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

COMPETENCY BASED CURRICULUM

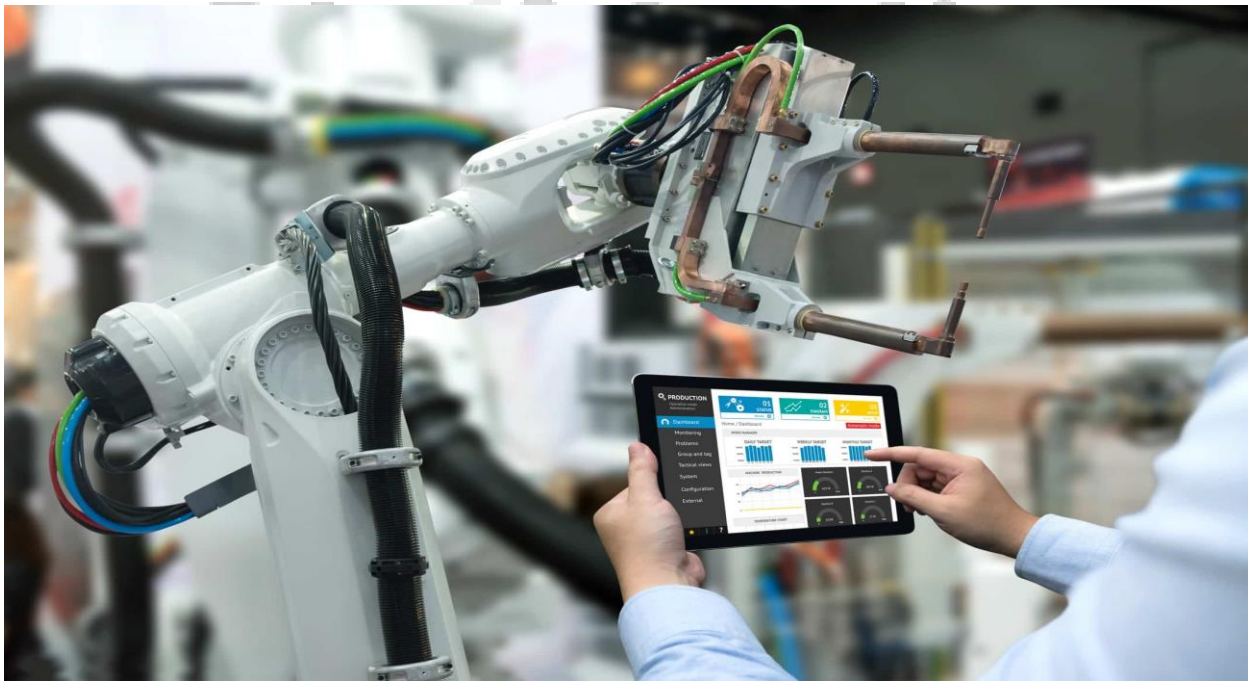
Smart Manufacturing Operator (Electronics)

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

(Flexi MoU)

NSQF LEVEL- 4



SECTOR – Electronics & Hardware

Directorate General of Training

Skill India
कौशल भारत-कुशल भारत

SMART MANUFACTURING OPERATOR (Electronics)

(Engineering Trade)

(Designed in 2022)

Version: 1.0

CRAFTSMEN TRAINING SCHEME (CTS)

(Flexi MoU)

NSQF LEVEL - 4

Developed By

Government of India
Ministry of Skill Development and Entrepreneurship

Directorate General of Training
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1. COURSE INFORMATION

Flexi- MoU is one of the pioneer programmes under DGT on the basis of the MoU in between DGT & LAVA International Limited for propagating vocational training to allow industries to take advantage of various schemes for conducting training programme in higher employment potential courses according to needs of industries. The concept of Flexi- MoUs was introduced in June-July 2014. DGT and LAVA INTERNATIONAL LIMITED have decided to sign this memorandum of understanding to provide an opportunity to the youth to acquire skills related to SMART MANUFACTURING OPERATOR (ELECTRONICS) through specially designed "Learn and Earn" approach consisting a mix of theoretical and On-the-Job Training (OJT) components and hence improve their employability potential & to contribute in the overall growth of Electronics Manufacturing industry by creating a pool of skilled resources.

During the two-year duration, a candidate is trained on subjects Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Science & Calculation and Employability Skills. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task.

The content broadly covers skills in Smart Manufacturing with Internet / wireless based integration for Electronic Manufacturing Industry. The **two-year** course coverage is categorized as below:

The contents covered are Fundamentals of Electricity, Electronics and Physics which form the basis of further study. Electronic Components and Tools, their identification & usage, Soldering & De-soldering of components are also covered. The course further covers SMT technology and moves on to Smart systems and IOT covering various components, protocols and connectivity of the devices. It also covers examples of different smart systems, while teaching the student their conceptualization, planning and implementation.

2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. DGT is futuristic in preparing the prospective Indian workforce in building skills and capabilities as per the needs of the industry. In this quest, it has changed the paradigm of growth to a job oriented training by partnering with industry to be an enabler of responsible, sustainable and inclusive growth. Towards this end, DGT signed this MOU with the Lava International Limited

The course and the on the job training will be conducted inside the Plant premises. Lava will also ensure the eligible trainees take up Apprenticeship / higher education in suitable streams. Lava will strictly follow the policy guidelines for Flexi - MoU as in place from time to time. No deviation for the same would be permitted. Admission and Exam for trades run under Flexi MoU at training locations of Lava International Limited. Theory content to be 25% and practical content to be 75%.

Broadly candidates need to demonstrate that they are able to:

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

2.2 CAREER PROGRESSION PATHWAYS

- Can work as Operator in any of Electronic Manufacturing companies and specially in work areas of smart manufacturing and internet / wireless based integration.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).

2.3 COURSE STRUCTURE

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

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	1440
2	Professional Knowledge (Trade Theory)	780
3	Employability Skills	180
	OJT	1980
	Total	**4380**

2.4 ASSESSMENT & CERTIFICATION

I. Conducting training of selected candidates is the sole responsibility of Industrial Training Partner (ITP).

II. Assessment will be jointly done by ITP and DGT. Practical and formative assessment shall be conducted by ITP, and Computer Based theoretical exams shall be conducted by DGT.

III. ITP must refer to the latest examination reform guidelines issued by DGT dated 4th October 2018 any changes or revisions to the same shall be applicable to flexi-MoU scheme.

IV. Maximum attempts for clearing the exam and obtaining NTC shall be in line with CTS.

V. For practical examination and formative assessment, ITP has been given flexibility to design the questions, assess the candidates and upload their marks in the scheme portal.

VI. ITP shall develop a comprehensive Question Bank (in English and Hindi) of minimum 1000 questions, grouped by chapters and difficulty level. The same shall be vetted by NIMI experts and then be handed over to DGT for conducting theory exams. DGT may add some questions to the same before conducting actual exams.

VII. Theoretical exams shall be conducted by DGT in Computer Based Test format. Upon completion of course and payment of requisite examination fee by ITP, admit cards shall be generated by scheme portal.

VIII. DGT shall arrange for conduct of computer based theory exam at designated examination centres & certify the successful trainees with e-NTC under flexi-MoU scheme with mention of ITP name in the Certificate.

IX. Students, who have successfully passed in the final exam after completion of course, are eligible to register as apprentices.

The trainee will be tested for his skill, knowledge and attitude during the period of the course and at the end of the training program as notified by the Government of India (GoI) from time to time.

The **Internal Assessment** 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 template (Annexure –II).

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

The minimum pass percentage for practical is 60% & minimum pass percentage of theory 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 the assessment. Due consideration should 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 the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment

Evidences of internal assessments are to be preserved until forthcoming yearly 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 produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	• 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. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	• 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. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.
(c) Weightage in the range of more than 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 procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

1. **SMT Operator**
   i. Operation Flow of SMT
   ii. Process switch between models
   iii. SMT panel handling
   iv. SMT Component Feeding
   v. SMT Testing (Sensor based)

2. **Smart Stores Executive**
   i) Smart Tag Configuration
   ii) Sensor Maintenance
   iii) System generated Ordering Review
   iv) Vendor Store sensor incorporation
   v) Updation of Stores requirement as per production plans
   vi) Stores Issue and receipt documentation

3. **Production Planning executive**
   i. Aligning Production Plan as per Sales input
   ii. Communicating / Monitoring system communication to Stores & Procurement
   iii. Shift Alignment
   iv. Planning Model switch on assembly lines
   v. Assembly operator rostering (if automated)

4. **Maintenance technician – Sensors & IOT**
   i. Knowledge of all Sensors and Network Communication devices
   ii. Installation of new Smart systems
   iii. Monitoring of existing smart systems and their regular maintenance

5. **Control Room / Panel Operator**
   i. All alarm levels and their follow up process
   ii. All Smart systems
   iii. Panel Operation
   iv. Model switch operation
   v. Coordination between various departments

6. **Predictive Maintenance Executive**
   i. Time scheduled Maintenance charts
   ii. Panel Operation
   iii. Review of various system status and alarm levels

iv. Knowledge of systems employed in the factory

7. **Smart system implementation Executive**
   i. Types of sensors
   ii. Ergonomic placement of sensors
   iii. Installation of sensors
   iv. Types of Microcontrollers
   v. Networking / Connectivity
   vi. Input – Output relationships
   vii. Understanding of Alarm levels
   viii. Panel Operation

8. **QC Executive – Smart Sensors**
   i. Operation of Sensors
   ii. Using system output to track faults
   iii. QC processes, Alarm levels and Alarm level follow up action
   iv. Visual inspection to merge sensory data
   v. Panel Operation

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.

Functional Tester: is responsible for checking functions of manufactured industrial equipment such as UPS, inverter, energy meter, PLC, oscilloscope, control panel. The individual at work tests specified functions of every product being assembled on the production line.

Reference NCO-2015:

(i) 7421.0300 – Electronics Mechanic
(ii) 7543.0801 – Functional Tester

4. GENERAL INFORMATION

Name of the Trade	**Smart Manufacturing Operator (Electronics) (Flexi MoU)**
NCO – 2015	7421.0300, 7543.0801
Qualification Code	DGT/7018
NSQF Level	Level-4
Duration of Craftsmen Training	Two years (4410 Hrs)
Entry Qualification	Passed 10th Class examination with Aptitude test
Minimum Age	18 years as on first day of academic session.
Unit Strength (No. Of Student)	20
Space Norms	192 Sq. m.
Power Norms	17 KW
Instructors Qualification for	
1. Theory & Practical	B.Voc/Degree in Electricalor Electronics Engineering from recognized Engineering College /university with one year experience in the relevant field. **OR** 3 years Diploma in Electrical orElectronics Engineering from recognized board of technical education with two years experience in the relevant field. **OR** NTC/NAC in the Trade of "ELECTRONICS MECHANIC" with 3 years post-qualification experience in the relevant field. **Essential Qualification:** NCIC (National Craft Instructor Certificate) in Relevant trade. ***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. Employability Skill	MBA/ BBA /any Graduate / Diploma in any discipline with Two years' experience with short term ToT course in Employability Skills from DGT institutes. (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 from DGT institutes.
List of Tools and Equipment	As per Annexure – I

5. NSQF LEVEL COMPLIANCE

NSQF level for **Smart Manufacturing Operator (Electronics)** trade under CTS (Flexi MoU): **Level -4.**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

a. Process
b. Professional Knowledge
c. Professional Skill
d. Core Skill
e. Responsibility

The broad learning outcome of **Smart Manufacturing Operator (Electronics)** Trade under CTS (Flexi MoU) mostly matches with the Level descriptor at Level-5.

The NSQF Level-5 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 4	Work in familiar, predictable, routine, situation of clear choice.	Factual knowledge of field of knowledge or study.	Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts.	Language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment.	Responsibility for own work and learning.

6. LEARNING OUTCOME

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

6.1 GENERIC LEARNING OUTCOMES (Employability Skills)

1. Introduction to Employability Skills
2. Constitutional values - Citizenship
3. Becoming a Professional in the 21st Century
4. Basic English Skills
5. Career Development & Goal Setting
6. Communication Skills
7. Diversity & Inclusion
8. Financial and Legal Literacy
9. Essential Digital Skills
10. Entrepreneurship
11. Customer Service
12. Getting Ready for Apprenticeship & Jobs

6.2 SPECIFIC LEARNING OUTCOMES

FIRST YEAR

1. Demonstrate the fundamentals of Electricity, Electronics and Basic Physics.
2. Identify various Electronic Components and explain usage of these components.
3. Identify various Tools, Safety Equipment &explain their usages.
4. Plan and perform Soldering and De-soldering methods with precision of soldering parameters *viz. voltage, wattage, temperature control and precautions like anti-static protection.*
5. Operate SMT machines with due care and safety norms using proper tools/setup.
6. Identify, install, configure, and connect various Storage devices and demonstrate their best use cases.
7. Demonstrate different Data structures in which data is stored and retrieved
8. Plan and execute the operation of various Sensors & Actuators and demonstrate their outputs & usages.
9. Identify various Micro Controllers and demonstrate their outputs & usage
10. Install, configure, interconnect given computer system(s) and demonstrate & utilize Computer Networks packages for different application.
11. Demonstrate knowledge of Input & Output of information and use cases of common devices.
12. Enumerate modes of data transmission and advantages of various modes.

13. Assign and interface communication protocols to hardware devices.
14. Identify and Select various components of Internet of things including installation, configuration and checking up of a small smart system.
15. Enumerate system security threats to a smart system and common precautions taken
16. Ascertain and troubleshoot physical and logical design of IOT system having multiple communication medium, protocols and device management and monitoring.
17. Demonstrate and Deploy IOT levels and implementation of domain specific templates.
18. Read and apply engineering drawing for different application in the field of work.
19. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.

SECOND YEAR

20. Plan and connect Sensor and Micro controllers using IOT Protocols.
21. Identify and test various parts of Embedded systems and their relation with IOT.
22. Demonstrate different Industrial IOT and areas of usage.
23. Plan, execute and implement usages of IIOT for Managing Resource Consumption and reducing wastage.
24. Plan, execute and implement usages of IIOT for Predictive Maintenance.
25. Plan, execute and implement usages of IIOT for Quality Management & tracking.
26. Plan, execute and implement usages of IIOT for Continuous Line Balancing and Productivity Optimization.
27. Plan, execute and implement usages of IIOT for Automated Decision making.
28. Plan and interface Machine to Machine communication and usages of machine operating machine.
29. Plan, execute and implement usages of IIOT for HR processes.
30. Plan, execute and implement usages of IIOT for Safety & Security.
31. Construct and Operate Industrial Control Systems (Cyber Physical system).
32. Read and apply engineering drawing for different application in the field of work.
33. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

SPECIFIC LEARNING OUTCOME	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
FIRST YEAR	
1. Demonstrate the fundamentals of Electricity, Electronics and Basic Physics.	11.1 Define Electricity and types thereof.
	11.2 List relation between Voltage, Current, Resistance, Capacitance and Power.
	11.3 Differentiate between AC & DC. List common values (including those for common appliances/ gadgets and difference in power supply across major countries).
	11.4 Identify major functionalities of any electrical/electronic circuit like supply, load, conductor and form a basic circuit.
2. Identify various Electronic Components and explain usage of these components.	12.1 Identify electronic components like resistors, inductors, capacitors, diodes, MCB, ELCB in training sample/ jig.
	12.2 Define the characteristics of each of the major components.
	12.3 Identify value of resistors and condensers.
	12.4 Calculate series and parallel resistance value.
3. Identify various Tools, Safety Equipment & explain their usages.	13.1 Identify different tool and equipment and explain their use.
	13.2 List the PPE equipment required for EMS and mention their uses. Also highlight the need for PPE.
	13.3 Use multi-meter and clamp meter to measure voltage, resistance, current and check continuity.
	13.4 Check Earthing.
4. Plan and perform Soldering and Desoldering methods with precision of soldering parameters viz. *voltage, wattage, temperature control and precautions like anti-static protection*.	14.1 Define the requirement and importance of Soldering and Desoldering.
	14.2 List the types of Soldering, the tools & equipment used and the characteristics of each.
	14.3 List the types of Solder, Components and Flux.
	14.4 Define the importance of proper ventilation while soldering.
	14.5 List the types of Soldering irons and their tips and ways of keeping them clean.

	14.6 Detail the use of Infrared oven and Hotplate for Surface Mount Soldering.
	14.7 Differentiate between Solder wick, syringe type sucker, vacuum desoldering, hot tweezers and hot air nozzle desoldering.
5. Operate SMT machines with due care and safety norms using proper tools/setup.	15.1 Define Surface Mounted Technology (SMT).
	15.2 Show loading of SM components on SMT machine.
	15.3 List the processes in SMT.
	15.4 List the precautions and Control Panel commands for Solder printing on a blank PCB. Also, list the sensors used to QC the solder paste.
	15.5 List the precautions and Control Panel commands for Component placement. Also demonstrate the loading of SM components.
	15.6 List the precautions and Control Panel commands for Reflow soldering also demonstrate the loading of solder paste.
	15.7 List and present diagram of sensor based inspections during the entire process of SMT. Mention the types of Sensors used.
6. Identify, install, configure, and connect various Storage devices and demonstrate their best use cases.	16.1 List the types of storage devices along with the characteristics and benefits.
	16.2 Differentiate between Volatile and Non Volatile (MTP & OTP) memory storage devices.
	16.3 Differentiate between Flash Memory and DDR Memory. Also highlight the characteristics of eMMC and UFS Memory.
	16.4 Define the requirement of storage devices for IOT systems and commonly used storage devices.
	16.5 Ascertain the apt storage device for a given set of IOT system.
7. Demonstrate different Data structures in which data is stored and retrieved.	17.1 Define Data Structures.
	17.2 List the various types of Data structures and their characteristics.
	17.3 Define the relevance of data structures for IOT systems.

8. Plan and execute the operation of various Sensors & Actuators and demonstrate their outputs & usage.	18.1 Define and differentiate between Sensors and Actuators.
	18.2 Detail the working of various Sensors like Temperature Sensors, Proximity Sensors, Infrared Sensors, Ultrasonic Sensors, Pressure Sensors, Optic Sensors, Gyroscope, LDR and chemical Sensors.
	18.3 Demonstrate wiring of each of the Sensors.
	18.4 Detail the working of various Actuators like Comb Drive, Hydraulic Piston, Electric Motor, Relay, Thermal Bimorph, Piezoelectric Actuator and Electro active Polymer.
	18.5 Demonstrate wiring of each of the Actuators.
9. Identify various Micro Controllers and demonstrate their outputs and usage.	19.1 Differentiate between Microprocessor and Microcontroller.
	19.2 List the different Bits of Micro Controllers and the relevance of the different Bits.
	19.3 List and define the factors affecting the choice of a Micro Controllers (Processing Power, Memory, Power Consumption, First Wake up time, Network Connectivity interface, Hardware and Manufacturing cost, Manufacturing Support, Number of ports, Security and Memory Protection).
	19.4 Define the characteristics of the commonly used Micro Controllers namely ARM, MIPS and X86.
	19.5 Demonstrate wiring of each of the commonly used Micro Controller.
10. Install, configure, interconnect given computer system(s) and demonstrate & utilize Computer Networks packages for different application.	20.1 Define Computer Networks and their usage.
	20.2 List the types of Networks and their characteristics.
	20.3 Define Network Topology.
	20.4 Illustrate different types of Network Topology through diagram and detail their characteristics (Star, Bus, Ring).
	20.5 Define Network protocols.
	20.6 List the characteristics of Wired and Wireless Networks and define the factors influencing the choice of Network.
	20.7 Define the different layers of OSI Model.

11. Demonstrate knowledge of Input & Output of information and use cases of common devices.	21.1 Depict input and output of a smart system with actuator, at various stages.
	21.2 Detail Input and Output of mentioned Sensors.
	21.3 Input and Output of mentioned Actuators.
12. Enumerate modes of Data transmission and advantages of various modes.	22.1 List the various modes of Data transmission along with their characteristics.
	22.2 Define Serial and Parallel Data transmission.
	22.3 List the factors affecting the choice of Data transmission mode (Flexibility, scalability, energy efficiency, multi-use of network and security).
13. Assign and interface communication Protocols to Hardware devices.	23.1 List various layers of protocols.
	23.2 List the 4 mediums of protocols in Link Layer and their associated modes with standards.
	23.3 Connect 2 Link layer devices.
	23.4 List the modes in the Network layer along with their standards.
	23.5 List the modes in the Transport layer along with their standards.
	23.6 List the modes in the Application layer along with their standards.
	23.7 Connect 2 Application layer devices.
14. Identify and Select various components of Internet of things including installation, configuration and checking up of a small smart system.	24.1 Define Internet of Things, its characteristics and its uses.
	24.2 Define and differentiate between related terms like Industry 4.0, Cyber Physical systems, Smart manufacturing, Lights out Manufacturing and Industrial IOT.
	24.3 Create / Conceptualize a Small smart system with a Barometric sensor.
15. Enumerate System security threats to a smart system and common precautions taken.	25.1 List the security threats to a smart system and detail level of damage with possible examples.
	25.2 List the IOT Security Solutions.
	25.3 List the 4 major areas of IOT security (Protocols & Network, Micro Controllers, Storage Devices and Software Protection).

	25.4 Assess and Quantify the importance and Security Threat of a smart system.
	25.5 Illustrate how choice of components (Sensors & Actuators, Storage, Micro Controllers, Protocols & Network) is dependent on the importance and security threat of the smart system. Concentrate on the choice between performance and security.
	25.6 Define Importance of Software Security as it least affects the performance of the system.
16. Ascertain and troubleshoot physical and logical design of IOT system having multiple communication medium, protocols and device management and monitoring.	26.1 Create Block diagrams of IOT system.
	26.2 Create connectivity diagram of IOT system.
	26.3 List Input - Output of devices on the system.
	26.4 List benefits of the sample smart system.
	26.5 Calculate financial benefits from the Smart system.
17. Demonstrate and Deploy IOT levels and implementation of domain specific templates.	27.1 List the six levels of IOT.
	27.2 Highlight the characteristics of each level.
	27.3 Differentiate between IOT levels.
	27.4 Identify the level of IOT required for a sample problem statement.
18. Read and apply engineering drawing for different application in the field of work.	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.
19. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic	Solve different mathematical problems
	Explain concept of basic science related to the field of study

science in the field of study.	
SECOND YEAR	
20. Plan and connect Sensor and Micro controllers using IOT Protocols.	28.1 List various layers of protocols.
	28.2 List the modes in each layer.
	28.3 List different mediums with their standards in each mode.
	28.4 Choose the right mediums for your system.
	28.5 Connect an IOT system.
21. Identify and test various parts of Embedded systems and their relation with IOT.	29.1 Define Embedded systems.
	29.2 Define relation of embedded systems with IOT.
22. Demonstrate different Industrial IOT and areas of usage.	30.1 Comprehend usage of IOT in Industrial space.
	30.2 List some basic templates for IIOT.
	30.3 Create block diagram for these systems.
	30.4 Identify connectivity protocols for these systems.
23. Plan, execute and implement usages of IIOT for Managing Resource Consumption and reducing wastage.	31.1 Inculcate urgency to reduce resource consumption and wastage.
	31.2 Identify / conceptualize 5 use cases.
	31.3 Create Block diagrams of Electricity Management system and a raw material wastage use case.
	31.4 Identify connectivity protocols for Electricity Management system and a raw material wastage use case.
24. Plan, execute and implement usages of IIOT for Predictive Maintenance.	32.1 Differentiate between scheduled and predictive maintenance.
	32.2 Identify / conceptualize 2 use cases.
	32.3 Create Block diagrams of predictive AC maintenance system.
	32.4 Identify connectivity protocols for predictive AC maintenance system.
25. Plan, execute and implement usages of IIOT for Quality Management	33.1 List various PQC checks in the plant.
	33.2 Comprehend the importance of Quality Management.
	33.3 Create Block diagrams of a visual sensor based PCB QC

& tracking.	system.
	33.4 Create Block diagrams of a tagging each finished product with an employee & machines.
26. Plan, execute and implement usages of IIOT for Continuous Line Balancing and Productivity Optimization.	34.1 List benefits of continuous Line balancing.
	34.2 Conceptualize a model to generate changes in line (manpower, machine run time, raw material) as per change in model in production.
27. Plan, execute and implement usages of IIOT for Automated Decision making.	35.1 Define Automated Decision making.
	35.2 Identify / conceptualize 2 use cases apart from Store connected ordering management system, highlighting physical changes required at the plant.
	35.3 Create Block diagrams of Vendor store (remote location) connected order management system.
	35.4 Identify connectivity protocols for Vendor store (remote location) connected order management system.
28. Plan and interface Machine to Machine communication and usages of machine operating machine.	36.1 Define machine to machine communication.
	36.2 Create a model of machine to machine communication.
	36.3 Create a model where one machine alters its output as per the input received from other machine.
29. Plan, execute and implement usages of IIOT for HR processes.	37.1 Identify existing use of smart systems for HR processes.
	37.2 Create Block diagram of a output based incentive processing system.
	37.3 Identify connectivity protocols for output based incentive processing system.
	37.4 Conceptualize smart systems for Medical support and Manpower Rostering.
30. Plan, execute and implement usages of IIOT for Safety & Security.	38.1 Identify existing use of smart systems for Safety & Security.
	38.2 Conceptualize a 3-level smart system for visitor entry.
	38.3 Conceptualize a multi input (fire and intrusion)- multi output (multiple responses to ensure safety) smart system for Safety & Security.

31. Construct and Operate Industrial Control Systems (Cyber Physical system).	39.1 List the benefits of Industrial Control system.
	39.2 Operate Central control panel / control room.
	39.3 Proficiency in Alarm levels and process maps along with clear understanding of system outputs.
32. Read and apply engineering drawing for different application in the field of work.	39.4 Read & interpret the information on drawings and apply in executing practical work.
	39.5 Read & analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	39.6 Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
33. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	39.7 Solve different mathematical problems
	39.8 Explain concept of basic science related to the field of study

8. SYLLABUS

SYLLABUS – SMART MANUFACTURING OPERATOR (ELECTRONICS)			
FIRST YEAR			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
1-4	Demonstrate the fundamentals of Electricity, Electronics and Basic Physics.	1. Understanding the fundamentals of electricity and electronics i.e. ohm's law, measurement of units, Power consumption, Resistors and resistance, diodes, color codes in resistance. 2. Practice and understand multi meter and clamp meter, measuring voltage using multimeter, measuring current using clamp meter, measuring AC voltage using multimeter. 3. Demonstration of the earthing and check earthing, measuring resistance, voltage and current through series and parallel connected networks.	Basics of Electricity and Electronics. Basic Physics i.e. voltage, current, components of electricity, types of voltage and current series, types of circuits, Power consumption, Resistors and resistance, states of matter, types of heat transfer, Temperature, Types of heat, heat emersion and absorption, energy.
4-8	Identify various Electronic Components and explain usage of these components. Identify various Tools, Safety Equipment & explain their usages. Plan and perform Soldering and Desoldering	4. Identification of electronic components like resistors and color codes, inductors, capacitors, diodes, MCB and its types, ELCB and its types in training sample/jig. 5. Identification and handling of tools and equipment such as UPS, Scanner cum Printer, connecting scanner/printer through network, connecting peripheral devices such as spike guard and ups, installation of camera LCD Projector with precautions.	Importance of electronic components like resistors, inductors, capacitors, diodes, MCB, ELCB Identifying different tool and equipment and explain their use Importance of Soldering & De-soldering Procedure, understanding the parameters of soldering such as temperature, voltage, wattage.

	methods with precision of soldering parameters viz. *voltage, wattage, temperature control and precautions like anti-static protection*.	6. Perform Soldering & Desoldering Procedure, Understanding of soldering parameters i.e. voltage, wattage, temperature control, precautions like anti-static protection, Steps to be taken in soldering, de-soldering methods.	
8-13	Operate SMT machines with due care and safety norms using proper tools/setup.	7. Practice and understand Sensor based testing i.e. Smt pick and place considerations, sensor rework, PCB assembly special handling, Design feature of PCB assembly.	Basic understanding of Components, Operation, Roles of a Operator, Sensor based testing & quality Recommendation of soldering process
13-15	Identify, install, configure, and connect various Storage devices and demonstrate their best use cases. Demonstrate different Data structures in which data is organized, processed, stored and retrieved.	8. Demonstrate the operations with the storage devices, types of storage devices such as hard disk drives, solid state drives, flash memory devices, floppy disks, optical storage devices, RAM. 9. Understanding the concept of data structures to store and retrieve the data. Types of data structures i.e. Array, linked list, graph, choosing the right data structures.	Importance of storage devices such as hard disk drives, solid state drives, flash memory devices, floppy disks, optical storage devices, RAM Importance of data structures, Uses of data structures, characteristics of data structures, Data types.
15-19	Plan and execute the operation of various Sensors & Actuators and demonstrate their outputs and usages.	10. Demonstrate different types of actuators viz., electrical, hydraulic and Pneumatic.	Explanation about sensor and its types, actuators, Usage of sensors and actuators, understanding the input/output relation of sensors, Actuators and its types i.e. electrical actuators, hydraulic actuators, Pneumatic actuators
19-23	Identify various Micro Controllers and demonstrate	11. Practicing the operations such as arithmetic, square wave generation, LED/LCD display	Understanding the micro-controllers, Importance of micro-controllers, Applications of micro-

	their outputs & usage.	related to micro controllers, identifying the types of microcontrollers i.e. PIC microcontroller, ARM microcontroller, 8051 microcontroller, AVR microcontroller, MSP microcontroller.	controllers, basic components of micro-controllers i.e. CPU, memory, I/O ports, serial ports, timers, ADC, DAC, Interpret control etc.
23-25	Install, configure, interconnect given computer system(s) and demonstrate & utilize Computer Networks packages for different application.	12. Demonstrating the operations such as connecting computer to the LAN network, Adding printers through TCP/IP network in windows, Installation of virtual machine in a PC, connecting computers with crossover cable, share files in two computers. Understand the concept of IP addressing.	Importance of computer networks and the concepts related to it such as Internet, Intranet and extranet, network links, communication protocol, LAN, MAN, WAN technologies, network nodes, network topology, types of networks, OSI model.
25-28	Demonstrate knowledge of Input & Output of information and use cases of common devices. Enumerate modes of Data transmission and advantages of various modes.	13. Basic understanding of the operations related to Input and Output. 14. Identification of serial & parallel data transmission and perform operations related to data transmission.	Describe Input is something put into a system or expended in its operation to achieve output or a result. The information entered into a computer system, examples include: typed text, mouse clicks, etc. Output is the information produced by a system or process from a specific input Understand the Data transmission that refers to the process of transferring data between two or more digital devices. Different modes of data transmission i.e. half duplex, full duplex, synchronous, asynchronous, serial and parallel transmission
28-34	Assign and interface communication	15. Practice and understand the network protocols explaining with example the types of	Understand and explain the purpose of network protocols and hardware i.e. http, https, ftp,

	Protocols to Hardware devices.	network protocols such as http, https, ftp, smtp, ssh, telnet etc. and hardware.	smtp, ssh, telnet etc.
35-39	Identify and Select various components of Internet of things including installation, configuration and checking up of a small smart system. Enumerate System security threats to a smart system and common precautions taken.	16. Basic understanding of Principles of Internet of Things, types of technologies who have made IOT possible, Ways some IOT applications are deployed. 17. Configuring system security such as home security system in biometric devices, types of biometric devices i.e. Fingerprint, Facial Recognition, voice Recognition, Iris Recognition, Retina Scan, Keystroke Dynamics Signature Recognition.	Importance of principles of Internet of things such as 'do your research', 'concentrate on value 'etc. types of technologies who have made IOT possible, Application of IOT, industrial advantages of IOT Basic understanding of System Security which means the development and implementation of security countermeasures. These include firewalls, data encryption, passwords and biometrics.
40-45	Ascertain and troubleshoot physical and logical design of IOT system having multiple communication medium, protocols and device management and monitoring.	18. Develop a design for an Internet of Things system or device to solve a problem IOT protocols, wired and wireless connections. 19. Demonstrate IoT system or device design process and documentation. 20. Demonstrate the steps involved in developing a design for an IoT system or device to solve a problem i.e. risks of IOT development, learning the basics, determining the use case, Choosing an IOT platform and tools, choosing an IOT hardware, creating a prototype. 21. Provide design solution for Machine-to-machine (M2M) system and device architecture, design framework of the M2M system, Implementation of	Development of design for an IoT system or device to solve a problem, and will develop a prototype of an integrated IoT system or device to solve a problem. Develop a general block diagram of physical design of IOT, various steps involved in IOT development, Develop a logical design of IOT system, explanation about different types of communication model and communication APIs Understanding the components of machine learning system design such as reliability, scalability, maintainability, adaptability Basic concepts of M2M system. Understanding the system

		prototype in M2M systems.	architecture of M2M system
46-48	Demonstrate and Deploy IOT levels and implementation of domain specific templates.	22. Perform the task through the device like sensing and/or actuation, stores data, performs analysis and hosts the application. Implementation of IOT architecture levels i.e. level 1,2,3,4,5 and its deployment templates.	Understanding the deployment templates i.e. of i.e. device, resource, controller service, web service etc.
Professional Knowledge ED: 40 Hrs WSC: 35 Hrs	Read and apply engineering drawing for different application in the field of work. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**ENGINEERING DRAWING: (40 Hrs.)** Introduction to Engineering Drawing and Drawing Instrument – (02 Hrs.) • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument Free hand 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: (04 Hrs.) • Angle, Triangle, Circle, Rectangle, Square, Parallelogram. • Lettering & Numbering – Single Stroke Symbolic representation – (04 Hrs.) • Different Electronic symbols used in therelated trades Reading of Electronic Circuit Diagram. (14 Hrs.) Reading of Electronic Layout drawing. (12 Hrs.) **Material Science**	**WORKSHOP CALCULATION & SCIENCE: (35 Hrs)** **Unit, Fractions (04 Hrs.)** 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 (06 Hrs.)** 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 (06 Hrs.)**

		Types metals, types of ferrous and non ferrous metals. Introduction of iron and cast iron.	Types metals, types of ferrous and non ferrous metals. Introduction of iron and cast iron. **Heat & Temperature and Pressure (04 Hrs.)** 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 (12 Hrs.)** 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 (03 Hrs.)** Measurement of angles Trigonometrical ratios Trigonometrical tables

	Project work a) Full wave Voltage rectifier with indicator. b) Flashing LEDs. c) Microcontroller d) Interconnection of components of IoT system. e) Visit to IoT Lab of different industries.
51	**Revision**
52	**Examination**

Note: -

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*

SYLLABUS – SMART MANUFACTURING OPERATOR (ELECTRONICS)			
SECOND YEAR			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
53-59	Plan and connect Sensor and Micro controllers using IOT Protocols.	23. Accomplish the task/mini project given by trainer through Sensor and micro controller using the IOT Protocol , Implementation of interface the sensor of microcontroller interface, humidity sensing, pressure sensing, analog interfaces.	Understanding data link, network and session layer of OSI model in IOT systems
60-61	Identify and test various parts of Embedded systems and their relation with IOT.	24. Accomplish the basic serial experiments like-Serial, clock, interrupt & etc. 25. Embedded IOT gateway, Implementation of embedded system hardware and embedded system software.	Basic understanding of Embedded system along with ingratiation of embedded and IOT system, Understanding of embedded system hardware and software
62-63	Demonstrate different Industrial IOT and areas of usage.	26. Tasks defined by trainer on innovation in network connectivity of industry (low energy wireless, edge & cloud computing along with Automation used in industry.	Basic understanding of usage of IOT in Industry with basic template used along with Protocols and basic block diagram
64-67	Plan, execute and implement usages of IIOT for Managing Resource Consumption and reducing wastage.	27. A case study on Smart waste management system in industry, case study on smart garbage system architecture, hardware structure of smart garbage bins, Implementation of the garbage system, Experimentation of the garbage system.	Importance of resource consumption and wastage. Electrical Management system & Integration protocols. Understanding the IOT technique of smart garbage system Basic understanding of optimal path planning algorithm for waste collection

68-74	Plan, execute and implement usages of IIOT for Predictive Maintenance	28. Documentation of report in presentation format after creating the groups defined by trainer on to identify potential failure and increase the production of highly critical assets.	Understanding different types of maintenance in required in industry. Basic understanding of predictive maintenance in IOT Explaining the wind river solutions in predictive maintenance Designing basic block diagram of Ac predictive maintenance along with connectivity protocols
75-78	Plan, execute and implement usages of IIOT for Quality Management& tracking	29. Preparation of checklist used for quality check using IIOT. Understanding how IOT is impacting quality control. 30. Demonstration of visual checking and tagging for final product.	Basic understanding of the quality and standards required in particular industry along with the quality checks, quality management. Importance of different types of sensor used for visual checks & tagging system for final product
79-82	Plan, execute and implement usages of IIOT for Continuous Line Balancing and Productivity Optimization.	31. An industrial visit on over all equipment Effectiveness generated by controllers, sensors and transaction system. 32. Understanding over all equipment Effectiveness loss and how we can optimize maintenance plan.	Basic understanding about line balancing & different model to generate changes in line as per change in model in production. This module will also make learner understand about over all equipment Effectiveness
83-87	Plan, execute and implement usages of IIOT for Automated Decision making.	33. This activity will be club with task no 31 where observation of the third party assistance I.e how remote access service provide by vendor through IOT platform, Implementation of automated decision making.	Importance of Automated decision making system like Store connected Order Management, Vendor Store connected Order mgmt., Secondary Sales to production plans, Benefits of profiling and automated decision making
88-89	Plan and interface Machine to	34. Exploration of the components and domains described in the unit	Basic Understanding of Machine-2-Macine learning concept.

	Machine communication and usages of machine operating machine.	content, e.g. sensors, connectivity, platform, analytics, user interface. 35. Working together in small groups to investigate the content for a series of three linked webpage's - one for each of the following: a) system and device communication principles b) system and device capabilities c) The identification and network location of secure connected components to support the design of a scalable and efficient system and devices.	M2M integrated system or device operations How the machine communicate to each other with I/O. Architecture of M2M communications in IoT systems and devices?
90-92	Plan, execute and implement usages of IIOT for HR processes.	36. Documentation of report and understanding of IOT system work and organize their industry services in organization uses to control and optimize its physical, technological and human resources across business units and geographical locations in HR perspective.	Describe functional department can work using IOT like Salary processing, Medical support, Workforce management etc
93-94	Plan, execute and implement usages of IIOT for Safety & Security.	37. Documentation on a) 1-Industry 4.O security b) 2-Control hierarchy c) 3-Best practices implementing for safety and security d) Implementation DAC, RBAC, MAC.	Understanding about different access control system. Understanding different types of access control models i.e. DAC, RBAC, MAC Monitoring of Security and entry access by IOT Working of security system in IOT
95-100	Construct and Operate Industrial Control Systems (Cyber Physical	38. Documenting an individual report on how the industry keep track and monitor their control room, equipment or a plant in	Describe an industry operate and control through IOT specifically the control room, machines with better deficiency

	system)	industries like water and waste control, telecommunications, energy, transport etc. What type of system or SCADA gives notifications by sounding alarms if situations develop into hazardous scenarios.	Understanding the difference between cyber safety and physical security
Professional Knowledge ED: 40 Hrs WSC: 16 Hrs	Read and apply engineering drawing for different application in the field of work. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**ENGINEERING DRAWING: (40 Hrs.)** • Reading of Electronics Sign and Symbols. (04 Hrs.) • Sketches of Electronics components. (06 Hrs.) • Reading of Electronics wiring diagram and Layout diagram. (06 Hrs.) • Drawing of Electronics circuit diagram. (12 Hrs.) 39. Drawing of Block diagram of Instruments & equipment of trades. (12 Hrs.)	**WORKSHOP CALCULATION & SCIENCE: (16 Hrs)** **Algebra, (08 Hrs.)** Addition, Subtraction, Multiplication & Divisions. Algebra – Theory of indices, Algebraic formula, related problems. **Estimation and Costing (08 Hrs.)** Simple estimation of the requirement of material etc., as applicable to the trade. Problems on estimation and costing.
	In-plant training/ Project work a) Connect Sensor and Micro controllers using IOT Protocols b) Embedded System c) IIOT- Quality Management & tracking d) IIOT- Automated Decision making a) Industrial Control Systems		
	Revision		
	Examination		

Note: -

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*

3. *The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*

9. SYLLABUS - CORE SKILLS

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

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

10. ON THE JOB TRAINING

Learning to be covered in Industry for Smart Manufacturing Operator (Electronics).

1. Warehouse/Store Department Duration:- 300 hrs.

- **Incoming Quality Control-**

  IQC to check the raw material, components and parts from their suppliers, before admitting to the warehouse & to understand the below charts. To go through the all the three phases-the preparatory, initial, and follow-up
  Fishbone diagram.
  Control chart.
  Stratification.
  Pareto chart.
  Histogram.
  Scatter Diagram

- **Material Control-**

To take raw material from IQC and send to the production line as per the requirement plan.To safe and efficient operation of materials movements and materials storage with the site storage space.
Technique-eliminating and minimising all kinds of wastes and losses while the materials are being purchased, stored, handled, issued or consumed.

- **Coordinating Materials**

Material Controllers coordinate and expedite movement of materials between departments according to each department's production and shipping requirements. They also create and maintain computerized records of these movements.

- **Order Management**

Computation of the amounts of material or items required to complete specific job orders is a responsibility of Material Controllers. They must have knowledge of product

manufacturing and related processes to successfully estimate how much each department or job requires.

- **Inventory Control**

Knowing how to create, compile and maintain manual or computerized records is an essential job duty of Material Controllers. They need these records to be able to verify inventory numbers and locations and to have available in the instance of an audit. Various software programs can be utilized to help with inventory control.

- **Transporting Materials**

Material Controllers often have to move or transport materials between departments in response to production needs. Knowledge of equipment such as forklifts or pallet jacks is helpful. In addition, knowing how to move items safely without bodily injury to themselves or others is essential.

- **Examining and Verifying Materials**

Upon receiving new inventory, Material Controllers are tasked with examining the materials to verify that they conform to production specifications. They must be familiar with these specifications or have the ability to look in the reference manuals for the information. They must document any exceptions and arrange for the return or exchange of any materials that fail to meet specifications.

2. Assembly Line Duration:- 350 hrs.

Assembly line, Industrial arrangements of the machine, equipment's and workers for continuous flow of workplace in mass production. Use a variety of tools such as soldering guns and pincers to perform assembly work. Perform preventative and regular maintenance on tools and equipment used during cell phone assembly tasks.

- **Soldering-**

Soldering of major parts of mobile phone such as Speaker, Mic, Camera and LCD.

- Soldering Basic components

- De soldering Basic components
- Soldering SMD components
- De soldering SMD components

➢ **Process Quality Control-**

- To check the various functions of the product such as RF testing, Camera testing, MIC testing, Network Checking, Charging Jack testing, Earphone Jack testing, LCD testing.
- Check blueprints and plans in order to determine correct assembly functions.
- Take precision measurements in order to ensure that all parts fit together.
- Select the right components for each cell phone assembly project.
- Align components properly so that they fit.

➢ **Visual Inspection-**

- Physical Inspection of the product quality to ensure the no major defects in the product. There are two types of visual inspection manual visual inspection and Automated Optical Inspection.
- Correct any issues such as inappropriately fixed covers.
- Check assembled cell phones from all ends to ensure durability.
- Ensure that all accessories such as chargers, earphones, and USB cables are placed in the box.

➢ **Outgoing Quality Control –**

- To check the quality of the finished product through AQL sampling plan. They are supposed to pick defective product, parts/material and if any product is found defective, sent back to rework.
- Switch cell phones on in order to determine their functionality.
- Check cell phone systems, such as boards and batteries to determine their functioning.
- Read and comprehend cell phone assembly work orders.
- Take precision measurements in order to ensure that all parts fit together.

3. Packaging Duration:- 200 hrs.

- Packing of adapter, headphone, cable, user manual, Battery and warranty card in the gift box.
- Place assembled cell phones into provided packaging.
- Ensure that all accessories such as chargers, earphones, and USB cables are placed in the box
- Complete documentation associated with cell phone assembly.
- Write notes of specific sets, regarding function or packaging issues.
- cleaning packaging materials, loading items into containers, and weighing and labeling the items appropriately
- Also perform final checks for defective items, ensure all working items make it to the loading area or inventory, and keep detailed records of materials and shipments.
- Performing packing operations in accordance with time, quality and quantity targets. Loading packing machines with packing materials (e.g. cans, boxes, bags, containers, wrapping etc.

4. SMT Line Production Duration:-350 hrs.

➢ **Assembly**

- Mounting of the SMT components in the PCB such as resistor, inductor, capacitor, SIM jack, SD card Jack, Earphone jack etc.
- Monitors and maintains equipment used to create electronic circuits with surface mount technology (SMT).
- Understand the following process-Material preparation and examination, Stencils preparation, Solder Paste printing, SMC Placement, Reflow soldering, Clean & Inspection

➢ **Soldering –**

- Soldering of mounted component through reflow machine.

➢ **Parts of SMT Machine**

- Magazine Board Loader, Solder past printer, Conveyor, solder print inspection equipment, barcode reading conveyor, monunters, Reflow machine, magazine board unloader.

5. Maintenance Department Duration:-300 hrs.

Inspection is concerned with the routine schedule checks of the plant facilities to examine and check for needed repairs. Inspection ensures the safe and efficient operation of equipment and machinery.

- **Preventive maintenance**
  It prevents breakdown (before it occurs) by well-conceived plans of inspection, lubrication, adjustment, repair and overhauling.

- **Engineering**
  Engineering involves alteration and improvements in existing equipment and machine to minimize breakdown.

- **Overhaul**
  Overhauling involves replacement, reconditioning of machinery and equipment's.

- **Repair**
  Maintenance department carries out corrective repairs to alleviate unsatisfactory conditions found during preventive inspection.

6. Rework Duration:- 200 hrs.

- Correcting of defective, failed or non-conforming items, during or after inspection.
- Rework includes all follow-on efforts such as disassembly, repair and replacement.
- Perform rework of circuits and defective components to IPC standards, maintaining records of analysis and rework
- Implemented IPC standards to conduct SMT and through hole soldering of various electronic components.

7. GENERAL TRAINING Duration:- 300 hrs.

1. Storing of tools, tackles, packing, etc.
2. Check resistance using multimeter and clamp meter.
3. Check Voltage using multimeter and clamp meter.
4. Check current using multimeter and clamp meter.
5. Check continuity & loop testing using multimeter and clamp meter.
6. Check Earthing using multimeter and clamp meter.
7. Measure signal characteristics on CRO.
8. Measure and test the voltage of given cells/batteries.

9. Handle the given tool safely by following the instructions.
10. Read and Understand SOP & WI.
11. Identify ESD Safety devices.
12. Check ESD clothing.
13. Explain general factory rule.
14. Good Manufacturing & Quality Norms
    - Kaizen
    - Quality assurance and checklist
    - Packing of the product
    - Inventory management
    - Lean Manufacturing
    - SWOT Analysis
15. Perform identification of the types of fault.
16. Perform steps required for rectification of faults.
17. Perform fault analysis based on hardware and software components.
18. Perform repair/replace on product/component.
19. Demonstrate troubleshooting and repairing of the product.
20. Perform steps required in diagnostic and testing methods.
21. Give demonstration of visual inspection.
22. Perform steps required to perform earth continuity test.
23. Perform insulation resistance test.
24. Practice Kaizen principles in workshop.
25. Test various components.
26. Perform categorization of fault.
27. Perform repairing of faulty products.
28. Identify Hazardous material.
29. Identify Non-Hazardous material.
30. Identify Imported material.
31. Identify local material.
32. Identify defective material.
33. Explain about inward, outward and suspense material.

ANNEXURE-I

List of Tools & Equipment			
SMART MANUFACTURING OPERATOR (ELECTRONICS) **(For batch of 20 candidates)**			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-12 is required additionally)			
1.	Connecting screwdriver	10 X 100 mm	10 Nos.
2.	Neon tester 500 V.	500 V	6 Nos.
3.	Screw driver 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	10 Nos.
8.	Electrician knife	100 mm	6 Nos.
9.	Tweezers	150 mm	10 Nos.
10.	Digital Multimeter	(3 3/4 digit) ,4000 Counts	10 Nos.
11.	Soldering Iron Changeable bits	15 Watt, 240 Volt	6 Nos.
12.	De- soldering pump electrical heated, manual operators	230 V, 40 W	10 Nos.
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 meter	4 Nos.
17.	Tools makers vice	100 mm (clamp)	1 No.
18.	Tools maker vice	50 mm (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	2Nos.
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	With 4 ½ Digit Display and 20k Count	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 Equipments			
39.	Multiple Output DC regulated power supply	0-30V, 2 Amps, ± 15V Dual Tracking ,5V/5A, Display digital, Load & Line Regulation: ± (0.05 %+100 mV), Ripple & Noise: 1 mVrms. Constant Voltage & Current operation	4 Nos.
40.	DC Regulated Variable Programmable DC Power Supply	0-30V/3A with numeric keypad, PC interface and LCD for Voltage, Current & Power	2 Nos.
41.	LCR meter (Digital) Handheld	It can Measure six basic parameters R,C,L equipped with SMD Component Test Fixture	1 No.
42.	70 MHz Mixed Signal Oscilloscope (4 Analog + 16 Digital Channel)	With more than 20Mpt memory Real time Sampling 1GSa/sec , having LAN Interface with, I2C , SPI, Runt etc .. And RS232/UART,I2C and SPI trigger decoding functions , two channel 25MHz awg plus math functions like differentiation,integration, abs, AND,OR,NOT etc..an	1 No.

43.	25 MHz Arbitrary Waveform Generator with Digital Display for Frequency and Amplitude	Two Channel , 200MSa/Sec and 2Mpt memory with more than 150 different arbitrary waveforms and built-in 8th order harmonic generation and 150MHz Frequency counter PC Connectivity USB Device/Host and LAN	1 No
44.	6 1/2 Digit Digital Multimeter	Measurement Functions: DC & AC Voltage, DC&AC Current,2- wire & amp; 4-wire Resistance, CAP, Diode, Connectivity, Frequency, Period, Any Sensor. Temperature: RTD, THERM,TC (B/E/J/K/N/R/S/T) PC Interface USB Host, USB Device,LAN(LXI-C) Measurement Speed 10k readings/sec	1 No.
OR	**Electronics Workbench**	**Item no. 39, 41, 42, 43, 44 and can be preferred in the form of workbench.**	**1 No.**
45.	Multi Function Test & Measuring Tool for Field Applications and Testing compatible with Laptop	300 MHz Bandwidth 2 Channel Digital Storage Oscilloscopes, Spectrum Analyzer. Arbitrary Waveform Generator Sine 50MHz ,Square 15MHz,Triangle 100KHz , AM – FM Modulation, 16 Channel Logic Analyzer Frequency and Phase Meter USB 2.0/ 3.0 Interface	1 No.
46.	Electrical Safety Trainer	Demonstration of importance of earthing in any electrical device. Arrangement to study role of fuse and types of slow blow, high blow fuse in any electronic circuit. Arrangement to study the importance of MCB and it's working.	1 No.
47.	Analog Component Trainer	Breadboard for Circuit design	1 No.
48.	Laptop latest configuration		1 No.
49.	Laser jet Printer		1 No.
50.	Internet Broadband Connection		1 No.

51.	Different types of electronic and electrical cables, connectors, sockets, terminations.		As required
52.	Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB		As required
53.	SMD Soldering & De soldering Station with necessary accessories	SMD Soldering &Desoldering Station Digitally Calibrated Temperature Control SMD Soldering &Desoldering Power Consumption : 60 Watts I/P Voltage : 170 to 270 V De-soldering : 70 Watt Temperature Range : 180 to 480º Centigrade Power Consumption : 270 Watts Hot Air Temperature : 200 to 550º Centigrade	1 No.
54.	SMD Technology Kit	SMD component identification board with SMD components Resistors, Capacitors, Inductors, Diodes, Transistors & IC's packages. Proto boards with readymade solder pads for various SMD Components. SMD Soldering Jig.	1 No.
55.	Microcontroller kits (8051) along with programming software (Assembly level Programming) With six important different application modules 1. Input Interface Switch, Matrix Keypad, ASCII Keypad 2. Display LCD, Seven Segment, LED Matrix 3. ADC & DAC 4. PC Interface module 5. Motor DC, Stepper, Servo 6. DAQ	Core 8051 MCU clocked at 11.0592 MHz., supporting both programming modes Keypad and computer ,LCD for both programming and run mode, ready to run programmer to support family of controllers AT89C52 ,DC Power Supplies +12V, -12V, +5V & -5V, Breadboard to make circuits, Learning content through simulation Software and following application modules 1. Input Interface : 4x4 Matrix Keypad, ASCII Key PAD, Four Input Switch 2. Display 16X2 LCD, Seven Segment, LED Bar Graph 3. ADC/DAC with ADC/DAC0808 4. PC Interface: RS232 & USB 5. Motor Drive: DC, Servo, Stepper 6. DAQ: 4ch analog 10bit, 22 DIO	1 No.

		resolution,6MHz Frequency Counter (square wave), DAQ with PC interface software	
56.	Sensor Trainer Kit Containing following Sensors a) Air humidity and Temperature b) RTD c) Atmospheric Pressure d) Air Quality e) Smoke Detector Sensors f) Limit Switch g) Photo sensors h) Capacitive displacement	IoT enabled Android based 7" Graphical touch LCD with inbuilt cortex processor & DAQ for acquiring analog data and software for viewing the output waveforms with USB storage and HDMI output. Ethernet port to connect real world. Inverting, Non – Inverting, Power, Current, Instrumentation and Differential Amplifier, F to V, V to F, I to V, V to I Converter, High Pass and Low Pass Filter, Buffer, LED, Buzzer, LED Bar Graph, Touch Switch Included Sensors :RTD,NTC Thermistor,LM35,Photovoltic, Air humidity and Temperature, Gas(Smoke), Air Quality, Atmospheric Pressure, Limit switch, Capacitive displacement	2 Nos.
57.	Internet of Things Explorer	Processor : 64bit ARMv7 with 1GB RAM , Memory 32GB ,OS: Open source Linux, Connectivity: Wireless LAN, Bluetooth, Zigbee, USB & Ethernet, HDMI interface, 1.77" Color TFT LCD , Driver for Stepper and DC Motor, six 16 bit Analog Input, RTC and 4-20mA input. Zigbee: 2.4GHz, Sensors: Temperature and Humidity, Air Quality, Soil Moisture, Ambient Light, Soil/Water temperature, PIR Sensor. GSM IoT Gateway - Quad-Band 850/900/1800/1900 MHz - GPRS multi-slot class, Control via AT commands. Explore physical and application layer protocols like RS232, RS485, GSM, Ethernet and MQTT, CoAP, HTTP, FTP. Cloud/server configuration includes HTML, Java, php and mySQL. IoT Node: Wireless 2.4GHz Zigbee, 5 Analog Inputs and at least 3 Digital Outputs, At least one I2C Channel, support OTA. Online Cloud/Server	1 No.

		Services for 2 years. Battery 3.7V/4400mAH with Solar Panel, USB interface.	
58.	Wireless Communication modules for interfacing with microcontrollers a) RFID Card Reader b) Finger Print c) Zigbee d) GPS e) GSM f) Bluetooth g) WiFi	Core 8051 MCU clocked at 11.0592 MHz, supporting both programming modes Key Pad and PC, LCD for both programming mode and run mode, ready to run programmer to support family of controllers AT89C51/52 & 55 ,DC Power Supplies +12V, -12V, +5V & -5V,Breadboard to make circuits, detailed learning content through simulation Software and following application modules : RFID Card Reader ,Finger Print, Zigbee, GPS, GSM, Bluetooth and WiFi	1 No.
59.	Networking Equipment	MODEM, Router, Firewall, Switch, Racks, Wireless Access Point, Enclosures, Storage	As Required
60.	Surface Mounted technology	Soldering Iron Kit, Heat Gun, Drill Machine, Air blower, Socket set etc.	As Required

Tools & Equipment for Employability Skills		
S No.	**Name of the Equipment**	**Quantity**
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	20 nos.
2.	UPS	As required
3.	Scanner cum Printer	1 no.
4.	Computer Tables	20 nos.
5.	Computer Chairs	20 nos.
6.	LCD Projector	One in each class room
7.	White Board 1200mm x 900mm	One in each class room

ANNEXURE-II

Lava International Limited Training Center

Trainee Internal Assessment Report

Name :		**Batch No:**	
Card ID No :		**Dept:**	
Attendance % :			

Quarters	Month	Attend %	Month	Attend %	Month	Attend %	Quarterly Average Attend. %
Qtr-1							
Qtr-2							
Qtr-3							
Qtr-4							

General Assessment **Assessment Period :**

S.No	ATTRIBUTES		Score Qtr-1	Score Qtr-2	Score Qtr-3	Score Qtr-4	Score Sum of 4-Qtrs
1	**Safety**	Knowledge, follow safety precautions and rules					
2	**Sense of Responsibility**	Does he obey Sup/Line i/c instructions					
		Does he attend shift start meetings regularly					
		Does he take supervisors feedback properly					
		Whether he takes planned leaves					
		Does he participates in new drives					
		Does he take care in handling tools					
		Is Punctual					
		Positive, Behaviour, response, learning					
		Maintain 5S at his work station					
		Co-operation - Consider team work, willingness to work with and for others					
		Able to identify and report irregularities at his work place					
3	**Method**	Follow WIS/MOS					
		Able to check faults of previous station					
		Understands tools/equipment functions and its different parts					
		Able to perform the job independently					
4	**Speed**	Able to match line "TACT" time					
		Willingness to learn/flexibility for alternate job					
		Work completion/target achievement					
5	**Quality**	Able to contain defects					
		Awareness about GCA/PDI					
		Skill acquired during "On job training"					
		Total Score					
		Max. Marks					

Fill score in relevant box	**Exellent:4**	**Very Good:3**	**Good:2**	**Fair:1**
			Need Improvement:0	
Remark of Supervisor: Mention Achievement				
Remark of Shift In charge/Dept, Mgr.				
Remark of NISP Training In charge				
Any Remark				

COMMITTEE OF TRADE EXPERT

S.N.	Name(S/Shri.)	Qualification	Past Experience with Designation	Current Org & Designation	Status
1	Raju Kumar Chaurasia	BE ,Electronics	11 Yrs, Shindengen Pvt. Ltd	Lava International Limited, Manager SMT-Production	Chairman
2	Vivek Sharma	BE ,Electronics	10.2 Yrs, Elentec India Pvt Ltd	Lava International Limited, Manager SMT-Production	Member
3	Tilak	B.Tech, Machinical	10.5 Yrs, Eglo India Pvt. Ltd	Lava International Limited, Dy. Manager Assembly Production	Member
4	Ravish Yadav	B.Tech, Machinical	11 Yrs, Lenskart Pvt Ltd	Lava International Limited, Manager Assembly- Production	Member