Circuit Series Inverter Single Phase PWM Inverter	On Platform Breadboard to circuit design-2Nos. On board DC Power Supply: $\pm 5V/500mA$ ; $\pm 12V/500mA$ ; $+15V/250mA$ ; $\pm 35V/250mA$ , On board AC power Supply: 18V-0V-18V; 0V-15V On board firing circuit with Frequency range: 30Hz to 900Hz variable; Amplitude: 12V; PWM control of G1, G2, G3 & G4; Duty cycle control of Gate signal is 0 to 100%. SCR Assembly: 4 SCRs 2P4M, 400V/2A	4 Nos.
57.	Desktop Computer	CPU: 32/64 Bit i3/i5/i7 or latest processor, Speed: 3 GHz or Higher. RAM: -4 GB DDR-III or Higher, Wi-Fi Enabled. Network Card: Integrated Gigabit Ethernet, with USB Mouse, USB Keyboard and Monitor (Min. 17 Inch. Licensed Operating System OR Open source and Antivirus compatible with trade related software.	4 Nos.
58.	Computer Trainer System	CPU with fan: Intel processor (Core i3/i5/i7) Mother board: With Intel chipset Memory (RAM): 4 GB DDR 3 RAM, Display adaptor card: Built in motherboard, Hard disk: 1 TB (SATA) Monitor: 15" TFT colour VGA	1 No.

		Keyboard: Multimedia keyboard Mouse: Scroll mouse (optical) SMPS: 450 watts, DVD R/W drive (SATA): Included, Sound card: Built in motherboard, Speakers & MIC: Stereo speakers, Video camera: USB camera	
59.	Laptops latest configuration		1 No.
60.	Laptop Trainer kit	System: CPU: Intel® Core™ i3 with Intel HD memory. Display: 15" diagonal HD BrightView WLED-backlit (1366 x 768 Network interface: Integrated 10/100 BASE-T Ethernet LAN. Key board: Island-style keyboard. Pointing device: Touchpad. Power Supply: 65 W EM AC power adapter Battery type: 4-cell, 41 Wh Li-ion. Test points and Switched faults.	1 No.
61.	Laser jet Printer		1 No.
62.	INTERNET BROADBAND CONNECTION		1 No.
63.	Electronic circuit simulation software with 6 user licenses	Circuit Design and Simulation Software with more than 20000 various components PCB Design with Gerber and G Code Generation, 3D View of PCB, Breadboard View, Fault Creation and Simulation.	1 No.
64.	Different types of electronic and electrical cables, connectors, sockets, terminations.		As required
65.	Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB		As required
66.	DSO (colour)	2 Channel, 50MHz Real Time Sampling 1G Samples/Sec, 12 Mpts Memory with PC Interface USB, LAN and math function includes +, -, FFT, differential, integral, abs, log etc.	1 No.
67.	Soldering & De-soldering	Soldering- 60W, Temperature Range:	1 No.

	Station	180-270°C, De Soldering - 70W, Temperature Range: 180-480°C, Pump: Diaphragm Type	
68.	SMD Soldering & De-soldering Station with necessary accessories	<p><b>SMD Rework Station</b></p> <p>Soldering station: Output Voltage: 26V – 40V AC Temp Range: 50 to 480 degree centigrade</p> <p>Desoldering Station: Output Voltage: 24V – 40V AC</p> <p>Vacuum Generator: Vacuum pump: double cylinder type Vacuum Pressure: 80 k Pa Suction flow: 15 L/min. Hot air station: Air flow: 1-9 L/min Temp: 50 o 500 °C Hand piece of Hot air accessories</p>	2 Nos.
69.	Consumer Electronics servicing/Maintenance work station	<p>Workbench should have following Technical Specifications:</p> <ol style="list-style-type: none"> <li><b>Soldering &amp; Desoldering Station:-60 W Desoldering : 70 watts</b> <b>SMD Technology Kit :SMD</b> Identification Board 1 no. ,Proto BOARDS 2 no's each , Discrete Surface Mount ,SOP,SO ,Through Holes, Chip Scale , SMD Soldering Jig 1 no., SMD Soldering Iron 1 no. SMD components Resistors, Capacitors, Diodes, Transistors 10 no. each, Tweezers 2 no. Manual 1 no.</li> <li>Soldering Smoke / Fume absorber</li> <li>Electrical Outputs</li> <li>Safety Circuit Breaker</li> <li>DMM</li> <li>LCR Meter</li> <li>Soldering Magnifier Lamp</li> <li>Test Point Microscope with USB Camera</li> </ol>	1 No.
70.	AC Motor Trainer Kit 1 HP motor Single	Suitable for 1 HP, single Phase, Induction Motor with AC drive of 1 HP Timer relay of suitable rating Switchgear rating suitable for 1 HP	1 No.

	Phase Contactors Relays MCB	Should Consist of the following minimum components <ul style="list-style-type: none"> <li>• Box enclosure with DIN rail mounting bracket –2Pole Isolator</li> <li>• 2 Pole RCCB</li> <li>• 10A MCB</li> <li>• 20A MCB</li> <li>• Contactor with thermal overload relay –</li> <li>• Timer relay</li> <li>• Momentary push button (N.O. contact and N.C. contact)</li> <li>• Pilot lamps (1 red and 1 green)</li> </ul>	
71.	PAM, PPM, PWM trainer kit	<b>Natural, Flat-top, Sample &amp; Hold</b> sampling methods in PAM. <b>Selectable sampling frequencies:</b> 8 kHz, 16 kHz; 32 kHz, 64 kHz. Built-in <b>signal generator</b> with 1 kHz & 2 kHz sine and square waves. <b>Voice communication</b> enabled On-board <b>AC amplifier</b> with adjustable gain and <b>DC output (0–4V)</b> . <b>4th order low-pass filter, switchable faults</b>	2 Nos.
72.	BLDC Motor Training System	Mains Supply Single Phase, 230V $\pm 10\%$ , 50Hz, Machine Type BLDC Rating 200W, Voltage Rating 24V, Current 8 Amp., Speed 2500 rpm (approx.), Loading arrangement Mechanical Brake, Instrumentation power supply 24V, 10Amp	1 No.
73.	DC Motor Training System	Input mains 230V AC $\pm 10\%$ , 50Hz, DC output voltage, Fixed 220V $\pm 10\%$ , 2A, Variable 0-220V $\pm 10\%$ , 12A, DC machine Type Shunt, Rating 1 HP, Voltage rating 220V $\pm 10\%$ , Speed 1500 rpm $\pm 7.5\%$ , Insulation Class 'B', Loading arrangement: Mechanical, Single phase MCB 16A, Emergency switch 10A, Start and stop push button 1 no each, Digital tachometer 19,999 rpm	1 No.
74.	AC Motor Training System	Mains supply Single phase, 230V $\pm 10\%$ , Single phase induction motor, Type Capacitor start	1 No.

		<p>Rating: 1HP, Voltage rating: 220V, Speed 1440 RPM <math>\pm</math>5%</p> <p>Insulation Class 'B', Loading arrangement: Mechanical, DOL starter 1HP, 230VAC, Single Phase AC drive</p> <p>Topology: SCR based, Loading capacity: Upto 7A</p>	
75.	Fuzzy Logic Trainer Kit		1 No.
76.	AI / IoT Enabled SMART HOME APPLIANCE		1 No.
77.	AM/FM Commercial radio receivers	<p>AM Receiver Construction: Superheterodyne, AM Frequency Band: 530 KHz – 1650 KHz</p> <p>Local Oscillator Freq. Range: 980 KHz to 2.060 MHz, Intermediate Frequency (IF): 455 KHz, FM Receiver, Construction: Superheterodyne, FM Frequency Band: 88 MHz to 108 MHz</p> <p>Tuning Range: 96 MHz to 120 MHz</p> <p>IF Frequency: 10.7 MHz, Input Circuit: RF amplifier, Mixer, Local oscillator, IF amplifier 1, IF amplifier 2, FM Detector, Automatic Frequency Control, Audio Output: Amplifier with speaker, Switched Faults: 12 Nos</p>	2 Nos.
78.	Microcontroller kits (8051), ESP32 and STM32 along with programming software	<p>Core 8051, ready to run programmer for programming modes Keypad and PC circuits. Detailed learning content through simulation software.</p> <p>Microcontroller (MCU) Model: STM32F103C8T6, Architecture: ARM Cortex-M3 Core, Clock Frequency: 72 MHz, Development Board: Board Model: STM32 Blue Pill, On-board GPIO:4 General Purpose Input/Output (GPIO) pins, Communication: ST-Link for programming and debugging, Programming Port: USB-B (female), Programming Software: Arduino IDE.</p> <p>Microcontroller: ESP32, Architecture: 32-bit Single-core, Clock Speed: 240 MHz, GPIO Pins: 10 Pins,</p>	4 Nos.

		Communication Interface: USB, Programming Port: USB-B (Female), Development Environment: Arduino IDE, Flash Storage: 4MB to 16MB, RAM: 520KB, Operating Voltage: 3.3V, Input Voltage: 5V (via USB), Power Consumption: ~200mA (varies depending on usage).	
79.	Application kits for Microcontrollers 6 different applications	<ol style="list-style-type: none"> <li>1. Input Interface: 4x4 Matrix Keypad, ASCII Key PAD, Four Input Switch</li> <li>2. Display Module 16X2 LCD, Seven Segment, LED Bar Graph</li> <li>3. ADC/DAC Module with most popular DC/DAC0808</li> <li>4. PC Interface: RS232 &amp; USB</li> <li>5. Motor Drive: DC, Servo, Stepper</li> </ol>	1 set
80.	<p>Sensor</p> <p>Following Sensors</p> <ol style="list-style-type: none"> <li>1. Thermocouple</li> <li>2. RTD</li> <li>3. Load Cell/ Strain Gauge</li> <li>4. LVDT</li> <li>5. Smoke Detector Sensors</li> <li>6. Speed Sensor</li> <li>7. Limit Switch</li> <li>8. Photo sensors</li> <li>9. Opto-coupler</li> <li>10. Proximity Sensor</li> </ol>	IoT enabled Linux based 7" Graphical touch LCD with inbuilt cortex ARM processor & DAQ for acquiring analog data and software for viewing the output waveforms with USB storage and HDMI output. LM35 : 10mV/ °C, Platinum RTD: 100Ω at 0°C (Temp. coefficient 0.385 Ω /°C), K Type Thermocouple:- 200°C to 1250°C ,NTC Thermistor : 4.7KΩ ,BPX65 Photo Diode : 500nm – 1100nm ,L14G1 Photo Transistor : 500nm – 1100nm ,Photovoltaic Cell : 500mV – 580mV.	2 Nos. Sensors as required may be procured
81.	Various analog and digital ICs useful for doing project works mentioned in the digital and analog IC applications modules		As required
82.	Different types of electronic and electrical cables, connectors, sockets, terminations.		As required
83.	Seven segment DPM trainer	Three measurement sections- Voltage Measurement (both AC and DC), Current Measurement and Resistance Measurement. Signal Conditioning, AC	6 Nos.

		to DC Conversion Sections, LED Display and Continuity tester should also available on this Demonstrator. Rotary Switches should be provided for the Function, Range and Decimal Selection.	
84.	Precision set of screw drivers	T5, T6, T7	2 Nos.
85.	SMPS of different make		4 Nos.
86.	UPS trainer	PWM switching technology with its waveform study, Test points to measures the voltages of different sections Overall functioning of UPS Trainer, AVR transformer, UPS with load condition, Switched faults to enhance troubleshooting method	1 No.
87.	UPS		04 No.
88.	SMPS Training Kit	Input: 80 to 230V AC $\pm 10\%$ , 50 / 60Hz, Output: +12V DC regulated -12V DC regulated, +5V DC regulated Switching Transformer, Input: 320V DC switching at 132kHz, Output: 30V AC (approximate).	1 No.
89.	Inverter Trainer Kit	Rated Power: 60W Charging Transformer: Step down type Input voltage: 230V Output voltage: 16V Inverter Transformer: Step up type Input voltage: 12-0-12V Output voltage: 230V Inverter output voltage: 230V $\pm 10\%$ 50Hz $\pm 5\%$ Inverter voltage control: By PWM technique Battery: 12V DC /7.5Ah /12 Hours Relay: 2 Pole/12V/285W LED Indicators: Inverter ON, mains ON, charging ON	1 No.
90.	Allen key screwdriver	5 no. of set	1 Set
91.	CCTV Training set up	DVR- Cameras with amplifier set up Dome camera Camera type: CCTV indoor IR camera Resolution: 720p (1 megapixel), Camera type: CCTV indoor/outdoor IR Bullet HD camera Resolution: 1080p (2 megapixel), Digital Video Recorder: 4 channel (DVR), Hard disk (HDD): 500GB Component video: Provided	2 System

**Mechanic Consumer Electronic Appliances**

		Display type: VGA LCD display with Test points and switch fault.	
92.	Washing machine Trainer	Auto or semi-automatic with Test Point and Fault Switches	1 each
93.	Vacuum cleaner Trainer	Portable or industry model with Test Point and Fault Switches	2 Nos. (1 each)
94.	Microwave oven	20 liters	1 No. each
95.	Mixer cum grinder		2 Nos.
96.	Steam iron automatic	Automatic	Each 2 Nos.
97.	Electric rice cooker		3 Nos.
98.	Water purifier Trainer	(RO and UV technologies) with Test Point and Fault Switches	1 No.
99.	LED TV	21-inch full HD LCD Color Television should support PAL/ NTSC video formats Complete block diagram of a LCD TV system, Study board indicating various sections of LCD TV along with the test points the test points of all sections including front panel controls and LVDS signals test points and switch faults,	1 No.
100.	Electric Geyser	3 KW	2 Nos.
101.	Induction cooktop	Induction cook top with following feature: Safety sensor Auto switch-off Auto heat-up Booster Protection against overflows	2 Nos.
102.	Printer	laser	1 each
103.	L ED/LCD Projector		1 No.
104.	DTH Trainer Kit with accessories	RF Input: 950 - 2150 MHz RF Output Input Impedance: 470 MHz t 75W o 862MHz Dish Input: F - Connector Composite Video Output: RCA type Audio Output: RCA type (L/R) TV Output: RCA type Video Output: PAL IF Frequency: 70MHz Video Output level: 1Vpp (75 load) Uplink Satellite: INSAT 4B Controls: Channel Up/Down, Volume Up/Down, Power On/Off.	1 set
105.	Public Address System Training System	Power Output: 100W RMS at 10% THD, Pre-amplifier Output: 200mV Line output: 1V/ 1K $\Omega$ Input Channels: Mic: 5nos; 0.65mV/ 4.7K $\Omega$ , Tone Controls: Bass, Treble,	1 No.

**Mechanic Consumer Electronic Appliances**

		Master Control, Speaker Outputs: 4Ω, 8Ω, 16Ω, 70-100V Line Matching Speakers: 2 nos, Microphones: 2 nos (Dynamic)	
106.	AC Trainer	Includes all major components of an automotive air-conditioning system, such as compressors, condensers, evaporators, and expansion valves.	1 No.
107.	Mobile phone Trainer	4G /5G Dual SIM GSM Handset. Tx, Rx constellation signals, study of AT commands side keys, vibrator, and other user interface sections, IOT Enabled application Frequency measurement and band verification. Real time Mobile Operation	2 Nos.
108.	Home Safety Trainer	Automatic Lock, Camera, Home Automation to understand Safety and home Automation	1 No.
109.	Wi-fi System		1 No.
110.	Co- Axial cable cutter		1 No.
111.	LED TV	21" screen smart TV, with different inputs (HDMI, VGA, component video etc.)	2 Nos.
112.	Jacket stripper/ Coring tool for 500 series cable		1 No.
113.	Universal drop trimmer for RG 6/11 cables		1 No.
114.	F - connector tool for RG 6/11 cables		1 No.
115.	F – connector compression tool for RG 6/11 cables		1 No.
116.	Wi-Fi / Smart LED Television Training System	Display Type: Wi-Fi/Smart LED, HD Screen Size: 80cm, Display Resolution: 1366 X 768 pixels Contrast Ratio: Mega Contrast Ratio Display Color: 16.9 million Display Colors with Test points and Fault Switches.	1 No.
117.	Home theatre system		1 No.
118.	Dishwasher		1 No.
119.	Smart locks doors System	Wi-Fi Smart Door Lock for Main Door with Built-in Camera   App, Fingerprint, PIN, RFID Card & Emergency Key.	1 No.

**Mechanic Consumer Electronic Appliances**

120.	Security Access System	Wireless WiFi Smart Home Security Alarm System, Home Wi-Fi Alarm with Motion Detector, Notifications with app, Door/Window Sensor, Siren, Compatible with Alexa	1 No.
121.	AIoT enable Home Training System	AI and IoT convergence training equipment using 2D model of living room of home, 4-inch TFT LCD with 800×480 resolution and 8M pixel high resolution camera, Provides Gigabit Ethernet, dual band Wi-Fi (2.4GHz, 5GHz) and Bluetooth 4.2 or 5.0, This system included Temperature and Humidity sensor, PIR Sensor, Dust Sensor, luminance Sensor, Gas Sensor, Touch Keypad, RGB LED, Fan	1 No.

**D. Shop Floor Furniture and Materials - For 2 (1+1) units no additional items are required.**

122.	Instructor's table		1 No.
123.	Instructor's chair		2 Nos.
124.	Metal Rack	100cm x 150cm x 45cm	4 Nos.
125.	Lockers with 16 drawers' standard size		2 Nos.
126.	Steel Almirah	2.5 m x 1.20 m x 0.5 m	2 Nos.
127.	Black board/white board (one for lab and one classroom)	12' x 4'	2 Nos.
128.	Fire Extinguisher	Operate and test clinical equipment/ instruments used in hospital.	2 Nos.
129.	Classroom furniture (dual desk)		12 Nos.
130.	Lab tables (work bench)		6 Nos.
131.	Stools for lab		24 Nos.

**Note: -**

1. All the tools and equipment are to be procured as per BIS specification.
2. Internet facility is desired to be provided in the classroom.

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<b>LIST OF CONTRIBUTORS</b>			
<b>S No.</b>	<b>Name &amp; Designation Mr./Ms.</b>	<b>Organization</b>	<b>Remarks</b>
1.	T. Ragulan, Director	CSTARI, Kolkata	Chairman
2.	Prof. Abdul Wahid, Dean	School of Technology, Maulana Azad National Urdu University	Member
3.	Mohammed Ameer, Vocational Instructor Electronic Mechanic	MANUU ITI Hyderabad	Member
4.	Dr. Arshia Azam, Assist. Professor & ITI Principal	MANUU ITI Hyderabad	Member
5.	Dr. Mohammed Yousuf Khan, Principal Polytechnic	MANUU Polytechnic Hyderabad	Member
6.	Sreedhar, Assistant Divisional Engineer	TGSPDCL	Member
7.	Ch. N.V Phani	Physitech Electronics	Member
8.	K. Yadagiri, Instructor	MANUU ITI Hyderabad	Member
9.	Praveen Mohan, So/F	Nuclear Fuel Complex, Hyderabad	Member
10.	Rai Rama Krishna, Scientific Officer-D	Nuclear Fuel Complex, Hyderabad	Member
11.	V. Ravi, Director	Anshuman Tech Pvt. Ltd.	Member
12.	Shankar Nair, Director	Akademika Lab Solutions	Member
13.	Dr. R Vijayarajeswaran, Manager Director	Vi Microsystem Pvt. Ltd., Chennai	Member
14.	Dr. Mahesh. D, T.O.	NSTI-R, Hyderabad	Member
15.	MD. Raunaque Hasan, Instructor	MANUU, Hyderabad	Member
16.	MD. Ashfaq Hussain, Instructor	MANUU ITI Hyderabad	Member
17.	Lilcharur Rahman Khan, Instructor	MANUU Polytechnic Hyderabad	Member
18.	Mohd. Abdul Quadeer, Instructor	MANUU ITI Hyderabad	Member
19.	Satyendra Singh Pawar, Sales	Scientech, Indore	Member
20.	A. Kavitha, A.T.O.	Govt. ITI Old city	Member
21.	J Sandeep Kumar, Junior Section Officer	B.E.L Hyderabad	Member
22.	M.R.R Sheela Rani, A.T.O.	Govt. ITI Sanath Nagar, Hyderabad	Member
23.	V.V Sailaja, T.O.	N.S.T.I-R Hyderabad	Member

### **Mechanic Consumer Electronic Appliances**

24.	Vijay Singh Kushwah, Manager	Accura Tequipment	Member
25.	P. Srinivas, Proprietor	Innovative Systems	Member
26.	N.P Bannibagi	N.S.T.I-R Hyderabad	Member
27.	TVLN Rao, Director	Former RD, MSDE, Tachyon Automations Hyderabad	Member
28.	P. Dharani Sai, CEO	Tachyon Automations	Member
29.	G. Buchaiah, Scientist-E	Meity, STQC Directorate ETDC, Hyderabad	Member
30.	K. Mallesham, Scientist-D	ETDC, STQC, Meity GoI ECIL Hyderabad	Member
31.	Uday Bhole, Deputy CEO	NVIS Technologies Pvt. Ltd. Indore	Member
32.	G.V.V Sharma, Associate Professor	IIT Hyderabad	Member
33.	Tarun Agarwal, COO	Edge FX Technologies Hyderabad	Member
34.	Mubeen Baig	Edge FX Technologies Hyderabad	Member
35.	D. Venkatesan, Sales Manager	Vi microsystems Ltd.	Member
36.	N. Satish Kumar Reddy, Scientist-G	DLRL, Hyderabad	Member
37.	Guruprasad, Engineer	Mulitech Systems Kachiguda, Hyderabad	Member
38.	Asma Mohammadi, Instructor	MANUU-ITI, Hyderabad	Member
39.	Syeda Imrana Fatima, Asst. Professor (contractual)	MANUU CS&IT	Member
40.	Tajvar Sultana, Instructor-EL	MANUU-ITI, Hyderabad	Member
41.	K. Sandhya Rani, A.T.O.	Govt. ITI, Medchal	Member
42.	Chand Pasha Shaik, A.T.O.	Govt. ITI, Mallepally, Hyderabad	Member
43.	Shaik Khaleel Ahmed, A.T.O.	Mallepally Hyderabad	Member
44.	B. Sharanappa, A.D.	N.S.T.I-R Hyderabad	Member
45.	Katta Kiran, Tech-B	BEL Hyderabad	Member
46.	G. Niranjana, Tech	BEL Hyderabad	Member
47.	P. Nagaraju, Instructor	MANUU-ITI	Member
48.	G. Kusuma, Junior General manager	Medha Servo Drives pvt.ltd	Member
49.	Mohammed Taqui & Phani, Manager	Physitech Electronics	Member
50.	P.K Bairagi, T.O.	CSTARI Kolkata	Member
51.	K.V Satya Narayana, T.O.	CSTARI Kolkata	Member
52.	Ch. Rajender, A.T.O.	DET, Hyd Govt ITI Mancherial	Member
53.	P. Vidyasagar Reddys, T.O.	Govt. ITI Ramagundam	Member
54.	MD. Asif, Maintance Assistant	MANUU-Vtc ITI	Member
55.	K. Ashok Kumar, Principal	Govt. ITI Karimnagar	Member
56.	Khaja Moizuddim, Technical Assistant Electronic	MANUU-Vtc ITI	Member
57.	Mohammed Ali, Technical Assistant Electronic	MANUU Polytechnic	Member
58.	M.D Irfan Ali, Technical Assistant Electronic	MANUU Polx	Member

### **Mechanic Consumer Electronic Appliances**

59.	K. Ravi Kiran, Technical Assist	Manuu CSIT & CIT	Member
60.	Lalu Dharavath, Regional Manager	Electronics Sector Skills Council of India, New Delhi	Member
61.	Manohar S Desai, Technical Head	Skill Bahn LLP	Member
62.	Kafil Ajmeri, Service Manager	Sukshmatark Technologies	Member
63.	Ishan parekh, Engineer	Siddhi54@gmail.com	Member
64.	Manish Joshi, Country Manager	Siglent Technologies Co.Ltd.	Member
65.	Dr Pratik J Mhatre, R&D & master Trainer	Grok Learning Private Limited	Member
66.	Pravin K Chhaya, Master Trainer	L&T Skill Trainers Academy	Member
67.	Balagopal Padmakumar, Technical associate	Arsiare Pvt.Ltd.	Member
68.	Akshay Jadhav, Sr. Design Engineer	Tata Technologies	Member
69.	Ashutosh Pimparkar, Automation Engineer	Tata Technologies Ltd	Member
70.	Pradeep Chamle, Assistant manager	Tata Technologies Ltd	Member
71.	Kailas N Gurav, Master Trainer	L&T Skill Trainers Academy	Member

<b>ABBREVIATIONS</b>	
CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprenticeship Certificate
NCIC	National Craft Instructor Certificate
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfism
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities

