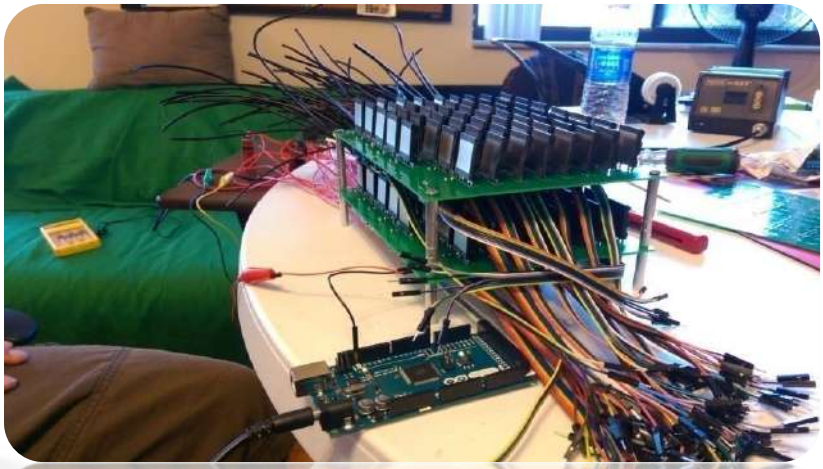
ELECTRONICS MECHANIC

NSQF LEVEL- 6



SECTOR- ELECTRONICS & HARDWARE

COMPETENCY BASED CURRICULUM

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

GOVERNMENT OF INDIA
Ministry of Skill Development & Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City, Kolkata – 700091

ELECTRONICS MECHANIC

Also Applicable for – Technician Power Electronics System,
Mechanic Consumer Electronic Appliances,
Smartphone Technician Cum App Tester

(Engineering Trade)

SECTOR – Electronics & Hardware

(Revised in 2019)

Version 1.1

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Developed By
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1. COURSE OVERVIEW

The Craft Instructor Training Scheme is operational since inception of the Craftsmen Training Scheme. The first Craft Instructors' Training Institute was established in 1948. Subsequently, 6 more institutes namely, Central Training Institute for Instructors (now called as National Skill Training Institute (NSTI)), NSTI at Ludhiana, Kanpur, Howrah, Mumbai, Chennai and Hyderabad were established in 1960's by DGT. Since then the CITS course is successfully running in all the NSTIs across India as well as in DGT affiliated institutes viz. Institutes for Training of Trainers (IToT). This is a competency based course of one year duration. "Electronics Mechanic" CITS trade is applicable for Instructors of "Electronics Mechanic, Technician Power Electronics System, Mechanic Consumer Electronic Appliances and Smartphone Technician Cum App Tester" Trades.

The main objective of Craft Instructor training programme is to enable Instructors explore different aspects of the techniques in pedagogy and transferring of hands-on skills so as to develop a pool of skilled manpower for industries, also leading to their career growth & benefiting society at large. Thus, promoting a holistic learning experience where trainee acquires specialized knowledge, skills & develops attitude towards learning & contributing in vocational training ecosystem.

This course also enables the instructors to develop instructional skills for mentoring the trainees, engaging all trainees in learning process and managing effective utilization of resources. It emphasizes on the importance of collaborative learning & innovative ways of doing things. All trainees will be able to understand and interpret the course content in right perspective, so that they are engaged in & empowered by their learning experiences and above all, ensure quality delivery.

2. TRAINING SYSTEM

2.1 GENERAL

CITS courses are delivered in National Skill Training Institutes (NSTIs) & DGT affiliated institutes viz., Institutes for Training of Trainers (IToT). For detailed guidelines regarding admission on CITS, instructions issued by DGT from time to time are to be observed. Further complete admission details are made available on NIMI web portal http://www.nimionlineadmission.in. The course is of one-year duration. It consists of Trade Technology (Professional skills and Professional knowledge), Training Methodology and Engineering Technology / Soft skills. After successful completion of the training programme, the trainees appear in All India Trade Test for Craft Instructor. The successful trainee is awarded NCIC certificate by DGT.

2.2 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year:

S No.	Course Element	Notional Training Hours
1.	**Trade Technology**	
	Professional Skill (Trade Practical)	640
	Professional Knowledge (Trade Theory)	240
2.	**Engineering Technology**	
	Workshop Calculation & Science	80
	Engineering Drawing	120
3.	**Training Methodology**	
	TM Practical	320
	TM Theory	200
	Total	**1600**

2.3 PROGRESSION PATHWAYS

- Can join as a Technical Instructor in vocational training Institute/ technical Institute.
- Can join as a supervisor in Industries.

2.4 ASSESSMENT & CERTIFICATION

The CITS trainee will be assessed for his/her Instructional skills, knowledge and attitude towards learning throughout the course span and also at the end of the training program.

a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** to test competency of instructor with respect to assessment criteria set against each learning outcomes. The training institute has to maintain an individual trainee portfolio in line with assessment guidelines. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in.

b) The **Final Assessment** will be in the form of **Summative Assessment Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment**.** The external 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 CRITERIA

Allotment of Marks among the subjects for Examination:

Sl. No.	Subject		Marks	Internal Assessment	Full Marks	Pass Marks	
						Exam	Internal Assessment
1.	Trade Technology	Trade Theory	100	40	140	40	24
2.		Trade Practical	200	60	260	120	36
3.	Engineering Technology	Workshop Cal. & Sc.	50	25	75	20	15
4.		Engineering Drawing	50	25	75	20	15
5.	Training Methodology	TM Practical	200	30	230	120	18
6.		TM Theory	100	20	120	40	12
Total Marks			**700**	**200**	**900**	**360**	**120**

The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%. There will be no Grace marks.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while

undertaking the assessment. While assessing, the major factors to be considered are approaches to generate solutions to specific problems by involving standard/non-standard practices.

Due consideration should also be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising of the following:

- Demonstration of Instructional Skills (Lesson Plan, Demonstration Plan)
- Record book/daily diary
- Assessment Sheet
- Progress chart
- Video Recording
- Attendance and punctuality
- Viva-voce
- Practical work done/Models
- Assignments
- Project work

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

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an ***acceptable standard*** of crafts instructorship with ***occasional* guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***fairly good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Occasional support in imparting effective training.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional	• Demonstration of ***good*** skill to establish

design, implement learning programme and assess learners which demonstrates attainment of a ***reasonable standard*** of crafts instructorship with ***little*** **guidance** and engage students by demonstrating good attributes of a trainer.	a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Above average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A ***good*** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Little support in imparting effective training.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***high standard*** of crafts instructorship with ***minimal or no support*** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***high*** skill level to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Good engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A ***high*** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Minimal or no support in imparting effective training.

3. GENERAL INFORMATION

Name of the Trade	**ELECTRONICS MECHANIC-CITS**
Trade Code	DGT/ 4006
NCO – 2015	3114.0100, 3122.5600, 7421.0100, 7421.0300, 7421.0601, 7421.0701, 7421.1402, 7421.0801, 7422.1300, 7421.9900, 7422.1200, 7422.2301, 2356.0100
NSQF Level	Level-6
Duration of Craft Instructor Training	One Year
Unit Strength (No. Of Student)	25
Entry Qualification	Degree in appropriate branch of Electronics Engineering from AICTE/UGC recognized Engineering College/ University OR Three year Diploma in appropriate branch of Electronics Engineering from AICTE/ recognized board / Institution. OR National Trade Certificate in **Electronics Mechanic** or related trades. OR National Apprenticeship Certificate in **Electronics Mechanic** or related trades.
Minimum Age	18 years as on first day of academic session.
Space Norms	120 Sq. m
Power Norms	8 KW
Instructor's Qualification for	
1. Electronics Mechanic -CITS Trade	B.Voc/Degree in appropriate branch of Electronics Engineering from AICTE/UGC recognized University with two years experience in relevant field. **OR** 03 years Diploma in appropriate branch of Electronics Engineering from AICTE/ recognized Board/ Institution or relevant Advanced Diploma (Vocational) from DGT with five years experience in relevant field. **OR** NTC/ NAC passed in the Electronics Mechanic with seven years experience in relevant field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in Electronics Mechanic trade, in any of the variants under DGT.

2. Workshop Calculation & Science	B.Voc/Degree in any Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. **OR** 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. **OR** NTC/ NAC in any Engineering trade with seven years experience in relevant field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade **OR** 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 two years experience in relevant field. **OR** 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. **OR** NTC/ NAC in any one of the 'Electrical group (Gr-II) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with seven years experience. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.
4. Training Methodology	B.Voc/Degree in any discipline from AICTE/ UGC recognized College/ university with two years experience in training/ teaching field. **OR** Diploma in any discipline from recognized board / University with five years experience in training/teaching field. **OR** NTC/ NAC passed in any trade with seven years experience in training/ teaching field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in any of the variants under DGT / B.Ed /ToT from NITTTR or equivalent.
5. Minimum Age for Instructor's	21 Years

Distribution of training on Hourly basis: (Indicative only)						
Total Hrs /week	**Trade Practical**	**Trade Theory**	**Workshop Cal. & Sc.**	**Engg. Drawing**	**TM Practical**	**TM Theory**
40 Hours	16 Hours	6Hours	2 Hours	3 Hours	8 Hours	5 Hours

4. JOB ROLE

Brief description of job roles:

Manual Training Teacher/Craft Instructor; instructs students in ITIs/Vocational Training Institutes in respective trades as per defined job role. Imparts theoretical instructions for the use of tools & equipments of related trades and related subjects. Demonstrate process and operations related to the trade in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment and tools in stores.

Electronic, Technician; applies electronic theory, principles of electrical circuits, electrical testing procedures, engineering mathematics, physics and related subjects to layout, build, test;, troubleshoot, repair and modify developmental and production electronic equipment such as computers, missile control instrumentation and machine tool numerical controls. Draws sketches to clarify design details and functional criteria of electronic units. Assembles experimental circuitry (bread board) or complete prototype model according to engineering instructions, technical manuals and knowledge of electronic systems and components and their functions. Recommends changes in circuitry or installation specifications to simplify assembly and maintenance. Sets up standard test apparatus or contrives test equipment and circuit, and conducts functional, operational and environmental and life tests to evaluate performance and reliability of prototype or production model. Analyses and interprets test data. Adjusts, calibrates, aligns and modifies circuit and components and records effects on unit performance. Writes technical reports and develops charts, graphs and schematics to describe and illustrate systems operating characteristics, malfunctions, deviations from design specifications and functional limitations for consideration by professional engineering personnel in broader determinations affecting systems design and laboratory procedures. May operate bench lathes, drills and other machine tools to fabricate non-procurable items, such as coils, terminal boards and chassis. May check out newly installed equipment in airplanes, ships and structure to evaluate system performance under actual operating conditions. May instruct and supervise lower grade technical personnel.

Supervisor and Foreman Electrical and Electronic Equipment; supervises fittings assembling, installing and repairing of electrical and electronic equipment, motors, generators etc., and ensures stipulated performance. Studies drawings and wiring diagrams and explains details to workers. Checks connection, quality and thickness of wire, resistance, condensers, valves, coils, etc., gets defective parts or components replaced and ensures conformity with prescribed specifications. Guides workers in fitting, assembling and installing electrical and electronic equipment including electrical motors and generators and assists them where necessary, to test and remove snags. Tests completed unit for electrical circuit, flow of current, resistance, frequency, earthing, etc. gets defects removed and ensures stipulated performance. May use substitute parts or change wiring system, if authorised. May specialize in electrical or electronic equipment and be designated accordingly. Individuals at this job are responsible for providing

support to production operations through maintenance of process control systems installed at shop floor for various manufacturing processes.

Electronics Fitter, General; fits, assembles and repairs various kinds of electronic equipment in factory or workshop or at place of use. Examines drawings and wiring diagrams; checks parts for accuracy of fit and minor adjustments; assembles parts or mounts them on chassis or panels with aid of hand tools; installs and connects wiring, soldering joints equipment, diagnoses faults with aid of electronic testing equipment; dismantles equipment if required and replaces faulty parts or wiring. Electronics Fitter, other include all other workers engaged in fitting, assembling, repairing and maintaining electronic equipment, machinery, appliances, etc., not elsewhere classified.

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

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

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

Solar PV System Installation Engineer; is responsible for designing and installing the solar photovoltaic system at the customer's premises to meeting their power requirement. The individual at work evaluates the installation site, designs the installation, plans and arranges for materials, and ensures smooth installation process. The individual also supervises the installation technicians' work.

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.

Television Service and Repairman; repairs and adjusts radios and television receivers, using hand tools and electronic testing instruments. Tunes receiver on all channels and observes audio and video characteristics to locate source of trouble. Adjusts controls to obtain desired density, linearity, focus and size of picture. Examines chassis for defects. Tests voltages and resistance of circuits to isolate defect following schematic diagram and using voltmeter, oscilloscope, signal generator and other electronic testing instruments. Tests and changes tubes, solders loose connections and repairs or replaces defective parts, using hand tools and soldering iron. Repair radios and other audio equipment. May install television sets.

Electronic Mechanics and Servicers, other; include all other workers engaged in installing, servicing and repairing radios and television sets and other audio equipment, not elsewhere classified.

Cable Television Installer; installs cable television cables and equipment on customer's premises, using electrician's tools and test equipment: Measures television signal strength at utility pole, using electronic test equipment. Computes impedance of wire from pole to house to determine additional resistance needed for reducing signal to desired level. Installs terminal boxes and strings lead-in wires, using electrician's tools. Connects television set to cable system and evaluates incoming signal. Adjusts and repairs cable system to ensure optimum reception. May collect installation fees and explain cable service operation to subscriber. May communicate with SUPERVISOR, using two-way radio or telephone, to receive instructions or technical advice and to report problems to be repaired. May report unauthorized use of cable system to SUPERVISOR. May clean and maintain tools, test equipment.

Smartphone Technician cum App Tester; diagnoses problems and repairs the faulty module of smartphone. The individual at work is responsible for rectifying faults in the smartphone brought in by the customer. The individual receives the faulty smartphones, diagnoses the problems, performs front end or hardware level testing& replacement as required, resolves software issues and ensures effective functioning before delivering back to customer. The individual at work is responsible for mobile app testing to verify functionality of mobile applications on Android/iOS platform, perform mobile app security to find out and fix mobile app security flaws, ensures prevention of malware and troubleshoot mobile application performance.

The individual may also work for the following job roles in the field of smartphone, Tablet computer and testing:

- Mobile application tester
- Mobile software platform Architect
- Mobile phone system engineer
- Tab repairing technician

Reference NCO 2015:

a) 2356.0100 - Manual Training Teacher/Craft Instructor
b) 3114.0100 - Electronic, Technician
c) 3122.5600 - Supervisor and Foreman Electrical and Electronic Equipment
d) 7421.0100 - Electronics Fitter, General
e) 7421.0300 - Electronics Mechanic
f) 7421.0601 - Field Technician, Washing Machine - ELE/Q3103
g) 7421.0701 - Field Technician, Other Home Appliances - ELE/Q3104
h) 7421.1402 - Solar PV System Installation Engineer - ELE/Q5902
i) 7421.0801 - Field Technician: UPS and Inverter - ELE/Q7201
j) 7422.1300 - Television Service and Repairman repairs
k) 7421.9900 - Electronic Mechanics and Servicers, other
l) 7422.1200 - Cable Television Installer
m) 7422.2301-Smartphone Repair Technician - ELE/Q8104

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 TRADE TECHNOLOGY

1. Explain Quality Management tools- 5S, 7QC etc. & ensure compliance of safety practices and Handling of Hand tools, special tools and maintenance of them.
2. Assemble, test and troubleshoot various analog and digital circuits; Simulate & analyze circuits using electronic simulator software.
3. Test, service and troubleshoot various components of different domestic/ industrial programmable systems.
4. Execute the operation of different process sensors; Demonstrate, wire & test various sensors of different industrial processes by selecting appropriate test instruments.
5. Detect the faults and troubleshoot SMPS, UPS and inverter.
6. Test different SMD discrete components and IC packages with due care and rework on PCB after checking defects from SMD soldering and de-soldering.
7. Test and Interface LCD, LED, DPM panels to various circuits and evaluate performance; Check various parts of LED lights and stacks and troubleshoot.
8. Install a solar panel, execute testing and evaluate performance by connecting the panel to the inverter.
9. Plan and Prepare fibre optic setup and execute transmission and reception.
10. Assemble different parts and operate various controls, troubleshoot and replace modules of the LCD/LED/Smart TV and its remote.
11. Check Installation of a DTH system by proper selection of site, assemble different parts and operate various controls.
12. Monitor and check dismantling of various parts and interface of a cell phone to a PC; Estimate and troubleshoot.
13. Set and test network connections, check SD Card Interactions, mobile App settings on different platforms.
14. Assemble and disassemble various smart phones; Demonstrate different types of ICs and perform basic editing in different apps, OS installation, reboot procedure, password creation and defect identification in smart phones; Replace faulty components and perform testing.
15. Plan and setup a CCTV system and configure the system for surveillance function.
16. Demonstrate operation of various control play switches, troubleshoot and replace faulty boards of a home theatre and its remote.
17. Demonstrate dismantling control circuits, sensors of various domestic appliances; Estimate and troubleshoot.

18. Execute the operation of different indication on PLC modules, wire different field devices of PLC, configure the system, perform suitable functions, test and control the electro pneumatic actuators using various pneumatic valves.
19. Assemble, test and troubleshoot single phase & 3-phase controlled and uncontrolled rectifier using SCR.
20. Perform speed control of DC machine and single phase and 3-phase AC machines and check the performance of AC & DC drive to control the speed.
21. Perform speed control of servo motors and test different industrial process circuits by selecting the suitable function.

6. COURSE CONTENT

SYLLABUS FOR ELECTRONICS MECHANIC -CITS TRADE			
TRADE TECHNOLOGY			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Practical 16 Hrs Theory 06 Hrs	Explain Quality Management tools-5S, 7QC etc. & ensure compliance of safety practices and Handling of Hand tools, special tools and maintenance of them.	1. Practice 5s techniques in the Electronics Mechanic work shop. 2. Precautions to be observed while working in the work shop an. 3. Handling & maintenance of hand tools, special tools, equipments& machineries. 4. Maintenance of workshop equipments in the workshop.	Admission, introduction, facility available in the institute. Importance of safety, safety precautions& first aid. Concept of 5S & 7QC tools, time management as employed for quality circle. Importance of healthy environment. Application and safety to be observed while handling hand tools, special tools, equipments& machineries Importance and types of maintenance of vehicles/engines. Safely handling of hazardous materials.
Practical 64Hrs Theory 24Hrs	Assemble, test and troubleshoot various analog and digital circuits; Simulate & analyze circuits using electronic simulator software.	**Basic Gates** 5. Demonstrate different Logic Gates (AND, OR, NAND, NOR, EX-OR, EX-NOR, NOT ICs) by the number printed on them. 6. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. 7. Construct and verify the truth table of all the gates using NAND and NOR gates. 8. Use digital IC tester to test the various digital ICs (TTL and CMOS).	Introduction to Digital Electronics. Difference between analog and digital signals. Logic families and their comparison, logic levels of TTL and CMOS. Number systems (Decimal, binary, octal, Hexadecimal). BCD code, ASCII code and code conversions. Various Logic Gates and their truth tables.
		Combinational Circuits 9. Construct Half Adder circuit	Combinational logic circuits such

		using ICs and verify the truth table. Construct Full adder with two Half adder circuit using ICs and verify the truth table. 10. Construct the adder cum subtractor circuit and verify the result. 11. Construct and Test a 2 to 4 Decoder. 12. Construct and Test a 4 to 2 Encoder. 13. Construct and Test a 4 to 1 Multiplexer. 14. Construct and Test a 1 to 4 De Multiplexer.	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.
		Flip Flops 15. Demonstrate different Flip-Flop (ICs) by the number printed on them. 16. Construct and test four bit latch using 7475. 17. Construct and test R-S flip-flop using IC7400 with clock and without clock pulse. 18. Verify the truth tables of Flip-Flop ICs (RS, D, T, JK, MSJK) by connecting switches and LEDs.	Introduction to Flip-Flop. S-R Latch, Gated S-R Latch, D-Latch. Flip-Flop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop. Master-Slave flip flops and Timing diagrams. Basic flip flop applications like data storage, data transfer and frequency division.
		Counter & shift Registers 19. Construct and test a four bit asynchronous binary counter using 7493 20. Construct and test 7493 as a modulus-12 counter. 21. Construct and test a four bit Synchronous binary counter using 74163. 22. Construct and test synchronous Decade counter.	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. BCD display and BCD to decimal decoder. BCD to 7 segment display circuits.

		23. Construct and test an up/down synchronous decade counter using 74190 and monitor the output on LEDs. 24. Demonstrate and test common anode and common cathode seven segment LED display using multi meter. 25. Display the two digit count value on seven segment display using decoder/driver ICs. 26. Construct a shift register using RS/D/JK flip flop and verify the result. 27. Construct and test four bit SIPO register. 28. Construct and test four bit PIPO register. 29. Construct and test bidirectional shift registers.	Basics of Register, types and application of Registers.
		Electronic circuit simulator 30. Prepare simple digital and electronic circuits using the software. 31. Simulate and test the prepared digital and analog circuits. 32. Convert the prepared circuit into a layout diagram. 33. Prepare simple, power electronic and domestic electronic circuit using simulation software.	Study the library components available in the circuit simulation software. Various resources of the software.
Practical 32Hrs Theory 12Hrs	Test, service and troubleshoot various components of different domestic/ industrial programmable	**Microcontroller 8051** 34. Demonstrate various ICs & their functions on the given Microcontroller Kit. 35. Demonstrate the address range of RAM & ROM.	Introduction Microprocessor & 8051Microcontroller, architecture, pin details & the bus system. Function of different ICs used in

	systems.	36. Measure the crystal frequency, connect it to the controller. 37. Demonstrate the port pins of the controller & configure the ports for Input & Output operation. 38. Use 8051 microcontroller, connect 8 LED to the port, blink the LED with a switch. 39. Perform the initialization, load & turn on a LED with delay using Timer. 40. Perform the use of a Timer as an Event counter to count external events. 41. Demonstrate entering of simple programs, execute & monitor the results. 42. 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.	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.
Practical 32Hrs Theory 12Hrs	Execute the operation of different process sensors; Demonstrate, wire & test various sensors of different industrial processes by selecting appropriate test instruments.	**Sensors, Transducers and Applications** 43. Demonstrate sensors used in process industries such as RTDs, Temperature ICs, Thermocouples, proximity switches (inductive, capacitive and photo electric), load cells, strain gauge. LVDT PT 100 (platinum resistance sensor), water level sensor, thermostat float switch,	Basics of passive and active transducers. 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 –

		float valve by their appearance. 44. Measure temperature of a lit fire using a Thermocouple and record the readings referring to data chart. 45. Measure temperature of a lit fire using RTD and record the readings referring to data chart. 46. Measure the DC voltage of a LVDT. 47. Detect different objectives using capacitive, inductive and photoelectric proximity sensors.	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
Practical 32Hrs Theory 12Hrs	Detect the faults and troubleshoot SMPS, UPS and inverter.	**SMPS and Inverter** 48. Demonstrate the components/devices and draw their corresponding symbols. 49. Dismantle the given stabilizer and find major sections/ ICs components. 50. List the defect and symptom in the faulty SMPS. 51. Measure / Monitor major test points of computer SMPS. 52. 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 Use SMPS used in TVs and PCs for Practice. 53. Install and test the SMPS in PC. Install and test a inverter. 54. 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 principals.

		the given inverter unit. Rectify the defects and verify the output with load. Construct and test IC Based DC-DC converter for different voltages 55. Construct and test a switching step down regulator using LM2576. Construct and test a switching step up regulator using MC 34063.	
		UPS 56. Connect battery stack to the UPS. 57. Demonstrate front panel control & indicators of UPS. 58. Connect Battery & load to UPS & test on battery mode. 59. Open top cover of a UPS; Demonstrate its isolator transformers, the UPS transformer and various circuit boards in UPS. 60. Demonstrate the various test point and verify the voltages on these. 61. Demonstrate various circuit boards in UPS and monitor voltages at various test points. 62. Perform load test to measure backup time. 63. Perform all above experiment for three phase UPS.	Concept of Uninterrupted power supply. Difference between Inverters and UPS. Basic block diagram of UPS & operating principle. Types of UPS : Off line UPS, On line 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.
Practical 32Hrs Theory 12Hrs	Test different SMD discrete components and IC packages with due care and rework on PCB after checking	**<u>Electronics Mechanic Trade</u>** **Basic SMD (2, 3, 4 terminal components)** 64. Demonstration of 2, 3, 4 terminal SMD components.	Introduction to SMD technology Demonstration of 2, 3, 4 terminal SMD components. Advantages of SMD components over conventional lead

	defects from SMD soldering and de-soldering.	65. De-solder the SMD components from the given PCB. 66. Solder the SMD components in the same PCB. 67. Check for cold continuity of PCB. Demonstration of loose /dry solder, broken tracks on printed wired assemblies.	components. Soldering of SM assemblies - Reflow soldering. Tips for selection of hardware, Inspection of SM.
		PCB Rework 68. Check and Repair Printed Circuit Boards single, Double layer, and important tests for PCBs. 69. Inspect soldered joints, detect the defects and test the PCB for rework. 70. Remove the conformal coatings by different methods. 71. Perform replacement of coating. Perform baking and preheating. Repair solder mask and damage pad.	Introduction to Static charges, prevention, handling of static sensitive devices, various standards for ESD. Introduction to non soldering 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.
Practical 32Hrs Theory 12Hrs	Test and Interface LCD, LED, DPM panels to various circuits and evaluate performance; Check various parts of LED lights and stacks and troubleshoot.	**<u>Technician Power Electronics System</u>** 72. Digital panel Meter 73. LED Display module and its decoder/driver ICs. 74. Display a word on a two line LED. 75. Measure/current flowing through a resistor and display it on LED Module. 76. Measure/current flowing through a sensor and display it on a LED module (DPM). 77. Demonstrate LCD Display	Different types of seven segment displays, decoders and driver ICs. Concept of multiplexing and its advantages. Block diagrams of 7106 and 7107 and their configuration for different measurements. Use of DPM with seven segment display. Principles of working of LCD. Different sizes of LCDs. Decoder/ driver ICs used with LCDs and their pin diagrams. Use of DPM with LCD to display

		module and its decoder/driver ICs. 78. Measure/current flowing through a resistor and display it.	different voltage & current signals.
		Electronics Mechanic Trade 79. LED Lights 80. Dismantle the LED light, Demonstrate the connections of LEDs stacks, protection circuits, regulator 81. Demonstrate the rectifier, controller part of LED lights. 82. Make series string connection of six LED's and connect four Series strings in parallel. 83. Connect to such parallel sets in Series to create a matrix of LED's. 84. Apply suitable voltage and check Voltage across series strings.	Types of LED panels used in various lighting applications. Stacking of LEDs. Driving of LED stacks.
Practical 32Hrs Theory 12Hrs	Install a solar panel, execute testing and evaluate performance by connecting the panel to the inverter.	**Solar Power (Renewable Energy System)** 85. Install a solar panel to a roof. Wire a solar controller to a battery storage station. Install solar power 500 panels to directly 12 V DC appliances. Connect storage batteries to a power inverter 86. Connect and test solar panel to the Inverter and run the load. 87. Install a solar power to charge a rechargeable 12 V DC battery and find out the charging time 88. Install a Solar Inverter.	Need for renewable energy sources, Solar energy as a renewable resource. Materials used for solar cells. Principles of conversion of solar light into electricity. Basics of photovoltaic's cell. Module, panel and Arrays. Factors that influence the output of a PV module. SPV systems and the key benefits. Difference between SPV and conventional power. Solar charge controller or regulator and its role. Safety precautions while working with solar systems.

Practical 32Hrs Theory 12Hrs	Plan and Prepare fibre optic setup and execute transmission and reception.	**Fiber optic communication** 89. Demonstrate the resources and their need on the given fiber optic trainer kit. 90. Make optical fiber setup to transmit and receive analog and digital data. 91. Set up the OFC trainer kit to study AM, FM, PWM modulation and demodulation. 92. Perform FM modulation and demodulation using OFC trainer kit using audio signal and voice link. 93. Perform PWM modulation and demodulation using OFC trainer kit using audio signal and voice link. 94. Perform PPM modulation and demodulation using OFC trainer kit using audio signal and voice link.	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.
Practical 16Hrs Theory 06Hrs	Assemble different parts and operate various controls, troubleshoot and replace modules of the LCD/LED/Smart TV and its remote.	**<u>Electronics Mechanic Trade</u>** **LCD / LED TV/Smart TV** 95. Demonstrate and operate different Controls on LCD, LED, Smart TV. 96. Demonstrate components and different sectors of LCD, LED and SmartTV. 97. Dismantle; Demonstrate the parts of the remote control. 98. Dismantle the given LCD, LED, Smart TV to find faults with input stages through connectors. 99. Detect the defect in a LCD, LED, Smart TV receiver given to you. Rectify the fault.	Difference between a conventional CTV with LCD, LED, Smart TV Principle of LCD, LED, Smart 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

		100. Troubleshoot the faults in the given LCD, LED, Smart TV receiver. Locate and rectify the faults. 101. Test LCD, LED, Smart TV after troubleshooting the defects. 102. Demonstrate various connectors and connect the cable operator's external decoder (set top box) to the TV.	faults in remote control.
Practical 16Hrs Theory 06Hrs	Check Installation of a DTH system by proper selection of site, assemble different parts and operate various controls.	**DTH System** 103. Demonstration& use of DTH system assembly. 104. Demonstration& use of different tools and equipments used in DTH installation procedure &cabling procedure. 105. Demonstration of various types of connectors and cables. 106. Connection procedure. 107. Install a DTH system & get a TV station. 108. Site selection, installation mounting tracking for azimuth and elevation angles using SAT meter. 109. Detect the faults in DTH system & rectify. 110. Demonstration& use of various I/O ports of STB. 111. STB connection and first installation. 112. Demonstrate the faults in STB & rectify.	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 & 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.
Practical 32Hrs Theory	Monitor and check dismantling of various parts and interface of	**Cell phones** 113. Dismantle, identify the parts and assemble	Introduction to mobile communication.

12Hrs	a cell phone to a PC; Estimate and troubleshoot.	different types of smart phones. 114. Dismantle the cell phone/smart phone remove the key pad and clean it, test for the continuity of the matrix/tracks. 115. Interface the cell phone/smart phone to the PC and transfer the data card. 116. Flash the various brands of cell phone/smart phone (at least 3). 117. Format the cell phone/smart phone for virus (approach the mobile repair shop/service centre). 118. Unlock the handsets through codes and software. 119. Perform the interfacing of cell phone/smart phone to the PC and dismantle the cell phone and identify the power section and test its healthiness. 120. Find out the fault of basic cell phone system. Rectify the fault in ringer section and check the performance. 121. Replace various faulty parts like mic, speaker, data/ charging/ audio jack etc.	Concept cell site, hand off, frequency reuse, block diagram and working of cell phones, cell phone features. GSM and CDMA technology. Use IEMI number to trace lost/misplaced mobile phone.
Practical 16Hrs Theory 06Hrs	Set and test network connections, check SD Card Interactions, mobile App settings on different platforms.	**Smartphone Cum App Tester Trade** 122. Perform network connections, SD Card Interactions and Bluetooth testing.	Different SD cards and their features and best practices related to mobile app and setting testing.

		123. Execute testing Mobile Apps on different platforms. 124. Apply Best Practices in Mobile app & setting testing.	
Practical 32Hrs Theory 12Hrs	Assemble and disassemble various smart phones; Demonstrate different types of ICs and perform basic editing in different apps, OS installation, reboot procedure, password creation and defect identification in smart phones; Replace faulty components and perform testing.	125. Demonstrate popular applications used in android mobile system. Demonstrate popular applications used in windows based mobile system. 126. Demonstrate process of making Ringtone, Singtone, Editing Video Clip, Basic photo editing using apps. 127. Demonstrate downloading procedure, registration procedure via banking, sharing internet via hotspot, file sharing procedure of Bluetooth, data cable, OTG, card reader, etc. 128. Perform assembling and disassembling of Smartphone using different tools. 129. Demonstrate different types of ICs and practice of replacement with the blower machine. 130. Demonstrate process of password cracking. 131. Install various Operating Systems (OS) in mobile phones. 132. Perform Reboot procedure. 133. Practice setting different parameters for proper use of various machine viz., blower, DC power supply, charging booster machine etc	Difference between Smartphone and basic mobile phone. Study various part of Smartphone architecture. Overview of mobile operating system and types of OS. Concept of Android and windows technology in mobile system. Basic features of Android &windows and its applications. Functions of Smartphone components. Concept of Wi-Fi. Downloading through internet, share with Blue tooth, share internet via hotspot, Data cable & Card reader, concept of OTG, NFC. Study Various tools and equipment used in Smartphone repairing. Concept of different type of IC that is used in Smartphone (windows and android). Different kind of application that is used in windows and android. Android Mobile recovery procedure through coding. Windows mobile recovery procedure through coding. Techniques of crack password code of windows and android mobile phone. Procedure of reboot (window and android). Overview of BTS, MTS Testing of various parts and components that are used in

		134. Demonstrate SMD rework station and BGA IC Reballing and Installing. 135. De-solder and remove the BGA IC from the PCB and clean the solder from the bottom of the IC. 136. Practice use of different soldering iron (10W & 25W) and de-soldering wire or wick. 137. Replace various ICs on mobile handsets. 138. Demonstrate damages from ingress of water and practice to resolve. Analyze the hanging issues and practice to resolve it. 139. Perform replacement of touch sensor and finger print sensor in Smartphones. 140. Replace camera of faulty Smartphones.	mobile phone for hardware repairing. Recognize and troubleshoot common handset problems like hanging issues, camera problems. Study various radiation Levels of Smartphone. Study Compliance standards for mobile phones in India. Study Mobile phone hardware troubleshooting procedure (hanging, USB charging & touch sensor problems). Concept of Ultrasonic cleaning. Overview of SMD rework station Overview of BGA, BGA Soldering. IC Reballing and Installation. Concept of Power failure of mobile phone and process to solve it. (dead handsets)
Practical 32Hrs Theory 12Hrs	Plan and setup a CCTV system and configure the system for surveillance function.	**<u>Mechanic Consumer Electronics Appliances Trade</u>** **CCTV** 141. Demonstration of different CCTV components. 142. Draw, trace or follow the CCTV setup of any commercial installation. 143. Demonstrate the strategic locations for the installation of cameras. 144. Operate and learn the procedure for switching cameras to have different views. 145. Demonstration of connectors and sockets	Types of cameras and their specifications used in CCTV systems. CCTV setup and its components Working of Digital Video Recorders and types of DVRs

		used on DVRs. 146. Test the healthiness cables and connectors. 147. Connect CCTV Cameras to DVR, Record and Replay. 148. Dismantle DVR and Demonstrate major functional blocks and test for the healthiness. 149. Take the students to any nearby commercial CCTV installation to carry out the above tasks.	
Practical 16Hrs Theory 06Hrs	Demonstrate operation of various control play switches, troubleshoot and replace faulty boards of a home theatre and its remote.	**Home theatre** 150. Demonstration of different parts of home theatre. 151. Testing of speakers, woofers& tweeters. 152. Set up of home theatre using specific devices. 153. Demonstration of different parts of AV receiver. 154. Demonstrate the faults in AV receiver & rectify.	Introduction to home theatre, surround sound system, basic components, block diagram of home theatre & working.
Practical 32Hrs Theory 12Hrs	Demonstrate dismantling control circuits, sensors of various domestic appliances; Estimate and troubleshoot.	**Domestic Appliances** 155. Check controls on touch key pad of Microwave oven. 156. Monitor and check Dismantling of various parts, wiring, tracing of various controls of Microwave oven. 157. Detect the faults in the given Microwave oven & rectify. 158. Monitor dismantling of various parts, sensors, wiring, tracing of various controls, Electronic circuits, in various types of washing M/C. 159. Identify the faults in the	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 automatic machines, basic working principle of manual, semi-automatic and fully automatic

		given washing M/C and rectify. 160. Check dismantling of various parts, wiring, tracing of various controls, Electronic circuits in various types of Vacuum cleaners. 161. Identify the faults in various types of Vacuum cleaners & rectify. 162. Monitor and check dismantling of various parts, wiring, tracing of various controls, Electronic circuits in various types of Mixers/grinders. 163. Detect in various types of Mixer s/grinders & rectify. 164. Dismantle and identification of various parts, wiring, tracing of various controls, Electronic circuits in steam Iron. 165. Detect the faults in steam iron & rectify. 166. Test various components of Electric rice cooker, controls and trace the circuit and rectify the simulated faults. 167. Monitor various components of Water purifier, mantling and dismantling of water purifier, connection between different parts of water purifier. 168. Clean and replace the worn out consumable parts following the troubleshooting manual 169. Simulate and rectify the	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. 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.

		faults. Repeat the above exercise for UV type water purifier. 170. Monitor and check dismantling of various parts, wiring and connections of immersion heater. 171. Demonstrate Replacing of coil and fixing insulation failure problems. Remove scale formation from heating element. 172. Check the faults in Induction cooktop and rectify. 173. Check dismantling of various parts, wiring and tracing of various controls, Electrical and electronics circuit in Induction cooktop. 174. Replacing the Induction tube (coil) in Induction cooktop.	
Practical 64Hrs Theory 24Hrs	Execute the operation of different indication on PLC modules, wire different field devices of PLC, configure the system, perform suitable functions, test and control the electro pneumatic actuators using various pneumatic valves.	**PLC** 175. Demonstrate various indicators on PLC Modules and interpret. 176. Wire in various digital input and output devices to the respective modules. 177. Wire analog input and output devices to the respective modules. 178. Connect and configure PLC hardware and the software. 179. Develop and run simple programs to read sensor status and to control various outputs. 180. Force input and output devices using the software. 181. Perform online editing of a	Evolution of control technology. Advantages of PLCs Modular architecture of PLCs, working principle of PLCs. Various modules and addressing Wiring of field devices to various modules, interpretation of indications on CPU and other modules Specification of PLC Modules Implementation of relays, timers and counters using PLCs

		rung/network. 182. Prepare data tables and monitor.	
		Electronic Pneumatics 183. Demonstrate different pneumatic and electro pneumatic components. 184. Construct and control a single acting cylinder. 185. Construct and control a double acting cylinder. 186. Construct and control single/double acting cylinder using series/ parallel circuits. 187. Construct and perform bidirectional control of a cylinder. 188. Construct and control, automatic return of a double acting cylinder. 189. Construct and control the oscillating motion of a double acting cylinder. 190. Construct and control a latching circuit using single or double acting cylinder. 191. Construct and control, automatic return initiated by a limit switch. 192. Throttle a cylinder to adjust forward and return strokes. 193. Adjust the pressure as per the requirements.	Introduction to pneumatic power source and measure of compressed air, storage and transmission of compressed air, applications of pneumatics in the industries. Symbols of different pneumatic and electro-pneumatic components. Various supply elements such as compressors, reservoir, pressure regulating valve, service unit etc. Various input elements such as push button valves, roller lever valves, proximity switches, Air barriers etc. Various pneumatic control elements, processing elements such as directional control valves, shuttle valves, non-return valves, pressure control valves, Timers and sequencers etc. Function and application of solenoid valves. Limit switches, memory valves, pressure dependent valves and time dependent valves.
Practical 32Hrs Theory 12Hrs	Assemble, test and troubleshoot single phase & 3-phase controlled and uncontrolled rectifier using SCR.	**<u>Technician Power Electronics System Trade</u>** **3-Phase Rectifier controlled & uncontrolled** 194. Construct & test three phase uncontrolled rectifiers (half wave &	High current rectifiers. Differentiate uncontrolled and controlled rectifiers. Discuss on 3-phase uncontrolled rectifier, control and power circuits and their applications. Discussion on 3-phase controlled

		bridge). 195. Construct & test single phase half controlled rectifier using SCR. 196. Construct & test single phase full controlled rectifier using SCR. 197. Demonstrate and replace the faulty components. 198. Test, 3-phase controlled rectifiers under fault condition & rectify faults. 199. Construct & test three phase controlled rectifiers (half wave & bridge) using SCR.	rectifiers, control and power circuits and their applications.
Practical 32Hrs Theory 12Hrs	Perform speed control of DC machine and single phase and 3-phase AC machines and check the performance of AC & DC drive to control the speed.	**Technician Power Electronics System Trade** **Electrical control of AC/DC machines** 200. Demonstrate (unmarked) terminals of 3 phase induction motors. 201. Construct a self hold contactor circuit and run a 3-Phase Induction Motor. 202. Familiarize with different types of motor and Demonstrate the different parts. 203. Study & connect the motor and run (below 5hp) in star, note phase Voltage, line voltage and current. Study and connect and run the motor in Delta and note phase current line current. Phase voltage and line voltage. 204. Connect and operate an induction motor using DOL	Fundamentals of AC 3 phase &single phase Induction motors, synchronous speed, slip, rotor frequency, torque – speed characteristics, Starters used for Induction motors, speed control of Induction motors Types of motors: Advantages &disadvantages among each other. DC Motors– types, working, torque speed characteristics, staring of DC Motors & change the DOR, 3 point and 4 point Starters, speed control of DC motor, Field flux control & armature current control. Brushless DC Motors.

		starter. 205. Connect and run a 3-phase motor using manual and automatic star-delta starters. 206. Change the direction of rotation of Induction motor. 207. Connect & run three phase induction motors in a sequence using contactor & relay. 208. Construct, run, stop and jog in both directions of an induction motor. 209. Understand all the information on a Motor template. 210. Familiarize with different types of DC motors. 211. Connect & run DC shunt motor using 3 point starter. 212. Change the direction of rotation of DC motor. 213. Control the speed of DC motor by armature control method. 214. Control the speed of DC motor by the field control method. 215. Construct the circuit for speed control of DC shunt motor (phase control method). 216. Construct the PWM circuit for the speed control of DC shunt motors. 217. Control the speed of DC shunt motor using SCR chopper by using a trainer.	
		AC Drives	

		218. Study the AC Drive set up and its connections. 219. Demonstrate different cables and connectors used in the AC DRIVE setup. 220. Demonstrate various input and output terminals of the DRIVE unit, Operator panel and display unit. 221. Familiarization with PMU & different terminals of Micro – Master AC Drive. 222. Demonstration – Access parameter number & values. 223. Familiarization with parameters. 224. Parameter values for various operations. 225. Commissioning parameter numbers and values. 226. Installation of AC Drive(similar to SIEMENS MM-420/440). 227. Familiarization with: Commissioning & Quick 228. Commissioning (similar to SIEMENS MM-420/440). 229. Reset to default values/ Factory setting values. 230. MM Drive Programming/ Parameterization for different control operations. 231. ON/OFF, Forward/ Reverse, Jog (R)/Jog (L), braking and speed control.	Block diagram of AC Drive – (Sources of supply – Converter/Rectifier – DC Link – Inverter –Motor Load) 1 phase & 3 phase rectifier circuits. Inverter – 1 phase Inverter 3 phase Inverter Switching circuit (Sequence and Switching timing control – PWM Technique & Switching Devices. Microprocessor/ Microcontroller) -VFD (Variable Frequency Drive) VVVF Control – (3 phase induction Motor) Speed control. Introduction of PID controller. Installation of AC Drive/ Siemens Micro master Drive – MM-420/440 Commissioning/ Quick Commissioning of MM –420/440 Micro – Master Drive – Programming (Parameterization)
Practical 16Hrs Theory 06Hrs	Perform speed control of servo motors and test different industrial process circuits by	**Servo Motor** 232. Construct a simple circuit to control servo motor using IC 555.	Servo mechanism, Servo motor principal, Difference between motors & servo motor. Types of

	selecting the suitable function.	233. Connect servo motor with drive & control its parameters. 234. Connect the servo motor to computer for monitoring & controlling of various parameters. 235. Parameter programming of servo motor. 236. Various control method for controlling velocity & torque.	servo motor, AC & DC - brushless servo motor &permanent magnet servo motor construction & application. Control method for servo motor. Study of servo drive.

SYLLABUS FOR CORE SKILLS
1. Workshop Calculation &Science(Common for all Engineering CITS trades) (80 Hrs)
2. Engineering Drawing (Group II) (120Hrs)
3. Training Methodology (Common for all CITS trades) (320Hrs + 200Hrs)

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

7. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
TRADE TECHNOLOGY	
1. Explain Quality Management tools- 5S, 7QC etc. & ensure compliance of safety practices and Handling of Hand tools, special tools and maintenance of them.	Explain 5s & 7QC techniques in the work shop.
	Identify precautions to be observed while working in the work shop.
	Check handling & maintenance of hand tools, special tools, equipment & machineries.
	Ensure compliance of safety precautions while handling hand tools, special tools, equipment & machineries.
	Check Preventive maintenance of equipment in the workshop.
2. Assemble, test and troubleshoot various analog and digital circuits; Simulate & analyze circuits using electronic 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
	Illustrate practice of digital trainer kit with safety.
	Demonstrate 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 a adder cum subtractor circuits and verify the truth table.
	Construct a decoder/encoder/multiplexer/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.
	Plan the work incompliance with standard procedure.
	Prepare simple analog and digital electronic circuits using the simulator software.
3. Test, service and troubleshoot various components of different domestic/ industrial programmable systems.	Ensure execution of procedure as per manual of Micro controller.
	Select various ICs & their functions on the given Microcontroller Kit.
	Check the address range of RAM & ROM.
	Execute data into RAM & observe its volatility.
	Illustrate the port pins of the controller & configure the ports for Input & Output operation.
	Demonstrate entering of simple programs, execute &monitor the results.
	Prepare a program/ compile / Dump the code on to the on-chip

	flash memory of the PIC development.
	Control an LED connected to port pin using anI/P switch connected to another port pin.
	Ensure execution for LED connected to a port pin with a delay of 500 ms.
	Enable a siren using port pin to generate variable audio signals.
	Develop & execute a program to perform serial communication using on board USART.
4. Execute the operation of different process sensors; Demonstrate, wire & test various sensors of different industrial processes by selecting appropriate test instruments.	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.
	Select 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.
5. Detect the faults and troubleshoot SMPS, UPS and inverter.	Check the tools and equipments to perform the job with due care and safety.
	Dismantle the given stabilizer and find major sections/ ICs components.
	Evaluate various input and output sockets/connectors of the given SMPS.
	Test major sections/ ICs/components of SMPS.
	Inspect faulty components and construct and test IC Based DC-DC converter for different voltages.
	Check & verify front panel control & indicators of UPS.
	Connect Battery & load to UPS & test on battery mode.
	Open Top cover of UPS and inspect isolator transformer/ UPS transformer/additional circuit other than inverter.
	Check & Verify circuit boards in UPS and monitor voltages at various test points.
	Test UPS under Fault condition & rectify fault.
6. Test different SMD discrete components and IC packages with due care and rework on	Demonstrate various crimping tools for various IC packages.
	Check different types of soldering guns and choose the suitable tip for the application.
	Test soldering/de-soldering of different active /passive

PCB after checking defects from SMD soldering and de-soldering.	components/ IC base on GPCBs using solder/flux/pump / 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.
	Check SMD components, de-solder/ 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.
	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.
7. Test and Interface LCD, LED, DPM panels to various circuits and evaluate performance; Check various parts of LED lights and stacks and troubleshoot.	Check LCD/LED Display module and its decoder/driver ICs and display a word on a two line LCD/LED.
	Measure/current flowing through a resistor and display it.
	Measure/current flowing through a sensor and display it on a LCD/LED module (DPM).
	Demonstrate measuring procedure as per manual.
	Conduct systematic trouble shooting.
	Dismantle the LED light, identify the connections of LEDs stacks, protection circuits, regulator.
	Measure the voltage across LED stacks.
	Check the rectifier/controller part of LED lights.
	Test various subassemblies of the given LED light system.
	Comply with safety rules when performing the above operations.
8. Install a solar panel, execute testing and evaluate performance by connecting the panel to the inverter.	Select appropriate tools and equipment.
	Install a solar panel to a roof.
	Wire a solar panel to a solar controller.
	Wire a solar controller to a battery storage station.
	Connect storage batteries to a power inverter.
	Wire a power inverter to an electrical service panel.
	Connect and test solar panel to the Inverter and run the load.
	Installation of Solar Inverter.
	Demonstrate the installation with team.
9. Plan and Prepare fibre optic setup and execute transmission and reception.	Plan and construct 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 and voice link.

	Demonstrate PPM modulation and demodulation using OFC trainer kit using audio signal and voice link.
10. Assemble different parts and operate various controls, troubleshoot and replace modules of the LCD/LED/Smart TV and its remote.	Ascertain & select tools and equipment an order-related in a timely manner.
	Demonstrate and operate different control on LCD/ LED/SmartTV.
	Select the proper parts use suitable cable to interface to the desktop computer, make necessary adjustment and operate.
	Ensure Dismantling of the TV and Demonstrate all major functional modules, test the power supply, exhaust fan etc.
	Comply with safety rules when performing the above operations.
11. Check Installation of a DTH system by proper selection of site, assemble different parts and operate various controls.	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.
	Check the faults in DTH system & rectify.
	Document materials, spare parts, work time and technical checks.
	Monitor, evaluate and check own work.
12. Monitor and check dismantling of various parts and interface of a cell phone to a PC; Estimate and troubleshoot.	Understand and interpret repair procedure as per manual of cell phone and select appropriate tools & equipment for undertaking job.
	Plan to repair and assemble the components used as per circuit diagram.
	Dismantle, identify the parts and assemble different types of smart phones.
	Interface the cell phone/smart phone to the PC and transfer the data and browse internet.
	Flash the various brands of cell phone/smart phone (at least 3) and upgrade the OS.
	Format the cell phone/smart phone for virus (approach the mobile repair shop/service centre).
	Identify the defective parts and rectify.
13. Set and test network connections, check SD Card Interactions, mobile App settings on different platforms.	Establish and test network connection/SD Card Interactions
	Demonstrate Bluetooth testing.
	Perform mobile app setting testing

14. Assemble and disassemble various smart phones; Demonstrate different types of ICs and perform basic editing in different apps, OS installation, reboot procedure, password creation and defect identification in smart phones; Replace faulty components and perform testing.	Identify applications used in windows/ android mobile system.
	Demonstrate process of making Ringtone/Sing tone/ Editing Video Clip/ Basic photo editing using apps.
	Demonstrate downloading procedure/ registration procedure via banking/sharing internet via hotspot/ file sharing procedure of Bluetooth/data cable/ OTG/ card reader.
	Assemble/Disassemble of Smartphone via different tools.
	Identify different types of ICs and replace with blower machine.
	Apply Process of password cracking.
	Install various Operating Systems (OS) in given Smartphone handset.
	Demonstrate Reboot procedure.
	Plan work in compliance with standard safety norms.
	Set different parameters for efficient use of different machines viz., blower/DC power supply/ Charging booster machine etc.
	Identify and resolve problems like water damaged.
	Identify the hanging issues of given Smartphone and resolve it.
	Replace touch sensor/ camera/ finger print sensor of given faulty Smartphones.
	Apply hot air using SMD rework station.
	Desolder / remove the BGA IC from the PCB.
	Clean the solder from the bottom of the IC of the given phone.
	Use a soldering iron (10W & 25W)/desoldering wire/ wick.
	Select the right size of the IC depending on the number of balls from the stencil supplied with the kit.
	Place the IC on the stencil and tightly hold it with the stencil using clip or tape.
	Apply solder paste from the other side of the stencil.
	Clean the IC with Acetone or IPA solution and remove it from the stencil.
15. Plan and setup a CCTV system and configure the system for surveillance function.	Demonstrate different tools and equipment used for installation of CCTV, handle the tools with due care and safety.
	Demonstrate the different CCTV components, Trace or follow the CCTV setup for any commercial installation.
	Demonstrate the strategic locations for the installation of cameras.
	Plan and setup the procedure for switching the cameras to have different views.
	Demonstrate the connectors and sockets used on DVRs, connect CCTV Cameras to DVR, Record and Replay.
	Check dismantling DVR and Demonstrate major functional blocks and test for the healthiness.
	Judge making tools, machine tools, test, measure 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.
16. Demonstrate operation of various control 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.
	Check Installation/setup of home theatre using specific devices.
	Demonstrate different parts of AV receiver and rectify the faults
	Check dismantling andDemonstrate 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.
17. Demonstrate dismantling control circuits, sensors of various domestic appliances; Estimate and troubleshoot.	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, electriccircuits 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 thevarious 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.
18. Execute the operation of different indication on PLC modules, wire different field devices of PLC, configure the system, perform suitable functions, test and control the electro pneumatic	Demonstrate various indicators on PLC Modules and interpret.
	Check connection of PLC hardware and configuration of the software.
	Examine wire in various digital and analog input and output devices to the respective modules.
	Develop and run simple programs to read sensor status and to control various outputs.

actuators using various pneumatic valves.	Check online editing of a rung/network and prepare data tables and monitor.
	Demonstrate different pneumatic and electro-pneumatic components.
	Construct and control a single acting cylinder and double acting cylinder.
	Construct and control single/double acting cylinder using series/ parallel circuits.
	Construct and perform bidirectional control of a cylinder.
	Construct and control, automatic return of a double acting cylinder.
	Construct and control the oscillating motion of a double acting cylinder.
	Construct and control a latching circuit using single or double acting cylinder.
	Construct and control, automatic return initiated by a limit switch.
19. Assemble, test and troubleshoot single phase & 3-phase controlled and uncontrolled rectifier using SCR.	Ascertain and select tools and instruments for carrying out the jobs.
	Plan and work in compliance with standard safety norms.
	Demonstrate soldering components on lug board with safety.
	Demonstrate the passive/active components by visual appearance.
	Construct & Test 3-phase uncontrolled half wave rectifier.
	Construct & Test 3-phase uncontrolled Bridge rectifier.
	Construct & Test single phase half control rectifier using SCR.
	Construct & Test single phase full control rectifier using SCR.
	Construct & Test 3 phase controlled rectifiers (half wave & bridge) using SCR.
20. Perform speed control of DC machine and single phase and 3-phase AC machines and check the performance of AC & DC drive to control the speed.	Demonstrate different parts for different types of motor.
	Monitor measurement of the coil resistance (armature and field) of AC and DC motor.
	Connect & run DC shunt motor using 3 point starter.
	Control the speed of DC motor by armature control method and field control method.
	Construct PWM circuit and SCR chopper circuit for the speed control of DC shunt motors.
	Construct a self-hold contactor circuit and run a 3-Phase Induction Motor.
	Connect and run the motor (below 5hp) in star and delta connection, record the phase voltage, line voltage and line current.
	Connect and operate an induction motor using DOL starter.
	Connect and run a 3-phase motor using manual and automatic star-delta starters.

	Reverse the direction of rotation of Induction motor.
	Connect & run three phase induction motors in a sequence using contactor & relay.
	Demonstrate different cables and connectors used in the AC DRIVE setup.
	Demonstrate various input and output terminals of the DRIVE unit, operator panel and display unit.
	Check installation of AC Drive(similar to SIEMENS MM-420/440)
	Adjust the pressure as per the requirements MM Drive Programming/Parameterization for different control operations.
	Monitor performance of ON/OFF, Forward/Reverse, Jog (R)/Jog (L), braking and speed control familiarization with different parts and terminals of DC Drive.
	Monitor Performance Parameterization for variation of motor speed through POT with Armature voltage feedback (with internal setting) through POT with encoder feedback and external speed raise/ lower buttons.
21. Perform speed control of servo motors and test different industrial process circuits by selecting the suitable function.	Construct a simple circuit to control servo motor using IC 555.
	Connect servo motor with drive &control its parameters.
	Connect the servo motor to computer for monitoring & controlling of various parameters.
	Show the Parameter programming of servo motor.
	Demonstrate various control method for controlling velocity & torque.

8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT FOR ELECTRONICS MECHANIC -CITS TRADE			
for batch of 25 candidates			
S No.	**Name of the Tool & Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1.	Connecting screwdriver	100 mm	25+1 Nos.
2.	Neon tester	500 V.	25+1 Nos.
3.	Screw driver set	(set of 5)	25+1 Nos.
4.	Insulated combination pliers	150 mm	25+1 Nos.
5.	Insulated side cutting pliers	150 mm	25+1 Nos.
6.	Long nose pliers	150 mm	25+1 Nos.
7.	Soldering iron	25 W. 240 V.	25+1 Nos.
8.	Electrician knife		25+1 Nos.
9.	Tweezers	100mm	25+1 Nos.
10.	Digital Multi meter	(3 1/2digit)	25+1 Nos.
11.	Soldering Iron Changeable bits	10 W	25+1 Nos.
12.	De- soldering pump		25+1 Nos.
B. GENERAL MACHINERY SHOP OUTFIT			
13.	Steel rule	300mm	3 Nos.
14.	Steel measuring tape	3 m	3 Nos.
15.	Tools maker vice	50mm (clamp)	2 Nos.
16.	Crimping tool (pliers)		2 Nos.
17.	Scriber straight	150mm	2 Nos.
18.	Allen key set	set of 9	2 Nos.
19.	Double ended spanner	set of 6	2 Sets
20.	Magnifying lenses	75mm	2 Nos.
21.	Hacksaw frame adjustable		2 Nos.
22.	Cold chisel	20mm	2 Nos.
23.	Scissors	200mm	2 Nos.
24.	Handsaw	450mm	2 Nos.
25.	Drill Machine (electrical)		2 Nos.
26.	First aid kit		1 No.
27.	Fire Extinguisher		2 Nos.
28.	Bench Vice		2 Nos.
29.	Dual DC regulated power supply	30-0-30 V, 2 Amps	4 Nos.
30.	LCR meter (Digital)		2 Nos.
31.	CRO Dual Trace (component testing facilities)	20 MHz	4 Nos.
32.	Battery Charger		2 Nos.
33.	Analog multi meter		4 Nos.
34.	Function generator (Triangular, square and sine wave)		2 Nos.
35.	ELECTRONIC WORK BENCH		2 Nos.

	comprising of DC power supply, DMM, AMM, CRO, Function Generator, Dimmer-stat, component tray, soldering station.		
36.	Dimmer state	5 Amps	2 Nos.
37.	Analog Component Trainer		4 Nos.
38.	Op Amp trainer		4 Nos.
39.	Digital IC Trainer		4 Nos.
40.	Digital IC Tester		2 Nos.
41.	Digital and Analog Bread Board Trainer		6 Nos.
42.	Rheostats various values and ratings		2 Nos.
43.	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.	10 Nos.
44.	Laptops latest configuration		1 No.
45.	Printer		1 No.
46.	Multi function printer		1 No.
47.	Internet broadband connection Wi-Fi		1 No.
48.	Electronic circuit simulation software with 11 user licenses		1 No.
49.	Different types of electronic and electrical cables, connectors, sockets, terminations (consumables).		As required
50.	Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB(consumables)		As required
51.	Crimping tools as necessary for performing terminations for computer networking		As required
52.	8051 Microcontroller trainer kit with applications		6 Nos.
53.	UPS		As required
54.	Sensor Trainer kit		3 Nos.
55.	SMPS		4 Nos.
56.	SMD Soldering Station with		4 Sets

	accessories		
57.	Solar power inverter with panels	10 user license	2 Nos.
58.	Antivirus software	11 user license	1 no.
59.	Application software		As required
60.	File flat	200mm bastard	2 Nos
61.	File flat	200mm smooth	2 Nos.
62.	pliers	100mm flat	2 Nos.
63.	Spanner	set of 6Nos	2 Sets
64.	Continuity tester		4 Nos.
65.	Hand Drill Machine		2 Nos.
66.	Signal Generator	0-100 KHz	2 Nos.
67.	POWER ELECTRONICS TRAINER with at least 6 nos. of onboard applications		4 Nos.
68.	Electric machines trainer to conduct experiments as mentioned in sl. no.7 of TT-II		2 Nos.
69.	AC Drive (VFD) with fractional HP Motor with electrical panel		2 Nos.
70.	Servo Drive with low torque motor with electrical panel		2 Nos.
71.	PLC System with i/o modules, hardware simulator and software		2 Nos.
72.	Electro pneumatic Trainer kit with electro-pneumatic components		2 Nos.
73.	LED/LCD TV		1 No.
74.	LED/LCD TV trainer Kit		1 No.
75.	LED Lighting system		6 Nos.
76.	PIC Microcontroller trainer kit with applications		5 Nos.
77.	Cell phones/smart phones		4 Nos.
78.	Microwave oven (convection and grill types)		1 No each
79.	Washing machine (fully automatic and semi automatic types)		1 No each
80.	Steam iron		2 Nos.
81.	Mixer/Grinder		1 No
82.	Water purifier (RO and UV types)		1 No each
83.	Immersion heater		4 Nos.
84.	Induction cook-top		2 Nos.
85.	Rice cooker		2 Nos.

86.	CCTV set up with camera 6 monitoring system		1 Set
87.	Computer with latest configuration		10 Nos.
88.	Air Conditioner		As Required

ANNEXURE – I

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts and all others who contributed in revising the curriculum. Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

List of Expert members contributed/ participated for finalizing the course curriculum of CITS Electronics Mechanic trade			
S No.	**Name & Designation Sh/Mr/Ms**	**Organization**	**Remarks**
1.	M.R.K Naidu, Head (CR&D)	ECIL, Hyderabad	Chairman
2.	Pradeep Doshi , SVP	ESSCI, New Delhi	Member
3.	Dr. Malini, HOD	University College of Engg., Osmania University	Member
4.	Uma Reddy, M.D.	Hi-tech Magnetics, Bangalore	Member
5.	T. Venkateswara Sharma, Sr. Officer (HR)	BEL, Hyderabad	Member
6.	P. Chandrashekhar, MD	Techno Design Group, Hyderabad	Member
7.	S.CH. Apparao, Manager (operations)	BEL, Hyderabad	Member
8.	Noor Ahmed, Manager	ECIL, Hyderabad	Member
9.	Prodeep Doshi, Supervisor	ESSCI, New Delhi	Member
10.	M Manoharan, MD	Automation Solutions, Hyderabad	Member
11.	T Venkateswara Rao. Asstt. Professor	Osmania University, Hyderabad	Member
12.	C. Chandra Sekhar , Director in charge	ATI-EPI, Hyderabad	Member
13.	R.L Singh, DDG(T)	DGET, MOLE, New Delhi	Mentor
14.	Sandhya Salwan, Director. (AT & WT)	DGET, MOLE, New Delhi	Mentor
15.	C.S Murthy, DDT	ATI-EPI, Hyderabad	Team Leader
16.	C.H Ravi , DDT	ATI, Mumbai	Member
17.	L K Mukherjee, DDT	CSTARI, Kolkata	Member
18.	K. Srinivash Rao, JDT	NIMI, Chennai	Member
19.	C. Ramasubramanian, DDT	AHI, Bangalore	Member
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22.	R. Malathi, TO	RVTI(W), Bangalore	Member
23.	D K Ojha, DDT	ATI-EPI, Dehradun	Member
24.	DM Basha, TO	ATI, Mumbai	Member
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