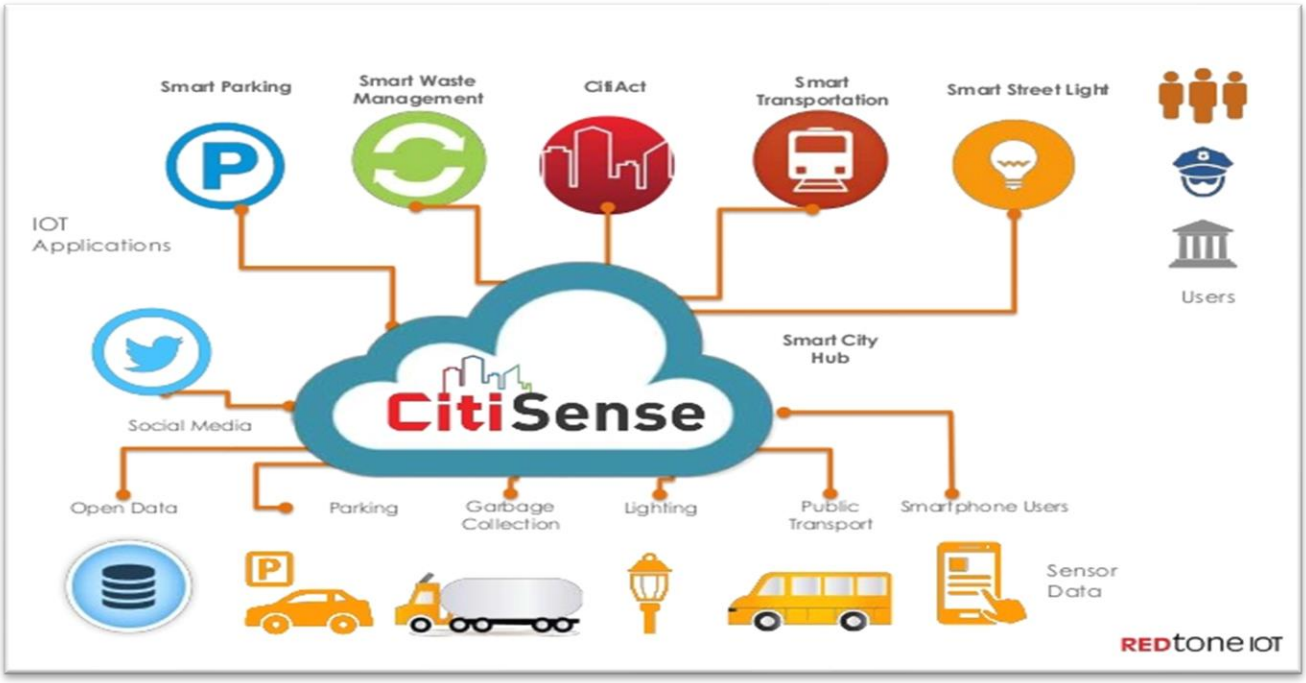
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

**COMPETENCY BASED CURRICULUM**

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

**(Duration: One year)**

## CRAFTSMEN TRAINING SCHEME (CTS)
## NSQF LEVEL- 3.5




## SECTOR –IT & ITES

Directorate General of Training

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

**(Non-Engineering Trade)**

**(Revised in March 2023)**

**Version: 2.0**

## CRAFTSMEN TRAINING SCHEME (CTS)

## NSQF LEVEL – 3.5

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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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 role. In addition to this a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered under Professional skill subject are as below:-

The trainee will select and perform electrical/ electronic measurement of meters and instruments. They will test various electronic components using proper measuring instruments and compare the data using standard parameter. The trainees will be able to Identify, place, solder and de-solder and test different ICs package with due care and following safety norms using proper tools/setup. They will construct, test and verify the input/ output characteristics of various analog circuits. They will also assemble simple electronic power supply circuit and test for functioning and test and troubleshoot various digital circuits. They will install, configure, interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications. Trainees will apply the principle of sensors and transducers for various IoT applications. They can explore the need of different signal conditioning and converter circuits. They will also identify, test and troubleshoot the various families of Microcontroller. Trainees will plan and interface input and output devices to evaluate performance with Microcontroller. The trainee will identify different IoT Applications with IoT architecture.

The trainees will identify and test various parts of embedded system. 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 Module/GSM Module. The trainees will identify Solar Panel Basic Testing, Characteristics, Charge Controller Circuit. They will perform installation, configuration and check working 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 DGTwhich 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** |

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

| | | |
|---|---|---|
| 4 | On the Job Training (OJT)/ Group Project | 150 |
| 5 | Optional Courses (10th/ 12th class certificate along with ITI certification or add on short term courses) | 240 |

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

## 2.4 ASSESSMENT & CERTIFICATION

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

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

b) The final assessment will be in the form of summative assessment. The All India Trade Test for awarding NTCwill be conducted by Controller of examinations, DGT as per the guidelines. The pattern and marking structure are being notified by DGT from time to time. **The learning outcome and assessment criteria will be the basis for setting question papers for final**

**assessment. The examiner during final examination will also check** the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

### 2.4.1 PASS REGULATION

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

### 2.4.2 ASSESSMENT GUIDELINE

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

| Performance Level | Evidence |
|---|---|
| (a) Marks in the range of 60 -75% to be allotted during assessment | |
| For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable | • Demonstration of good skill in the use of hand tools, machine tools and workshop equipment<br>• 60-70% accuracy achieved while undertaking different work with those |

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

## 3. JOB ROLE

**IoT Technician(Smart City)**; tests electronic components and circuits to locate defects, using instruments such as oscilloscopes, signal generators, ammeters and voltmeters. Replaces defective components and performs basic/SMD soldering/de-soldering. Assembles, tests and troubleshoot various digital circuits. Constructs & tests electronic power supply circuit for proper functioning. Install, configure and interconnect different computer systems & networking for different applications. Develop various standard electronic circuits using electronic simulator software. Applies the principle of sensors & transducers for various IoT applications. Plans & interfaces input & output devices to evaluate performance with microcontrollers.

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 Aurduino-Uno board/ Raspberry Pi 3 B module, integrated development platform (IDE), **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, 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, Structural Crack monitoring. 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 &Thingspeak (IoT Platform) cloud.

**Information and Communications Technology Installers and Servicers, Other**; include installers and servicers who install, repair and maintain telecommunications equipment, data

transmission equipment, cables, antennae and conduits and repair, fit and maintain computers not elsewhere classified

**Reference NCO-2015:** 7422.9900

**Reference NOS:**

i. ELE/N9401
ii. ELE/N7001
iii. ELE/N7812
iv. ELE/N5804
v. SSC/N9408
vi. ELE/N1201
vii. SSC/N9445
viii. SSC/N9462
ix. SSC/N9446
x. SSC/N9463
xi. SSC/N9447
xii. SSC/N9448
xiii. SSC/N9449
xiv. SSC/N8239
xv. SSC/N9452
xvi. SSC/N9464
xvii. SSC/N9465
xviii. SSC/N9466
xix. SSC/N9467
xx. SSC/N9468
xxi. SSC/N9444

## 4. GENERAL INFORMATION

| | |
|---|---|
| **Name of the Trade** | **IoT TECHNICIAN (SMART CITY)** |
| **NCO – 2015** | 7422.9900 |
| **NOS covered** | ELE/N9401, ELE/N7001, ELE/N7812, ELE/N5804, SSC/N9408, ELE/N1201, SSC/N9444, SSC/N9445, SSC/N9462, SSC/N9446, SSC/N9463, SSC/N9447, SSC/N9448, SSC/N9449, SSC/N8239, SSC/N9451, SSC/N9452, SSC/N9464, SSC/N9465, SSC/N9466, SSC/N9467, SSC/N9468 |
| **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 forPwD** | 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/Electronics and Instrumentation Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.<br>**OR**<br>Diploma (Minimum 2 years)in Electronics/ Electronics and telecommunication/ Electronics and communication/Electronics and Instrumentation from AICTE/recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.<br>**OR**<br>NTC/NAC passed in the Trade of "IoT Technician (Smart City)" With three years' experience in the relevant field.<br><br>**<u>Essential Qualification:</u>**<br>Relevant Regular / RPL variants of National Craft Instructor Certificate (NCIC) under DGT.<br><br>**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' experience with short term ToT Course in Employability Skills. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above)<br><br>OR<br><br>Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills. |
| **(iii) 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

1. Select and perform electrical/ electronic measurement of meters and instruments following safety precautions. (NOS: ELE/N9401)
2. Test various electronic components using proper measuring instruments and compare the data using standard parameter. (NOS: ELE/N7001)
3. Identify, place, solder and de-solder and test different SMD discrete components and ICs package with due care and following safety norms using proper tools/setup. (NOS: ELE/N7812)
4. Construct, test and verify the input/ output characteristics of various analog circuits. (NOS: ELE/N5804)
5. Assemble, test and troubleshoot various digital circuits. (NOS: ELE/N7812)
6. Install, configure, interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications. (NOS: SSC/N9408)
7. Develop troubleshooting skills in various standard electronic circuits using Electronic circuit design. (NOS: ELE/N1201)
8. Apply the principle of sensors and transducers for various IoT applications. (NOS: SSC/N9444)
9. Identify, select and test different signal conditioning and converter circuits. Check the specifications, connections, configuration, calibration and measurement of various type of sensor inputs as well as control outputs. (NOS: SSC/N9444)
10. Identify, Test and troubleshoot the various families of Microcontroller. (NOS: SSC/N9445)
11. Plan and Interface input and output devices to evaluate performance with Microcontroller. (NOS: SSC/N9445)
12. Identify different IoT Applications with IoT architecture. (NOS: SSC/N9462)
13. Identify, test and interconnect components/parts of IoT system. (NOS: SSC/N9446)
14. Select and interface various types of sensors based on the applications used in Smart City. (NOS: SSC/N9447)
15. Identify and test Wired & Wireless communication medium such as RS232, RS485, Ethernet, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol. (NOS: SSC/N9448)
16. Test Solar Panel and Charge Controller Circuit. (NOS: SSC/N9449)
17. Perform installation, configuration and check working of IoT devices, network, database, app and web services. Monitor environmental parameters like Temperature, Humidity, Air Quality, PM2.5, PM10, CO2 etc. (NOS: SSC/N8239)

18. Establish and troubleshoot IoT connectivity of devices to cloud having multiple communication medium, protocols and networking topology and device management and monitoring. (NOS: SSC/N9451)
19. Demonstrate and Deploy responsive Web Application using APIs and generate reports using templates. (NOS: SSC/N9452)
20. *Identify and test Smart Lighting system and its components. (NOS: SSC/N9464)
21. *Identify, select, install and troubleshoot different module / devices used in SMART Street Light based on IoT and Cloud Technology. (NOS: SSC/N9465)
22. *Identify, select, install and troubleshoot different module / devices used in SMART Parking. (NOS: SSC/N9466)
23. *Identify, select, install and troubleshoot different module / devices used in SMART Traffic. (NOS: SSC/N9467)
24. *Apply IoT Application for Water & Waste Management. (NOS: SSC/N9468)

***Note: * Artificial Intelligence (AI) and Machine Learning approach can be used by using AI enabled devices/Apps/ APIs. This can be achieved with the help of industry.***

## 6. ASSESSMENT CRITERIA

| LEARNING OUTCOMES | ASSESSMENT CRITERIA |
|---|---|
| 1. Select and perform electrical/ electronic measurement 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: ELE/N7001) | 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. Identify, place, solder and de-solder and test different SMD discrete components and ICs package with due care and following safety norms using proper tools/setup. (NOS: ELE/N7812) | Identify the various crimping tools for various IC packages. |
| | Identify different types of soldering guns and choose the suitable tip for the application. |
| | Identify SMD components, de-solder and solder the SMD components on the PCB. |
| | Check the cold continuity, identify loose/dry solder and broken track on printed wired assemblies and rectify the defects. |
| | Avoid waste, ascertain unused materials and components for safe disposal. |
| | |
| 4. Construct, test and verify the input/ output characteristics of various analog circuits. (NOS: ELE/N5804) | Ascertain and select tools and instruments for carrying out the jobs. |
| | Plan and work in compliance with standard safety norms. |
| | Practice on soldering components on lug board with safety. |

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| | Identify the passive /active components by visual appearance, Code number and test for their condition. |
| | Construct and test the transistor based switching circuit |
| | Construct and test CE amplifier circuit |
| | Ascertain the performance of different oscillator circuits. |
| | Construct and test Clipper, Clamper circuit. |
| | |
| 5. Assemble, test and troubleshoot various digital circuits. (NOS: ELE/N7812) | Illustrate to practice the digital trainer kit with safety. |
| | Identify various digital ICs, test IC using digital IC tester and verify the truth table. |
| | Test and verify the truth table of all gates using NOR and NAND gates. |
| | Construct and verify the truth table of various flip flop, counter and shift register circuits. |
| | |
| 6. Install, configure, interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications. (NOS: SSC/N9408) | Plan, work in compliance with standard safety norms. |
| | Select hardware and software component. |
| | Install and configure operating systems and applications. |
| | Integrate IT systems into networks. |
| | Deploy tools and test programmes. |
| | Avoid e-waste and dispose the waste as per the procedure. |
| | |
| 7. Develop troubleshooting skills in various standard electronic circuits using Electronic circuit design. (NOS: ELE/N1201) | Identify & Select the component |
| | Prepare simple digital and electronic circuits using the software. |
| | Convert the circuit into layout diagram. |
| | Follow the instruction manual. |
| | |
| 8. Apply the principle of sensors and transducers for various IoT applications. (NOS: SSC/N9444) | Identify the sensor. |
| | Select the sensor for proper applications. |
| | Check the functioning of the sensor. |
| | Measure the voltage of LVDT. |
| | Measure the voltage output of Thermocouple, Resistance of RTD. |
| | Measure the voltage output of Load Cell/Strain Gauge, Smoke |
| | Follow instruction manual. |
| | |
| 9. Identify, select and test different signal conditioning | Explore different driving circuits used for sensors. |
| | Explore different converters like V/I, I/V, F/V and V/F. |

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| and converter circuits. Check the specifications, connections, configuration, calibration and measurement of various type of sensor inputs as well as control outputs. (NOS: SSC/N9444) | Explore low pass and high pass filter. |
| | Explore analog to digital and digital to analog converter ICs like ADC0808, DAC0808. |
| | Connect and measure AC/DC Analog Input such as voltage / current / RTD two-three-four wire AC mV etc. signals. |
| | Configure Electrical zero/span – mV, 0-10VDC, 4-20mA, 0-20mA |
| | Configure Engineering zero/span – understanding various units and zero span configuration as per sensor datasheet such as temperature, pressure, flow, level, lux level, environment, soil, moisture etc. |
| | Test the Analog Input as per configuration and sensor selection. |
| | Generate 0-10VDC and measure analog outputs to operate control valves and actuators |
| | Connect and measure Digital Inputs of various voltage level such as TTL (0-5V), 24VDC (0-24 VDC) and verify the expected output. |
| | Connect and measure Pulse Inputs of various frequency ranging from 10 Hz to 1 KHz and configure the filters and verify the expected output. |
| | Select, Configure and Connect Digital Outputs and Relay Outputs to take On and Off action for various actuators and verify the expected output. |
| | |
| 10. Identify, Test and troubleshoot the various families of Microcontroller. (NOS: SSC/N9445) | Understand and interpret the procedure as per manual of Micro controller. |
| | 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 entering of simple programs, execute &monitor the results. |
| | |
| 11. Plan and Interface input and output devices to evaluate performance with Microcontroller. (NOS: SSC/N9445) | Use 8051 microcontroller, connect 8 LED to the port, blink the LED with a switch |
| | Use 8051 microcontroller, connect LCD, Relay, Keypad and seven segments |
| | Perform the use of an ADC and DAC to read input voltage and provide output voltage |

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| | Perform the use of RS232 and USB interface with Computer interface. |
| | 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 Arduino board to computer and execute sample programs from the example list. |
| | Write and upload computer code to the physical Arduino board Micro controller to sound buzzer. |
| | Set up & test circuit to interface potentiometer with Arduino board and map to digital values. |
| | Rig up the circuit and upload a program to interface temperature sensor – LM35 with a controller to display temperature on the LCD. |
| | Set up Circuit and upload program to Interface DC motor (actuator) with microcontroller to control on/off/forward/reverse operations. |
| | |
| 14. Select and interface various types of sensors based on the applications 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. |
| | |
| 15. Identify and test Wired & Wireless communication medium such as RS232, RS485, Ethernet, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol. (NOS: SSC/N9448) | Check the blue tooth module along and explore the possibility of pairing with Android Smart Phone. |
| | Check the GSM Module and its interconnections. |
| | Download mobile app from play store and control (ON/OFF) a simple LED via Bluetooth. |
| | Cable selection and Termination for Wired Communication Mediums: Pin Diagram, Cable Core, characteristics and |

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| | specifications, Connector and crimping of various RJ9/RJ11/RJ45 connectors. |
| | Frequency Band, Gain, Antenna and Modulation selection for wireless communication Mediums |
| | Basic Network Configuration of Local Area Networks - Ethernet, Wi-Fi. |
| | |
| 16. Test Solar Panel and Charge Controller Circuit. (NOS: SSC/N9449) | Test 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 |
| | Check Microphone for predictive maintenance of machinery. |
| | Test running different applications i.e. LEDs, Dusk to Dawn sensing |
| | |
| 17. Perform installation, configuration and check working of IoT devices, network, database, app and web services. Monitor environmental parameters like Temperature, Humidity, Air Quality, PM2.5, PM10, $CO_2$ etc. (NOS: SSC/N8239) | Install Linux Operating System porting. |
| | 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. |
| | Manage user access and data security (Cyber security) by Cryptography. |
| | Test Cloud and Server Configuration for IoT. |
| | Select and Install Carbon dioxide sensors, Oxygen sensors, Volatile organic compound sensor etc. as per requirement. |
| | Identify and Install Air temperature, Air humidity atmospheric pressure and UV sensor. |
| | Select and Install PM2.5,PM10, Carbon dioxide, air Quality Sensor. |
| | |
| 18. Establish and troubleshoot IoT connectivity of devices to cloud having multiple communication medium, protocols and networking topology and device | 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 and integrate multiple devices with serial protocol working on RS232 DLMS Server – Client architecture |
| | Configure cellular IoT Connectivity using GSM/GPRS networks |

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| management and monitoring. (NOS: SSC/N9451) | for MODBUS over MQTT in IoT Applications |
| | Select, Configure and ascertain various media converters to convert serial devices to Ethernet, Wi-Fi and GPRS Devices |
| | Select, Configure and ascertain various protocol converters to convert serial as well as networking devices to IoT Devices |
| | 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 |
| | |
| 19. Demonstrate and Deploy responsive Web Application using APIs and generate reports using templates. (NOS: SSC/N9452) | Develop and Deploy web application using ready to use API of IoT platform or architecture |
| | Display and Configure graphs, charts and other ready to use controls and widgets |
| | Generate reports using readily available API, templates and to export it to excel, word pdf and other required formats |
| | |
| 20. 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 Microcontroller, LDR and Light to vary brightness in accordance with illumination of the light. Upload the code to microcontroller and test for proper operation |
| | Test System architecture of smart lighting and identify wiring. |
| | |
| 21. 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. |
| | Install Security camera on street light. |
| | Apply Smart embedded system that controls the street light based on detection of sunlight. |
| | Configure and Communicate 3 Phase Modbus Energy Meter with IoT based Smart Streetlight Controller. |
| | Apply check for Over voltage protection and over current protection |
| | Responsive Web application for Smart streetlight management |

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| | system having with map view based dash board and individual system details |
| | |
| 22. Identify, select, install and troubleshoot different module / devices used in SMART Parking. (NOS: SSC/N9466) | Install LED display board. |
| | Use of ultrasonic and IR. |
| | Execute installation of proximity sensor for boom barrier, IR Sensor for presence. |
| | Apply 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. |
| | |
| 23. Identify, select, install and troubleshoot different module / devices used in SMART Traffic. (NOS: SSC/N9467) | Use scanner for real-time traffic and pedestrian estimation. |
| | Carry out Smartphone Detection (Bluetooth, Wi-Fi, 3G/4G-GPRS etc.). |
| | Apply linear displacement sensor for Structural Crack monitoring. |
| | |
| 24. Apply IoT Application for Water & Waste Management. (NOS: SSC/N9468) | Select and install pH, Cupric (Cu2+), Silver (Ag+), Lithium (Li+), 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. |
| | |

| SYLLABUS FOR IoT TECHNICIAN (SMART CITY) TRADE | | | |
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| **DURATION: ONE YEAR** | | | |
| **Duration** | **Reference Learning Outcome** | **Professional Skills (Trade Practical)** | **Professional Knowledge (Trade Theory)** |
| Professional Skill 30 Hrs.;<br><br>Professional Knowledge 12 Hrs. | Select and perform electrical/ electronic measurement of meters and instruments following safety precautions. | **Trade and Orientation**<br>1. Visit to various sections of the institute and identify location of various installations.<br>2. Identify safety signs for danger, warning, caution & personal safety message.<br>3. Use of personal protective equipment (PPE).<br>4. Practice elementary first aid.<br>5. Preventive measures for electrical accidents & steps to be taken in such accidents.<br>6. Use of Fire extinguishers.<br>7. Identify, Care & maintenance the different Basic hand tools. | Familiarization with the working of Industrial Training Institute system.<br>Introduction to IoT techniques.<br>Explain each block of the IoT block diagram.<br>Brief on opportunities in the applications of IoT.<br>Introduction to Safety and PPEs. |
| | | **Basics of AC and Electrical Cables**<br>8. Identify the single Phase and three phase, Neutral and Earth on power socket, use a tester to monitor AC power.<br>9. Construct a test lamp and use it to check mains healthiness. Measure the voltage between phase and ground and rectify | Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance.<br>Basics of AC & DC.<br>Various terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, Instantaneous value.<br>Single phase and Three phase supply.<br>Different type of electrical cables. |

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| | | earthing.<br>10. Prepare terminations, skin the electrical wires /cables using wire stripper and cutter.<br>11. Measure the gauge of the wire using SWG and outside micrometer.<br>12. Demonstrate various test and measuring instruments<br>13. Measure voltage and current using clamp meter. | |
| Professional Skill 30Hrs.;<br><br>Professional Knowledge 15 Hrs. | Test various electronic components using proper measuring instruments and compare the data using standard parameter. | **Active and Passive Components**<br>14. Identify the different types of active and passive electronic components including SMD.<br>15. Measure the resistor value by colour code, SMD Code and verify the same by measuring with multimeter.<br>16. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources.<br>17. Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law.<br>18. Verify laws of series and parallel circuits with voltage source in different combinations. | Ohm's law. Resistors; types of resistors, their construction & specific use, color-coding, power rating.<br>Equivalent of series circuits.<br>Distribution of V & I in series parallel circuits.<br>Principles of induction, inductive reactance & types.<br>Capacitance and Capacitive Reactance & types.<br><br>Functions of DSO, Regulated power supply multimeter and LCR meter. |

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| | | 19. Identify different inductors and measure the values using LCR meter. Identify the different capacitors and measure capacitance of various capacitors using LCR meter.<br>20. Identify and test the circuit breaker and other protecting devices (Fuse).<br>21. Test Step-up, Step-down, Isolation Transformer.<br>**AC & DC measurements**<br>22. Use the multi meter to measure the various functions (AC V, DC V, DC I, AC I, R).<br>23. Identify the different controls on the Digital Storage Oscilloscope front panel and observe the function of each control.<br>24. Measure DC voltage, AC voltage, time period, sine wave parameters using DSO.<br>25. Identify and use different mathematical functions +, -, X, diff, intg, AND, OR of DSO on the observed signal.<br>26. Identify and use different acquisition modes of normal, average, persistence mode. | |
| Professional Skill 50Hrs.;<br><br>Professional | Identify, place, solder and de-solder and test different SMD discrete components and ICs | **Soldering/ De-soldering**<br>27. Practice soldering on different electronic components, small | Soldering and De-soldering stations and procedure. |

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| Knowledge 12 Hrs. | package with due care and following safety norms using proper tools/setup. | transformer and lugs.<br>28. Practice soldering on IC bases and PCBs.<br>29. Practice de-soldering using pump and wick.<br>30. Check for cold continuity of PCB. | |
| Professional Skill 18 Hrs.;<br><br>Professional Knowledge 10 Hrs. | Construct, test and verify the input/ output characteristics of various analog circuits. (MAPPED NOS: ELE/N5804) | 31. Identify and test different types of diodes, diode modules using multi meter and determine forward to reverse resistance<br>32. Construct and test a transistor based switching circuit to control a relay.<br>33. Construct instrumentation amplifier using OPAMP. | Semiconductor materials, components, number coding for different electronic components such as Diodes and Zeners etc.<br>PN Junction, Forward and Reverse biasing of diodes.<br>Introduction to OPAMP |
| Professional Skill 20Hrs.;<br><br>Professional Knowledge 12 Hrs. | Assemble, test and troubleshoot various digital circuits. | 34. Identify and verify different Logic Gates (AND, OR, NAND, NOR, EX-OR, EX-NOR, NOT ICs) by the number printed on them.<br>35. Identify and test common anode and common cathode seven segment LED display using multi meter. | Introduction to Digital Electronics.<br>Difference between analog and digital signals.<br>Introduction to CMOS techniques<br>(Decimal, binary, octal) understanding of BCD code &<br>-Study on logic gates<br>Combinational logic circuits such as Half Adder, Full adder,<br>Need for multiplexing of data.<br>1:4 line Multiplexer / De-multiplexer.<br>Introduction to Flip-Flop. Data transfer and frequency division.<br>Types of seven segment display.<br>BCD display and BCD to decimal decoder.<br>BCD to 7 segment display circuits. |
| Professional Skill 25Hrs.; | Install, configure, interconnect given computer system(s) | 36. Identify various indicators, cables, connectors and ports on | Basic blocks of a computer, Components of desktop and motherboard. |

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| Professional Knowledge 16 Hrs. | and networking to demonstrate & utilize application packages for different applications. | the computer cabinet.<br>37. Demonstrate various parts of the system unit and motherboard components.<br>38. Identify various computer peripherals and connect it to the system.<br>39. Install antivirus software, printer, scan the system and explore the options in the antivirus software.<br>40. Browse search engines, create email accounts, practice sending and receiving of mails and configuration of email clients.<br>41. Identify different types of cables and network components e.g. Hub, switch, router, modem etc.<br>42. Configure a wireless Wi-Fi network. | Hardware and software, I/O devices, and their working. Various ports in the computer. Working principle of SMPS, its specification.<br>Windows OS<br>MS widows: Starting windows and its operation, file management using explorer, Display & sound properties, screen savers, font management, installation of program, setting and using of control panel., application of accessories, various IT tools and applications.<br><br>Concept of Internet, Browsers, Websites, search engines, email, chatting and messenger service. Downloading the Data and program files etc.<br><br>**Computer Networking:-**<br>Network features - Network medias Network topologies, protocols- TCP/IP, UDP, FTP, models and types. Specification and standards, types of cables, UTP, STP, Coaxial cables. Network components like hub, Ethernet switch, router, NIC Cards, connectors, media and firewall.<br>Difference between PC & Server.<br>WiFi and wireless network |
| Professional Skill 30 Hrs.;<br><br>Professional Knowledge 06 Hrs. | Develop troubleshooting skills in various standard electronic circuits using Electronic circuit design-software. | 43. Prepare simple digital and analog electronic circuits using the software. | Circuit design software.<br>Design of any electronic circuit using the software. |

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| Professional Skill 20 Hrs.;<br><br>Professional Knowledge 06 Hrs. | Apply the principle of sensors and transducers for various IoT applications. | 44. Identify and test RTDs, Temperature ICs and Thermo-couples.<br>45. Identify and test proximity switches (inductive, capacitive and photoelectric).<br>46. Identify and test, load cells, strain gauge, LVDT. | Basics of passive and active transducers.<br>Role, selection and characteristics.<br>Sensor voltage and current formats.<br>Thermistors/ Thermocouples - Basic principle, salient features, operating range, composition, advantages and disadvantages.<br>Strain gauges/ Load cell – principle, gauge factor, types of strain gauges.<br>Inductive/ capacitive transducers - Principle of operation, advantages and disadvantages.<br>Principle of operation of LVDT, advantages and disadvantages.<br>Proximity sensors – applications, working principles of eddy current, capacitive and inductive proximity sensors. |
| Professional Skill 40 Hrs.;<br><br>Professional Knowledge 25 Hrs. | Identify, select and test different signal conditioning and converter circuits.<br>Check the specifications, connections, configuration and measurement of various types of sensor inputs as well as control outputs. | **Integration of Analog sensors**<br>47. Select appropriate Analog sensor.<br>48. Connect & measure AC/DC Analog Input such as voltage / current / RTD two-three-four wire AC mV signal etc.<br>49. Configure Engineering & Electrical zero/span configuration mV, 0-10VDC, 4-20mA, 0-20mA.<br>50. Understand various units and zero span configuration as per sensor datasheet such as temperature, pressure, flow, level, lux level, | Explain circuit diagram with controller and sensor.<br><br>The specification and working of Analog sensor inputs as well as Analog control outputs.<br><br>The specifications and working of Digital sensor inputs, Pulse Input as well as Digital control outputs. |

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| | | environment, soil, moisture etc.<br>51. Measure the Analog Input as per configuration and sensor selection.<br>52. Generate and measure Analog Output to operate control valves and actuators.<br>**Integration of Digital sensors**<br>53. Identify various Digital sensors.<br>54. Identify Roles and Characteristics of each sensor.<br>55. Select appropriate Digital sensor.<br>56. Connect and Measure Digital Inputs of various voltage level such as TTL (0-5V), 24VDC (0-24 VDC) signals.<br>57. Connect Pulse Inputs of various frequency ranging from 10 Hz to 1 KHz and configure the filters.<br>58. Select, Configure and ascertain of Digital Outputs and Relay Outputs to take On and Off action for actuators. | |
| Professional Skill 35 Hrs.;<br><br>Professional Knowledge 12 Hrs. | Identify, Test and troubleshoot the various families of Microcontroller.<br><br>Plan and Interface input and output devices to evaluate | 59. Explore different microprocessor<br>60. Microcontroller and IOT Gate way Raspberry pi, RP 2040 and Arduino.<br>61. Explore the different Software IDE for IoT | Introduction to microprocessor and microcontroller.<br>Difference between microprocessor and microcontroller.<br>Raspberry Pi and RP2040<br>Introduction to ADC and DAC, schematic diagram, features and |

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| | performance with Microcontroller. | applications. | characteristic with the applications. |
| Professional Skill 40 Hrs.;<br><br>Professional Knowledge 12 Hrs. | Identify different IoT Applications with IoT architecture<br><br>Identify, test and interconnect components/parts of IoT system. | 62. Connect and test Arduino with ESP-32 & ESP-8266, RP-2040, Raspberry-pi board to computer and execute sample programs from the example list.<br>63. Upload computer code to the physical board (Microcontroller) to blink a simple LED.<br>64. Write and upload computer code to the physical Arduino board Micro controller to sound buzzer.<br>65. Circuit and program to Interface light sensor – LDR with arduino to switch ON/OFF LED based on light intensity.<br>66. Set up & test circuit to interface potentiometer with Arduino board and map to digital values for e.g. 0-1023.<br>67. Interface Pushbuttons or switches; connect two points in a circuit while pressing them. This turns on the built-in LED on pin 13 in Arduino, while pressing the button.<br>68. Rig up the Circuit and upload a program to Control a relay and switch on/off LED light using Arduino. | Internet of Things detailed explanation and applications in smart city& their distinctive advantages - smart environment, smart street light and smart water & waste management.<br>What is an IOT? What makes embedded system an IOT?<br>Role and scope of IOT in present and future marketplace.<br>Smart objects, Wired – Cables, hubs etc. Wireless – RFID, WiFi, Bluetooth etc.<br>Different functional building blocks of IOT architecture.<br><br>Arduino development board, Pin diagram, Functional diagram, Hardware familiarization and operating instructions.<br><br>Integrated development Environment, Running Programs on IDE, simple Programming concepts. |

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| | | 69. Make Circuit and upload a program to Interface of LCD display with a microcontroller to display characters.<br>70. Rig up the circuit and upload a program to interface temperature sensor – LM35 with a controller to display temperature on the LCD.<br>71. Set up Circuit and upload program to Interface DC motor (actuator) with microcontroller to control on/off/forward/reverse operations.<br>72. Rig up Circuit and upload program micro-controller to switch on/off two lights using relay. | |
| Professional Skill 30 Hrs.;<br><br>Professional Knowledge 06 Hrs. | Select and interface various types of sensors based on the applications used in Smart City. | 73. Identify and select appropriate sensor as per requirement.<br>74. Determine air quality and use noise pollution Sensors.<br>75. Measure PM2.5 and PM10 levels using Electrochemical Sensors.<br>76. Explore sensors used in weather monitoring system.<br>77. Measure air temperature, humidity, atmospheric pressure | Principle of operation of various sensors used in Smart city; their roles and characteristics.<br>Selection of appropriate sensor as per requirement.<br>Use of air quality and noise pollution Sensors.<br>Measurement of PM2.5 and PM10 levels using Electrochemical Sensors for pollution control in smart environment.<br>Explore sensors used in weather monitoring system.<br>Measurement and record of Information such as air temperature, wind speed, dew point temperature, atmospheric |

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| | | | pressure etc. at predetermined intervals by Weather Stations. |
| Professional Skill 60 Hrs.;<br><br>Professional Knowledge 12 Hrs. | Identify and test Wired & Wireless communication medium such as RS232, RS485, Ethernet, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol. | 78. Identify the interfacing of Bluetooth module to create local sensor network.<br>79. Explore the interfacing of GSM module to make node as a gateway.<br>80. Apply IoT Gateway using WiFi and Ethernet.<br>81. Check UART Communication, Communication, I2C Protocol device interfacing SPI Protocol device interfacing, Ethernet configuration, Wi-Fi AP and Router interfacing.<br>82. Test the android phone and its features, use of sensors & usage.<br>83. Check the bluetooth module along and explore the possibility of pairing with Android Smart Phone.<br>84. Test Bluetooth module with a micro controller and Program to switch on/off an LED/Buzzer.<br>85. Check the GSM Module and its interconnections.<br>86. Download mobile app from play store and control (ON/OFF) a simple LED via Bluetooth.<br>87. Test GPS module.<br>88. Check Wifi module. | Introduction to, Block of Zigbee<br>Introduction to Concept of interfacing of Bluetooth module to local sensor network, interfacing of GSM modules and other gateways.<br>IoT Gateway using WiFi and Ethernet.<br>Application of GPS satellites in Location Sensors.<br>Creation of a combine sensor appropriate for local climate monitoring.<br>Concept of Weather Stations. |

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| | | 89. Design and Test Local Area Networks over Ethernet & Wi-Fi. | |
| Professional Skill 30 Hrs.;<br><br>Professional Knowledge 06 Hrs. | Test Solar Panel and Charge Controller | 90. Explore and test series combination of Solar PV Modules.<br>91. Test parallel combination of Solar PV Modules.<br>92. Check series-parallel combination of Solar PV Modules.<br>93. Measure VI Characteristics of Solar PV Module.<br>94. Explore and test blocking diode and its working in Solar PV Module.<br>95. Observe bypass diode and its working in Solar PV Module.<br>96. Measure effect of inclination angle of Solar PV Module.<br>97. Explore and test different charging techniques.<br>98. Test Buck & Boost converter.<br>99. Check effect of change in solar radiation on Solar PV Module.<br>100. Power up the Solar Inverter (similar device) as per the device manual.<br>101. Explore and test running different applications i.e. LEDs, Dusk to Dawn sensing. | 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. |

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| | | 102. Explore the use of P V Analyzer.<br>103. On Grid Smart Energy Management. | |
| Professional Skill 42Hrs.;<br><br>Professional Knowledge 12 Hrs. | Perform installation, configuration and check working of IOT devices, network, database, app and web services.<br><br>Monitor environmental parameters like Temperature, Humidity, Air Quality, PM2.5, PM10, $CO_2$ etc. | 104. Install Linux Operating System porting.<br>105. Configure Local cloud & server.<br>106. Check IoT Gateway using Wi-Fi and Ethernet.<br>107. Work with the command line and the Shell.<br>108. Manage directories and files.<br>109. Test Cloud and Server Configuration for IoT.<br>110. Test IoT Web and Application Development Tools for IoT.<br>111. Select and Install Carbon dioxide sensors.<br>112. Identify and Install Oxygen sensors.<br>113. Identify and Install Air temperature, Air humidity atmospheric pressure<br>114. Select and Install Nitric Oxide (NO), Hydrogen Sulphide, Sulphur Dioxide, Carbon Monoxide, Ozone Soil Moisture and Soil Temperature sensor.<br>115. Demonstrate ultrasonic and IR sensorfor smart parking, PIR for human presence. | IoT gateway with internet and WiFi<br>Installation of Linux Operating System porting.<br>Cloud and Server Configuration for IoT.<br>IoT Web and Application Development Tools for IoT.<br>Principle of operation, selection and installation of Carbon dioxide sensors, Oxygen sensors.<br>Volatile organic compound sensor<br>Selection and Installation of Air temperature, Air humidity and atmospheric pressure, UV sensor, Nitric Oxide (NO),Hydrogen Sulphide, Sulphur Dioxide, Carbon Monoxide, Ozone Soil Moisture and Soil Temperature sensor.<br>Study and test of Magnetic field for smart parking, IR for human presence.<br>Study and test of Hall Effect (doors and windows openings), |

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| Professional Skill 80 Hrs.;<br><br>Professional Knowledge 12 Hrs. | Establish and troubleshoot IoT connectivity of devices to cloud having multiple communication medium, protocols, device management and monitoring. | 116. Integrate Solar Inverter (similar device) with serial protocol working on Modbus RTU.<br>117. Communicate and verify the parameters on Modbus Master Software.<br>118. Power up the Energy Meter (similar device) as per the device manual.<br>119. Communicate and Configure Modbus devices through GSM GPRS network.<br>120. Setup Ethernet IoT Data Acquisition system, connect to cloud and verify.<br>121. Setup WiFiIoT Data Acquisition system, connect to cloud and verify<br>122. Setup Cellular (GSM / GPRS) IoT Data Acquisition system, connect to cloud and verify<br>123. Explore IoT Cloud Configuration utility.<br>124. Create / modify organization, Connect devices over cloud.<br>125. Configuration of parameters, alarms, notifications on cloud platform.<br>126. Explore user management roles and security. | - Basics of Industrial protocols ModbusRTU, ModbusTCP, DLMS<br>- Client server communication<br><br>Basics of Protocol Converters.<br>Basics of IoT Data Acquisition System.<br>Device connectivity over cloud and troubleshooting.<br><br>GUI based IoT Cloud Configuration utility.<br>IoT device and its parameter configuration<br>Cloud Device Management and troubleshooting. |

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| | | 127. Observer Device Diagnostics for troubleshooting. | |
| Professional Skill 70 Hrs.;<br><br>Professional Knowledge 12 Hrs. | Demonstrate and Deploy responsive Web Application using APIs and generate reports using templates. | 128. Explore Web API, required input parameters and output<br>129. Map Web API to Widget / Control / Plugin.<br>130. Display and configure graphs, charts and other ready to use controls and widgets.<br>131. Generate reports using readily available API, templates and to export it to excel, word pdf and other required formats. | Usage of Web Services / Web API Development of Sample Web Application.<br>Generation and export of Reports<br>User access and rights management.<br>IOT Security. |
| Professional Skill 60 Hrs.;<br><br>Professional Knowledge 12 Hrs. | Identify and test Smart Lighting system and its components. | 132. Rig up circuit to lighting system and measure different parameter such as Voltage, current, Lux using multimeter and Lux Meter.<br>133. Test different types of Lighting System such as Outdoor, Indoor, street Light etc.<br>134. Check circuits to test and troubleshoot Sensor integrated lighting System.<br>135. Apply non-sensor integrated lighting System.<br>136. Rig up the circuit to interface Microcontroller, LDR and Light to vary brightness in accordance with illumination of the light. Upload the code to | Fundamental science of lighting system. Different types of light Luminaries, Smart Light Drivers. Lumen, Lux, Wattage etc. Sensor integrated, Non-sensor integrated lighting System.<br>Different dimming control methods in lighting system. Concept of dimming. Basics of interfacing micro controllers. Schematic diagrams, datasheets LDR, Motion sensor, MQ135. Components of System architecture of smart lighting. Principle of CCTV Camera and installation process and recording and recover the data. |

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| | | microcontroller and test for proper operation.<br>137. Check Circuit to test and troubleshoot MQ135 pollution sensor module.<br>138. Install IP based CCTV Camera for building security and roadside safety.<br>139. Rig up the circuit to interface Microcontroller, MQ135 pollution sensors and vary brightness of light in accordance with Fog/Smog environment. Upload the code to microcontroller and test for proper operation.<br>140. Test System architecture of smart lighting and Identify<br>• Wired–DALI, GREENBUS2, etc.<br>• Wireless<br>• Hybrid | |
| Professional Skill 40Hrs.;<br><br>Professional Knowledge 12 Hrs. | Identify, select, install and troubleshoot different module / devices used in SMART Street Light based on IoT and Cloud Technology. | 141. Install, test and troubleshooting of Smart Light.<br>142. Install and test Solarstreet light.<br>143. Execute testing of sensors used in street light like dusk to dawn, Temperature sensor.<br>144. Check solar battery management system.<br>145. Check solar street light components.<br>146. Test LED used on solar street light. | Basic concepts of Smart Light- Working Principle of Solar street light, sensors used in street light like dusk to dawn, Temperature sensor.<br>Solar battery management system - Basic concepts battery, types, preventive maintenance, arrangement of battery and battery management.<br>Solar street light components, LED used on solar street light, Security camera on street light.<br>Smart embedded system that controls the street light based on |

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| | | 147. Install Security camera on street light.<br>148. Apply Smart embedded system that controls the street light based on detection of sunlight.<br>149. Configure and Communicate 3 Phase Modbus Energy Meter with IoT based Smart Streetlight Controller. | detection of sunlight. |
| Professional Skill 30 Hrs.;<br><br>Professional Knowledge 06 Hrs. | Identify, select, install and troubleshoot different module / devices used in SMART Parking. | 150. Install LED display board.<br>151. Use of ultrasonic and IR for smart parking.<br>152. Execute installation of proximity sensor for boom barrier, IR Sensor for presence.<br>153. Apply 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. | Concept of Smart parking<br>- LoRa WAN private network for better understanding and better management of car park availability.<br>Use of proximity sensor, IR Sensor in smart parking. |
| Professional Skill 30 Hrs.;<br><br>Professional Knowledge 06 Hrs. | Identify, select, install and troubleshoot different module / devices used in SMART Traffic. | 154. Understanding navigation app (google map) by using smart phone for real time traffic visibility.<br>155. Carry out Smartphone Detection (Bluetooth, Wifi, 3G/4G-GPRS etc.). | Concept of Smart Road & Traffic, Live & Connected roads - Benefits - experience of quicker, safer and more effective trips. |
| Professional Skill 30 Hrs.;<br><br>Professional Knowledge 06 Hrs. | Apply IoT Application for Water & Waste Management. | 156. Select and install pH, Cupric (Cu2+), Silver (Ag+), Lithium (Li+), Conductivity, Temperature for maintenance of water | Smart Waste Management system: Definition, Application, working, challenges, constraints, Detection of rubbish levels in containers to optimize the trash collection routes - Concept of |

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| | | quality.<br>157. Install Smart dustbin.<br>158. IoT based tracking system for smart bin.<br>159. Maintain dry waste and wet waste separately.<br>160. Install, test & apply different components like Ultrasonic sensors, Wifi module &Thingspeak (IoT Platform) cloud.<br>161. Smart water metering and water level monitoring. | Smart Garbage Bin.<br>Different components- Ultrasonic sensors, Wifi module for any IoT patform for user registration and use (IoT Platform) cloud. |

**Project Work/Industrial Visit (Optional)**

**Broad Area:-**

a) Cloud based water quality analysis system using different sensors on IoT Explore.
b) Wireless Building automation system using PIR, camera and Alarm.
c) Environmental monitoring system using different sensors.
d) Responsive Web based IoT Smart rooftop management system with Over voltage & current protection using 3 phase MODBUS energy meter with class 1.0 accuracy
e) Responsive Web application for Smart Energy management system having map view based dashboard with Three Phase 415 VAC input, 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 Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in/ dgt.gov.in

| List of Tools & Equipment | | | |
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| **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+1 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 meter | 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 | 2Nos. |
| 24. | Plier - Flat Nose | 150 mm | 4 Nos. |
| 25. | Round Nose pliers | 100 mm | 4 Nos. |
| 26. | Scriber straight | 150 mm | 2 Nos. |
| 27. | Hammer ball pen | 500 grams | 1 No. |

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| 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 | |
| 39. | Wire stripper | | 12 Nos. |
| **List of Equipments** | | | |
| 40. | Multiple Output DC regulated power supply | 0-30V, 2 Amps, ± 15V Dual Tracking,5V/5A, Display digital, | 4 Nos. |
| 41. | Regulated Variable DC Power Supply | 0-30V/3A with seven segment LED display | 2 Nos. |
| 42. | LCR meter (Digital) Handheld | | 1 No. |
| 43. | Storage Oscilloscope | 30 MHz | 1 No. |
| 44. | Multi Waveform Signal Generators | 10 MHz | 4 No. |
| 45. | 3GHz Spectrum Analyzer with built-in Tracking Generator | Frequency Range 9 kHz to 3.2 GHz Resolution Bandwidth(-3 dB): 10 Hz to 1 MHz | 1 No. |
| **OR** | **Electronics Workbench** | **Item no. 39, 41, 42, 43, 44 and 45 can be preferred in the form of workbench.** | **1No.** |
| 46. | Multi Function Test & Measuring Tool for Field Applications and Testing compatible with Laptop | 300 MHz Bandwidth 2 Channel Digital Storage Oscilloscopes, Arbitrary Waveform Generator Sine ,Square Triangle AM –FM Modulation | 1No. |
| 47. | 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 | 1No. |

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| | | of MCB and it's working. | |
| 48. | Analog Component Trainer with following Seven Basic Modules<br>• Diode Characteristics (Si,Zener,LED)<br>• Rectifier Circuits<br>• Diode as Clipper Circuit<br>• Diode as Clamping Circuit<br>• Zener as voltage regulator.<br>• Transistor Type NPN & PNP and CE Characteristics<br>• Transistor as a switch | Breadboard for Circuit design DC power supply: +5V,1A (Fixed); +12V, 500mA (Fixed); ±12V, 500mA (Variable)<br>AC power Supply: 9V-0V-9V, 500mA Function Generator: Sine, Square, Triangle<br>Modulating Signal Generator: Sine, Square, Triangle | 1 No. |
| 49. | Digital IC Trainer | Breadboard: Regular DC Supply: +5 V/1 A +12V/1A Clock Frequency 4 different steps from 1Hz – 100KHz Amplitude: Seven Segment Display, Teaching &Learning Simulation Software | 1 No. |
| 50. | IT Workbench for computer hardware and networking | As per Requirement | 1 No. |
| 51. | Laptop latest configuration | | 1 No. |
| 52. | Desktop computer | Latest configuration | 24+1 No. |
| 53. | UPS | 5 KVA | As required |
| 54. | Laser jet Printer | | 1 No. |
| 55. | Internet Broadband Connection | | 1 No. |
| 56. | Electronic circuit simulation software with five user licenses | Circuit Design and Simulation Software with PCB Design with Gerber and G Code Generation, 3D View of PCB, Breadboard View, Fault Creation and Simulation. | 1 No. |
| 57. | Different types of electronic and electrical cables, connectors, sockets, terminations. | | As required |
| 58. | Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB | | As required |

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| 59. | SMD Soldering & De soldering Station with necessary accessories | SMD Soldering &Desoldering Station Digitally Calibrated Temperature Control SMD Soldering &Desoldering<br>Power Consumption: 60 Watts<br>De-soldering : 70 Watt<br>Power Consumption : 270 Watts<br>Hot Air Temperature : 200 to 550º Centigrade | 1 No. |
| 60. | SMD Technology Kit | SMD component identification board with SMD components Resistors, Capacitors, Inductors, Diodes, Transistors & IC's packages. Proto boards with readymade solder pads for various SMD Components. SMD Soldering Jig. | 1 No. |
| 61. | Arduino and Raspberry-pi based IoT system with cloud access, accessories, analog and digital ports, support for stepper motor, servo motors, UART port for serial data communication and separate port for I2C | Arduino, Raspberry-pi and RP 2040 based IoT system with all accessories sensors and cloud access minimum 10 sensors | 12 Nos. |
| 62. | Sensor Trainer kit with sensor Containing following Sensors<br>a) Air humidity and Temperature<br>b) RTD<br>c) Atmospheric Pressure<br>d) Air Quality<br>e) Smoke Detector Sensors<br>f) Limit Switch<br>g) Photo sensors<br>h) Capacitive displacement | Interfacing all listed sensors and test their working status | 2 Nos. |
| 63. | Different types of electronic and electrical cables, connectors, sockets, terminations. | | As required |
| 64. | Internet of Things Explorer | System with attached and database modules for sensors, controllers, gateway and application control facility | 1 No. |

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| 65. | Field Interface and Protocol Simulation Kit | A console including :Any Branded Desktop Computer with Windows Operating System<br>1. Ethernet Devices with Isolated Supply and port<br>▪ 4 AI(0.1% FSR), 4 AO<br>▪ Ethernet Port – Qty 1<br>▪ 8 Relay Outputs, Ethernet Port – Qty 1<br>▪ 8 Pulse Outputs, Ethernet Port – Qty 1<br>▪ 8 Digital Inputs, Ethernet Port – Qty 1<br>▪ 4 RS485 Slave ports, 1 Ethernet Port – Qty 4<br>2. 16 Port Ethernet Switch for networking of field ethernet devices<br>3. SMPS to power up multiple ethernet based field simulation devices<br>4. Required Connectors, Switches and LED indicators for Field Interface circuits such as Digital Inputs, Relay Outputs, Analog Inputs, Analog Outputs, Pulse Signals<br>5. Software<br>▪ Communication with simulation device on ethernet MODBUS TCP Protocol<br>▪ Field Interface simulation using HMI replica of Console for easy understanding of students<br>▪ Port Simulation – Serial Port Terminal, TCP/IP, UDP, HTTP<br>▪ Protocol Simulation – MODBUS RTU Master/Slave, MODBUS TCP Master/Slave, | 1 No. |
| **LIST OF THE MACHINERIES** | | | |

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| 66. | Solar Power Lab | Solar PV Modules.<br>Open Circuit Voltage Voc 10V, Short Circuit Current Isc.60m A<br>Maximum Power Voltage (Vmp) 8.80V, Maximum Power Current (Imp): 0.57A, Batteries, Voltage 6V, 4Ah. Buck & Boost Converter, Dusk to Dawn Sensing, LCD for Voltage and Current. Interactive Solar Training Software | 12 Nos. |
| 67. | Solar PV Module Analyzer | Micro-controller Based with 16X2 LCD, PC Interface, mains & battery operated. Capable to measure Open Circuit Voltage and Short Circuit Current, Maximum Voltage and Current at Maximum Power<br>DCV Range 0-50V, DCA Range 10A | 12 Nos. |
| 68. | Wireless Communication modules for interfacing with microcontrollers<br><br>a) RFID Card Reader<br>b) Finger Print<br>c) GPS<br>d) GSM<br>e) Bluetooth<br>f) WiFi | programmable controller supporting both programming modes Key Pad and PC ,LCD for both programming mode and run mode, ready to run programmer to support family of controllers Breadboard to make circuits, detailed learning content through simulation Software and following application modules: RFID Card Reader,Finger Print, GPS, GSM, Bluetooth and WiFi | 1 No. |
| 69. | Sensors for Smart Parking | All should be compatible with Sensor Training Platform & IOT Explorer mentioned above:<br>CCTV Camera , Motion Sensor, RFID, Relays, Hooter, Magnetic Hall Sensor, Ultrasonic, Application Software for SMART Dashboard | 12 Nos. |
| 70. | Sensors for Smart Water & Waste water Management & Monitoring | All should be compatible with Sensor Training Platform & IOT Explorer mentioned above:<br><br>Conductivity Sensor, PH Sensor<br>Cupric (Cu2+), Silver (Ag+), Lithium | 12 Nos. |

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| | | (Li+) with 10, 100 and 1000 ppm solution calibration kit. Level Sensor, Flow Sensor, Ultrasonic Sensor & Temperature. | |
| 71. | Weather Monitoring System | Temperature Range : -10°C to 90°C, Relative Humidity Operating Range 0 to 95% ,Wind Speed Sensor Speed : 0 to 20m/S Resolution 1m/S ,Wind Direction, Rainfall Bucket collector, Solar Radiation, UV Index, Atmospheric Pressure, Air Quality PM2.5, GSM based cloud connectivity, Application Software for Dashboard for remote monitoring and analysis. Solar panel for 240 W | 12 Nos. |
| 72. | Smart Solar Street Lighting Training Platform | Microcontroller based Wireless connectivity using WiFi The system should come with following Sensors Temperature, Humidity, Air Quality, PIR, and Auto diming Street light 10W | 12 Nos. |
| 73. | IoT based Smart Streetlight System | 1. IoT based Smart Streetlight Controller with Three Phase 415 VAC input, Single RS485 Communication Port, 4 Digital Inputs for Door sensors as well as contactor feedback, 3 Relay outputs for switching of streetlight circuits, Local Ethernet connectivity, SD Card Storage, Remote GSM/GPRS connectivity using Quad Band GSM/GPRS Module<br>2. Overvoltage protection<br>3. Over current protection<br>4. Three phase MODBUS energy meter with class 1.0 accuracy and IS13779 certification<br>5. SMC box with IP65 and IK10 ratings | 12 Nos. |

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| | | Responsive Web application for Smart streetlight management system having with map view based dash board and individual system details | |
| 74. | Smart Transportation Monitoring System | Processor : 32 Bit, Modem : Quad-Band 850/900/1800/1900MHz GPS Frequency : 1575.45 MHZ Built in Sensors : Temperature, humidity, Accelerometer, Speed tracker. | 12 Nos. |
| 75. | Sensors for Smart Building | All should be compatible with Sensor Training Platform & IOT Explorer mentioned above:<br><br>CCTV Camera , Motion Sensor<br>RFID, Smoke, Fire, LPG Gas, Air Quality, Ambient Temperature & Humidity, $CO_2$, Light, Relays, Hooter, Touch Panel | 12 Nos. |
| 76. | IoT Data Acquisition Systems & Protocol Converters | Connectivity to Cloud (IBM, Microsoft, Amazon)<br>8 Digital Inputs, 4 Relay Outputs<br>Ethernet IOT DAQ, WiFiIoT DAQ, Cellular (GSM / GPRS) IoT DAQ<br>MODBUS RTU to MODBUS TCP 24 VDC Isolated Power Supply, 4 Isolated MODBUS RTU Master Port<br>Serial to Ethernet, Serial to Wi-Fi, Serial to GPRS | 12 Nos. |
| 77. | IoT EDGE Computing Device | Embedded SCADA for 50 Tags | 1 No. |
| 78. | Cloud Based IoT SCADA | 100 Tag License for Cloud based SCADA to connect IoT Devices and IoT based Smart Systems with Device Manager, IO Server, Alarm Server, Historian and Reporter, Web Server. Cloud Hosting Services for 20 devices for 7 years | 1 No. |
| 79. | Arduino Board with accessories | Arduino Moule - latest specifications | As required |
| 80. | Raspberry-pi Board with accessories | Raspberry Pi Module - latest | As |

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| | | specifications | required |
| **D. Shop Floor Furniture and Materials** - For 2 (1+1) units no additional items are required. | | | |
| 81. | Instructor's table | | 1 No. |
| 82. | Instructor's chair | | 2 Nos. |
| 83. | Computer Table | | 24+1 Nos. |
| 84. | Computer Chair | | 24+1 Nos. |
| 85. | Metal Rack | 100cm x 150cm x 45cm | 4 Nos. |
| 86. | Lockers with 16 drawers standard size | | 2 Nos. |
| 87. | Steel Almirah | 2.5 m x 1.20 m x 0.5 m | 2 Nos. |
| 88. | Interactive Smart Board with Projector | | 1 No. |
| 89. | Fire Extinguisher | Arrange all proper NOCs and equipments from Municipal/Competent authorities. | |
| ***Note:***<br>*1. Internet facility is desired to be provided in the class room.* | | | |

## 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 Expert Members participated/ contributed for finalizing the course curriculum of IoT Technician (Smart City) trade held on 16.03.2023 at Bengaluru.** | | | |
|---|---|---|---|
| **S No.** | **Name & Designation** | **Organization** | **Remarks** |
| 1. | Shri. B.N. Sridhar | Regional Director<br>RDSDE, Bengaluru | Chairman |
| 2. | Ms. Naina Nagpal | Assistant Director<br>NSTI (W), Bengaluru | Co-ordinator |
| 3. | Shri. V.Babu | Principal/ Deputy Director<br>NSTI (W), Bengaluru | Member |
| 4. | Shri M.J. Vijaya Raju | Assistant Director<br>CSTARI, Kolkata | Co-ordinator |
| 5. | Shri. B.K. Nigam | Training Officer<br>CSTARI, Kolkata | Member |
| 6. | Shri P.K. Bairagi | Training Officer<br>CSTARI, Kolkata | Member |
| 7. | Ms. Pooja Singh | Training Officer<br>NSTI, Bengaluru | Member |
| 8. | Shri. Rohit Prajapathi | Technical Director<br>Digito AD Technologies<br>Bengaluru | Member |
| 9. | Shri N. Ramesh | Taining Assistant Manager<br>BOSCH | Member |
| 10. | Girish. H | Engg. Head Phantan<br>BOSCH | Member |

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|---|---|---|---|
| 11. | Shri Lohit. M.V | Technology and Innovation Head<br>SIEMENS | Member |
| 12. | Shri Kondinya S.R | Technology and Innovation AI/ML<br>SIEMENS | Member |
| 13. | Shri S.Janardhanam | Training Officer<br>NSTI, Chennai | Member |
| 14. | Shri N.P. Bannibagi | Deputy Director<br>NIMI, Chennai | Member |
| 15. | Shri D.Subhashree | Deputy Director<br>RDSDE, Bengaluru | Member |
| 16. | Shri Nitin S Komawar | CEO, GROK Learning Pvt. Ltd. | Member |
| 17. | Shri Brajesh Sing | E.D, GROK Learning Pvt. Ltd. | Member |
| 18. | Shri R. Malathi | Training Officer,<br>NSTI (W), Bengaluru | Member |
| 19. | Shri Rajeswari | Vocational Instructor,<br>NSTI (W), Bengaluru | Member |
| 20. | Shri Basavaraj | Training Officer,<br>NSTI (W), Bengaluru | Member |
| 21. | Shri Navaneeth Ganesh | MGNF, Bengaluru Urban | Member |
| 22. | Shri Dinesh K.P | NASSCOM, Bengaluru | Member |
| 23. | Shri Darshak Upadhyaya | Bengaluru | Member |
| 24. | Shri Vijay Singh Kushwah | Manager,<br>3V Technix Pvt. Ltd. Hyderabad | Member |
| 25. | Shri G.Jayakumar | Manager, NTTF, Bengaluru | Member |
| 26. | Shri George Jacob | CEO, Semicon Design Tech.<br>Benguluru | Member |
| 27. | Shri N. Srikanth | Iobit Solutions<br>Benguluru | Member |
| 28. | Shri G.N. Eswarappa | Ex. JDT, CSTARI, Kolkata | Member |
| 29. | Dr. A.Phani Ratna | Director, Nano Ram Technologies | Member |

## ABBREVIATIONS

| | |
|---|---|
| CTS | Craftsmen Training Scheme |
| ATS | Apprenticeship Training Scheme |
| CITS | Craft Instructor Training Scheme |
| DGT | Directorate General of Training |
| MSDE | Ministry of Skill Development and Entrepreneurship |
| NTC | National Trade Certificate |
| NAC | National Apprenticeship Certificate |
| NCIC | National Craft Instructor Certificate |
| LD | 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