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

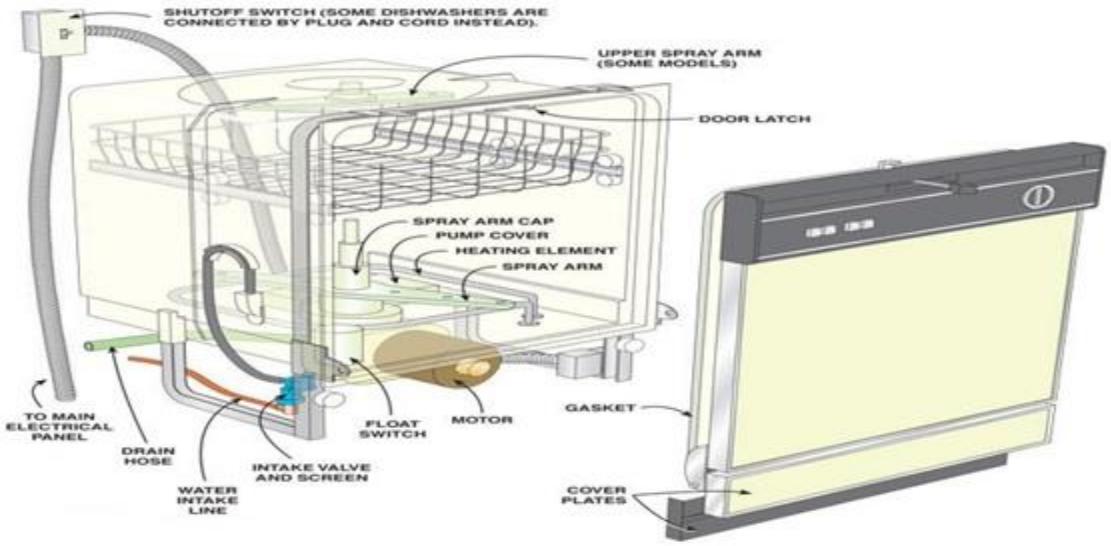
COMPETENCY BASED CURRICULUM

MECHANIC CONSUMER ELECTRONIC APPLIANCES

(Duration: Two Years)
Revised in July 2022

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4



SECTOR –ELECTRONICS & HARDWARE

Directorate General of Training

MECHANIC CONSUMER ELECTRONIC APPLIANCES

(Engineering Trade)

(Revised in July 2022)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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1. COURSE INFORMATION

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

FIRST YEAR: In this year, the trainee learns about safety and environment, use of fire extinguishers, artificial respiratory resuscitation to begin with. He gets the idea of trade tools & its standardization, familiarize with basics of electricity, test the cable and measure the electrical parameter. Skilling practice on different types & combination of cells for operation and maintenance of batteries being done. Identify and test passive and active electronic components. Construct and test unregulated and regulated power supplies. Practice soldering and de-soldering of various types of electrical and electronic components on through-hole PCBs. Assemble a computer system, install OS, Practice with MS office. Use the internet, browse, create mail IDs, download desired data from internet using search engines.

The candidate will be able to construct and test amplifier, oscillator and wave shaping circuits. Testing of power electronic components. Construct and test power control circuits. Identify and test optoelectronic devices. Verifying the truth tables of various digital ICs by referring Data book. Practice circuit simulation software to simulate and test various circuits. Identify various types of LEDs, LED displays and interface them to a digital counter and test. Construct and test various circuits using linear ICs 741 & 555.

SECOND YEAR: In this year, the trainee will be able to operate DSO and perform various functions like testing of signal Generator etc. Able to achieve the skill on SMD Soldering and De-soldering of discrete SMD components. Able to identify the defects and do rework of PCB. Construct and test simple electrical control circuits and various electrical protective devices. Identify, prepare, terminate and test various types of electronic cables used in various electronic systems. Identify various functional blocks and I/O Ports of an8051-microcontroller system, familiarize with the instruction set of 8051 micro controller. Interface a model application with the Microcontroller kit and run the application. Construct and test various modulation/demodulation circuits. The trainee will identify, and test various types of sensors used in electronic industries and, construct and test circuits using various sensors system. They can construct and test analog and digital IC based application circuits as a part of project work.

The candidate will be able to prepare Fiber optic set up and execute transmission and reception. He is also required to coordinate activities for installation and commissioning of Optical fiber cable (OF) as per the route plan.Trainees will be able to identify the defects & faults, and troubleshoot SMPS, UPS & inverter, replace modules of the LCD/LED TV and its

remote. The trainee will be identifying the parts, control circuits, sensor of various domestic appliances. Install/ configure various control adjustment of the display, troubleshoot and secure LCD/LED projector, printer. Identify different accessories of DTH, site selection and installation and performtroubleshooting.Trainees will be able to install a CCTV system and configure the system for surveillance function. Identify various controls play switches, troubleshoot and replace faulty board of a home theater. They will plan and carry out the selection of aproject, assemble the project and evaluate its performance fordomestic/commercial appliances.

2. TRAINING SYSTEM

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of Labour market. The vocational training programmes are running under aegis of 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.

Traineebroadlyneeds to demonstratethat 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).
- 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	
		1st Year	2nd Year
1	Professional Skill (Trade Practical)	840	840
2	Professional Knowledge (Trade Theory)	240	300
3	Employability Skills	120	60
	Total	**1200**	**1200**

Every year 150 hours of mandatory OJT (On the Job Training) at nearby industry, wherever not available then group project is mandatory.

4	On the Job Training (OJT)/ Group Project	150	150

Trainees of one-year or two-year trade can also opt for optional courses ofup to 240 hours in each year for 10th/ 12th class certificate along with ITI certification, or, add on short term courses.

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his 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 onwww.bharatskills.gov.in

b) The final assessment will be in the form of summative assessment. The All India Trade Test for awarding NTCwill be conducted by Controller of examinations, 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 examiner during final examination will also check** the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

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

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration to be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitive to environment and regularity in training.The sensitivity towards OSHE and self-learning attitude to be considered while assessing competency.

Assessment will be evidence based comprising 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:

Performance Level	Evidence
(a) Marksin the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b)Marksin the range of above75% - 90% to be allotted during assessment	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A good level of neatness and consistency in the finish • Little support in completing the project/job
(c) Marksin the range of above 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% accuracy achieved while

procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

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 FibreTechnician; 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.

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 notfunctioning. 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 ServiceTechnician; installs set-top boxes andprovides after sales service for DirecttoHome (DTH) system. The individual atwork installs the set-top box at customers'premises; addresses the field serviceablecomplaints and co-ordinateswiththetechnical team for activation of newconnections.

Field Technician, Washing Machine is also,called 'Washing Machine RepairTechnician'.This job is about providingafter sales service to customers. Theindividual at work installs the washingmachine, interacts with customers todiagnose the problem and assessespossible causes of fault reported. Oncethe problem and causes have beenidentified, the individual rectifies minorproblems or replaces faulty modules forfailed parts or recommends factoryrepairs for bigger faults.

Field Technician, Other Home Appliances; is also called, 'Home Appliance RepairTechnician', this is an after-sales servicejob for installing and providing support tothe water purifier, mixer/grinder buyers.The individual at work installs theappliance and interacts with customers todiagnose the problem and possiblecauses. Once the problem and causeshave been identified,

the individualrectifies minor problems or replaces faultymodules for failed parts or recommendsfactory repairs for bigger faults.

Access Controls Installation Technician; Also called 'Access Control DeviceInstaller', the Access Control InstallationTechnician provides after sale supportservices for access control devices andsystems such as point of sale scanners,fingerprint or iris scan. The individual atwork is responsible for installing theaccess control system at the customer'spremises. The individual undertakes siteassessment, installs the hardware andintegrates the system to meet customer's requirement.

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 toassess 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: ELE/N1002, ELE/N7001, ELE/N5804, ELE/N7812, ELE/N4614, ELE/N9801, ELE/N9802, ELE/N1201, ELE/N6102, ELE/N5102, ELE/N6307, ELE/N9802, ELE/N7202, ELE/N3102, ELE/N8105, ELE/N3118, ELE/N3119, ELE/N3120, ELE/N3121, ELE/N4610, ELE/N4611, ELE/N9435,ELE/N9436,ELE/N9437,ELE/N9438,ELE/N9439, ELE/N9440, ELE/N9441, ELE/N9442, ELE/N9443, ELE/N9444, ELE/N9445, ELE/N9446

4. GENERAL INFORMATION

Name of the Trade	**MECHANIC CONSUMER ELECTRONIC APPLIANCES**
Trade Code	DGT/1066
NCO – 2015	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
NOS Covered	ELE/N1002, ELE/N7001, ELE/N5804, ELE/N7812, ELE/N4614, ELE/N9801, ELE/N9802, ELE/N1201, ELE/N6102, ELE/N5102, ELE/N6307, ELE/N9802, ELE/N7202, ELE/N3102, ELE/N8105, ELE/N3118, ELE/N3119, ELE/N3120, ELE/N3121, ELE/N4610, ELE/N4611, ELE/N9435,ELE/N9436,ELE/N9437,ELE/N9438,ELE/N9439, ELE/N9440, ELE/N9441, ELE/N9442, ELE/N9443, ELE/N9444, ELE/N9445, ELE/N9446
NSQF Level	Level-4
Duration of Craftsmen Training	Two Years (2400 hours + 300 hours OJT/Group Project)
Entry Qualification	Passed 10th class examination with Science and Mathematics or with vocational subject in same sector or its equivalent.
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, LC, DW, AA, LV, DEAF, AUTISM, SLD
Unit Strength (No. Of Students)	24(There is no separate provision of supernumerary seats)
Space Norms	56 Sq m
Power Norms	3.04 KW
Instructors Qualification for:	
1. Mechanic Consumer Electronic Appliances Trade	B.Voc/Degree in Electronics/ Electronics and Telecommunication/ Electronics and Communication Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Electronics/ Electronics and Telecommunication/ Electronics and Communication from AICTE recognized board of technical education or relevantAdvanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR**

	NTC/NAC passed in the Trade of "Mechanic Consumer Electronic Appliances" With three years' experience in the relevant field. **Essential Qualification:** Relevant Regular / RPL variants of National Craft Instructor Certificate (NCIC) under DGT. ***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. However, both of them must possess NCIC in any of its variants.***
2. Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/ NAC in any one of the engineering trades with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade **OR** Regular / RPL variants NCIC in RoDA or any of its variants under DGT
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/ NAC in any one of the Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade **OR**

	Regular / RPL variants of NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.
4. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) **OR** Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills.
5. Minimum Age for Instructor	21 Years
List of Tools and Equipment	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 (TRADE SPECIFIC)

FIRST YEAR:

1. Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety following safety precautions. ELE/N1002
2. Select and perform electrical/ electronic measurement of single range meters and calibrate the instrument. ELE/N9435
3. Test & service different batteries used in electronic applications and record the data to estimate repair cost. ELE/N7001
4. Test various electronic components using proper measuring instruments and compare the data using standard parameter. ELE/N5804
5. Plan and execute soldering & de-soldering of various electrical components like Switches, PCB & Transformers for electronic circuits. ELE/N7812
6. Assemble simple electronic power supply circuit and test for functioning. ELE/N5804
7. Install, configure, interconnect given computer system(s) and demonstrate & utilize application packages for different application. ELE/N4614
8. Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications. ELE/N9801 & ELE/N9802
9. Construct, test and verify the input/output characteristic of various analog circuits. ELE/N9436
10. Plan and construct different power electronic circuits and analyse the circuit functioning. ELE/N9437
11. Select the appropriate opto-electronics components and verify the characteristics in different circuit. ELE/N9438
12. Assemble, test and troubleshoot various digital circuits. ELE/N1201
13. Simulate and analyze the analog and digital circuits using Electronic simulator software. ELE/N6102
14. Construct and test different circuits using ICs 741 Operational amplifiers & ICs 555 linear integrated circuits and execute the result. ELE/N9439
15. Read and apply engineering drawing for different application in the field of work. CSC/N9401

16. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. CSC/N9402

SECOND YEAR:

17. Measure the various parameters by DSO and execute the result with standard one. ELE/N9440
18. Identify, place, solder and desolder and test different SMD discrete components and IC's package with due care and following safety norms using proper tools/setup. ELE/N5102
19. Rework on PCB after identifying defects from SMD soldering and de-soldering. ELE/N5102
20. Construct different electrical control circuits and test for their proper functioning with due care and safety. ELE/N9441
21. Prepare, crimp, terminate and test various cables used in different electronics industries. ELE/N6307
22. Assemble and test a commercial AM/FM receiver and evaluate performance. ELE/N9442
23. Test, service and troubleshoot the various components of different domestic/ industrial programmable systems. ELE/N9443
24. Execute the operation of different process sensors, identify, wire & test various sensors of different industrial processes by selecting appropriate test instruments. ELE/N9444
25. Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/ commercial applications. ELE/N9802
26. Prepare fibre optic set up and execute transmission and reception. ELE/N9445
27. Detect the faults and troubleshoot SMPS, UPS and inverter. ELE/N7202
28. Identify, operate various controls, troubleshoot and replace modules of the LCD/LED TV and its remote. ELE/N3102
29. Install/configure, various control adjustment of the display, troubleshoot and secure LCD/LED projector/ printer. ELE/N8105
30. Install a DTH system by proper selection of site, assembling of different parts/ accessories and troubleshoot the system. ELE/N8105
31. Dismantle; identify the parts, control circuits, sensors of a various domestic appliance. Estimate and troubleshoot. ELE/N3118, ELE/N3119, ELE/N3120, ELE/N3121
32. Install a CCTV system and configure the system for surveillance function. ELE/N4610,ELE/N4611
33. Identify, operate various controls play switches, troubleshoot and replace faulty boards of a home theatre and its remote. ELE/N9446
34. Read and apply engineering drawing for different application in the field of work. CSC/N9401
35. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. CSC/N9402

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
FIRST YEAR	
1. Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety following safety precautions. ELE/N1002	Identify basic hand tools for fitting, riveting, drilling etc. with due care and safety.
	Fix surface mounting type of accessories in a panel board.
	Connect electrical accessories.
	Make and wire up of a test board and test it.
2. Select and perform electrical/ electronic measurement of single range meters and calibrate the instrument. ELE/N9435	Plan work in compliance with standard safety norms.
	Identify the type of electronic instruments.
	Determine the measurement errors while measuring resistance by voltage drop method.
	Extend the range of MC voltmeter and ammeter.
	Measure the value of resistance, voltage and current using digital multimeter.
	Calibrate analog multimeter.
3. Test &service different batteries used in electronic applications and record the data to estimate repair cost. ELE/N7001	Identify tools and instruments for testing of batteries.
	Observe safety procedure during testing of batteries and work as per standard norms and company guidelines.
	Identify the primary and secondary cells.
	Measure and test the voltages of the given cells/battery using analog/ digital multimeter.
	Charging and discharging the battery.
	Maintain and estimate the repair cost of secondary battery.
	Use a hydrometer to measure the specific gravity of the secondary battery.
4. Plan and execute soldering & de-soldering of various electrical components like	Plan work in compliance with standard safety norms.
	Identify different types of mains transformer and test.
	Identify the primary and secondary transformer windings and test the polarity.

Switches, PCB &Transformers for electronic circuits. ELE/N7812	Measure the primary and secondary voltage of different transformers.
	Solder the given components
	Identify and test the variac.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
5. Test various electronic components using proper measuring instruments and compare the data using standard parameter. ELE/N5804	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Plan work in compliance with standard safety norms.
	Identify the different types of resistors.
	Measure the resistor values using colour code and verify the reading by measuring in multi-meter.
	Identify the power rating using size.
	Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter.
	Identify different inductors and measure the values using LCR meter.
	Identify the different capacitors and measure capacitance of various capacitors using LCR meter.
	Ascertain and select tools and materials for the job and make this available for use in.
6. Assemble simple electronic power supply circuit and test for functioning. ELE/N5804	Practice soldering on components, lug and board with safety.
	Identify the passive/active components by visual appearance, Code number and test for their condition.
	Identify the control and functional switches in CRO and measure the D.C. & A.C. voltage, frequency and time period.
	Construct and test a half & full wave rectifier with and without filter circuits.
	Construct and test a bridge rectifier with and without filter circuits.
	Construct and test a Zener based voltage regulator circuit.
7. Install, configure, interconnect given	Plan, work in compliance with standard safety norms.
	Select hardware and software component.

	computer system(s) and demonstrate & utilize application packages for different application. ELE/N4614	Install and configure operating systems and applications.
		Integrate IT systems into networks.
		Deploy tools and test programmes.
		Avoid e-waste and dispose the waste as per the procedure.
8.	Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications. ELE/N9801, ELE/N9802	Plan, analyze and estimate the cost of the particular project.
		Identify the various tools required for the job.
		Prepare the simple digital/analog electronic circuit.
		Simulate and test the prepared circuit.
		Assemble and test the circuit.
9.	Construct, test and verify the input/ output characteristics of various analog circuits. ELE/N9436	Ascertain and select tools and instruments for carrying out the jobs.
		Plan and work in compliance with standard safety norms.
		Practice on soldering components on lug board with safety.
		Identify the passive/active components by visual appearance, code number and test for their condition.
		Construct and test the transistor-based switching circuit.
		Construct and test CB, CE &CC amplifier circuit.
		Ascertain the performance of different oscillator circuits.
		Construct and test clipper, clamper and Schmitt trigger circuit.
10.	Plan and construct different power electronic circuits and analyze the circuit functioning. ELE/N9437	Construct and test of Transistor and JFET amplifiers, oscillators and multi-vibrators.
		Construct and test a UJT as relaxation oscillator.
		Construct and test lamp dimmer using TRIAC/DIAC with safety.
		Construct and test MOSFET, IGBT test circuit and apply for suitable operation with proper safety.
		Construct and test the universal motor speed controller using SCR with safety.
		Construct and test a switching circuit using optical devices.
11.	Select the appropriate opto- electronics	Plan work in compliance with standard safety norms.
		Identify the different types of LEDs and IR LEDs.

components and verify the characteristics in different circuit. ELE/N9438	Measure the resistance, voltage, current through electronic circuit using multimeter.
	Construct and test a circuit using photo transistor and verify its characteristics.
	Identify photo coupler/ optical sensor input/output terminals and measure the quantum of isolation between the terminals.
12. Assemble, test and troubleshoot various digital circuits. ELE/N1201	Illustrate to practice the digital trainer kit with safety.
	Identify various digital ICs, test IC using digital IC tester and verify the truth table.
	Construct and verify the truth table of all gates using NOR and NAND gates.
	Construct an adder cum subtractor circuits and verify the truth table.
	Construct a decoder and encoder, multiplexer and de-multiplexer circuits and verify the truth table.
	Construct a multiplexer and de-multiplexer and verify the truth table.
	Construct and verify the truth table of various flip flop, counter and shift register circuits.
13. Simulate and analyze the analog and digital circuits using Electronic simulator software. ELE/N6102	Plan the work incompliance with standard procedure.
	Prepare simple analog and digital electronic circuits using the simulator software.
	Simulate and test the prepared analog and digital circuits.
	Convert the prepared circuit into layout diagram.
	Explore various trouble shooting and fault finding the resources provided in the simulation software.
14. Construct and test different circuits using ICs 741operational amplifiers & ICs 555 linear integrated circuits and execute the result. ELE/N9439	Demonstrate analog trainer kit with safety precautions.
	Identify various ICs, differentiate by code No. and test for their condition.
	Construct and test various OPAMP circuits.
	Construct and test R-2R ladder type digital to analog converter circuit.
	Construct and test different configurations of 555 IC e.g. astable,

	monostable, bi-astable and VCO circuits.
15. Read and apply engineering drawing for different application in the field of work. CSC/N9401	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
16. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. CSC/N9402	Solve different mathematical problems
	Explain concept of basic science related to the field of study
SECOND YEAR	
17. Measure the various parameters by DSO and execute the result with standard one. ELE/N9440	Identify and demonstrate various control elements on front panel of a DSO.
	Measure different parameters of electronic signals using DSO.
	Store the waveform of a signal in DSO.
	Connect DSO with a printer and take printout of signal waveforms.
18. 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. ELE/N5102	Identify the various crimping tools for various IC packages.
	Identify different types of soldering guns and choose the suitable tip for the application.
	Practice the soldering and de-soldering the different active and passive components, IC base on GPCBs using solder, flux, pump and wick.
	Make the necessary setting on SMD soldering station to solder and de-solder various IC's of different packages by following the safety norms.
	Identify SMD components, de-solder and solder the SMD components on the PCB.
	Check the cold continuity, identify loose/dry solder and broken track on printed wired assemblies and rectify the defects.

	Avoid waste, ascertain unused materials and components for safe disposal.
19. Rework on PCB after identifying defects from SMD soldering and de-soldering. ELE/N5102	Plan the work in compliance with standard safety procedures.
	Demonstrate various tools and accessories used in PCB rework.
	Construct a PCB to demonstrate defects on soldered joints.
	Repair defective soldered joints.
20. Construct different electrical control circuits and test for their proper functioning with due care and safety. ELE/N9441	Measure the coil winding of the given motor.
	Prepare the setup and control an induction motor using a DOL starter by following the safety norms.
	Construct a direction control circuit to change direction of an induction motor.
	Connect an overload relay and test for its proper functioning.
21. Prepare, crimp, terminate and test various cables used in different electronics industries. ELE/N6307	Plan and work incompliance with standard safety norms.
	Prepare, terminate and test various electronics cable using proper crimping tools.
22. Assemble and test a commercial AM/ FM receiver and evaluate performance. ELE/N9442	Plan and select tools to assemble the receiver.
	Modulate and demodulate various signals using AM and FM on the trainer kit and observe waveforms.
	Construct and test IC based AM Receiver.
	Construct and test IC based FM transmitter and receiver.
	Modulate and demodulate a signal using PAM, PPM, PWM Techniques.
	Troubleshoot and replace the faulty components.
	Check the functionality of AM/ FM receiver.
23. Test, service and troubleshoot the various components of different domestic/ industrial	Understand and interpret the procedure as per manual of Micro controller.
	Identity various ICs & their functions on the given Microcontroller Kit.

programmable systems. ELE/N9443	Identify the address range of RAM & ROM.
	Write data into RAM & observe its volatility.
	Identify the port pins of the controller & configure the ports for Input & Output operation.
	Demonstrate entering of simple programs, execute & monitor the results.
24. Execute the operation of different process sensors, identify, wire & test various sensors of different industrial processes by selecting appropriate test instruments. ELE/N9444	Ascertain and select tools, material for the job and make this available for use in the timely manner.
	Plan work in compliance with safety norms.
	Demonstrate possible solution and agree task within the team.
	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.
	Measure temperature of a lit fire using a Thermocouple and record the readings referring to data chart.
	Measure temperature of a lit fire using RTD and record the readings referring to data chart.
	Measure the DC voltage of a LVDT.
	Detect different objectives using capacitive, inductive and photoelectric proximity sensors.
25. Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications. ELE/N9802	Plan, analyze and estimate the cost of the particular project.
	Identify the various tools required for the job.
	Prepare the simple digital/ analog electronic circuit.
	Simulate and test the prepared circuit.
	Assemble and test the circuit.
26. Prepare fibre optic setup and execute transmission and reception. ELE/N9445	Plan and select appropriate tools to complete the job safely.
	Identify the resources and their need on the given fiber optic trainer kit.
	Make optical fibre setup to transmit and receive analog and digital data.
	Demonstrate and apply FM modulation and demodulation using OFC trainer kit using audio signal and voice link.

	Demonstrate PWM modulation and demodulation using OFC trainer kit using audio signal.
	Demonstrate PPM modulation and demodulation using OFC trainer kit using audio.
27. Detect the faults and troubleshoot SMPS, UPS and Inverter. ELE/N7202	Identify the tools and equipments to perform the job with due care and safety.
	Dismantle the given stabilizer and find major sections/ ICs components.
	Identify various input and output sockets/ connectors of the given SMPS.
	Identify major sections/ ICs/components of SMPS.
	Identify and replace the faulty components and construct and test IC Based DC-DC converter for different voltages.
	Identify front panel control & indicators of UPS.
	Identify various circuit boards in UPS and monitor voltages at various test points.
	Test UPS under Fault condition & rectify fault.
28. Identify, operate various controls, troubleshoot and replace modules of the LCD/LED TV & its remote. ELE/N3102	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Select measuring procedure and measuring devices, assess measurement errors and set up LCD/LED TV.
	Dismantle, identify the parts of the remote control.
	Trace and rectify the faults of a various remote controls.
	Measured and checked various connectors and connect the cable operator's external decoder (set top box) to the TV.
	Comply with safety rules when performing the above operations.
	Monitor, evaluated and check own work and work done by others.
29. Install/configure, various control adjustment of the display, troubleshoot and secure LCD/LED projector and printer.	Ascertain & select tools and equipment an order-related in a timely manner.
	Identify and operate different control on LCD/ LED projector.
	Select the proper parts use suitable cable to interface to the desktop computer, make necessary adjustment and operate.
	Dismantle the projector and identify all major functional modules,

ELE/N4614	test the power supply, exhaust fan etc.
	Comply with safety rules when performing the above operations.
	Select, prepare, lay and use of controls/ switches/ sockets of a dot matrix printer and internal assembly/ section/parts of Printer.
	Select and handle measuring equipment for the measurement and checking paper sensor, print head coils, home position sensor, print head needle coil & cleaning of ribbon mask, paper feed motor gears, printer head movement gears, print head guide and troubleshoot.
	Select, install, wire up & use of controls/ switches/ sockets of an inkjet printer, interconnect printer to computer, perform printer test & clean the ink cartridge and troubleshoot.
	Identify& use of controls/ switches/ sockets of a Laser printer interconnect printer to computer, perform printer test & cleaning of an ink cartridge and rectify the faults.
	Monitor, evaluate and check own work and work done by others.
30. Install a DTH system by proper selection of site, assembling of different parts/ accessories and troubleshoot the system. ELE/N8105	Plan & setup the workplace different tools and equipment used in DTH installation procedure & cabling procedure and take due care using the tools.
	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. Set up the connection to STB by selecting the suitable port and cable.
	Identify the faults in DTH system & rectify.
	Document materials, spare parts, work time and technical checks.
	Monitor, evaluate and check own work.
31. Dismantle, identity the parts, control circuits, sensors of a various domestic appliances. Estimate and troubleshoot. ELE/N3118, ELE/N3119, ELE/N3120, ELE/N3121	Systematically seek causes of errors and qualify defects, rectify and document such errors and defects.
	Identify, use the controls on touch keypad of Microwave oven, dismantle, wire the Microwave oven and rectify the faults.
	Identify the faults in the given Microwave oven & rectify.
	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.
	Dismantle and identify various parts, electric circuits in various

	types of Vacuum cleaners and rectify the faults.
	Assemble and identify of various parts, electric circuits in various types of mixer/grinder and rectify the faults.
	Dismantle and identify various parts of steam iron and rectify the faults.
	Dismantle and identify the various parts, electronic circuits in of rice cooker and rectify the faults.
	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.
	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.
32. Install a CCTV system and configure the system for surveillance function. ELE/N4610, ELE/N4611	Identify & use different tools and equipment used for installation of CCTV, handle the tools with due care and safety.
	Identify the different CCTV components, Trace or follow the CCTV setup for any commercial installation.
	Identify the strategic locations for the installation of cameras.
	Plan and setup the procedure for switching the cameras to have different views.
	Identify the connectors and sockets used on DVRs, connect CCTV Cameras to DVR, Record and Replay.
	Dismantle DVR and identify major functional blocks and test for the healthiness.
	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.
	Monitor, evaluate and check own work.
33. Identify, operate various controls, play switches, troubleshoot and replace faulty boards of a home theatre and its remote.	Select test methods and test use of different parts of home theatre, test the speakers, woofers & tweeters.
	Contribute to continuous improvement troubleshoot of work process in home theatre front panel.
	Install/setup of home theatre using specific devices.

ELE/N9446	Identify different parts of AV receiver and rectify the faults.
	Dismantle, identify the parts of the remote control, trace and rectify the faults of a various remote controls as home theatre.
	Document materials, spare parts, work time and technical checks.
34. Read and apply engineering drawing for different application in the field of work. CSC/N9401	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
35. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. CSC/N9402	Solve different mathematical problems
	Explain concept of basic science related to the field of study

7. TRADE SYLLABUS

SYLLABUS FORMECHANIC CONSUMER ELECTRONIC APPLIANCES TRADE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) with Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 40 Hrs.; Professional Knowledge 08 Hrs.	Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety following safety precautions. (Mapped NOS: ELE/N1002)	**Trade and Orientation** 1. Visit to various sections of the institute and identify location of various installations. (04 hrs.) 2. Identify safety signs for danger, warning, caution & personal safety message. (03hrs.) 3. Use of personal protective equipment (PPE). (04 hrs.) 4. Practice elementary first aid.(05hrs.) 5. Preventive measures for electrical accidents & steps to be taken in such accidents.(02 hrs.) 6. Use of Fire extinguishers.(05hrs.)	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.(05 hrs.)
		Hand tools and their uses 7. Identify the different hand tools. (05 hrs.) 8. Selection of proper tools for operation and precautions in operation. (05 hrs.) 9. Care & maintenance of trade tools. (02hrs.) 10. Practice safety precautions while working in fitting jobs. (03hrs.)	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. (03 hrs.)

		11. Workshop practice on filing and hacks swing. (02hrs.)	
Professional Skill 30 Hrs.; Professional Knowledge 08 Hrs.	Select and perform electrical/electronic measurement of single range meters and calibrate the instrument. (Mapped NOS: ELE/N9435)	**Basics of AC and Electrical Cables** 12. Identify the Phase, Neutral and Earth on power socket, use testers to monitor AC power. (02hrs.) 13. Construct a test lamp and use it to check mains healthiness. (01hr.) 14. Measure the voltage between phase and ground and rectify earthing. (02hrs.) 15. Identify and test different AC mains cables. (01 hrs.) 16. Prepare terminations, skin the electrical wires/cables using wire stripper and cutter. (02hrs.) 17. Measure the gauge of the wire using SWG and outside micro-meter. (02hrs.) 18. Refer table and find current carrying capacity of wires. (01 hr.) 19. Crimp the lugs to wire end. (02hrs) 20. Measure AC and DC voltages using multi-meter. (02hrs.)	Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC. 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 & cables, standard wire gauge (SWG). Classification of cables according to gauge (core size), number of conductors, material, insulation strength, flexibility etc. (04 hrs.)
		Single range meters 21. Identify the type of meters by dial and scale marking/ symbols. (02 hrs.) 22. Demonstrate various analog measuring instruments. (02 hrs) 23. Find the minimum and	Introduction to electrical and electronic measuring instruments. Basic principle and parts of simple meters. Specifications, symbols used in dial and their meaning. (04 hrs.)

		maximum measurable range of the meter. (02 hrs.) 24. Carryout mechanical zero setting of a meter. (03 hrs.) 25. Check the continuity of wires, meter probes and fuse etc. (03 hrs.) 26. Measure voltage and current using clamp meter. (03 hrs.)	
Professional Skill 25Hrs.; Professional Knowledge 08 Hrs.	Test &service different batteries used in electronic applications and record the data to estimate repair cost. (Mapped NOS: ELE/N7001)	**Cells & Batteries** 27. Identify the +ve and -ve terminals of the battery. (02 hrs.) 28. Identify the rated output voltage and Ah capacity of given battery. (01 hr.) 29. Measure the voltages of the given cells/battery using analog/ digital multimeter. (03 hrs.) 30. Charge and discharge the battery through load resistor. (05 hrs.) 31. Maintain the secondary cells. (05 hrs.) 32. Measure the specific gravity of the electrolyte using hydrometer. (03 hrs.) 33. Test a battery and verify whether the battery is ready for use of needs recharging. (06 hrs.)	**Cells & Batteries** Construction, typesofprimary and secondary cells. Materials used, specification of cells and batteries. Charging process, efficiency, life of cell/battery, estimate cost and repair of battery. Selection of cells/ batteries etc. Use of Hydrometer. Types of electrolytes used in cells and batteries. Series/ parallel connection of batteries and purpose of such connections. Introduction to Lithium Ion battery Lead Acid Battery Nickel–cadmium battery (08 hrs.)
Professional Skill 25Hrs.; Professional Knowledge	Test various electronic components using proper measuring instruments and	**AC & DC measurements** 34. Use the multi-meter to measure the various functions (AC V, DC V, DC I, AC I, R) (05hrs.)	Introduction to electrical measuring instruments. Importance and classification of meters.

08 Hrs.	compare the data using standard parameter. (Mapped NOS:ELE/N7001)	35. Identify the different types of meter for measuring AC &DC parameters (05hrs.) 36. Identify the different controls on the CRO front panel and observe the function of each control (05hrs.) 37. Measure DC voltage, AC voltage, time periodusing CRO sine wave parameters (05hrs.) 38. Identify the different controls on the function generator front panel and observe the function of each control. (05hrs.)	Forces necessary to work a meter. MC and MI meters. Range extension, need of calibration. Characteristics of meters and errors in meters. Various terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, Instantaneous value. Multi meter, use of meters in different circuits. Care and maintenance of meters. Use of CRO, Function generator, LCR meter (08 hrs.)
Professional Skill 20Hrs.; Professional Knowledge 06 Hrs.	Plan and execute soldering & de-soldering of various electrical components like Switches, PCB & Transformers for electronic circuits. (Mapped NOS: ELE/N7812)	**Soldering/ De-soldering and Various Switches** 39. Practice soldering on different electronic components, small transformer and lugs. (03 hrs.) 40. Practice soldering on IC bases and PCBs. (03 hrs.) 41. Practice de-soldering using pump and wick. (02 hrs.) 42. Join the broken PCB track and test. (02 hrs.) 43. Identify and use SPST, SPDT, DPST, DPDT, tumbler, push button, toggle, piano switches used in electronic industries (05 hrs.) 44. Make a panel board using different types of switches for a given application. (05	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. (06 hrs.)

		hrs.)	
Professional Skill 60 Hrs.; Professional Knowledge 10 Hrs.	Test various electronic components using proper measuring instruments and compare the data using standard parameter. (Mapped NOS: ELE/N5804)	**Active and Passive Components** 45. Identify the different types of active electronic components. (03hrs.) 46. Measure the resistor value by colour code and verify the same by measuring with multimeter (03hrs.) 47. Identify resistors by their appearance and check physical defects. (02 hrs.) 48. Identify the power rating of carbon resistors by their size. (03 hrs.) 49. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources. (08 hrs.) 50. Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law. (05Hrs.) 51. Verify laws of series and parallel circuits with voltage source in different combinations. (05 hrs.) 52. Measure the resistance, Voltage, Current through series and parallel connected networks using multi-meter (07hrs.) 53. Identify different inductors and measure the values using LCR meter (05 hrs.)	Ohm's law and Kirchhoff's Law. Resistors; types of resistors, their construction & specific use, color-coding, power rating. Equivalent resistance of series parallel circuits. Distribution of V & I in series parallel circuits. Principles of induction, inductive reactance. Types of inductors, construction, specifications, applicationsandenergy storage concept. Behaviour of inductor at low and high frequencies. Series and parallel combination. Capacitance and capacitive Reactance, Impedance. Types of capacitors, construction, specifications and applications. Dielectric constant. Significance of Series parallel connection of capacitors. Capacitor behaviour with AC and DC. Concept of resonance and its application in RC, RL & RLC series and parallel circuit. Relays, types, construction and specifications etc. (10 hrs.)

		54. Identify the different capacitors and measure capacitance of various capacitors using LCR meter (05 hrs.) 55. Identify and test the circuit breaker and other protecting devices. (04 hrs.) 56. Dismantle and identify the different parts of a relay. (05 hrs.) 57. Connect a timer relay in a circuit and test for its working. (03 hrs.) 58. Connect a contactor in a circuit and test for its working. (02 hrs.)	
Professional Skill 45 Hrs.; Professional Knowledge 08 Hrs.	Assemble simple electronic power supply circuit and test for functioning. (Mapped NOS: ELE/N5804)	**Power Supply Circuits** 59. Identify different types of diodes, diode modules and their specifications. (04 hrs.) 60. Test the given diode using multi-meter and determine forward to reverse resistance ratio. (04 hrs.) 61. Measure the voltage and current through a diode in a circuit and verify its forward characteristic. (07 hrs.) 62. Identify different types of transformers and test. (03 hrs.) 63. Identify the primary and secondary transformer windings and test the polarity (02 hrs.) 64. Construct and test a half wave, full wave and Bridge	Semiconductor materials, components, number coding for different electronic components such as Diodes and Zeners etc. PN Junction, forward and reverse biasing of diodes. Interpretation of diode specifications. Forward current and reverse voltage. Packing styles of diodes. Different diodes, Rectifier configurations, their efficiencies, Filter components and their role in reducing ripple. Working principles of Zener diode, varactor diode, their specifications and

		rectifier circuit. (09 hrs.) 65. Measure ripple voltage, ripple frequency and ripple factor of rectifiers for different load and filter capacitors. (04 hrs.) 66. Identify and test Zener diode. (02 hrs.) 67. Construct and test Zener based voltage regulator circuit. (05 hrs.) 68. Calculate the percentage regulation of regulated power supply. (05 hrs.)	applications. Working principle of a transformer,construction, Specificationsandtypesof cores used. Step-up Step down and isolation transformers with applications. Losses in Transformers. (08 hrs.)
Professional Skill 80 Hrs.; Professional Knowledge 15 Hrs.	Install, configure, interconnect given computer system(s) and demonstrate & utilize application packages for different application. (Mapped NOS: ELE/N4614)	**Computer Hardware, OS, MS office and Networking** 69. Identify various indicators, cables, connectors and ports on the computer cabinet. (05hrs.) 70. Demonstrate various parts of the system unit and motherboard components. (05hrs.) 71. Identify various computer peripherals and connect it to the system. (05hrs.) 72. Disable certain functionality by disconnecting the concerned cables SATA/ PATA. (04hrs.) 73. Replace the CMOS battery and extend a memory module. (04hrs.) 74. Test and Replace the SMPS (04hrs) 75. Replace the given DVD and HDD on the system (04hrs.)	Basic blocks of a computer, Components of desktop and motherboard. Hardware and software, I/O devices, and their working. Different types of printers, HDD, DVD. Various ports in the computer. Windows OS MS widows: Starting windows and its operation, file management using explorer, Display & sound properties, screen savers, font management, installation of program, setting and using of control panel, application of accessories, various IT tools and applications. Concept of word processing: MS word – Menu bar, standard tool bar,

		76. Dismantle and assemble the desktop computer system. (05hrs) 77. Boot the system from different options. (04hrs.) 78. Install OS in a desktop computer. (04hrs.) 79. Install a Printer driver software and test for print outs. (04hrs.) 80. Install antivirus software, scan the system and explore the options in the antivirus software. (04hrs.). 81. Install MS office software (02hrs) 82. Create folder and files, draw pictures using paint. (02hrs.) 83. Explore different menu/ tool/ format/ status bars of MS word and practice the options. (02hrs.) 84. Explore different menu/ tool/ format/ status bars of MS excel and practice the options. (03hrs.) 85. Prepare PowerPoint presentation on any three known topics with various design, animation and visual effects. (02hrs.) 86. Convert the given PDF File into Word file using suitable software. (02hrs.) 87. Browse search engines, create email accounts, practice sending and receiving of mails and	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. Introduction to power-point Basics of preparing slides, different design aspects of slides, animation with slides etc. Concept of internet, browsers, websites, search engines, email, chatting and messenger service. Downloading the data and program files etc. **Computer Networking:** 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 andfirewall. Difference between PC & Server. (15hrs.)

		configuration of email clients. (02hrs.) 88. Identify different types of cables and network components e.g. Hub, switch, router, modem etc. (02hrs.) 89. Prepare terminations, make UTP and STP cable connectors and test. (03hrs.) 90. Connect network connectivity hardware and check for its functioning. (04hrs.) 91. Configure a wireless Wi-Fi network (04hrs.)	
Professional Skill 16 Hrs.; Professional Knowledge 05Hrs.	Assemble simple electronic power supply circuit and test for functioning. (Mapped NOS: ELE/N5804)	**IC Regulators** 92. Construct and test a +12V fixed voltage regulator. (03 hrs.) 93. Identify the different types of fixed +ve and –ve regulator ICs and the different current ratings (78/79 series) (03 hrs.) 94. Identify different heat sinks for IC based regulators. (01 hr.) 95. Observe the output voltage of different IC 723 metal/ plastic type and IC 78540 regulators by varying the input voltage with fixed load (06 hrs.) 96. Construct and test a 1.2V – 30V variable output regulated power supply using IC LM317T. (03 hrs.)	Regulated Power supply using 78XX series, 79XX series. Op-amp regulator, 723 regulator, (Transistorized & IC based). Voltage regulation, error correction and amplification etc. (05 hrs.)

Professional Skill 20 Hrs.; Professional Knowledge 04 Hrs.	Plan and carry out the selection of a project, assemble the project and evaluate performance for a domestic/commercial application. (Mapped NOS: ELE/N9801, ELE/N9802)	Make simple project applications using ICs, Zenerdiode, transformer and other discrete components. a) Modular Rectifiers. b) Transformer less 12V dual power supply. c) AC/DC voltage tester. (Instructor will pick up any five of the projects for implementation) (20 hrs.)	Discussion on the identified projects with respect to data of the concerned ICs, components used in the project. (04 hrs.)
Professional Skill 80 Hrs.; Professional Knowledge 15 Hrs.	Construct, test and verify the input/ output characteristics of various analog circuits. (Mapped NOS: ELE/N9436)	**Transistor** 102. Identify different transistors with respect to different package type, B-E-C pins, power, switching transistor, heat sinks etc. (05 hrs.) 103. Test the condition of a given transistor using ohm-meter. (05 hrs.) 104. Measure and plot input and output characteristics of a CE amplifier. (07 hrs.) 105. Construct and test a transistor based switching circuit to control a relay (use Relays of different coil voltages and Transistors of different β) (08hrs.)	Construction, working of a PNP and NPN transistors, purpose of E, B & C terminals. Significance of α, β and relationship of a transistor. Need for biasing of transistor. VBE, VCB, VCE, IC, IB, 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. (05 hrs.)
		Amplifier 106. Construct and test fixed-bias, emitter-bias and voltage divider-bias transistor amplifier. (11 hrs.) 107. Construct and test a common emitter amplifier	Different types of biasing, various configurations of transistor (C-B, C-E & C-C), their characteristics and applications. Transistor biasing circuits and

		with and without bypass capacitors. (04hrs.) 108. Construct and test common base amplifier. (05hrs.) 109. Construct and test common collector/emitter follower amplifier. (05hrs.) 110. Construct and test Darlington amplifier. (05hrs.) 111. Construct and test a two stage RC Coupled amplifier. (05 hrs.)	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. (06 hrs.)
		Oscillators 112. Demonstrate Colpitts oscillator, Hartley oscillator circuits and compare the output frequency of the oscillator by CRO. (04hrs.) 113. Construct and test a RC phase shift oscillator circuits. (02hrs.) 114. Construct and test a crystal oscillator circuits. (02hrs.) 115. Demonstrate Astable, monostable, bistable circuits using transistors. (03hrs.)	Introduction to positive feedback and requisites of an oscillator. Study of Colpitts, Hartley, Crystal and RC oscillators. Types of multi-vibrators and study of circuit diagrams.(02 hrs.)
		Wave shaping circuits	

		116. Construct and test shunt clipper. (02hrs.) 117. Construct and test series and dual clipper circuit using diodes. (04hrs.) 118. Construct and test clamper circuit using diodes. (03hrs.)	Diode shunt clipper circuits, Clamping/limiting circuits andZener diode as peak clipper, uses their applications. (02 hrs.)
Professional Skill 77Hrs.; Professional Knowledge 12 Hrs.	Plan and construct different power electronic circuits and analyse the circuit functioning. (Mapped NOS: ELE/N9437)	**Power Electronic Components** 119. Identify different power electronic components, their specification and terminals. (06 hrs.) 120. Construct and test a FET Amplifier. (06hrs) 121. Construct a test circuit of SCR using UJT triggering. (07hrs.) 122. Identify different heat sinks used in SCRs. (03hrs.) 123. Construct a snubber circuit for protecting SCR use freewheeling diode to reduce back emf.(07hrs.) 124. Construct a jig circuit to test DIAC. (07 hrs.) 125. Construct a simple dimmer circuit using TRIAC. (08hrs.) 126. Construct UJT based free running oscillator and change its frequency. (08hrs.)	Construction of FET& JFET, difference with BJT. Purpose of Gate Drain and source terminals and voltage/ current relations between them and Impedances between various terminals. Heat Sink-uses &purpose. Suitability of FET amplifiers in measuring device applications. Working of different power electronic components such as SCR, TRIAC, DIAC and UJT. (08 hrs.)
		MOSFET & IGBT 127. Identify various Power MOSFET by its number and test by using multimeter.	MOSFET, Power MOSFET and IGBT, their types, characteristics, switching

		(05 hrs.) 128. Identify different heat sinks used with various power MOSFET devices. (05hrs.) 129. Construct MOSFET test circuit with a small load. (05hrs.) 130. Identify IGBTs by their numbers and test by using multimeter. (05 hrs.) 131. Construct IGBT test circuit with a small load. (05hrs.)	speed, power ratings and protection. Differentiate FET with MOSFET. Differentiate Transistor with IGBT. (04 hrs.)
Professional Skill 25 Hrs.; Professional Knowledge 10 Hrs.	Select the appropriate opto-electronics components and verify the characteristics in different circuit. (Mapped NOS: ELE/N9438)	**Opto-Electronics** 132. Test LEDs with DC supply and measure voltage drop and current using multimeter. (05hrs.) 133. Construct a circuit to test photo voltaic cell. (05hrs.) 134. Construct a circuit to switch a lamp load using photo diode. (05hrs) 135. Construct a circuit to switch a lamp load using photo transistor. (05hrs.) 136. 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. (05hrs.)	Working and application of LED, IR LEDs, Photo diode, photo transistor, their characteristics and applications. Optical sensor, opto-couplers, circuits with opto-isolators. Characteristics of LASER diodes. (10 hrs.)
Professional Skill 77Hrs.;	Assemble, test and troubleshoot various digital circuits.	**Basic Gates** 137. Identify different Logic Gates (AND, OR, NAND,	Introduction to Digital Electronics. Difference between analog

Professional Knowledge 12 Hrs.	(Mapped NOS: ELE/N1201)	NOR, EX-OR, EX-NOR, NOT ICs) by the number printed on them. (06 hrs.) 138. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. (10 hrs.) 139. Construct and verify the truth table of all the gates using NAND and NOR gates. (06 hrs.) 140. Use digital IC tester to test the various digital ICs (TTL and CMOS). (05 hrs.)	and digital signals. Logic families and their comparison, logic levels of TTL and CMOS. Number systems (Decimal, binary, octal, Hexadecimal). BCD code, ASCII code and code conversions. Various Logic Gates and their truth tables. (04 hrs.)
		Combinational Circuits 141. Construct Half Adder circuit using ICs and verify the truth table. (03hr.s) 142. Construct Full adder with two Half adder circuit using ICs and verify the truth table. (05hrs.) 143. Construct the adder cum subtractor circuit and verify the result. (05 hrs.) 144. Construct and test a 2 to 4 Decoder. (03hrs) 145. Construct and test a 4 to 2 Encoder. (03hrs.) 146. Construct and test a 4 to 1 multiplexer. (03hrs.) 147. Construct and test a 1 to 4 De multiplexer. (03hrs.)	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. Concept of encoder and decoder. Basic Binary Decoder and four-bit binary decoders. Need for multiplexing of data. 1:4-line Multiplexer/De-multiplexer. (04 hrs.)
		Flip Flops 148. Identify different Flip-Flop (ICs) by the number printed on them. (05hrs.)	Introduction to Flip-Flop. S-R Latch, Gated S-R Latch, D-Latch. Flip-Flop: Basic RS Flip Flop,

		149. Construct and test four-bit latch using 7475. (05 hrs.) 150. Construct and test R-S flip-flop using IC7400 with clock and without clock pulse. (05 hrs.) 151. Verify the truth tables of Flip-Flop ICs (RS, D, T, JK, MSJK) by connecting switches and LEDs. (10 hrs.)	edge triggered D Flip Flop, JK Flip Flop, T Flip Flop. Master-Slave flip flops and Timing diagrams. Basic flip flop applications like data storage, data transfer and frequency division. (04 hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 12 Hrs.	Simulate and analyze the analog and digital circuits using Electronic simulator software. (Mapped NOS: ELE/N6102)	**Electronic circuit simulator** 152. Prepare simple digital and electronic circuits using the software. (10 hrs.) 153. Simulate and test the prepared digital and analog circuits. (16 hrs.) 154. Convert the prepared circuit into a layout diagram.(10 hrs.) 155. Prepare simple, power electronic and domestic electronic circuit using simulation software. (14 hrs.)	Study the library components available in the circuit simulation software. Various resources of the software. (12 hrs.)
Professional Skill 60 Hrs.; Professional Knowledge10 Hrs.	Assemble, test and troubleshoot various digital circuits. (Mapped NOS: ELE/N1201)	**Counter & shift registers** 156. Construct and test a four bit asynchronous binary counter using 7493 (08hrs.) 157. Construct and test 7493 as a modulus-12 counter. (08hrs) 158. Construct and test a four bit Synchronous binary counter using 74163.	Basics of Counters, types, two bit and three bit Asynchronous binary counters and decade counters with the timing diagrams. 3-bit synchronous counters and synchronous decade counters. Types of seven segment display.

		(08hrs.) 159. Construct and test synchronous Decade counter. (04hrs.) 160. Construct and test an up/down synchronous decade counter using 74190 and monitor the output on LEDs. (08 hrs.) 161. Identify and test common anode and common cathode seven segment LED display using multi meter. (04hrs.) 162. Display the two-digit count value on seven segment display using decoder/driver ICs. (04hrs.) 163. Construct a shift register using RS/D/JK flip flop and verify the result. (04hrs.) 164. Construct and test four-bit SIPO register. (04 hrs.) 165. Construct and test four-bit PIPO register. (04 hrs.) 166. Construct and test bidirectional shift registers. (04hrs.)	BCD display and BCD to decimal decoder. BCD to 7 segment display circuits. Basics of Register, types and application of Registers. (10 hrs.)
Professional Skill 60 Hrs.; Professional Knowledge 10 Hrs.	Construct and test different circuits using ICs 741operational amplifiers & ICs 555 linear integrated circuits and execute the result. (Mapped NOS: ELE/N9439)	**Op – Amp & Timer 555 Applications** 167. Use analog IC tester to test the various analog ICs. (05 hrs.) 168. Construct and test various Op-Amp circuits Inverting, Non-inverting and	Block diagram and working of Op-Amp, importance, ideal characteristics, advantages and applications. Schematic diagram of 741, symbol. Non-inverting voltage

		Summing Amplifiers. (10hrs.) 169. Construct and test Differentiator and Integrator (07hrs.) 170. Construct and test a zero-crossing detector. (05hrs.) 171. Construct and test Instrumentation amplifier (06hrs.) 172. Construct and test a Binary weighted and R-2R Ladder type Digital-to-Analog Converters. (09hrs.) 173. Construct and test Astable timer circuit using IC 555 (06hrs.) 174. Construct and test mono stable timer circuit using IC 555. (06hrs.) 175. Construct and test 555 timers as pulse width modulator (06hrs.)	amplifier, inverting voltage amplifier, summing amplifier, comparator, zero cross detector, differentiator, integrator and instrumentation amplifier, other popular Op-Amps. Block diagram of 555, functional description w.r.t. different configurations of 555 such as monostable, astable. (10 hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 04 Hrs.	Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/ commercial applications. (Mapped NOS: ELE/N9801 & ELE/N9802)	Make simple project applications using ICs, transformer and other discrete components. a) Pencil charger indicator. b) Delayed automatic power on circuit. c) Neon flasher circuit using IC741. d) UJT act as a relaxation oscillator. e) Dimmer circuit of Light & Fan using DIAC & TRIAC.	Discussion on the identified projects with respect to data of the concerned ICs, components used in the project. (04 hrs)

		f) Timer Circuit using IC-555. (Instructor will pick up any five of the projects for implementation) (10 hrs. X 5)	
ENGINEERING DRAWING: (40 Hrs.)			
Professional Knowledge ED-40 Hrs.	Read and apply engineering drawing for different application in the field of work. (Mapped NOS: CSC/N9401)	Introduction to Engineering Drawing and Drawing Instrument – (02 Hrs.) • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument Freehand drawing of–(06 Hrs.) • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the free hand sketches. • Free hand drawing of hand tools. Drawing of Geometrical figures: • Angle, Triangle, Circle, Rectangle, Square, Parallelogram. • Lettering & Numbering – Single Stroke Symbolic representation • Different Electronic symbols used in therelatedtrades ReadingofElectronicCircuitDiagram. ReadingofElectronicLayoutdrawing.	
WORKSHOP CALCULATION & SCIENCE: (35 Hrs)			
WCS- 35 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (Mapped NOS: CSC/N9402)	**Unit, Fractions** 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, substraction, multiplication & division. Decimal fractions - Addition, subtraction, multiplication & division. Solving problems by using calculator. **Square root, Ratio and Proportions, Percentage** Square and suare 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. **Material Science** Types metals, types of ferrous and non ferrous metals. Introduction of iron and cast iron. **Mass, Weight, Volume and Density** Specific gravity. Potential energy, kinetic energy and related problems with assignment. **Heat & Temperature and Pressure** Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals. Scales of temperature, celsius, fahrenheit, kelvin and conversion between scales of temperature. **Basic Electricity** 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 & 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 **Trigonometry** Measurement of angles Trigonometrical ratios Trigonometrical tables

SYLLABUS FOR MECHANIC CONSUMER ELECTRONIC APPLIANCES TRADE			
SECOND YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 20 Hrs.; Professional Knowledge 06 Hrs.	Measure the various parameters by DSO and execute the result with standard one. (Mapped NOS: ELE/N9440)	**Digital Storage Oscilloscope** 180. Identify the different front panel control of a DSO. (04 hrs.) 181. Measure the amplitude, frequency and time period of typical electronic signals using DSO. (06 hrs.) 182. Take a print of a signal from DSO by connecting it to a printer and tally with applied signal. (05. hrs) 183. Construct and test function generator using IC 8038. (05 hrs.)	Advantages and features of DSO. Block diagram of Digital storage oscilloscope (DSO)/ CRO and applications. Applications of digital CRO. Block diagram of function generator. Differentiate a CRO with DSO. (06 hrs.)
Professional Skill 40 Hrs.; Professional Knowledge 10 Hrs.	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. (Mapped NOS: ELE/N5102)	**Basic SMD (2, 3, 4 terminal components)** 184. Identification of 2, 3, 4 terminal SMD components. (04 hrs.) 185. De-solder the SMD components from the given PCB. (04 hrs.) 186. Solder the SMD components in the same PCB. (04 hrs.) 187. Check for cold continuity of PCB. (02 hrs.) 188. Identification of loose/dry	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. (05hrs.)

		solder, broken tracks on printed wired assemblies. (06 hrs.)	
		SMD Soldering and De-soldering 189. Identify various connections and setup required for SMD Soldering station. (03 hrs.) 190. Identify crimping tools for various IC packages. (02 hrs) 191. Make the necessary settings on SMD soldering station to de-solder various ICs of different packages (at least four)by choosing proper crimping tools (05 hrs.) 192. Make the necessary settings on SMD soldering station to solder various ICs of different packages (at least four) by choosing proper crimping tools (05 hrs.) 193. Make the necessary setting rework of defective surface mount component used soldering/de-soldering method. (05 hrs.)	Introduction to Surface Mount Technology (SMT). Advantages, Surface Mount components and packages. Introduction to solder paste (flux). Soldering of SM assemblies, reflow soldering. Tips for selection of hardware, Inspection of SM. Identification of Programmable Gate array (PGA) packages. Specification of various tracks, calculation of track width for different current ratings. Cold/ Continuity check of PCBs. Identification of lose/ dry solders, broken tracks on printed wiring assemblies. Introduction to Pick place Machine, Reflow Oven, Preparing stencil& stencil printer. (05 Hrs.)
Professional Skill 20 Hrs.; Professional Knowledge 06 Hrs.	Rework on PCB after identifying defects from SMD soldering and de-soldering. (Mapped NOS: ELE/N5102)	**PCB Rework** 194. Checked and Repair Printed Circuit Boards single, Double layer, and important tests for PCBs. (07hrs.)	Introduction to Static charges, prevention, handling of static sensitive devices, various standards for ESD. Introduction to non-soldering

		195. Inspect soldered joints, detect the defects and test the PCB for rework. (02hrs.) 196. Remove the conformal coatings by different methods. (02hrs.) 197. Perform replacement of coating. (02hrs.) 198. Perform baking and preheating. (03hrs.) 199. Repair solder mask and damage pad. (04hrs.)	interconnections. Construction of Printed Circuit Boards (single, Double, multi-layer), Important tests for PCBs. Introduction to rework and repair concepts. Repair of damaged track. Repair of damaged pad and plated through hole. Repair of solder mask. (06 hrs.)
Professional Skill 40 Hrs.; Professional Knowledge 14 Hrs.	Construct different electrical control circuits and test for their proper functioning with due care and safety. (Mapped NOS: ELE/N9441)	**Protection devices** 200. Identify different types of fuses along with fuse holders, overload (no volt coil), current adjust (Biometric strips to set the current). (07 hrs.) 201. Test the given MCBs. (06 hrs.) 202. Connect an ELCB and test the leakage of an electrical motor control circuit. (06 hrs.)	Necessity of fuse, fuse ratings, types of fuses, fuse bases. Single/ three phase MCBs, single phase ELCBs. Types of contactors, relays and working voltages. Contact currents, protection to contactors and high current applications. (07hrs.)
		Electrical control circuits 203. Measure the coil winding resistance of the given motor. (05 hrs.) 204. Prepare the setup of DOL starter and Control an induction motor. (06 hrs.) 205. Construct a direction control circuit to change direction of an induction motor. (05 hrs.) 206. Connect an overload relay	Fundamentals of single-phase Induction motors, synchronous speed, slip, rotor frequency. Torque-speed characteristics, Starters used for Induction motors. (07hrs.)

		and test for its proper functioning. (05 hrs.)	
Professional Skill 40 Hrs.; Professional Knowledge 14 Hrs.	Prepare, crimp, terminate and test various cables used in different electronics industries. (Mapped NOS:ELE/N6307)	**Electronic Cables & Connectors** 207. 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 (10 hrs.) 208. Identify suitable connectors, solder/crimp/terminate & test the cable sets. (08 hrs.) 209. Check the continuity as per the marking on the connector for preparing the cable set. (08hrs) 210. Identify and select various connectors and cables inside the CPU cabinet of PC. (08hrs.) 211. Identify the suitable connector and cable to connect a computer with a network switch and prepare a cross over cable to connect two network computers. (06hrs.)	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 fibre optical Cables and Cable trays. Different types of connectors Servo 0.1" connectors, FTP, RCA,BNC,HDMI 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. (14hrs.)

Professional Skill 40 Hrs.; Professional Knowledge 14 Hrs	Assemble and test a commercial AM/ FM receiver and evaluate performance. (Mapped NOS: ELE/N9442)	**Communication electronics** 212. Modulate and demodulate various signals using AM and FM on the trainer kit and observe waveforms (04hrs.) 213. Construct and test IC based AM Receiver (04hrs.) 214. Construct and test IC based FM transmitter (04hrs) 215. Construct and test IC based AM transmitter and test the transmitter power. Calculate the modulation index. (04hrs.) 216. Dismantle the given FM receiver set and identify different stages (AM section, audio amplifier section etc.) (04hrs.) 217. Modulate two signals using AM kit draw the way from and calculate percentage (%) of modulation. (08 hrs.) 218. Modulate and demodulate a signal using PAM, PPM, PWM Techniques. (12 hrs.)	Radio Wave Propagation – principle, fading. Need for Modulation, types of modulation and demodulation. Fundamentals of Antenna, various parameters, types of Antennas & application. Introduction to AM, FM & PM, SSB-SC & DSB-SC. Block diagram of AM and FM transmitter. FM Generation & Detection. Digital modulation and demodulation techniques, sampling, quantization & encoding. Concept of multiplexing and de multiplexing of AM/ FM/ PAM/ PPM/PWM signals. *A simple block diagram approach to be adopted for explaining the above mod/demod techniques.* (14hrs.)
Professional Skill 60 Hrs.; Professional Knowledge 18 Hrs.	Test, service and troubleshoot the various components of different domestic/ industrial programmable	**Microcontroller (8051)** 219. Identify various ICs & their functions on the given Microcontroller Kit. (06hrs.) 220. Identify the address range	Introduction Microprocessor &8051Microcontroller, architecture, pin details & the bus system. Function of different ICs used

	systems. (Mapped NOS: ELE/N9443)	of RAM & ROM. (06hrs.) 221. Measure the crystal frequency, connect it to the controller. (07hrs.) 222. Identify the port pins of the controller & configure the ports for Input & Output operation. (06hrs.) 223. Use 8051 microcontroller, connect 8 LED to the port, blink the LED with a switch. (06hrs.) 224. Perform the initialization, load & turn on a LED with delay using Timer.(06hrs.) 225. Perform the use of a Timer as an Event counter to count external events. (06hrs) 226. Demonstrate entering of simple programs, execute & monitor the results. (07hrs.) 227. 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. (10hrs.)	in the Microcontroller Kit. Differentiate microcontroller with microprocessor. Interfacing of memory to the microcontroller. Internal hardware resources of microcontroller. I/O port pin configuration. Different variants of 8051 & their resources. Register banks & their functioning. SFRs & their configuration for different applications. Comparative study of 8051 with 8052. (18hrs.)
Professional Skill 70 Hrs.;	Execute the operation of different process sensors, identify, wire	**Sensors, Transducers and Applications** 228. Identify sensors used in	Basics of passive and active transducers.

Professional Knowledge 18 Hrs.	& test various sensors of different industrial processes by selecting appropriate test instruments. (Mapped NOS: ELE/N9444)	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. (14 hrs.) 229. Measure temperature of a lit fire using a Thermocouple and record the readings referring to data chart. (14 hrs.) 230. Measure temperature of a lit fire using RTD and record the readings referring to data chart (14 hrs.) 231. Measure the DC voltage of a LVDT (14 hrs) 232. Detect different objectives using capacitive, inductive and photoelectric proximity sensors (14 hrs.)	Role, selection and characteristics. Sensor voltage and current formats. Thermistors/ Thermocouples - Basic principle, salient features, operating range, composition, advantages and disadvantages. Strain gauges/ Load cell – principle, gauge factor, types of strain gauges. Inductive/ capacitive transducers - Principle of operation, advantages and disadvantages. Principle of operation of LVDT, advantages and disadvantages. Proximity sensors – applications, working principles of eddy current, capacitive and inductive proximity sensors (18hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications. (Mapped NOS: ELE/N9802)	Make simple project applications using ICs, transformer and other discrete components. a) Electronic code lock. b) Temperature control circuit using a thermostat in an electric circuit.	Discussion on the identified projects with respect to data of the concerned ICs, components used in the project. (10 hrs.)

		c) AM/FM transmitter circuit. d) Smoke detector. e) Water level sensor. f) Programmable musical bell. g) Laptop Protector. h) Mobile phone charged with Battery Monitor. i) Lead Acid Battery Charger/ Auto Turn-off Battery Charger with Indicator. j) Emergency Light. k) Dancing LEDs. (Instructor will pick up any five of the project for implementation) (50 hrs.)	
Professional Skill 20 Hrs.; Professional Knowledge 06 Hrs.	Prepare fibre optic setup and execute transmission and reception. (Mapped NOS: ELE/N9445)	**Fiber optic communication** 233. Identify the resources and their need on the given fiber optic trainer kit.(02 hrs.) 234. Make optical fiber setup to transmit and receive analog and digital data. (04 hrs.) 235. Set up the OFC trainer kit to study AM, FM, PWM modulation and demodulation. (05 hrs.) 236. Perform FM modulation and demodulation using OFC trainer kit using audio signal and voice link (03 hrs.) 237. Perform PWM modulation and	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. (06 hrs.)

		demodulation using OFC trainer kit using audio signal and voice link. (03 hrs.) 238. Perform PPM modulation and demodulation using OFC trainer kit using audio signal and voice link (03 hrs.)	
Professional Skill 90 Hrs.; Professional Knowledge 25 Hrs.	Detect the faults and troubleshoot SMPS, UPS and inverter. (Mapped NOS: ELE/N7202)	**SMPS and Inverter** 239. Identify the components/devices and draw their corresponding symbols (03 hrs.) 240. Dismantle the given stabilizer and find major sections/ ICs components. (05 hrs.) 241. List the defect and symptom in the faulty SMPS. (04 hrs.) 242. Measure/ Monitor major test points of computer SMPS. (04 hrs.) 243. Troubleshoot the fault in the given SMPS unit. Rectify the defect and verify the output with load. Record your procedure followed for trouble shooting the defects (07 hrs.) 244. Use SMPS used in TVs and PCs for Practice. (02 hrs.) 245. Install and test the SMPS in PC (02 hrs.) 246. Install and test an inverter. (02 hrs.) 247. Troubleshoot the fault in	Concept and block diagram of manual, automatic and servo voltage stabilizer, o/p voltage adjustment. Voltage cut-off systems, relays used in stabilizer. Block Diagram of different types of Switch mode power supplies and their working principles. Various types of chopper circuits. Inverter; principle of operation, block diagram, power rating, change over period. Installation of inverters, protection circuits used in inverters. Battery level, overload, over charging etc. Various faults and its rectification in inverter. Block diagram of DC-DC converters and their working principles. (12 hrs.)

		the given inverter unit. Rectify the defects and verify the output with load. (02 hrs.) 248. Construct and test IC Based DC-DC converter for different voltages (02hrs.) 249. Construct and test a switching step down regulator using LM2576 (02 hrs.) 250. Construct and test a switching step up regulator using MC 34063 (02 hrs.)	
		UPS 251. Connect battery stack to the UPS. (03 hrs) 252. Identify front panel control & indicators of UPS. (03 hrs.) 253. Connect Battery & load to UPS & test on battery mode. (05 hrs.) 254. Open top cover of a UPS; identify its isolator transformers, the UPS transformer and various circuit boards in UPS. (07 hrs.) 255. Identify the various test point and verify the voltages on these (05 hrs.) 256. Identify various circuit boards in UPS and monitor voltages at	Concept of uninterrupted power supply. Difference between Inverters and UPS. Basic block diagram of UPS & operating principle. Types of UPS: Offline UPS, Online UPS, Line interactive UPS & their comparison UPS specifications. Load power factor & types of indications & protections. UPS circuit description and working - controlling circuits, Micro controller circuits, power circuits, charging circuits, alarm circuits, Indicator circuits. Installation of single phase & three phase UPS. (13hrs.)

		various test points (05 hrs.) 257. Perform load test to measure backup time. (05 hrs.) 258. Perform all above experiment for three phase UPS. (20 hrs.)	
Professional Skill 90 Hrs.; Professional Knowledge 25 Hrs.	Identify, operate various controls, trouble shoot and replace modules of the LCD/LED TV & its remote. (Mapped NOS: ELE/N3102)	**LCD and LED TV** 259. Identify and operate different Controls on LCD, LED TV (07 hrs.) 260. Identify components and different sectors of LCD and LED TV. (15 hrs.) 261. Dismantle; identify the parts of the remote control (07 hrs.) 262. Dismantle the given LCD/LED TV to find faults with input stages through connectors. (15 hrs.) 263. Detect the defect in a LED/LCD TV receiver given to you. Rectify the fault. (18 hrs.) 264. Troubleshoot the faults in the given LED/LCD TV receiver. Locate and rectify the faults. (18 hrs.) 265. Test LED/LCD TV after troubleshooting the defects. (07 hrs.) 266. Identify various connectors and connect the cable operator's external decoder (set top	Difference between a conventional CTV with LCD & LED TVs. Principle of LCD and LED TV and function of its different section. Basic principle and working of 3D TV. IPS panels and their features. Different types of interfaces like HDMI, USB, RGB etc. TV Remote Control–Types, parts and functions, IR Code transmitter and IR Code receiver. Working principle, operation of remote control. Different adjustments, general faults in remote control. (25 hrs.)

		box) to the TV. (03 hrs.)	
Professional Skill 25 Hrs.; Professional Knowledge 07 Hrs.	Install /configure, various control adjustment of the display, troubleshoot and secure LCD/LED projector. (Mapped NOS: ELE/N4614)	**LCD/ LED Projector** 267. Identify various front panel controls on the given LCD/LED Projector and operate the projector using them.(05 hrs.) 268. Identify rear connectors and terminate them using proper cables to the desktop computer. (04 hrs.) 269. Make necessary adjustments of the display using remote. (03 hrs.) 270. Dismantle the projector and identify all major functional modules.(05 hrs.) 271. Test the healthiness of power supply, exhaust fan etc.(04 hrs.) 272. Identify the LCD/LED lamp stack and monitor the necessary voltages. (04 hrs.)	Differentiate LCD and LED projectors. Specifications of LED Projector Working principle of LED Projector. Most frequently occurring faults in a LED projector and their remedies. (07 hrs.)
Professional Skill 25 Hrs.; Professional Knowledge 07 Hrs.	Install a DTH system by proper selection of site, assembling of different parts/ accessories and troubleshoot the system. (Mapped NOS: ELE/N8105)	**DTH System** 273. Identification & use of DTH system assembly.(02hrs.) 274. Identification & use of different tools and equipments used in DTH installation procedure & cabling procedure.(02hrs.)	Basic satellite communication, Merits& Demerits of satellite communication, applications, types of satellite & its orbits, Satellite Frequency Bands. Basic components of DTH system: PDA, LNBC, Satellite receiver terminal, dish installation aspects, Azimuth

		275. Identification of various types of connectors and cables.(02hrs.) 276. Connection procedure.(02 hrs) 277. Install a DTH system & get a TV station. (03hrs.) 278. Site selection, installation mounting tracking for azimuth and elevation angles using SAT meter. (04hrs.) 279. Identify the faults in DTH system &rectify.(04hrs.) 280. Identification & use of various I/O ports of STB.(02hrs.) 281. STB connection and first installation. (02hrs.) 282. Identify the faults in STB &rectify.(02hrs.)	& 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 & customer premises equipments. (07 hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 20 Hrs.	Dismantle, identify the parts, control circuits, sensors of a various domestic appliances. Estimate and troubleshoot. (Mapped NOS:ELE/N3118, ELE/N3119, ELE/N3120, ELE/N3121)	**Domestic Appliances** 283. Identification & use of controls on touch keypad of Microwave oven.(02 hrs.) 284. Dismantle and identification of various parts, wiring, tracing of various controls of Microwave oven.(02hrs.) 285. Identify the faults in the given Microwave oven &rectify.(03hrs.) 286. Dismantle and identification of various parts, sensors, wiring, tracing of various	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 & working, working of Power supply. Washing M/c: different types of machines, washing techniques, (Block diagram) parts of manual, semi-automatic and fully

		controls, Electronic circuits, in various types of washing M/C. (03 hrs.) 287. Identify the faults in the given washing M/C and rectify. (03 hrs.) 288. Dismantle and identification of various parts, wiring, tracing of various controls, Electronic circuits in various types of Vacuum cleaners. (03 hrs.) 289. Identify the faults in various types of Vacuum cleaners &rectify.(03hrs.) 290. Dismantle and identification of various parts, wiring, tracing of various controls, Electronic circuits in various types of Mixers/grinders.(02 hrs.) 291. Identify the faults in various types of Mixers/grinders & rectify (03hrs.) 292. Dismantle and identification of various parts, wiring, tracing of various controls, Electronic circuits in steam Iron (02hrs.) 293. Identify the faults in steam iron & rectify (03hrs.) 294. Identify various components of Electric	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 diagram) working principle, main parts of Vacuum cleaner, study of different features of the machine, study & working of motor used, Electronic circuit, power supply. Various parts & functions of Mixer/Grinder, speed control circuit & auto overload protector. Principle of electric iron, parts of steam iron, thermostat heat controls. 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. Principal of Immersion heater, part of immersion heater, Insulation in Immersion heater.

		rice cooker, controls and trace the circuit and rectify the simulated faults.(03hrs.) 295. Identify various components of Water purifier, mantling and dismantling of water purifier, connection between different parts of water purifier. (02 hrs.) 296. Clean and replace the worn-out consumable parts following the troubleshooting manual(02 hrs.) 297. Simulate and rectify the faults. (02 hrs.) 298. Repeat the above exercise for UV type water purifier.(02 hrs.) 299. Dismantle and identify various parts, wiring and connections of immersion heater.(02 hrs.) 300. Replacing coil and fixing insulation failure problems. Remove scale formation from heating element.(02hrs.) 301. Identify the faults in Induction cooktop and rectify. (02 hrs.) 302. Dismantle and identify various parts, wiring and tracing of various controls, Electrical and electronics circuit in	Working principle of Induction cook top, study of different features of machine. Types of induction tubes, study of different component of induction cooktop, Fault identification, Heat sinking in induction cooktop.(20 hrs.)

		Induction cook-top.(02hrs.) 303. Replacing the Induction tube (coil) in Induction cook top.(02 hrs.)	
Professional Skill 20 Hrs.; Professional Knowledge 06 Hrs.	Install/configure, various control adjustment of the display, troubleshoot and secure LCD/LED projector/ printer. (Mapped NOS:ELE/N4614)	**Printers** 304. Identification of internal assembly/ section/parts of DMP. (02 hrs.) 305. Testing of the paper sensor, print head coils, home position sensor, print head needle coil & cleaning of ribbon mask, paper feed motor gears, printer head movement gears & print head guide. (03 hrs.) 306. Identify the faults in DMP & rectify. (01 hr.) 307. Identification & use of controls/ switches/ sockets of an inkjet printer. (01 hr.) 308. Interconnect printer to computer & perform printer test & cleaning of an ink cartridge. (02 hrs.) 309. Identification of internal assembly/ section/parts of an inkjet printer. (01 hr.) 310. Identify the faults of an inkjet printer & rectify. (02 hrs.) 311. Identification & use of controls/ switches/	Printer & its types, principle, parts, inkjet & Laser printer, Advantages, disadvantages of each, comparison between impact &non-impact printers & cables used to connect the various printers o computer. (06 hrs.)

		sockets of laser printer. (02 hrs.) 312. Interconnect printer to computer & perform printer test & cleaning of an ink cartridge. (02 hrs.) 313. Identification of internal assembly/ section/parts of Laser printer (02 hrs.) 314. Identify the faults of laser printer & rectify. (02 hrs.)	
Professional Skill 50 Hrs.; Professional Knowledge 14Hrs.	Install a CCTV system and configure the system for surveillance function. (Mapped NOS: ELE/N4610,ELE/N4611)	**CCTV** 315. Identification of different CCTV components.(03 hrs.) 316. Draw, trace or follow the CCTV setup of any commercial installation.(08 hrs.) 317. Identify the strategic locations for the installation of cameras.(08 hrs.) 318. Operate and learn the procedure for switching cameras to have different views.(08 hrs.) 319. Identification of connectors and sockets used on DVRs.(04 hrs.) 320. Test the healthiness cables and connectors.(03 hrs.) 321. Connect CCTV Cameras to DVR, Record and Replay.(04 hrs.) 322. Dismantle DVR and identify major functional	Types of cameras and their specifications used in CCTV systems. CCTV setup and its components Working of Digital Video Recorders and types of DVRs (14 hrs.)

		blocks and test for the healthiness.(12 hrs.) ***Take the students to any nearby commercial CCTV installation to carry out the above tasks.***	
Professional Skill 40 Hrs.; Professional Knowledge 12 Hrs.	Identify, operate various controls play switches, troubleshoot and replace faulty boards of a home theatre and its remote. (Mapped NOS: ELE/N9446)	**Home theatre** 323. Identification of different parts of home theatre. (02 hrs.) 324. Testing of speakers, woofers& tweeters. (09 hrs.) 325. Set up of home theatre using specific devices. (09 hrs.) 326. Identification of different parts of AV receiver. (09 hrs.) 327. Identify the faults in AV receiver & rectify. (11 hrs.)	Introduction to home theatre, surround sound system, basic components, block diagram of home theatre & working. (12 hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 12Hrs.	Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications. (Mapped NOS: ELE/N9802)	Make simple project applications (any three) using ICs, transformer and other discrete components. a) Solar power inverter b) Remote control for home appliances c) Metal Detector d) Digital video recorder Door Watcher e) Remote Control jammer f) Clap Switch g) Digital Lucky random Number Generator h) Count Down Timer	Discussion on the identified projects with respect to data of the concerned ICs, components used in the project. (12 hrs)

		i) Digital Clock j) Even Counter k) Seven Segment LED Display Decoder Drive Circuit (50 hrs.)	
ENGINEERING DRAWING: (40 Hrs.)			
Professional Knowledge ED-40 Hrs.	Read and apply engineering drawing for different application in the field of work. (Mapped NOS: CSC/N9401)	• Reading of Electronics Sign and Symbols. • SketchesofElectronicscomponents. (06 Hrs.) • ReadingofElectronicswiringdiagramandLayoutdiagram. • Drawing of Electronicscircuitdiagram • Drawing of Block diagram of Instruments & equipment of trades.	
WORKSHOP CALCULATION & SCIENCE: (16 Hrs)			
WCS- 16 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (Mapped NOS: CSC/N9402)	**Algebra** Addition, Subtraction, Multiplication & Divisions. Algebra– Theory of indices, Algebraic formula, related problems. **Estimation and Costing** Simple estimation of the requirement of material etc., as applicable to the trade. Problems on estimation and costing.	

SYLLABUS FOR CORE SKILLS
1. Employability Skills(Common for all CTS trades) (120Hrs. +60 Hrs.)

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in/ dgt.gov.in

ANNEXURE-I

List of Tools & Equipment			
MECHANIC CONSUMER ELECTRONIC APPLIANCES (For batch of 24 candidates)			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
TRAINEES TOOL KIT (For each additional unit trainees tool kit s no. 1-12 is required additionally)			
1.	Connecting screwdriver	100 mm	12nos.
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	12nos.
8.	Electrician knife	100 mm	6 nos.
9.	Tweezers	150 mm	12 nos.
10.	Digital Multi-meter	(3 3/4 digit),4000 Counts	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	12nos.
B. SHOP TOOLS, INSTRUMENTS– For 2 (1+1) units no additional items are required			
Lists of Tools:			
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.
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	
List of Equipment			
39.	Dual DC regulated power supply	30-0-30 V, 2 Amps	4 nos.
40.	DC Regulated Variable Programmable DC Power Supply	0-30V/3A	2 nos.
41.	LCR meter (Digital) Handheld		1 no.
42.	CRO Dual Trace C	20 MHz (component testing facilities)	2 nos.
43.	Signal Generator with Digital Display for Frequency Amplitude	10 Hz to 100 Khz, 50/600 Ohms (output impedance)	2 nos.
44.	Battery Charger	0 - 6 - 9 - 12 - 24, 15 Amps	1 no.
45.	Analog multi-meter		4 nos.
46.	Clamp meter	0 - 10 A	2 nos.
47.	Function generator (DDS Technology (Sine, Square,	1 mHz -10 MHz Function-Pulse – Modulation Generator with Built-	2 nos.

	Triangle, Ramp, Pulse, Serial Data, TTL and Modulation.)	in 40MHz Frequency Counter	
48.	Dimmer starter	3 Amps	2 nos.
49.	Autotransformer	15 Amps	2 nos.
50.	Analog Component Trainer	Breadboard for Circuit design with necessary DC /AC power supply: • 8 pin ZIF socket • 16 pin ZIF socket • Resistor bank • Capacitor bank • Potentiometers • Diodes • Zener diodes • NPN Transistor • N-channel MOSFET • LED • Bread board • Ready to use Experimental Boards Lab Manual with list of experiments to perform various experiments	4 nos.
51.	Milli Ammeter (AC)	0 – 200 mA	2 nos.
52.	Milli Ammeter (DC)	0 – 500 mA	2 nos.
53.	Op-Amp trainer	• ±15V, ±12 and +5V fixed DC power supply • 8pin ZIF socket • 16 pin ZIF socket • Resistor bank • Capacitor bank • Potentiometers • Bread board • Built in oscillator: sine, square and tri-anglular waveform	2nos.
54.	Digital IC Trainer	Breadboard for Circuit design with necessary DC Power Supply, Graphical LCD, Clock Frequency 4 different steps, Data Switches: 8 Nos., LED Display:	4 nos.

		8 nos. (TTL), Seven Segment Display, Teaching Simulation Software	
55.	Digital and AnalogIC Tester		1 no. each
56.	Rheostats various values and ratings		2 nos. each
57.	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		4 nos.
58.	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 and Antivirus compatible with trade related software.	4 nos.
59.	Laptops latest configuration		1 no.
60.	Laser jet Printer		1 no.
61.	INTERNET BROADBAND CONNECTION		1 no.
62.	Electronic circuit simulation software with 6 user licenses	Circuit Design and Simulation Software with PCB Design with Gerber and G Code Generation, 3D View of PCB, Breadboard View, Fault Creation and Simulation.	1 no.
63.	Different types of electronic and electrical cables, connectors, sockets, terminations.		As required
64.	Different types of Analog electronic components, digital ICs, power electronic		As required

	components, general purpose PCBs, bread board, MCB, ELCB		
65.	DSO (colour)	4 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.
66.	Soldering & De-soldering Station		1 no.
67.	SMD Soldering & De-soldering Station with necessary accessories	**SMD Rework Station** Soldering station: Output Voltage: 26V – 40V AC Temp Range: 50 to 4800 C Desoldering Station: Output Voltage: 24V – 40V AC 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	2 nos.
68.	DOL starter	½ hp	1 no.
69.	AC Motor Trainer Kit ¼ HP motor Single Phase Contactors Relays MCB DOL Starter		1 no.
70.	Frequency modulator and Demodulator trainer kit	FM Modulator Type: Reactance Modulator, Varactor Modulator, VCO Based Modulator FM Demodulator type All 5 demodulation techniques Detailed teaching and learning	2 nos.

		contents through software.	
71.	PAM, PPM,PWM trainer kit	With on board function Generator Analog inputs in 4 steps 1-10 Hz, 10-100,100-1Khz, -10khz Analog input voltage variable from 0 to12 V Built in Square wave pulse	2 nos.
72.	AM/FM Commercial radio receivers		2 nos.
73.	Microcontroller kits (8051) along with programming software (Assembly level Programming)	Core 8051, ready to run programmer for AT89C51/52 & 55, programming modes Keypad and PC circuits. Detailed learning content through simulation software.	4 nos.
74.	Application kits for Microcontrollers 6 different applications	1. Input Interface: 4x4 Matrix Keypad, ASCII Key PAD, Four Input Switch 2. Display Module 16X2 LCD, Seven Segment, LED Bar Graph 3. ADC/DAC Module with most popular DC/DAC0808 4. PC Interface: RS232 & USB 5. Motor Drive: DC, Servo, Stepper 6. DAQ: Data Acquisition to sense different sensors signals	1 set
75.	Sensor Trainer Kit Containing Following Sensors 1. Thermocouple 2. RTD 3. Load Cell/ Strain Gauge 4. LVDT 5. Smoke Detector Sensors 6. Speed Sensor 7. Limit Switch 8. Photo sensors 9. Opto-coupler 10. Proximity Sensor	Graphical touch LCD with inbuilt processor for viewing the output waveforms, In built DAQ, and standard processing circuits like Inverting, Non – Inverting, Power, Current, Instrumentation Differential Amplifier, F/V,V/F,V/I,I/V Converter, Sensors:RTD,NTC Thermistor,LM35 Thermocouple, Gas(Smoke) Sensor, Load cell, LVDT Sensor, Speed Sensor	2 nos.
76.	Various analog and digital ICs useful for doing project works		As required

	mentioned in the digital and analog IC applications modules		
77.	Different types of electronic and electrical cables, connectors, sockets, terminations.		As required
78.	Fiber-optic communication trainer	Full Duplex Analog& Digital Trans-receiver with 660nm & 950nm, Noise Generator with variable gain, Four Seven Segment Display BER Counter, Eye Pattern.	2 nos.
79.	Seven segment DPM trainer		6 nos.
80.	Precision set of screw drivers	T5, T6, T7	2 nos.
81.	SMPS of different make		4 nos.
82.	UPS trainer	PWM switching technology, Test points to measures the voltages of different sections Overall functioning of UPS Trainer, AVR transformer, UPS with load condition	1 no.
83.	UPS		As Required
84.	Allen key screwdriver	5 no. of set	1 set
85.	CCTV set up	DVR- Cameras with amplifier set up	2 system
86.	Washing machine	Auto and semi-automatic	1 each
87.	Vacuum cleaner	Portable and industry model	2 nos. (1 each)
88.	Microwave oven	20 liters(two technologies)	1 no. each
89.	Mixer cum grinder		2 nos.
90.	Steam iron automatic	Automatic and automatic with steam	Each 2 nos.
91.	Electric rice cooker		3 nos.
92.	Water purifier	(RO and UV technologies)	1 no.
93.	LCD TV (Trainer kit)	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 and switch	1 no.

		faults	
94.	Immersion Heater	2 KVA	4 nos.
95.	Induction cooktop	Induction cook top with following feature: Safety sensor Auto switch-off Auto heat-up Booster Protection against overflows	2 nos.
96.	Printers	DMP, laser,deskjet	1 each
97.	L ED/LCD Projector		1 no.
98.	DTH with accessories		1 set
99.	SAT meter		1 no.
100.	Co- Axial cable cutter		1 no.
101.	LCD TV	21" screen smart TV, with different inputs (HDMI, VGA, component video etc.)	2 nos.
102.	Jacket stripper/ Coring tool for 500 series cable		1 no.
103.	Centre conductor cleaner		1 no.
104.	Universal drop trimmer for RG 6/11 cables		1 no.
105.	F - connector tool for RG 6/11 cables		1 no.
106.	F – connector compression tool for RG 6/11 cables		1 no.
107.	LED TV (Trainer kit)	20-inch full HD LED Color Television, PAL/ NTSC video formats, complete block diagram of a LED TV system, Study board indicating various sections of LED TV along with the test points and switch faults Trouble shooting in different sections.	1 no.
108.	LED TV	21" screen smart TV, with different inputs (HDMI, VGA, component video)	2 nos.
109.	Home theatre system		1 no.
110.	Solar Training Kit/ Simulator	With built in meters for DCV, DCA, AC multifunction Meter (for ACI,	1 no.

		ACV, Power,Frequency), Protection Circuits, BS-10 terminals for making the connection, Single/ Dual axis tracking system Charge Controller: PWM based MPPT, Charging Stage: Bulk, Absorptions and Float	
111.	LED lighting system	Measurement of Power, Voltage, Current, Power Factor and Light output performance of different lighting products like LED, CFL at variable input voltages 0 to 245V variable AC	2 sets
D. Shop Floor Furniture and Materials - For 2 (1+1) units no additional items are required.			
112.	Instructor's table		1 no.
113.	Instructor's chair		2 nos.
114.	Metal Rack	100cm x 150cm x 45cm	4 nos.
115.	Lockers with 16 drawers standard size		2 nos.
116.	Steel Almirah	2.5 m x 1.20 m x 0.5 m	2 nos.
117.	Black board/white board	12' x 4'	2 nos.(one for lab and one classroom)
118.	Fire Extinguisher	Operate and test clinical equipment/ instruments used in hospital.	2 nos.
119.	Classroom furniture (dual desk)		12 nos.
120.	Lab tables (work bench)		6 nos.
121.	Stools for lab		24nos.

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.*

ABBREVIATIONS

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


कौशलं बलम्