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

COMPETENCY BASED CURRICULUM

IoT TECHNICIAN (SMART AGRICULTURE)

(INTERNET OF THINGS)

(Duration: One year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL : 3.5



SECTOR –IT & ITES

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

Kolkata-700091

IoT TECHNICIAN (SMART AGRICULTURE)

(INTERNET OF THINGS)

(Non-Engineering Trade)

(Revised in August 2025)

Version: 3.0

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NSQF LEVEL : 3.5

Directorate General of Training

Developed By

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1. COURSE INFORMATION

During the one-year duration of IoT Technician (Smart Agriculture) trade a candidate is trained on professional skill, professional knowledge and Employability skill related to job roles. In addition to this a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered under Professional skill subject are as below: -

In the first year, the trainee will Understand the concepts and terminology of the Internet of Things (IoT). Learn about components of IOT, IoT applications in Smart Agriculture, their distinctive advantages. Interface sensors and actuators to IoT devices and implement different circuits used in smart agriculture applications. They Will perform checks on IOT kit components as instructed in the kit readme.txt file or kit documents. They will develop troubleshooting skills in various standard electronic circuits using electronic design and validation software. Trainees will apply the principle of sensors and transducers for various IoT applications.

The trainees will identify different IoT applications with IoT architecture. They will also identify and select various types of sensors used in Smart Agriculture. Trainees will position the appropriate sensors and collect the information required in Smart Agriculture. They will identify and select different wireless communication modules and topology to generate and record the data. They will get knowledge of Solar Panel Basics Testing, Characteristics, Charge Controller Circuit. They can perform installation, configuration and working of IoT devices, network, database, app and web services. They will identify and install the devices used in green house. They will monitor soil moisture, temperature etc. for controlling irrigation & record data. They can select plant health monitoring system and apply proper water, fertilizer and pesticides. They will also Identify and install the appropriate device for livestock monitoring.

2. TRAINING SYSTEM

2.1 GENERAL

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

IoT Technician (Smart Agriculture) Trade under CTS is one of the newly designed courses. CTS courses are delivered nationwide through network of ITIs. The course is of one-year duration. It mainly consists of Domain area and Core area. In the Domain area (Trade Theory & Practical) impart professional skills and knowledge, while Core area (Employability Skills) impart requisite core skill, knowledge and life skills. After passing out the training program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Trainee needs to demonstrate broadly that they are able to:

- Read and 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& employability skills while performing the job and repair & maintenance work.
- Document the technical parameter related to the task undertaken.

2.2 PROGRESSION PATHWAYS

- Can join industry as IoT Technician and will progress further as Senior Technician, Supervisor and can rise to the level of Manager.
- Can become Entrepreneur in the related field.
- Can join as a technician in different IoT application industries for repair, servicing and installation of IoT devices.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

2.3 COURSE STRUCTURE

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

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

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

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

2.4 ASSESSMENT & CERTIFICATION

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

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

b) The final assessment will be in the form of summative assessment. The All India Trade Test for awarding NTC will be conducted by DGT as per the guidelines. The pattern and marking structure are being notified by DGT from time to time. **The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The examiner during final examination will also check** the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

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

2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising some of the following:

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

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

Marks Allotted during Assessment	Performance Level	Evidence
Marks between 60% to 75%	For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while

	craftsmanship with occasional guidance, and due regard for safety procedures and practices.	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.
Marks above 75% to 90%	For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices.	• 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.
Marks Above 90%	For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• 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

Brief Description of Job Role:

IoT Technician (Smart Agriculture); tests electronic components and circuits to locate defects, using instruments such as, ammeters and voltmeters and multimeter. Replaces defective components. Assembles, tests and troubleshoot various digital circuits. Develop various standard electronic circuits using electronic Circuit Design and Validation software. Applies the principle of sensors & transducers for various IoT applications. Plans & interfaces input & output devices to evaluate performance with microcontrollers and microprocessors.

The individual in this job identifies different IoT enabled system/application in agricultural field such as Precision Farming, Livestock Monitoring, etc. for farmers to maximize yields using minimal resources such as water, fertilizer and seeds. Selects various types of sensors as per requirement for Smart Agriculture. Positions appropriate sensors and collects necessary data like various types of soil properties including compaction, structure, pH and nutrient levels etc., soil temperature at various depths, rainfall etc. at predetermined intervals. Identifies and selects different wireless communication modules and topology such as Zigbee, Bluetooth, GSM module, WiFi, Ethernet, M2M Wireless Sensor Network (WSN) etc. Uses signals from GPS, for more detailed analysis of fields. Identifies and install the appropriate devices such as Location Sensors, GPS & GPS integrated circuits, Wearable sensors to cattle for livestock monitoring by collecting data regarding the location, well-being and health of cattle. Installs the devices used in green house such as Carbon dioxide, Oxygen, Air temperature sensors etc. Apply various Precision Agriculture tools like Soil Mapping, Yield Mapping, Integrated Pest & Weed Management, Water Management etc. for precision irrigation. Applies knowledge of Solar Panel Basics Testing, Characteristics, Charge Controller Circuit etc. Selects plant health monitoring system and measures leaf health, lighting brightness, chlorophyll amount, ripeness level, Leaf Area Index (LAI) etc. for crop mapping, disease/pest location alerts, solar radiation predictions and right amount of fertilizing etc. Integrating modules (Raspberry Pi 3 4B module) for crop monitoring & spraying, soil & field analysis, plant counting and yield prediction, plant height measurement, and so on.

Reference NCO-2015: 7422.9900 - Information and Communications Technology Installers and Servicers, Other

Reference NOS:

i.	ELE/N9401	viii.	SSC/N9445	xv.	SSC/N9568
ii.	SSC/N9563	ix.	SSC/N9567	xvi.	SSC/N9451
iii.	SSC/N9408	x.	SSC/N9462	xvii.	SSC/N9569
iv.	SSC/N9564	xi.	SSC/N9446	xviii.	SSC/N9453
v.	SSC/N9565	xii.	SSC/N9447	xix.	SSC/N9454
vi.	SSC/N9566	xiii.	SSC/N9448	xx.	SSC/N9455
vii.	SSC/N9444	xiv.	SSC/N9449		

4. GENERAL INFORMATION

Name of the Trade	**IoT TECHNICIAN (SMART AGRICULTURE)**
Trade Code	DGT/2005
NCO - 2015	7422.9900
NOS Covered	ELE/N9401, SSC/N9563, SSC/N9408, SSC/N9564, SSC/N9565, SSC/N9566, SSC/N9444, SSC/N9445, SSC/N9567, SSC/N9462, SSC/N9446, SSC/N9447, SSC/N9448, SSC/N9449, SSC/N9568, SSC/N9451, SSC/N9569, SSC/N9453, SSC/N9454, SSC/N9455
NSQF Level	Level-3.5
Duration of Craftsmen Training	One Year (1200 hours + 150 hours OJT/Group Project)
Entry Qualification	Passed 10th class examination with Science and Mathematics or with vocational subject in same sector or its equivalent.
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, LC, DW, AA, LV, DEAF, AUTISM, SLD
Unit Strength (No. Of Student)	24 (There is no separate provision of supernumerary seats)
Space Norms	70 Sq. m
Power Norms	3.45 KW
Instructors Qualification for	
1. IoT Technician (Smart Agriculture) Trade	B.Voc/Degree in Electronics / Electronics and Telecommunication/ Electronics and communication Engineering / Electronics & Instrumentation from AICTE/UGC recognized Engineering College/university with **one year of teaching or industry experience** in the IoT / Electronics / Electronics and Telecommunication / Electronics and communication Engineering field. **OR** 3-year Diploma in Electronics / Electronics and telecommunication/ Electronics and communication/ Electronics & Instrumentation from AICTE/recognized board of technical education with **two years' teaching or industry experience** in the IoT / Electronics / Electronics and Telecommunication / Electronics and communication Engineering field. **OR** NTC/NAC passed in the Trade of "IoT Technician (Smart Agriculture)" With three years' **teaching or industry** experience in the IoT / Electronics / Electronics and Telecommunication / Electronics and communication Engineering field. **<u>Essential Qualification:</u>**

	Regular/ RPL variants of National Craft Instructor Certificate (NCIC) in "IoT Technician (Smart Agriculture)" trade under DGT. **Note: -** Out of two Instructors required for the unit of 2 (1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However, both of them must possess NCIC in any of its variants.
2. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with **Two years' of teaching or industry experience with short term ToT Course** in Employability Skills conducted by DGT institutions. (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 conducted by DGT institutions.
Minimum Age for Instructor	21 Years
List of Tools & Equipment	As per Annexure – I

5. LEARNING OUTCOME

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

5.1 LEARNING OUTCOMES

Sl. No.	NOS Code	Learning Outcome	Duration		
			Practical	Theory	Total
1.	ELE/N9401	Select and perform electrical/ electronic measurements of meters and instruments following safety precautions.	30	15	45
2.	SSC/N9563	Test various electronic components using proper measuring instruments and compare the data using standard parameters.	30	15	45
3.	SSC/N9408	Install, configure, and interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications.	20	10	30
4.	SSC/N9564	Develop troubleshooting skills in various standard electronic circuits using Circuit Designing & Validating Software.	26	4	30
5.	SSC/N9565	Apply Programming knowledge to write and test IoT Application Programs Using Python.	60	15	75
6.	SSC/N9566	Demonstrate building & testing application logic using no-code Block Programming Software.	60	15	75
7.	SSC/N9444	Apply the principle of Sensors, Transducers and actuators for various IoT applications.	20	10	30
8.	SSC/N9445	Identify, Test, & troubleshoot microcontrollers.	25	05	30
9.	SSC/N9445	Plan and Interface input and output devices to evaluate performance with Microcontroller.	10	05	15
10.	SSC/N9567	Identify, Test, and troubleshoot Microprocessor.	10	05	15
11.	SSC/N9567	Plan and Interface input and output devices to evaluate performance with Microprocessor.	10	05	15
12.	SSC/N9462	Identify different IoT Applications with IoT architecture.	10	05	15
13.	SSC/N9446	Identify, test and interconnect components/ parts of IoT system.	20	10	30

14.	SSC/N9447	Identify and select various types of sensors used in Smart Agriculture.	39	06	45
15.	SSC/N9447	Interfacing sensors with IoT Gateway and collect sensor data required in Smart Agriculture.	39	06	45
16.	SSC/N9448	Identify, select different wireless communication modules and topology to generate and record the data.	39	06	45
17.	SSC/N9448	Identify and test Wired & Wireless communication medium such as RS485, Ethernet, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol.	37	08	45
18.	SSC/N9449	Identify Solar Panel Basics Testing, Characteristics, Charge Controller Circuit.	35	10	45
19.	SSC/N9568	Monitor the working of IoT devices, network, database, app and web services.	35	10	45
20.	SSC/N9451	Establish and troubleshoot IoT Connectivity of devices to cloud having multiple communication medium, protocols, device management and monitoring.	50	10	60
21.	SSC/N9569	Demonstrate configuration and use of web / mobile applications to connect, run and manage IoT applications.	50	10	60
22.	SSC/N9453	Identify and install the devices used in green house.	50	10	60
23.	SSC/N9453	Monitor soil moisture, temperature etc. for controlling irrigation & record data.	65	25	90
24.	SSC/N9454	Select plant health monitoring system and apply proper water, fertilizer and pesticides.	35	10	45
25.	SSC/N9455	Identify and install the appropriate system for cowshed management.	35	10	45
		Employability Skills	-	**120**	**120**
		Total	**840**	**360**	**1200**

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Select and perform electrical/ electronic measurements of meters and instruments following safety precautions. (NOS: ELE/N9401)	• Plan work in compliance with standard safety norms. • Identify the type of electronic instruments. • Measure the value of resistance, voltage and current using digital multimeter.
2. Test various electronic components using proper measuring instruments and compare the data using standard parameter. (NOS: SSC/N9563)	• Ascertain and select tools and materials for the job and make this available for use in a timely manner. • Plan work in compliance with standard safety norms. • Identify the different types of resistors. • Measure the resistor values using colour code and verify the reading by measuring in multi meter. • Identify the power rating using size. • Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter. • Identify different inductors and measure the values using LCR meter. • Identify the different capacitors and measure capacitance of various capacitors using LCR meter.
3. Install, configure, interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications (NOS: SSC/N9408)	• Plan, and work in compliance with standard safety norms. • Select hardware and software components. • Install and configure operating systems and applications. • Integrate IT systems into networks. • Deploy tools and test programs. • Avoid e-waste and dispose of the waste as per the procedure.
4. Develop troubleshooting skills in various standard electronic circuits using Circuit Designing & Validating software. (NOS: SSC/N9564)	• Identify & Select the component in Circuit Designing & Validation Software. • Prepare simple digital and analog circuits using the software. • Validate the circuit using Circuit Designing & Validation Software. • Follow the instruction manual.

	• Familiarize with all standard library components available in the circuit designing and validation software
5. Apply Programming knowledge to write and test IoT Application Programs using Python. (NOS: SSC/N9565)	• Identify Python syntax, data types, operators and simple program statements using Python programming IDE • Write a Python code for IoT Applications for energy-saving lights
6. Demonstrate building & testing application logic using no-code Block Programming Software. (NOS: SSC/N9566)	• Identify and demonstrate standard frequently used blocks for common actions in block programming software. • Demonstrate building simple Python statements, variable creation and use, mathematical operations using operators and text operations using blocks. • Demonstrate use of loop blocks to perform repetitive actions in a Python code. • Demonstrate use of logical and conditional blocks. • Demonstrate creation of functions and calling functions using blocks. • Build and test a simple IoT application block program for a security alarm system using motion sensor and buzzer.
7. Apply the principle of sensors, transducers and actuators for various IoT applications. (NOS: SSC/N9444)	• Identify the sensors and actuators. • Select the sensor and actuators for proper applications. • Check the functioning of the sensor. • Measure the voltage of different sensors. • Calibration of sensors as per desired output. • Follow the instruction manual.
8. Identify, Test, and troubleshoot Microcontrollers. (NOS: SSC/N9445)	• Understand and interpret the procedure as per the manual of the Microcontroller. • Identity various ICs & their functions on the given Microcontroller Kit. • Identify the address range of RAM & ROM. • Write data into RAM & observe its volatility. • Identify the port pins of the controller & configure the ports for Input & Output operation. • Demonstrate entry of simple programs and execute & monitor the results.

9. Plan and Interface input and output devices to evaluate performance with Microcontroller. (NOS: SSC/N9445)	• Perform the use of an ADC and DAC to read input voltage and provide output voltage. • Perform the use of USB interface with Computer interface. • Demonstrate entering of simple programs, execute &monitor the results.
10. Identify, Test, & troubleshoot Microprocessor. (NOS: SSC/N9567)	• Understand and interpret the procedure as per the manual of the Microprocessor. • Identify various ICs & their functions on the given Microprocessor Kit. • Identify the address range of RAM & ROM. • Write data into RAM & observe its volatility. • Identify the port pins of the microprocessor & configure the ports for Input & Output operation. • Demonstrate entry of simple programs and execute & monitor the results.
11. Plan and Interface input and output devices to evaluate performance with Microprocessor. (NOS: SSC/N9567)	• Demonstrate interfacing of different digital sensors and actuators with microprocessor and monitor results. • Demonstrate interfacing of different analog sensors and devices with microprocessor and monitor results. • Demonstrate entering of simple programs, execute & monitor the results.
12. Identify different IoT Applications with IoT architecture. (NOS: SSC/N9462)	• Identify various IoT Applications in Smart Agriculture viz. smart irrigation and smart green house. • Recognise the functions of various IoT Technician (Smart Agriculture) (IoT) applications & their distinctive advantages. • Identify and explore different functional building blocks of IOT enabled system / application. • Explore signal flow into IOT enabled system/application as per the IOT architecture.
13. Identify, test and interconnect components/parts of IoT system. (NOS: SSC/N9446)	• Connect and test IoT Gateway and execute sample programs from the example list. • Write and upload code to the physical IoT Gateway to sound buzzer. • Rig up the circuit and upload a program to interface temperature sensor with a IoT Gateway to display

	temperature on the LCD. • Set up Circuit and upload program to Interface DC motor (actuator) with IoT Gateway to control on/off/forward/reverse operations.
14. Identify and select various types of sensors used in Smart Agriculture. (NOS: SSC/N9447)	• Identify Roles and characteristics of various sensors. • Select appropriate sensor as per requirement. • Use signals from GPS satellites in Location Sensors. • Place self-contained units of Agricultural Weather Stations at various locations throughout growing fields. • Combine sensors appropriate for the local crops and climate for Agricultural Weather Stations. • Measure pH using Electrochemical Sensors and soil nutrient levels. • Apply Electrochemical Sensor to gather process and map soil chemical data.
15. Interfacing sensors with IoT Gateway and collect sensor data required in Smart Agriculture. (NOS: SSC/N9447)	• Identify sensors node block diagram and its components. • Connect sensors and send data wirelessly to a cloud. • Perform interfacing of wireless modules with IoT platform. • Select and Install sensors like CO2, O2, VOC, air temperature, humidity, moisture, etc. • Interface sensors such as NPK, EC, Soil Moisture, Soil Temperature, PH, TDS, Flow and Water Level sensor with IoT Gateway and test the sensor data. • Observe safety precaution.
16. Identify, select different wireless communication modules and topology to generate and record the data. (NOS: SSC/N9448)	• Create Wireless sensor network with interfacing of Zigbee module. • Identify interfacing of Bluetooth module to create local sensor network. • Interfacing of GSM module to make node as a gateway. • Interfacing of LoRa Module to IoT Gateway. • Use WiFi and Ethernet for IoT Gateway. • Apply GPS satellites in Location Sensors. • RS485 interface for industrial agriculture sensors. • Use portable Agricultural Weather Stations. • Apply Precision irrigation through water management in precision agriculture.

17. Identify and test Wired & Wireless communication medium such as RS485, Ethernet, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol. (NOS: SSC/N9448)	• Basic Network Configuration of Local Area Networks - Ethernet, Wi-Fi. • Basic Configuration of Cellular Wide Area Networks - GSM, GPRS. • Basic configuration of wired communication protocols such as SPI, I2C, UART and RS 485. • Basic Configuration of Personal Area Networks -RF, Zigbee, LoRa.
18. Identify Solar Panel Basics Testing, Characteristics, Charge Controller Circuit. (NOS: SSC/N9449)	• Test series combination of Solar PV Modules. • Test parallel combination of Solar PV Modules. • Test VI Characteristics of Solar PV Module. • Test series-parallel combination of Solar PV Modules. • Test blocking diode and its working in Solar PV Module. • Test bypass diode and its working in Solar PV Module. • Follow the instruction manual.
19. Monitor the working of IoT devices, network, database, app and web services. (NOS: SSC/N9568)	• Connect with cloud using software utility. • Check IoT Gateway using Wi-Fi and Ethernet. • Manage directories and files. • Test Cloud Configuration for IoT. • Test IoT Web and Application Development Tools for IoT.
20. Establish and troubleshoot IoT Connectivity of devices to cloud having multiple communication medium, protocols, device management and monitoring. (NOS: SSC/N9451)	• Configure and integrate multiple devices with serial protocol working on RS485 MODBUS Master –Slave architecture such as Solar Inverter, Solar Pump Controller, Energy Meter etc. • Configure Wired and Wireless Local Area Networks (Ethernet and Wi- Fi) for MODBUS over MQTT in IoT Applications. • Configure cellular IoT Connectivity using GSM/GPRS networks for MODBUS over MQTT in IoT Applications. • Create / Modify and Configure IoT Devices and its parameters on cloud platform. • Monitor and Diagnose IoT Devices on cloud platform. • Configure parameters, alarms, notifications on cloud platform. • Create / Modify organization and users to access device data with user management roles and security.

21. Demonstrate configuration and use of web / mobile applications to connect, run and manage IoT applications. (NOS: SSC/N9569)	• Demonstrate use of web/mobile application interface to execute a particular IoT application. • Monitor the messages/data received. • Manipulate the sensor response using web/mobile application interface.
22. Identify and install the devices used in green house. (NOS: SSC/N9453)	• Select and Install of Carbon dioxide sensors. • Select and Install Oxygen sensors. • Select and install Air Temperature & Humidity sensors. • Select and install PH, TDS, Water Temperature, Level and Flow sensors. • Select and install Water Pump, Solenoid Valves, Fans & Grow Lights etc.
23. Monitor soil moisture, temperature etc. for controlling irrigation & record data. (NOS: SSC/N9453)	• Carry out soil observations logged in the form of moisture level, soil temperature etc with the help of appropriate sensors. • Apply Precision irrigation through water management in precision agriculture. • Identify various benefits of application of Precision Irrigation in Smart Farming.
24. Select plant health monitoring system and apply proper water, fertilizer and pesticides. (NOS: SSC/N9454)	• Test Air temperature, humidity and pressure. • Test Electrical Conductivity, water content and soil temperature. • Test Soil nutrition using appropriate sensors. • Test plant health using Leaf wetness sensor.
25. Identify and install the appropriate system for cowshed management. (NOS: SSC/N9455)	• Use appropriate sensors and actuators to monitor and maintain optimal environment for cattle. • Install and configure automated timer-based feeding system for cattle. • Apply Wearable Electronics such as RFID tags to identify and monitor cattle. • Follow manual.

7. TRADE SYLLABUS

SYLLABUS FOR IoT TECHNICIAN (SMART AGRICULTURE) TRADE			
DURATION: ONE YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 30 Hrs. Professional Knowledge 15 Hrs.	1. Select and perform electrical/ electronic measurements of meters and instruments following safety precautions.	**Trade and Orientation** 1. Visit various sections of the institute & identify the location of various installations. 2. Identify safety signs for danger, warning, caution & personal safety messages 3. Use of personal protective equipment (PPE). 4. Practice elementary first aid. 5. Preventive measures for electrical accidents & steps to be taken in such accidents. 6. Use of Fire extinguishers. 7. Identify, Care & maintain the different Basic hand tools.	Introduction to IoT and it's applications in Smart Agriculture domain. Data protection, security & privacy. Familiarization with the working of the Industrial Training Institute system. Importance of safety and precautions to be taken in the industry/shop floor. Introduction to PPEs. Introduction to First Aid. Response to emergencies e.g. power failure, fire, and system failure. Importance of housekeeping & good shop floor practices. Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable.
		Basics of AC and Electrical Cables 8. Identify the Phase, Neutral, and Earth on the power socket, and use a tester to monitor AC power. 9. Construct a test lamp and use it to check mains healthiness. Measure the voltage between phase and ground and rectify earthing. 10. Prepare terminations, and	Basic terms such as electric charges, Potential difference, Voltage, Current, and Resistance. Basics of AC & DC. Various terms such as +ve cycle, -ve cycle, Frequency, Time-period, RMS, Peak, and Instantaneous value. Single phase and Three phase supply. Different types of electrical cables and their Specifications.

		skin the electrical wires/ cables using a wire stripper and cutter. 11. Measure the gauge of the wire using SWG and an outside micrometer. 12. Demonstrate various test and measuring instruments. 13. Measure voltage and current using a clamp meter.	Types of wires & cables, standard wire gauge (SWG). Classification of cables according to gauge (core size), number of conductors, material, insulation strength, flexibility, etc. Introduction to electrical and electronic measuring instruments.
Professional Skill 30 Hrs.; Professional Knowledge 15 Hrs.	2. Test various electronic components using proper measuring instruments and compare the data using standard parameters.	**Active and Passive Components** 14. Identify the different types of active and passive electronic components. 15. Measure the resistor value by color code, and SMD Code and verify the same by measuring with a multimeter. 16. Practice on measurement of parameters in a combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources. 17. Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law. 18. Verify laws of series and parallel circuits with voltage sources in different combinations. 19. Identify different inductors and measure the values using an LCR meter. 20. Identify the different capacitors and measure the capacitance of various capacitors using an LCR meter. 21. Identify and test the circuit breaker and other protecting	Ohm's law. Resistors; types of resistors, their construction & specific use, color-coding, power rating. Equivalent Resistance of series-parallel circuits. Distribution of V & I in series-parallel circuits. Principles of induction, inductive reactance. Types of inductors, construction, specifications, applications, and energy storage concept. Capacitance and Capacitive Reactance, Impedance. Types of capacitors, construction, specifications, & applications. Dielectric constant. Significance of Series parallel connection of capacitors. Multimeter, use of meters in different circuits. Use of LCR meter.

		devices (Fuse). **AC & DC measurements** 22. Use the multi-meter to measure the various functions (AC V, DC V, DC I, AC I, R).	
Professional Skill 20 Hrs.; Professional Knowledge 10 Hrs.	3. Install, configure, and interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications.	23. Identify various indicators, cables, connectors, & ports on the computer cabinet. 24. Demonstrate various parts of the system unit and components. 25. Identify various computer peripherals and connect them to the system. 26. Install antivirus software, and printer, scan the system, and explore the options in the antivirus software. 27. Browse search engines, create email accounts, practice sending & receiving mail, and configuration of email clients. 28. Identify different types of cables & network components e.g. Hub, switch, router, modem, etc. 29. Configure a wireless Wi-Fi network.	Basic blocks of a computer, Components of desktop and motherboard. Hardware and software, I/O devices, and their working. Different types of printers, HDD, DVD. Various ports in the computer. Working principle of SMPS, its specification. Windows OS MS widows: Starting windows and its operation, file management using Explorer, Display & sound properties, screen savers, font management, installation of the program, setting & using of the control panel., application of accessories, various IT tools, and applications. Concept of the Internet, Browsers, Websites, search engines, email, chatting and messenger service. Downloading the Data and program files etc. Computer Networking:- Network features – Network media Network topologies, protocols- TCP/IP, UDP, FTP, models and types. Specification and standards, types of cables, UTP, STP, and Coaxial cables. Network components like a hub, Ethernet switch, router, NIC Cards, connectors, media, and a firewall. Difference between PC & Server.

Professional Skill 26 Hrs.; Professional Knowledge 04 Hrs.	4. Develop troubleshooting skills in various standard electronic circuits using Circuit Designing & Validating Software.	30. Prepare simple digital and electronic circuits. 31. Try to connect all the library components available in the software with the IoT Gateway to understand the proper ports and connection rules. 32. Validate and test the prepared electronic circuits. 33. Convert the prepared circuit into a layout diagram.	Study the library components available in the Circuit Designing & Validating Software Explore various functionalities of the software.
Professional Skill 60 Hrs.; Professional Knowledge 15 Hrs.	5. Apply programming knowledge to write and test IoT application programs using Python.	34. Demonstrate Python syntax, Data Types, simple statements, operators and comments on the programming IDE. 35. Demonstrate simple mathematical operations and print functions in Python. 36. Demonstrate use of loops in a Python program. 37. Demonstrate use of logical statements and conditional statements in Python. 38. Demonstrate use of function definitions and function calls in Python. 39. Write and test a simple IoT application program for a smart energy saving lighting application using motion sensor and LED.	Study essential building blocks of an IoT application and how these are represented in a simple python program. Understand Python syntax, Data Types, operators, simple statements and comments in Python. Study mathematical operations and text operations in Python. Understand how loops work and their use in a Python code. Study logical and conditional statements in Python. Understand defining functions and calling functions in Python programs.
Professional Skill 60 Hrs.; Professional Knowledge 15 Hrs.	6. Demonstrate building & testing application logic using no-code Block Programming Software.	40. Identify and demonstrate standard frequently used blocks for common actions in block programming software. 41. Practice and demonstrate building simple Python statements, variable creation and use, mathematical	Study essential building blocks of an IoT application and how these can be represented using logical visual blocks to form a simple IoT application program Understand frequently used common action blocks in block programming software

		operations using operators and text operations using blocks. 42. Demonstrate use of loop blocks to perform repetitive actions in a Python code. 43. Demonstrate use of logical and conditional blocks. 44. Demonstrate creation of functions and calling functions using blocks. 45. Build and test a simple IoT application block program for a security alarm system using motion sensor and buzzer.	Understand use of blocks for variable creation, initiation and using variables, blocks for mathematical operations, operators, text operations Study of blocks available for loop operations Study how logical and conditional blocks are used to build a Python code. Understand use of function declaration and function call blocks.
Professional Skill 20 Hrs.; Professional Knowledge 10 Hrs.	7. Apply the principle of Sensors, Transducers and actuators for various IoT applications.	46. Identify and test Temperature sensor. 47. Identify and test Stepper Motor, DC Motor and Servo Motor. 48. Identify and test, load cells. 49. Calibrate different sensors as per desired output.	Basics of passive and active transducers. Role, selection, and characteristics. Sensor voltage and current formats. Overview of different actuators, working principles and use Load cell – principle. Inductive/ capacitive transducers - Principle of operation, advantages and disadvantages. Applications, working principles of different sensors. Sensor Calibration and it's need.
Professional Skill 35 Hrs.; Professional Knowledge 10 Hrs.	8. Identify, Test, & troubleshoot microcontrollers. 9. Plan and Interface input and output devices to evaluate performance with Microcontroller.	50. Explore representative microcontroller architecture like Arduino, ESP32. 51. Explore the different Software IDEs used for microcontrollers. 52. Identify the port pins of the controller & configure the ports for Input & Output operation. 53. Demonstrate interfacing of sensors and devices with	Introduction to Microprocessor & Microcontroller, architecture, pin details & the bus system. Differentiate microcontroller with microprocessor. I/O port pin configuration. Introduction to ADC and DAC, features, and characteristics of the applications.

		microcontroller and test the results.	
Professional Skill 20 Hrs.; Professional Knowledge 10 Hrs.	10. Identify, Test, and troubleshoot Microprocessor. 11. Plan and Interface input and output devices to evaluate performance with Microprocessor.	54. Explore architecture of different models of Raspberry Pi and compare their features. 55. Identify the port pins of the Microprocessor and configure the ports for input & output operations.	Introduction to Raspberry Pi Microprocessor, it's pin details, architecture. Study of different models of Raspberry Pi and it's evolution.
Professional Skill 30 Hrs.; Professional Knowledge 15 Hrs.	12. Identify different IoT Applications with IoT architecture. 13. Identify, test and interconnect components/ parts of IoT system.	56. Connect & test the IoT Gateway & execute sample programs from the example list. 57. Upload code to the IoT Gateway to blink a simple LED. 58. Write and upload code to the IoT Gateway to sound buzzer. 59. Circuit and program to Interface light sensor – LDR with IoT Gateway to switch ON/OFF LED based on light intensity. 60. Rig up the Circuit and upload a program to Control a relay and switch on/off LED light using IoT Gateway. 61. Make a Circuit and upload a program to Interface the LCD with a IoT Gateway to display characters. 62. Rig up the circuit and upload a program to interface the temperature sensor with an IoT Gateway to display the temperature on the LCD. 63. Set up Circuit and upload program to Interface DC	Introduction to Internet of Things applications in the smart city & its distinctive advantages – smart environment, smart street lights, and smart water & waste management. What is an IOT? What makes an embedded system an IOT? Role and scope of IOT in the present and future marketplace. Smart objects, Wired – Cables, hubs, etc. Wireless – RFID, WiFi, Bluetooth, etc. Different functional building blocks of IOT architecture. IoT gateway, Pin diagram, Functional diagram, Hardware familiarization and operating instructions. Integrated development Environment, Running Programs on IDE, simple Programming concepts.

		motor (actuator) with IoT Gateway to control on/off/forward/ reverse operations. 64. Rig up the Circuit and upload the program on IoT Gateway to switch on/off two lights using a relay.	
Professional Skill 39 Hrs.; Professional Knowledge 06 Hrs.	14. Identify and select various types of sensors used in Smart Agriculture.	65. Identify various sensors used in Smart Agriculture. 66. Identify the Roles and characteristics of various sensors. 67. Select the appropriate sensor as per requirement. 68. Determine pH of water using pH Sensor. 69. Test TDS value in water using TDS Sensor. 70. Explore sensors used in determining soil moisture and soil temperature. 71. Measure air temperature, humidity, atmospheric pressure, & solar radiation. 72. Measure and record Information such as air temperature, wind speed, wind direction, relative humidity, solar radiation, & atmospheric pressure at predetermined intervals by Weather Stations.	Principle of operation of various sensors used in Smart Agriculture; their roles and characteristics. Selection of appropriate sensor as per requirement. Use of air quality and noise pollution Sensors. Measurement of PM2.5 and PM10 levels using Electrochemical Sensors for pollution control in a smart environment. Explore sensors used in weather monitoring systems. Measurement and record of Information such as air temperature, wind speed, atmospheric pressure, etc. at predetermined intervals by Weather Stations.
Professional Skill 39 Hrs.; Professional Knowledge 06 Hrs.	15. Interfacing sensors with IoT Gateway and collect sensor data required in Smart Agriculture.	73. Identify the sensor node block diagram and its components. 74. Check connection with sensors & send data wirelessly to cloud. 75. Identify interfacing of wireless modules with the	Concept of sensor node blocks diagram and its components. Connection with sensors to send data wirelessly to cloud. Explore interfacing of wireless modules with IoT platform. Selection and Installation of sensors like Soil Moisture, pH,

		IoT platform. 76. Select and Install sensors like Soil Moisture, pH, TDS, air temperature, humidity, etc. 77. Configure sensor nodes and over-the-air programming. 78. Check the battery level and solar panel connection with the sensor node.	TDS, air temperature, humidity, etc. Data packet and sensor node configuration tool using USB and Over-the-air programming. Explore the battery level and the solar panel connection with the sensor node.
Professional Skill 39 Hrs.; Professional Knowledge 06 Hrs.	16. Identify, select different wireless communication modules and topology to generate and record the data.	79. Identify the interfacing of Zigbee module to create wireless sensor network. 80. Identify the interfacing of Bluetooth module to create local sensor network. 81. Identify the interfacing of GSM module to make node as a gateway. 82. Apply IoT Gateway using WiFi and Ethernet. 83. Check UART Communication, RS485 Communication, I2C Protocol device interfacing, SPI Protocol device interfacing, Ethernet configuration, Zigbee interfacing, Wi-Fi AP and Router interfacing. 84. Identify the Wi-Fi module for data communication. 85. Check USB and Ethernet connectivity for data communication. 86. Check RS485 interface for industrial agriculture sensors.	Introduction to Zigbee. Block diagram of Zigbee based sensor network. Introduction to wireless personal area network system. Introduction to Zigbee networking system. Concept of interfacing of Bluetooth module to local sensor network, interfacing of GSM module to make node as a gateway. IoT Gateway using WiFi and Ethernet. Application of GPS satellites in Location Sensors. RS485 interface for industrial agriculture sensors. Concept of portable Agricultural Weather Stations. Principle of operation & Application of Global Positioning System (GPS): satellites broadcasting signals that allow GPS receivers to calculate their position. Application of Precision irrigation through water management in precision agriculture. Identification of zones in the field that are irrigated with differing amountsand

			frequencies in precision irrigation.
Professional Skill 37 Hrs.; Professional Knowledge 08 Hrs.	17. Identify and test Wired & Wireless communication medium such as RS485, Ethernet, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol.	87. Design and Test Local Area Networks over Ethernet & Wi-Fi. 88. Design and Test Cellular Wide Area Networks over GSM & GPRS. 89. Design and Test Personal Area Networks over RF.	Basic blocks of networking, Specifications, Standards and types of cables, Concept of wired or wireless communication medium Different types of networks Design and establish networks
Professional Skill 35 Hrs.; Professional Knowledge 10 Hrs.	18. Identify Solar Panel Basics Testing, Characteristics, Charge Controller Circuit.	90. Identify, test and check series, parallel and series-parallel combination of Solar PV Modules. 91. Measure VI Characteristics of Solar PV Module. 92. Identify and test blocking diode and its working in Solar PV Module. 93. Observe bypass diode and its working in Solar PV Module. 94. Measure effect of inclination angle of Solar PV Module. 95. Identify and test different charging techniques.	Basics of solar Electricity, working principle of PV panel, advantages of solar electricity and components of solar electricity, Various combinations, VI characteristics of solar PV module, effect of inclination angle on PV module, different battery charging techniques.
Professional Skill 35 Hrs.; Professional Knowledge 10 Hrs.	19. Monitor the working of IoT devices, network, database, app and web services.	96. Connect with cloud using software utility. 97. Check IoT Gateway using Wi-Fi and Ethernet. 98. Manage directories and files 99. Test Cloud Configuration for IoT. 100. Test IoT Web and Application Development Tools for IoT	Configuration of cloud. IoT Gateway using Wi-Fi and Ethernet. Directories, and files. Connection of a system to the network. Database management system. Cloud Configuration for IoT.
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	20. Establish and troubleshoot IoT Connectivity of devices to cloud having multiple communication	101. Interface to IOT gateway I2C, LORA sensor Hub, UART as per the device manual. 102. Set up wired Local Area Network and wireless network.	Basics of Industrial protocols LORA Hub, I2C, UART. Basics of Protocol Converters. Basics of IoT Data Acquisition System. Device connectivity over

	medium, protocols, device management and monitoring.	103. Setup Ethernet IoT Data. 104. Acquisition system, connect to the cloud and verify. 105. Set up WiFi IoT Data Acquisition system, connect to the cloud, and verify. 106. Set up Cellular (GSM/GPRS) IoT Data Acquisition system, connect to the cloud & verify 107. Explore IoT Cloud Configuration process. 108. Create/modify organization and connect devices over the cloud. 109. Configuration of parameters, alarms, and notifications on a cloud platform. 110. Explore user management roles and security.	the cloud & troubleshooting.
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	21. Demonstrate configuration and use of web / mobile applications to connect, run and manage IoT applications.	111. Demonstrate use of web/mobile applications to run and control IoT applications, live data streaming and notifications.	Configuration of web/mobile applications through programs for setting up different sensor widgets for remotely controlling the application, setting up notifications and alerts for IoT applications programmatically
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	22. Identify and install the devices used in green house.	112. Carry out Selection and Installation of Volatile organic compound sensor. 113. Execute Selection and Installation of Air temperature, Air humidity and atmospheric pressure sensor. 114. Select and Install Soil Moisture and Soil Temperature sensor. 115. Carry out Installation of Solar pump, motors and drip irrigation systems.	Principle of selection and installation of Carbon dioxide sensor, Oxygen sensors &Volatile organic compound sensor. Selection and Installation of Air temperature, Air humidity and atmospheric pressure sensor. Selection and Installation of Soil Moisture and Soil Temperature sensor. Installation of Solar pump, motors and drip irrigation systems.

Professional Skill 65 Hrs.; Professional Knowledge 25 Hrs.	23. Monitor soil moisture, temperature etc. for controlling irrigation & record data.	116. Use Smartphone GPS for location for crop mapping, disease/pest location alerts, solar radiation predictions, and fertilizing. 117. Apply Precision irrigation through water management in precision agriculture. 118. Identify zones in the field that are irrigated with differing amounts and frequencies in precision irrigation. 119. Apply various Precision Agriculture tools: Soil Mapping, Nutrient Management, Integrated Pest & Weed Management, Water Management etc. for controlling irrigation & record data. 120. Identify various benefits of application of Precision Agriculture in Smart Farming: Optimising Production Efficiency, Optimising Quality, Minimising Environmental Impact, Minimising Risk, Information to Act On.	Usage of Smartphone GPS for location for crop mapping, disease/pest location alerts, solar radiation predictions, and fertilizing. Application of Precision irrigation through water management in precision agriculture. Identification of zones in the field that are irrigated with differing amounts and frequencies in precision irrigation. Application of various Precision Agriculture tools: Soil Mapping, Nutrient Management, Integrated Pest & Weed Management, Water Management etc. for controlling irrigation & record data. Identification of various benefits of application of Precision Agriculture in Smart Farming: Optimising Production Efficiency, Optimising Quality, Minimising Environmental Impact, Minimising Risk, Information to Act On.
Professional Skill 35 Hrs.; Professional Knowledge 10 Hrs.	24. Select plant health monitoring system and apply proper water, fertilizer and pesticides.	121. Check Soil oxygen level. 122. Test Solar radiation. 123. Measure Air temperature, humidity and pressure. 124. Observe Conductivity, water content and soil temperature. 125. Test Soil temperature and volumetric water content. 126. Measure Soil water potentials.	Checking of Soil oxygen level. Test of Solar radiation, Measurement of Air temperature, humidity and pressure. Observation of Conductivity, water content and soil temperature. Test of Soil temperature and volumetric water content. Measurement of Soil water

		127. Test Vapor pressure, humidity, temperature, and atmospheric pressure in soil and air. 128. Check Leaf wetness. 129. Measure Stem, trunk and fruit diameter. 130. Test Wind speed and precipitations.	potentials. Test of Vapor pressure, humidity, temperature, and atmospheric pressure in soil and air. Checking of Leaf wetness. Measurement of Stem, trunk and fruit diameter. Exploration and test of Wind and precipitations.
Professional Skill 35 Hrs.; Professional Knowledge 10 Hrs.	25. Identify and install the appropriate system for cowshed management.	131. Use Environmental Sensors for cow shed Climate Monitoring – Implement and calibrate temperature, humidity & Light sensors to gather real time data for effective climate control in Cow shed. 132. Integrate Actuators for climate control in cow shed – Install & Configure Actuators such as fans, Heaters, Automatic feeding conveyors, to respond to the sensor data ensuring stable environment for cattle. 133. Apply Wearable Electronics such as RFID tags to cattle.	Application of Wireless IoT in Cow shed management – Data collection from sensors and interfacing actuators for Cow shed Climate monitoring and Control. Usage of Location Sensors, GPS & GPS integrated circuits. Application of Wearable Electronics to cattle such as RFID tags.
Project Work/Industrial Visit (Optional) **Broad Area: -** a) Cloud-based water quality analysis system using different sensors. b) Wireless Building automation system using PIR, camera, and Alarm. c) Environmental monitoring system using different sensors. d) Responsive Web application for Smart Energy management system having dashboard with Single MODBUS, Ethernet, SD Card Storage, Remote GSM/GPRS connectivity.			

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

Learning outcomes, assessment criteria, syllabus and Tool List of Employability Skills is provided separately in www.cstaricalcutta.gov.in / www.bharatskills.gov.in / www.dgt.gov.in.

ANNEXURE-I

LIST OF TOOLS & EQUIPMENT			
IoT TECHNICIAN (SMART AGRICULTURE) (For batch of 24 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	12 Nos.
2.	Neon tester 500 V.	500 V	8 Nos.
3.	Screwdriver set	Set of 7	12 Nos.
4.	Insulated combination pliers	150 mm	8 Nos.
5.	Insulated side cutting pliers	150mm	8 Nos.
6.	Long nose pliers	150mm	8 Nos.
7.	Soldering iron	25-Watt, 240 Volt	12 Nos.
8.	Electrician knife	100 mm	8 Nos.
9.	Tweezers	150 mm	12 Nos.
10.	Digital Multimeter	(3 3/4 digit) ,4000 Counts	12 Nos.
11.	Soldering Iron Changeable bits	15-Watt, 240 Volt	8 Nos.
12.	De- soldering pump electrical heated, manual operators	230 V, 40 W	12 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 meters	4 Nos.
17.	Tools makers vice	100mm (clamp)	1 No.
18.	Tools maker vice	50mm (clamp)	1 No.
19.	Crimping tool (pliers)	7 in 1	2 Nos.
20.	Magneto spanner set	8 Spanners	2 Nos.
21.	File flat bastard	200 mm	2 Nos.
22.	File flat second cut	200 mm	2 Nos.
23.	File flat smooth	200 mm	2 Nos.
24.	Plier - Flat Nose	150 mm	4 Nos.
25.	Round Nose pliers	100 mm	4 Nos.
26.	Scriber straight	150 mm	2 Nos.

27.	Hammer ball pen	500 grams	1 No.
28.	Allen key set (Hexagonal set of 9)	1 - 12 mm, set of 24 Keys	1 No.
29.	Tubular box spanner	Set - 6 - 32 mm	1 set.
30.	Magnifying lenses	75 mm	2 Nos.
31.	Continuity tester	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 Equipment			
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.	6 1/2 Digit Digital Multimeter	Measurement Functions: DC & AC Voltage, DC&AC Current, 2-wire & 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	1 No.

		readings/sec	
43.	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.	1No.
44.	Laptop latest configuration		12 Nos.
45.	Laser jet Printer		1 No.
46.	Internet Broadband Connection	Minimum 200 Mbps speed	1 No.
47.	Different types of electronic and electrical cables, connectors, sockets, terminations.		As required
48.	Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB		As required
49.	Microcontroller based IoT Gateway	Arduino/ESP-32 based IoT Gateway with following features - 1. Compatible with any cloud platform such as AWS, Azure or Google cloud. 2. It should support analog and digital sensors, actuators and other devices 3. It should support different wireless communication protocols such as Bluetooth, Wi-Fi and LoRa 4. It should also support different Wired communication protocols such as RS 482, UART, I2C, SPI, One-Wire etc.	12 Nos.

		5. It should support Motor Drivers and Controllers for DC Motors, Servo Motors and Stepper Motors, relays, DAC and ADC, Keypad, Camera. 6. It should have separate ports for Keypad, I2C sensors, UART devices, Analog & Digital sensors. 7. Multiple output power options 3.3V, 5V, 12V. 8. Electrical isolation and protection of ports.	
50.	Microprocessor based IoT Gateway	Raspberry Pi based IoT Gateway with following features - 1. Compatible with any cloud platform such as AWS, Azure or Google cloud. 2. It should be compatible with analog and digital type sensors, actuators and other devices. 3. It should support different wireless communication protocols such as Bluetooth, Wi-Fi, RF, Zigbee and LoRa. 4. It should also support different Wired communication protocols such as UART, I2C, SPI, One-Wire, USB etc. 5. It should have integrated on-board Motor Drivers and Controllers for DC Motors, Servo Motors and Stepper Motors, Relays, DAC and ADC, Keypad, Camera. 6. It should have separate ports for Keypad, I2C	12 Nos.

		sensors, UART devices, Analog & Digital sensors, Stepper Motor, DC Motor, On-board Relay, separate port for Analog output, USB, HDMI. 7. Multiple output power options 3.3V, 5V, 12V. 8. Electrical isolation and protection of ports.	
51.	Sensor sets containing the following Sensors – • IR Sensor • Soil Moisture Sensor • LDR Sensor • DHT11 (Temperature & Humidity Sensor) • Raindrop Sensor • Keypad • Servo Motor • LED Module • Buzzer • Relay • Water Pump • DC Motor • Stepper Motor • PH Sensor • TDS Sensor • Carbon Monoxide Sensor • LCD Display • MPU6050 (Accelerometer & Gyro sensor) • RTC Module • PZEM004t (Energy Meter) • GPS Module • Camera • NPK Sensor • Soil PH, Electrical Conductivity, Soil Humidity & Temperature Sensor (4 in 1) • Leaf Wetness Sensor	Compatible with Microcontroller/ Microprocessor based IoT Gateway/ Hardware Platform with specifications as mentioned above, connected to cloud platform and web/ mobile interface	12 Nos.

	• Flow Sensor • Water Level Sensor • Tipping Bucket Rainfall Sensor		
52.	Solar Power Lab	Solar Panel – 50 Watts, Charge Controller – PWM based, Battery – 7 Ah	1 No.
53.	Wireless Communication modules for interfacing with microcontrollers a) RFID Card Reader b) Finger Print c) Zigbee d) GPS e) GSM f) Bluetooth g) WiFi	Compatible with IoT Gateways as mentioned above	2 Nos. each
54.	Cloud-connected IoT Application for Green House	This application should include – 1. CO2 sensor, O2 sensor, Air Temperature and Humidity sensor, Atmospheric Pressure sensor, Soil Moisture Sensor, Solar Radiation sensor and UV Index sensor, Leaf Wetness Sensor, Soil Nutrition Sensor, DC Fan, Lights. 2. A ruggedized industry-level IoT Gateway to interface with the sensors and which can connect with any cloud platform such as AWS, Microsoft Azure or Google cloud. 3. Cloud-based software stack with features as mentioned below in software section.	1 No.
55.	Cloud-connected IoT Application for Weather Monitoring	This application should include – 1. Air Temperature & Humidity sensor, Wind Speed Sensor, Wind Direction Sensor, Rainfall Bucket Sensor, Air	1 No.

		Quality PM 2.5 & PM 10, Atmospheric Pressure Sensor, Solar Radiation & UV Index Sensor. 2. A ruggedized industry-level IoT Gateway to interface with the sensors and which can connect with any cloud platform such as AWS, Microsoft Azure or Google cloud. 3. Cloud-based software stack with features as mentioned below in software section.	
56.	Cloud-connected IoT Application for Hydroponics (Soil-less Farming)	This application should include – 1. Air Temperature & Humidity sensor, pH Sensor, TDS Sensor, Water Pump, DC Fan, Grow Lights, Relays and USB Camera. 2. A ruggedized industry-level IoT Gateway to interface with the sensors and which can connect with any cloud platform such as AWS, Microsoft Azure or Google cloud. 3. Cloud-based software stack with features as mentioned below in software section.	1 No.
57.	Cloud-connected IoT Application for Smart Irrigation	This application should include – 1. Soil Moisture Sensor, Water Pump, Relay. 2. A ruggedized industry-level IoT Gateway to interface with the sensors and which can connect with any cloud platform such as AWS, Microsoft Azure or Google cloud. 3. Cloud-based software stack	1 No.

		with features as mentioned below in software section.	
58.	Cloud-connected IoT Application for Smart Irrigation using LoRa Protocol	This application should include – 1. Soil Moisture Sensor, Water Pump, Relay, LoRa Hub, LoRa Sensor Node, LoRa Switch Node. 2. A ruggedized industry-level IoT Gateway to interface with the sensors and which can connect with any cloud platform such as AWS, Microsoft Azure or Google cloud. 3. Cloud-based software stack with features as mentioned below in software section.	1 No.
59.	Cloud-connected IoT Application for Cowshed Management	This application should include – 1. IR Sensor, Temperature & Humidity Sensor, DC Motor, Servo Motor, DC Fan, RFID Tags & Reader. 2. A ruggedized industry-level IoT Gateway to interface with the sensors and which can connect with any cloud platform such as AWS, Microsoft Azure or Google cloud. 3. Cloud-based software stack with features as mentioned below in software section.	1 No.
60.	Cloud-connected IoT Application for Grain Silo/Warehouse Monitoring	This application should include – 1. Temperature & Humidity Sensor, CO2 Sensor, Dust Sensor, PIR Motion Sensor, Camera. 2. A ruggedized industry-level IoT Gateway to interface with the sensors and which can connect with any cloud	1 No.

		platform such as AWS, Microsoft Azure or Google cloud. 3. Cloud-based software stack with features as mentioned below in software section.	
61.	IoT EDGE Computing Device	IoT Gateway with specifications as above to implement SCADA for real-time monitoring with Gigabit Ethernet, Wi-Fi, Half-duplex RS485 and on-board Relays with integrated 12V power supply using Modbus TCP, Modbus RTU and MQTT	1 No.
C. SOFTWARE TOOLS			
62.	Cloud Platform supporting IoT Services such as MQTT, which can integrate with IoT Gateway	For Data storage, analysis, and remote access. It should support the students to create new IoT applications.	Min 12 Logins
63.	Cloud-Based software for IoT Circuit Designing	Create, modify, and validate circuit designs before implementing them in real-world devices.	Min 12 Logins
64.	Cloud-based software for IoT Block Programming	Development environment to write programs using Block/No Code Programming. Students should be able to download new programs on the IoT Gateway through the internet from this IDE.	Min 12 Logins
65.	Cloud based IDE for Python Programming	Development environment to write python program for IoT applications. Students should be able to download a new program on the IoT Gateway through the internet from this IDE.	Min 12 Logins
66.	Web/Mobile Interface to Manage IoT Application	Students should be able to remotely execute programs in the IoT Gateway to monitor and test the applications data.	Min 12 Logins

D. Shop Floor Furniture and Materials - For 2 (1+1) units no additional items are required.			
67.	Instructor's table		1 No.
68.	Instructor's chair		2 Nos.
69.	Computer Table		24+1 No.
70.	Computer Chair		24+1 No.
71.	Metal Rack	100cm x 150cm x 45cm	4 Nos.
72.	Lockers with 16 drawers standard size		2 Nos.
73.	Steel Almirah	2.5 m x 1.20 m x 0.5 m	2 Nos.
74.	Interactive Smart Board with Projector		1 No.
75.	Fire Extinguisher	Arrange all proper NOCs and equipment's from Municipal/Competent authorities.	

Note:

1. *Internet facility is desired to be provided in the classroom.*
2. *The cloud platform and Cloud-based software stack may be used commonly for all the use cases.*

ANNEXURE-II

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities 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.

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ANNEXURE-III

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


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