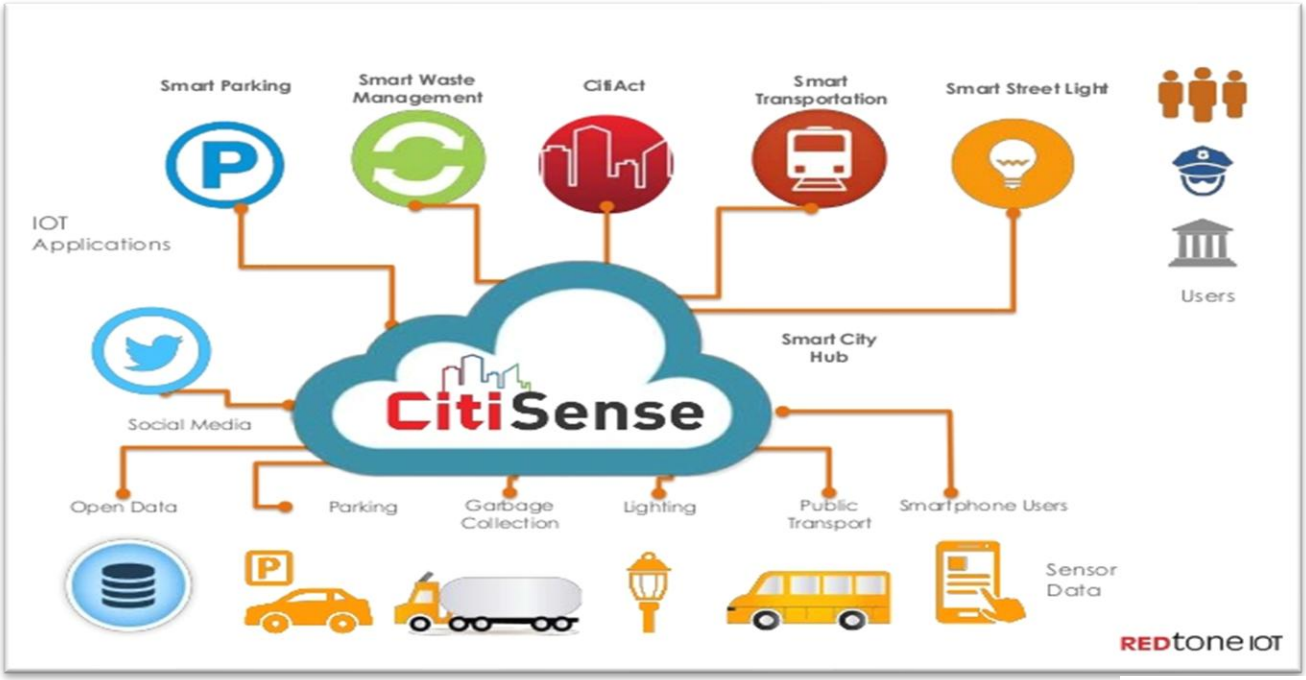
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

IoT TECHNICIAN (SMART CITY)
(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 CITY)
(INTERNET OF THINGS)

(Non-Engineering Trade)

(Revised in August 2025)

Version: 3.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL – 3.5

Developed By

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
Directorate General of Training
Ministry of Skill Development and Entrepreneurship
EN-81, Sector-V, Salt Lake City,
Kolkata – 700 091
www.cstaricalcutta.gov.in

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1. COURSE INFORMATION

During the one-year duration of IoT Technician (Smart City) 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: -

The trainee will understand the concepts and terminology of the Internet of Things (IoT). Learn about components of IoT, IoT applications in smart cities, their distinctive advantages. Interface sensors and actuators to IoT devices and implement different circuits used in smart city applications. Perform checks on IOT kit components as instructed in the kit. 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 trainee will identify different IoT Applications with IoT architecture.

The trainees will identify and check various parts of IoT system as recommended by the manufacturer. They will be able to identify, test and Interconnect components/parts of IOT system. They will learn to identify and select various types of sensors used in Smart City. They will be able to position the appropriate sensors and collect the information required in Smart City. They will identify and select different wireless communication modules and topology to generate and record the data. They will learn to identify and test wireless network component such as Bluetooth module /Wifi.

Trainee will identify different Module/GSM Module/GPS Module. The trainees will identify Solar Panel Basic Testing, Characteristics, Charge Controller Circuit. They will perform monitoring of IOT devices, network, database, app and web services. They will learn to monitor environmental parameters like Temperature, Humidity, Air Quality, PM2.5, PM10, CO2 etc. They will identify, test and troubleshoot different circuits of Smart Street lighting system and its components. They will explore and troubleshoot different circuits used in SMART Parking. They will be able to troubleshoot different circuits used in SMART Traffic. They will learn to apply IoT Application for Water & Waste Management.

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 City) trade under CTS is one of the newly designed courses. The 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) imparts requisite core skill, knowledge and life skills. After passing out the training program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Trainee 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 is 33%.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to 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 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.
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 City); 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 Internet of Things applications in smart city & their distinctive advantages like smart environment, smart streetlight and smart water & waste management. Identifies and tests various parts of embedded system like ESP-32 board/ Raspberry Pi 4B module, sensors and actuators as per requirement for Smart City. Determines air quality and noise pollution by Sensors. Measures & monitors CO2, O2, PM2.5 and PM10 levels using Electrochemical Sensors for pollution control in smart environment. Measures and records Information such as air temperature, wind speed, dew point temperature, wind direction, relative humidity, solar radiation and atmospheric pressure at predetermined intervals by Weather Stations. Applies knowledge of Solar Panel Basics Testing, Characteristics, Charge Controller Circuit etc. to test running different applications i.e. LEDs, Dusk to Dawn sensing etc. 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 by Location Sensors for precise positioning. Identifies, tests and troubleshoots different circuits of Smart Street lighting system and its components to ensure safety and to prevent energy wastage. Makes circuit to interface Microcontroller, microprocessor, LDR/MQ135 pollution sensors and vary brightness of light in accordance with illumination of the light or Fog/Smog environment. Identifies & selects different circuits used in Smart Road & Traffic (Live & Connected roads) to experience quicker, safer and more effective trips. Performs weather monitoring at risky points by Low-cost weather station, Pluviometer. Uses proximity sensor, IR Sensor etc. and troubleshoots different circuits used in Smart Parking (Connected Parking) for better management of car park availability and traffic in the city to improve citizen's life. Applies IoT Application for Smart Water & Waste Management system viz. Detection of rubbish levels in containers to optimize the trash collection routes using Smart Garbage Bin, ultrasonic sensors, Wi-fi module and (IoT Platform) cloud.

Reference NCO-2015:

7422.9900 - Information and Communications Technology Installers and Servicers, Other

Reference NOS:

i. ELE/N9401
ii. SSC/N9563
iii. SSC/N9408
iv. SSC/N9564
v. SSC/N9565
vi. SSC/N9566
vii. SSC/N9444
viii. SSC/N9445
ix. SSC/N9567
x. SSC/N9462
xi. SSC/N9446
xii. SSC/N9447
xiii. SSC/N9448
xiv. SSC/N9449
xv. SSC/N9568
xvi. SSC/N9451
xvii. SSC/N9569
xviii. SSC/N9464
xix. SSC/N9465
xx. SSC/N9466
xxi. SSC/N9467
xxii. SSC/N9468

4. GENERAL INFORMATION

Name of the Trade	**IoT TECHNICIAN (SMART CITY)**
Trade Code	DGT/2007
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/N9464, SSC/N9465, SSC/N9466, SSC/N9467, SSC/N9468
NSQF Level	Level-3.5
Duration of Craftsmen Training	One year
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	
(i) IoT Technician (Smart City) 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** 03 years Diploma in Electronics / Electronics and telecommunication/ Electronics and communication/ Electronics & Instrumentation from AICTE/recognized board of technical education with **two years' of 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 City)" With **three years' of 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 City)" 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.
(ii) 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 City.	35	10	45
15.	SSC/N9447	Interfacing sensors with IoT Gateway and collect sensor data required in Smart City.	35	10	45
16.	SSC/N9448	Identify and test Wired & Wireless communication medium such as RS485, Ethernet, Wi-Fi, GSM/GPRS, RF etc., & Communication protocol.	60	15	75
17.	SSC/N9449	Identify Solar Panel Basic Testing, Characteristics, Charge Controller Circuit.	25	05	30
18.	SSC/N9568	Monitor the working of IOT devices, networks, databases, apps, and web service.	45	15	60
19.	SSC/N9451	Establish and troubleshoot IoT connectivity of devices to the cloud having multiple communication mediums, protocols, device management, and monitoring.	60	15	75
20.	SSC/N9569	Demonstrate configuration and use of web / mobile applications to connect, run and manage IoT applications.	50	10	60
21.	SSC/N9464	Identify & test the Smart Lighting system & its components.	60	15	75
22.	SSC/N9465	Identify, select, install, & troubleshoot different modules/ devices used in SMART Street Light based on IoT & Cloud Technology.	50	10	60
23.	SSC/N9466	Identify, select, install, and troubleshoot different modules/ devices used in SMART Parking.	25	05	30
24.	SSC/N9467	Identify, select, install, and troubleshoot different modules/ devices used in SMART Traffic.	25	05	30
25.	SSC/N9468	Apply IoT Application for water & waste management.	39	06	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. • Identify 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 city viz. smart street light and smart water & waste management. • Recognise the functions of various IoT Technician (Smart City) (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 City. (NOS: SSC/N9447)	• Identify Roles and characteristics of various sensors used in Smart city. • Select appropriate sensor as per requirement. • Determine air quality and use noise pollution Sensors. • Measure PM2.5 and PM10 levels using Electrochemical Sensors. • Measure and record Information such as air temperature, wind speed, dew point temperature, wind direction, relative humidity, solar radiation, rainfall sensor and atmospheric pressure at predetermined intervals by Weather Stations.
15. Interfacing sensors with IoT Gateway and collect sensor data required in Smart City. (NOS: SSC/N9447)	• Identify sensors node block diagram and its components. • Check connection with sensors and send data wirelessly to a cloud. • Configure sensor node using USB and over the air programming.
16. Identify and test Wired & Wireless communication medium such as RS485, Ethernet, Wi-Fi, GSM/ GPRS, RF etc. and Communication protocol. (NOS: SSC/N9448)	• Check the GSM Module and its interconnections. • Basic configuration of wired communication protocols such as SPI, I2C, UART and RS 485. • Basic Network Configuration of Local Area Networks - Ethernet, Wi-Fi. • Basic Configuration of Cellular Wide Area Networks - GSM, GPRS. • Basic Configuration of Personal Area Networks - RF, Zigbee, LoRa.
17. Identify Solar Panel Basic Testing, Characteristics, Charge Controller Circuit. (NOS: SSC/N9449)	• Test series & parallel combination of Solar PV Modules. • Test VI Characteristics of Solar PV Module. • Test blocking diode/ bypass diode and its working in Solar PV Module. • Test Buck & Boost converter. • Test running different applications i.e. LEDs, Dusk to Dawn sensing.

18. Monitor the working of IOT devices, network, database, app and web services. (NOS: SSC/N9568)	• Sensors Node communication and testing. • Check IoT Gateway using WiFi and Ethernet. • Configure IoT Connectivity using GSM/GPRS networks for MODBUS over MQTT in IoT Applications. • Configure IoT Connectivity with cloud platform using HTTP, FTP and CoAP. • Test Cloud and Server Configuration for IoT. • Test IoT Web and Application Development Tools for IoT.
19. 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.
20. 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.
21. Identify and test Smart Lighting system and its components. (NOS: SSC/N9464)	• Rig up circuit to lighting system and measure different parameter such as Voltage, current, Lux using multimeter and Lux Meter. • Test different dimming control methods in lighting system. • Rig up the circuit to interface IoT Gateway, LDR sensor and Light to vary brightness in accordance with illumination of the light.

	• Upload the code to IoT Gateway and test for proper operation. • Test System architecture of smart lighting and identify wiring.
22. Identify, select, install and troubleshoot different module / devices used in SMART Street Light based on IoT and Cloud Technology. (NOS: SSC/N9465)	• Execute testing of sensors used in street light like dusk to dawn, Temperature sensor. • Check solar battery management system. • Apply Smart IoT system that controls the street light based on detection of sunlight.
23. Identify, select, install and troubleshoot different module / devices used in SMART Parking. (NOS: SSC/N9466)	• Install LED display board. • Execute installation of proximity sensor for boom barrier, IR Sensor for presence. • Apply full stack solution to deal with all aspects of parking including high level tools for management and analytics software down to street level occupation sensors and enforcing tools.
24. Identify, select, install and troubleshoot different module / devices used in SMART Traffic. (NOS: SSC/N9467)	• Track and display live location of a vehicle on map. • Select & apply sensors & devices to detect & notify about vehicles at blind spots along the road.
25. Apply IoT Application for Water & Waste Management. (NOS: SSC/N9468)	• Select and install pH, TDS, Conductivity, Temperature for maintenance of water quality. • Install Smart Garbage Bin & GPS based tracking system for smart bin. • Install, test & apply different components like Ultrasonic sensors, Wifi module, (IoT Platform) cloud.

7. TRADE SYLLABUS

SYLLABUS FOR IoT TECHNICIAN (SMART CITY) 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 City 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 skin	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.

		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.	Different types of electrical cables and their Specifications. Types of wires & cables, standard wire gauge (SWG). Classification of cables according to gauge (core size), number of conductors, material, insulation strength, flexibility, etc. 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.	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.

		21. Identify and test the circuit breaker and other protecting 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. Various ports in the computer. Working principle of SMPS, its specification. Operating System : 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 analog 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	6. Demonstrate	40. Identify and demonstrate	Study essential building

Skill 60 Hrs.; Professional Knowledge 15 Hrs.	building & testing application logic using no-code Block Programming Software.	standard frequently used blocks for common actions in block programming software. 41. Practice and demonstrate building simple Python statements, variable creation and use, mathematical 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.	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. 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 microcontroller and test the results.	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.
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	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.

		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 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.	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.
Professional Skill 35 Hrs.; Professional Knowledge 10 Hrs.	14. Identify and select various types of sensors used in Smart City.	65. Identify various sensors used in Smart City. 66. Identify the Roles and characteristics of various sensors. 67. Select the appropriate sensor as per requirement. 68. Determine air quality and use noise pollution Sensors. 69. Measure PM2.5 & PM10 levels using Electrochemical Sensors. 70. Explore sensors used in the weather monitoring system. 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	Principle of operation of various sensors used in Smart city; 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.

		predetermined intervals by Weather Stations.	
Professional Skill 35 Hrs.; Professional Knowledge 10 Hrs.	15. Interfacing sensors with IoT Gateway and collect sensor data required in Smart City.	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 IoT platform. 76. Select and Install sensors like PM2.5, PM10, CO2, O2, 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.	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 PM2.5, PM10, CO2, O2, VOC, 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 60 Hrs.; Professional Knowledge 15 Hrs.	16. Identify and test Wired & Wireless communication medium such as RS485, Ethernet, Wi-Fi, GSM/ GPRS, RF etc. & Communication protocol.	79. Identify the interfacing of the LORA module to create a local sensor network. 80. Explore the interfacing of the GSM module to make the node a gateway. 81. Apply IoT Gateway using WiFi and Ethernet. 82. Check, Ethernet configuration, Wi-Fi AP, & Router interfacing. 83. Identify the Wi-Fi module & Python for data communication. 84. Explore the application of GPS satellites in Location Sensors. 85. Check USB and Ethernet connectivity for data communication. 86. Create a combined sensor	Introduction to wireless personal area network system. Introduction to 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. Creation of a combined sensor appropriate for local climate monitoring. Concept of Weather Stations. Use of signals from GPS satellites to determine

		appropriate for local climate monitoring.	latitude, longitude, and altitude to within feet by Location Sensors for precise positioning. Principle of operation & Application of Global Positioning System (GPS): satellites broadcast signals that allow GPS receivers to calculate their position. Working principle of GPS module for vehicle speed measurement. Use of Computer Hardware & Software to analyze the data collected by GPS & supply it to users in usable format – such as maps, graphs, charts, or reports. Tooth technology, operating modes, Pin configuration. Basics of Wi-Fi modules, PIN configurations, and Modes of operations. Basics of GSM/GPS modules. 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 25 Hrs.; Professional Knowledge 05 Hrs.	17. Identify Solar Panel Basic Testing, Characteristics, Charge Controller Circuit.	87. Explore and test a series combination of Solar PV Modules. 88. Test a parallel combination of Solar PV Modules. 89. Check series-parallel combination of Solar PV	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 modules, the effect of

		Modules. 90. Measure VI Characteristics of Solar PV Module. 91. Explore and test blocking diode and its working in Solar PV Modules. 92. Observe the bypass diode and its working in the Solar PV Module. 93. Measure the effect of the inclination angle of the Solar PV Module. 94. Explore and test different charging techniques. 95. Test Buck & Boost converter. 96. Check the effect of change in solar radiation on the Solar PV Module. 97. Explore the use of PV Analyzer. 98. On Grid Smart Energy Management.	inclination angle on PV module, and different battery charging techniques.
Professional Skill 45 Hrs.; Professional Knowledge 15 Hrs.	18. Monitor the working of IOT devices, networks, databases, apps, and web services.	99. Configure Connect with cloud & server using software utility. 100. Check IoT Gateway using Wi-Fi and Ethernet. 101. Manage directories and files 102. Test Cloud & Server Configuration for IoT. 103. Test IoT Web and Application Development Tools forIoT.	Configuration of cloud & server. 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 60 Hrs.; Professional Knowledge 15 Hrs.	19. Establish and troubleshoot IoT connectivity of devices to the cloud having multiple communication mediums, protocols, device management,	104. Interface to IOT gateway I2C, LORA, UART as per the device manual. 105. Integrate with IOT platform. 106. Set up wired Local Area Network and wireless network. 107. Setup Ethernet IoT Data Acquisition system, connect to the cloud and verify.	Basics of Industrial protocols LORA Hub, I2C, UART Basics of Protocol Converters. Basics of IoT Data Acquisition System. Device connectivity over the cloud & troubleshooting. GUI-based IoT Cloud Configuration utility. IoT

	and monitoring.	108. Set up WiFi IoT Data Acquisition system, connect to the cloud, and verify. 109. Set up Cellular (GSM/GPRS) IoT Data Acquisition system, connect to the cloud & verify. 110. Explore IoT Cloud Configuration process. 111. Create/modify organization and connect devices over the cloud. 112. Configuration of parameters, alarms, and notifications on a cloud platform. 113. Explore user management roles and security.	device and its parameter configuration Cloud Device Management and troubleshooting.
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	20. Demonstrate configuration and use of web / mobile applications to connect, run and manage IoT applications.	114. 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 60 Hrs.; Professional Knowledge 15 Hrs.	21. Identify & test the Smart Lighting system & its components.	115. Rig up the circuit to the lighting system and measure different parameters such as Voltage, current, & Lux using a multimeter & Lux Meter. 116. Test different types of Lighting Systems such as Outdoor, Indoor, Street Light, etc. 117. Check circuits to test and troubleshoot sensor-integrated lighting System. 118. Apply a non-sensor integrated lighting System.	Fundamental science of lighting system. Different types of light Luminaries, Smart Light Drivers. Lumen, Lux, Wattage, etc. Sensor integrated, non-sensor integrated lighting System. Different dimming control methods in lighting systems. Concept of dimming. Basics of interfacing microcontrollers. Need of smart lighting. Schematic diagrams,

		119. Test different dimming control methods in the lighting system. 120. Rig up the circuit to interface the Microcontroller/ Microprocessor, LDR, and Light to vary brightness as per the illumination of the light. 121. Upload the code to the microcontroller/ microprocessor and test for proper operation. 122. Check the Circuit to test and troubleshoot the MQ135 pollution sensor module. 123. Install CCTV Cameras for building security & roadside safety. 124. Rig up the circuit to interface the Microcontroller/ Microprocessor, & MQ135 pollution sensors and vary the brightness of light as per the Fog/Smog environment. 125. Upload the code to the microcontroller/microprocessor and test for proper operation.	datasheets LDR, Motion sensor, MQ135. Components of System architecture of smart lighting. Principle of CCTV Camera and installation process and recording and recovering the data.
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	22. Identify, select, install, & troubleshoot different modules/ devices used in SMART Street Light based on IoT & Cloud Technology.	126. Install, test & troubleshooting of Smart Light. 127. Install & test Solar Street lights. 128. Execute testing of sensors used in street lights like dusk to dawn, Temperature sensors. 129. Check the solar battery management system. 130. Check solar street light	Basic concepts of Smart Light- Working Principle of Solar Street light, sensors used in street lights like dusk to dawn, Temperature sensor. Solar battery management system - Basic concepts of battery, types, preventive maintenance, arrangement of battery, and battery management.

		components. 131. Test LED used on solar street lights. 132. Apply a Smart embedded system that controls the street light based on the detection of sunlight. 133. Monitor Smart streetlight management system having a dashboard and individual system details.	Solar street light components, LED used on the solar street light, A smart embedded system that controls the street light based on the detection of sunlight. Benefits - ensure safety and prevent energy wastage.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	23. Identify, select, install, and troubleshoot different modules/ devices used in SMART Parking.	134. Install LCD display board. 135. Execute installation of proximity sensor for boom barrier, & IR Sensor for presence. 136. Apply full stack solution to deal with all aspects of parking including high-level tools for management and analytics software.	Concept of Smart parking for better management of car park availability & traffic in the city to improve citizen's life - smart parking solution. Connected Parking - LoRa WAN private network for better understanding and better management of car park availability. Use of proximity sensor, and IR Sensor in smart parking. Full stack solution to deal with all aspects of parking.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	24. Identify, select, install, and troubleshoot different modules/ devices used in SMART Traffic.	137. Use Location Sensors, GPS & GPS integrated circuits. 138. Monitor rainfall, temperature & humidity, wind speed and direction using required sensors. 139. Display warning regarding vehicles around blind turns and provide audio alarms using sensors, buzzer and LCD display.	Concept of Smart Road Safety Solution, Live & Connected roads - Benefits - the experience of quicker, safer, and more effective trips. Weather monitoring at risky points: Low-cost weather station (Rainfall, Temperature + Humidity, Wind speed & direction), Pluviometer, Anemometer, Temperature & Humidity.
Professional Skill 39 Hrs.;	25. Apply IoT Application for water & waste	140. Select and install PH, TDS, Conductivity, and Temperature sensors for the	Smart Waste Management system: Definition, Application, working,

Professional Knowledge 06 Hrs.	Management.	maintenance of water quality. 141. Install Smart dustbin using different components like Ultrasonic sensor, IR sensor, Servo Motor etc. 142. Install a GPS-based tracking system for the smart bin to display position on a map. 143. Maintain dry waste and wet waste separately using appropriate sensors.	challenges, constraints, Detection of rubbish levels in containers to optimize the trash collection routes - Concept of Smart Garbage Bin. Maintenance of dry waste and wet waste separately. Different components- Ultrasonic sensors, Wi-fi module.
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 CITY) (For batch of 24 candidates)			
Sl. 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	15Watt, 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 metre	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's			
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)	1 No.

		PC Interface USB Host, USB Device, LAN (LXI-C) Measurement Speed 10k 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.	1 No.
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. 5. It should support Motor Drivers	12 Nos.

		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 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.	12 Nos.

		8. Electrical isolation and protection of ports.	
51.	Sensor sets containing the following Sensors • IR Sensor • LDR sensor • SHT (Dew Measurement sensor) • Flame Sensor • DHT11 (Temperature & Humidity Sensor) • Ultrasonic Sensor • Alcohol Sensor • Raindrop Sensor • Weight Sensor • Keypad • Hall Effect Sensor • Servo Motor • LED Module • Buzzer • Relay • Water Pump • DC Motor • Stepper Motor • PH Sensor • TDS Sensor • Vibration Sensor • Gas Sensor • Sound Sensor • LCD Display • MPU6050 (Accelerometer & Gyro sensor) • RTC Module • PZEM004t (Energy Meter) • GPS Module • Particulate Matter Sensor • USB Camera • Tipping Bucket Rainfall 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.

	• Water Level Sensor • Water Flow Sensor		
C. SOFTWARE TOOLS			
52.	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
53.	Cloud-Based software for IoT Circuit Designing	Create, modify, and validate circuit designs before implementing them in real-world devices.	Min 12 Logins
54.	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
55.	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
56.	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
D. LIST OF THE MACHINERIES			
57.	Solar Power Lab	Solar Panel – 50 Watts, Charge Controller – PWM based, Battery – 7 Ah	1 No.
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	Compatible with IoT Gateways as mentioned above.	2 Nos. each

59.	IoT-based Application for Environment and Air Quality Monitoring	This application should include – 1. CO2 sensor, O2 sensor, Air Temperature and Humidity sensor, Atmospheric Pressure sensor, PM 2.5 and PM 10 sensors, Solar Radiation sensor and 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 above.	1 No.
60.	IoT-based Application for Smart Parking	This application should include – 1. Camera, Motion Sensor, Relays, Hooter/Buzzer, Magnetic Hall Sensor, LCD Display, IR Sensors, Servo Motor. 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 above.	1 No.
61.	Smart Water Management and Monitoring	This application should include – 1. Conductivity Sensor, pH Sensor, TDS Sensor, Level Sensor, Flow Sensor, Ultrasonic 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 as per specifications mentioned above. 3. Cloud-based software stack with	1 No.

		features as mentioned above.	
62.	Smart Waste Management Application	This application should include – 1. Camera, IR Sensor, Servo Motor, Hooter/Buzzer, GPS Sensor, LCD Display, Ultrasonic Sensor. 2. A ruggedized industry-level IoT Gateway to interface with the sensors and which can connect with any cloud platform such as AWS, Azure or Google cloud as per specifications mentioned above. 3. Cloud-based software stack with features as mentioned above.	1 No.
63.	Weather Monitoring System	This application should include – 1. Air Temperature and Humidity Sensor, Wind Speed Sensor, Wind Direction, Solar Radiation, UV Index Sensor, Atmospheric Pressure sensor, Air Quality PM2.5 and PM 10 sensors. 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 as per specifications mentioned above. 3. Cloud-based software stack with features as mentioned above.	1 No.
64.	Smart Solar Street Lighting Training Platform	This application should include – 1. Air Temperature and Humidity Sensor, Air Quality PM2.5 and PM 10 sensors, PIR Sensor, Auto Dimming, Solar Panel: 40 W (01no), Polycrystalline type, Battery: SMF type for rating 12V, 26Ah (01 no), Charge Controller: PWM type LED Light: 10 Watt (01no).	1 No.

		2. A ruggedized industry-level IoT Gateway to interface with the sensors and which can connect with cloud platform such as AWS, Microsoft Azure or Google cloud as per specifications mentioned above. 3. Cloud-based software stack with features as mentioned above.	
65.	IoT based Smart Streetlight System	This application should include – 1. PIR Motion Sensor, LED Lights, LDR Sensor, Auto Dimmer. 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 as per specifications mentioned above. 3. Cloud-based software stack with features as mentioned above.	1 No.
66.	Smart Transportation Monitoring System	This application should include – 1. GPS, GSM/GPRS, Accelerometer, Temperature and Humidity Sensor, PIR Motion Sensor, LED 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 as per specifications mentioned above. 3. Cloud-based software stack with features as mentioned above.	1 No.
67.	Smart Building Application	This application should include – 1. Camera, Motion Sensor, Smoke Detector, Fire Sensor, LPG Gas Sensor, Air Quality, Temperature and Humidity sensor, CO2, LDR	1 No.

		sensor, Hooter/Buzzer, Servo Motor, DC Motor, IR sensor, LED Light. 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 as per specifications mentioned above. 3. Cloud-based software stack with features as mentioned above.	
68.	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.
E. SHOP FLOOR FURNITURE AND MATERIALS			
69.	Instructor's table		1 No.
70.	Instructor's chair		2 Nos.
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 class room.*
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.

LIST OF CONTRIBUTORS			
S No.	**Name & Designation Mr. / Ms.**	**Organization**	**Remarks**
1.	T. Ragulan, Director	CSTARI, Kolkata	Chairman
2.	Sachidananda Javli, Managing Director	Athena Technology Solutions Pvt. Ltd., Bengaluru	Member
3.	Suresh Balepur, Advisory Consultant	Klickstart, Bengaluru	Member
4.	Jayant Pande, Director	Callidus Social Enterprises Pvt. Ltd., Bangalore	Member
5.	C. Murali Krishna, Director	-Do-	Member
6.	Vijay Mallya, Consultant	Vitoria Innoventures (OPC) Pvt. Ltd., Malleshwaram, Bangalore	Member
7.	G. Jaya Kumar, Manager Skill Development	NTTF, Electronics city, Bangalore	Member
8.	Anant Wadohkar, Director	Veritech Infosystems Pvt. Ltd., Bangalore	Member
9.	Kumar Parth	HCL Technologies, Bangalore	Member
10.	L. Parameswaran	Sunware Technologies Pvt. Ltd., Chennai	Member
11.	Mayur Appaiah, Asst. Professor	B.M.S. College of Engg., Bangalore	Member
12.	Bhuwan Sing Damahe, Head	L&T Skill Trainers Academy, Mumbai	Member
13.	Rathina Kumar Balasubhramanian, Lead Consultant	Radiant Consulting Services, Bangalore	Member
14.	Limesh Vijay Mahajan, CEO	Indala Group of Institutions, Kalyan	Member
15.	Makarand Joshi, Solution Manager	Grok Learning Pvt. Ltd., Mumbai	Member

16.	Dr. Pratik Mhatre, Master Trainer and R&D	Grok Learning Pvt. Ltd., Mumbai	Member
17.	Nitin K	Grok Learning Pvt. Ltd., Mumbai	Member
18.	Balagopal Padmakumar, Technical Support	Grok Learning Pvt. Ltd., Mumbai	Member
19.	Himansu Samal, EVP International Business	Grok Learning Pvt. Ltd., Mumbai	Member
20.	Prashant Gulalkari, Sr. Consultant	StanceCode Technology Pvt. Ltd., Pune	Member
21.	Harish Babu, CEO	Mythri Sarva Sava Samithi, Bangalore	Member
22.	Devaraja B.N.	Mythri Sarva Sava Samithi, Bangalore	Member
23.	Murthy N., Program Manager	Mythri Sarva Sava Samithi, Bangalore	Member
24.	Anslem Rosario	Mythri Sarva Sava Samithi, Bangalore	Member
25.	Anup Divakaran, Digital Technician	Bangalore	Member
26.	Dhruba Jyoti Dutta	Digi Toad Technologies	Member
27.	Sunil T. Shambhatnavar	Advanced Electronics Systems & Solutions, Bangalore	Member
28.	Sanjay Ladkhedkar, Director	SMS Engineers & Contractors, Nagpur	Member
29.	P.K Bairagi, TO	CSTARI, Kolkata	Member
30.	B. Biswas, TO	CSTARI, Kolkata	Member
31.	K. V. S. Narayana, TO	CSTARI, Kolkata	Member
32.	Sangeeta Sharma, ADT	CD, DGT, MSDE, New Delhi	Member
33.	Madhu G, H.R.	Athena Technology Solution Pvt. Ltd.	Member
34.	Reema Nandi, associate Manager	Accenture Newtown, Kolkata	Member
35.	Manish Joshi, Country Manager	Siglent Technologies, Indore	Member
36.	Dr. Ashish Jadhav, Professor, Department of IT, RAIT & Head, D Y Patil Innovation Foundation	D Y Patil Deemed to be University, Navi Mumbai, Maharashtra	Member
37.	Vijay Singh Kushwah, Manager	Accura Tequipment, Bangalore	Member
38.	Varun, head of Training and	Accura Tequipment, Bangalore	Member

	Development		
39.	Kumar K, AIOT Researcher	Accura Tequipment, Bangalore	Member
40.	Kafil Ajmeri, Service Manager	Sukshmatark Technologies, Ahmedabad Gujarat	Member
41.	Ishan Parekh, Engineer	Siddhi Industries, Ahmedabad Gujarat	Member
42.	Jagadish Mohan Gaglani, Architect	Wipro Ltd., Bangalore	Member
43.	Arpana Paul, AVP	Vitoria Innoventures, Haritha, Malleswaram	Member
44.	Anil Dhole, Program Director	Tata Technologies, Pune	Member
45.	Goutam Roy, Head Delivery Security	MRGS Infoway, Kolkata	Member
46.	Dr. Yumnam Jayanta Singh, Executive Director	NIELIT, Manipur	Member
47.	Amit Kumar Mandal, Assistant professor	Bengal Institute of technology, Kolkata	Member

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	Loco motor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfism
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities


कौशलं बलम्