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

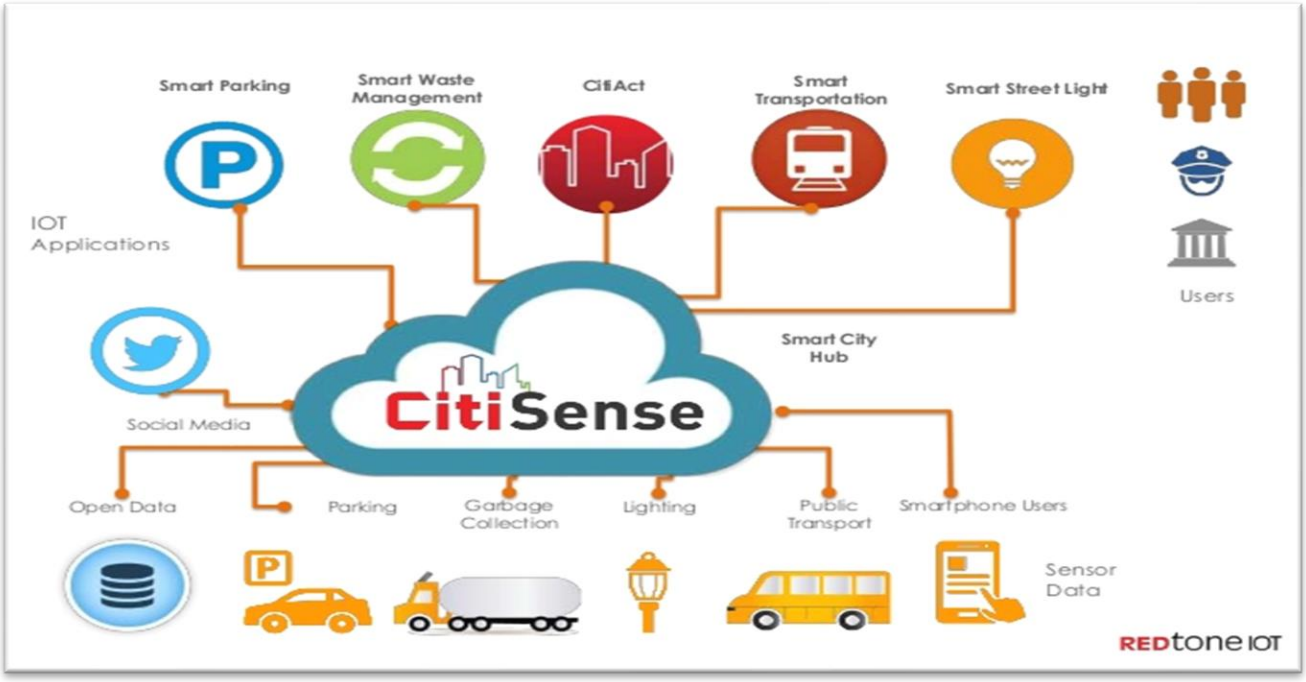
COMPETENCY BASED CURRICULUM

IoT TECHNICIAN (SMART CITY)
(INTERNET OF THINGS)

(Duration: One year)
Revised in July 2022

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 3



SECTOR –IT & ITES

Directorate General of Training

IoT TECHNICIAN (SMART CITY)
(INTERNET OF THINGS)

(Non-Engineering Trade)

(Revised in July2022)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 3

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 skillrelated 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 SMD discrete components and 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. They will develop troubleshooting skills in various standard electronic circuits using electronic simulation software. 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/GPS 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 variantsand 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 designedcourses. 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:

SNo.	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

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 standard of craftsmanship.	• 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/set standards. • A fairly good level of neatness and consistency in the finish • 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 • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A good level of neatness and consistency in the finish • 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 • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • 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)** toexperience 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 **SmartWater & 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.

Reference NCO-2015: NIL (To be prepared)

Reference NOS: -- ELE/N9401, ELE/N7001, ELE/N7812, ELE/N5804, ELE/N7812, 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

4. GENERAL INFORMATION

Name of the Trade	**IoT TECHNICIAN (SMART CITY)**
Trade Code	DGT/2007
NCO – 2015	-
NOS covered	ELE/N9401, ELE/N7001, ELE/N7812, ELE/N5804, ELE/N7812, 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
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. **OR** Diploma (Minimum 2 years)in Electronics/ Electronics and telecommunication/ Electronics and communication/Electronics and Instrumentation from AICTE/recognized board of technical education or relevantAdvanced Diploma (Vocational) from DGTwith two years' experience in the relevant field. **OR** NTC/NAC passed in the Trade of "IoT Technician (Smart City)" With three years' experience in the relevant field.

	<u>Essential Qualification:</u> Relevant Regular / RPL variants of National Craft Instructor Certificate (NCIC) 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' experience with short term ToT Course in Employability Skills. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) OR Existing Social Studies Instructors in ITIs withshort 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 OUTCOME

1. Select electrical/ electronic measurement by selecting of single range with 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 simulation software. (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 and measurement of various types 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. Identify and test various parts of embedded system. (NOS: SSC/N9463)
15. Identify and select various types of sensors used in Smart City. (NOS: SSC/N9447)
16. Position the appropriate sensors and collect the information required in Smart City. (NOS: SSC/N9447)
17. Identify and test Wired & Wireless communication medium such as RS232, RS485, Ethernet, Fiber Optic, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol. (NOS: SSC/N9448)

18. Identify Solar Panel Basic Testing, Characteristics, Charge Controller Circuit. (NOS: SSC/N9449)
19. 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)
20. Establish and troubleshoot IoT connectivity of devices to cloud having multiple communication medium, protocols, device management and monitoring. (NOS: SSC/N9451)
21. Demonstrate and Deploy responsive Web Application using APIs and generate reports using templates. (NOS: SSC/N9452)
22. Identify and test Smart Lighting system and its components. (NOS: SSC/N9464)
23. Identify, select, install and troubleshoot different module / devices used in SMART Street Light based on IoT and Cloud Technology. (NOS: SSC/N9465)
24. Identify, select, install and troubleshoot different module / devices used in SMART Parking. (NOS: SSC/N9466)
25. Identify, select, install and troubleshoot different module / devices used in SMART Traffic. (NOS: SSC/N9467)
26. Apply IoT Application for Water & Waste Management. (NOS: SSC/N9468)

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.
	Practice the soldering and de-soldering the different active and passive components, IC base on GPCBs using solder, flux, pump and wick.
	Make the necessary setting on SMD soldering station to solder and de-solder various IC's of different packages by following the safety norms.
	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.
	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.
	Test a decoder and encoder, multiplexer and de-multiplexer circuits and verify the truth table.
	Test a multiplexer and de-multiplexer and verify the truth table.
	Construct and verify the truth table of various flip flop, counter and shift register circuits.
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 simulation	Identify & Select the component
	Prepare simple digital and electronic circuits using the software.
	Test the simulation circuit.
	Convert the circuit into layout diagram.

software. (NOS: ELE/N1201)	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
	Test Digital Output of Speed Sensor,Limit Switch, Optocoupler, Photo and Proximity Sensor
	Follow instruction manual.
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)	Explore different driving circuits used for sensors.
	Explore different converters like V/I, I/V, F/V and V/F.
	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
	Perform the use of RS232 and USB interface with Computer interface.
	Demonstrate entering of simple programs, execute & monitor the results.
12. Identifydifferent 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. Identify and test various parts of embedded system. (NOS: SSC/N9463)	Test main heart of embedded system / micro controller and micro controller hardware board /Hardware platform of an embedded system such as Arduino-Uno.
	Test sensors and actuators such as LDR, temperature sensors, potentiometers, piezo element, servo, relay and push buttons, LED, Tri colour LED.
	Rig up the circuit to test Light dependent resistor to switch ON/OFF based light intensity.
	Rig up a test circuit to display 0-9 Numbers on 7 segment display.
	Rig up the test circuit to control the relay.
	Connect the test circuit to sound the Buzzer.
	Connect and test the motion sensor along with light /Buzzer /Streetlight.
	Set up a test circuit to test IR sensor/ rain sensor/ ultrasonic sensor.
15. 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 and atmospheric pressure at predetermined intervals by Weather Stations.
16. Position the appropriate sensors and collect the	Identify sensors node block diagram and its components.
	Check connection with sensors and send data wirelessly to a

information required in Smart City. (NOS: SSC/N9447)	central data logger at program.
	Configure sensor node using USB and over the air programming.
	Check the battery level and solar panel connection with sensor node.
	Control Variable rate controllers manually or automatically using an on-board computer guided by real GPS location.
17. Identify and test Wired & Wireless communication medium such as RS232, RS485, Ethernet, Fiber Optic, 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.
	Test Wi-fi& GPS module.
	Cable selection and Termination for Wired Communication Mediums: Pin Diagram, Cable Core, characteristics and 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,
	Basic Configuration of Cellular Wide Area Networks - GSM, GPRS
	Basic Configuration of Personal Area Networks - RF, Zigbee
18. Identify Solar Panel Basic Testing, Characteristics, 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
19. Perform installation, configuration and check	Install Linux Operating System porting.
	Configure Local cloud & server & Over the air (OTA) node.

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)	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.
	Test Qt based GUI, IoT Web and Application Development Tools 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.
	Measure Hall Effect (doors and windows openings), Water presence, Liquid flow, Temperature, Humidity for smart security.
	Test Calibration Kits for the sensor probes for water quality analysis.
20. 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)	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 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
	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
21. 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
22. 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.
23. 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 system having with map view based dash board and individual system details

24. Identify, select, install and troubleshoot different module / devices used in SMART Parking. (NOS: SSC/N9466)	Install LED display board.
	Test Magnetic field for smart parking.
	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.
25. Identify, select, install and troubleshoot different module / devices used in SMART Traffic. (NOS: SSC/N9467)	Apply Solar panel, Antenna & Radio Technology.
	Use scanner for real-time traffic and pedestrian estimation.
	Carry out Smartphone Detection (Bluetooth, Wi-Fi, 3G/4G-GPRS etc.).
	Detect liquid presence over road by Liquid presence sensor for Smart Security.
	Apply linear displacement sensor for Structural Crack monitoring.
26. 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.

7. TRADE SYLLABUS

SYLLABUS FORIoT TECHNICIAN (SMART CITY) TRADE			
DURATION: ONE YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 30Hrs.; Professional Knowledge 12 Hrs.	Select and perform electrical/ electronic measurement of meters and instruments following safety precautions. (MAPPED NOS: ELE/N9401)	**Trade and Orientation** 1. Visit to various sections of the institute and identify location of various installations. (02hrs.) 2. Identify safety signs for danger, warning, caution & personal safety message. (02hrs.) 3. Use of personal protective equipment (PPE). (03hrs.) 4. Practice elementary first aid. (02hrs.) 5. Preventive measures for electrical accidents & steps to be taken in such accidents. (03 hrs.) 6. Use of Fire extinguishers. (02hrs.)	Familiarization with the working of 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. (06 hrs.)

		7. Identify, Care & maintenance the different Basic hand tools. (4 hrs.)	
		Basics of AC and Electrical Cables 8. Identify the Phase, Neutral and Earth on power socket, use a tester to monitor AC power. (02hrs.) 9. Construct a test lamp and use it to check mains healthiness. Measure the voltage between phase and ground and rectify earthing. (02hrs.) 10. Prepare terminations, skin the electrical wires /cables using wire stripper and cutter. (02hrs.) 11. Measure the gauge of the wire using SWG and outside micrometer. (02hrs.) 12. Demonstrate various test and measuring instruments (02hrs.) 13. Measure voltage	Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC. Various terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, Instantaneous value. Single phase and Three phase supply. Different type 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. (06hrs.)

		and current using clamp meter. (02hrs.)	
Professional Skill 30Hrs.; Professional Knowledge 12 Hrs.	Test various electronic components using proper measuring instruments and compare the data using standard parameter. (MAPPED NOS: ELE/N7001)	**Active and Passive Components** 14. Identify the different types of active and passive electronic components. (02 hrs.) 15. Measure the resistor value by colour code, SMD Code and verify the same by measuring with multimeter. (02 hrs.) 16. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources. (02hrs.) 17. Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law. (02hrs.) 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. 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 and applications. Dielectric constant. Significance of Series parallel connection of capacitors. Properties of magnets and their materials, preparation of artificial magnets, significance of electro Magnetism, types of cores. Relays, types, construction and specifications etc. Multi meter, use of meters in different circuits. Use of DSO, Function generator, Arbitrary Waveform Generator, LCR meter (12 hrs.)

		(02hrs.) 19. Identify different inductors and measure the values using LCR meter.Identify the different capacitors and measure capacitance of various capacitors using LCR meter. (03 hrs.) 20. Identify and test the circuit breaker and other protecting devices (Fuse). (03 hrs.) 21. Test Step-up, Step-down, Isolation Transformer. (02hrs.) **AC & DC measurements** 22. Use the multi meter to measure the various functions (AC V, DC V, DC I, AC I, R). (02 hrs.) 23. Identify the different controls on the Digital Storage Oscilloscope front panel and observe the function of each control. (02hrs.)	

		24. Measure DC voltage, AC voltage, time period, sine wave parameters using DSO. (02 hrs.) 25. Identify and use different mathematical functions +,-,X, diff, intg, AND, OR of DSO on the observed signal. (03 hrs.) 26. Identify and use different acquisition modes of normal, average, persistence mode. (03 hrs.)	
Professional Skill 50Hrs.; Professional Knowledge 12 Hrs.	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. (MAPPED NOS: ELE/N7812)	**Soldering/ De-soldering** 27. Practice soldering on different electronic components, small transformer and lugs. (03 hrs.) 28. Practice soldering on IC bases and PCBs. (03 hrs.) 29. Practice Soldering on various SMD Components including SMD IC packages. (04hrs.) 30. Practice de-soldering using pump and wick. (02	Different types of soldering guns, related to Temperature and wattages, types of tips. Solder materials and their grading. Use of flux and other materials. Selection of soldering gun for specific requirement. Soldering and De-soldering stations and their specifications. Different switches, their specification and usage. Introduction to SMD technology Identification of 2, 3, 4 terminal SMD components. Advantages of SMD components over conventional lead components. Introduction to Surface Mount Technology (SMT). Advantages, Surface Mount components and packages. Cold/ Continuity check of PCBs. Identification of lose / dry solders, broken tracks on printed wiring assemblies.

		hrs.) 31. Practice Desoldering of SMD Components using SMD Hot Air Gun. (03 hrs.) 32. Join the broken PCB track and test. (03 hrs.) **Basic SMD (2, 3, 4 terminal components** 33. Identification of 2, 3, 4 terminal SMD components. De-solder the SMD components from the given PCB. (05hrs.) 34. Solder the SMD components in the same PCB. Check for cold continuity of PCB. (05 hrs.) 35. Identification of loose /dry solder, broken tracks on printed wired assemblies. (04hrs.) **SMD Soldering and De-soldering** 36. Identify various connections and setup required for SMD Soldering station. (05hrs.) 37. Identify crimping tools for various IC	(12 hrs.)

		packages. (03hrs.) 38. Make the necessary settings on SMD soldering station to de-solder various ICs of different packages (at least four) by choosing proper crimping tools (03hrs.) 39. Make the necessary settings on SMD soldering station to solder various ICs of different packages (at least four) by choosing proper crimping tools (03hrs.) 40. Make the necessary setting rework of defective surface mount component used soldering / de-soldering method. (04hrs.)	
Professional Skill 18Hrs.; Professional Knowledge 06 Hrs.	Construct, test and verify the input/ output characteristics of various analog circuits. (MAPPED NOS: ELE/N5804)	41. Identify and test different types of diodes, diode modules using multi meter and determine forward to reverse resistance ratio. Compare it with specifications.	Semiconductor materials, components, number coding for different electronic components such as Diodes and Zeners etc. PN Junction, Forward and Reverse biasing of diodes. Interpretation of diode specifications. Forward current and Reverse voltage. Working principle of a Transformer, construction, Specifications and types of cores used. Step-up, Step down and isolation transformers

		(03hrs.) 42. Measure the voltage and current through a diode in a circuit and verify its forward/Reverse characteristic. (02hrs.) 43. Construct and test a half wave, full wave and Bridge rectifier circuit. (03hrs.) 44. Identify and test Zener diode and construct peak clipper. (02hrs.) 45. Identify different types of transistors and test them using digital multimeter. (02hrs.) 46. Measure and plot input and output characteristics of a CE amplifier. (03hrs.) 47. Construct and test a transistorbased switching circuit to control a relay. (03hrs.)	with applications. Losses in Transformers. Phase angle, phase relations, active and reactive power, power factor and its importance. Construction, working of a PNP and NPN Transistors, purpose of E, B & C Terminals. Significance of α, β and relationship of a Transistor. Transistor applications as switch and CEamplifier. Transistor input and output characteristics. Transistor power ratings & packaging styles and use of different heat sinks.(06hrs.)
Professional Skill 17Hrs.; Professional Knowledge 12 Hrs.	Assemble, test and troubleshoot various digital circuits. (MAPPED NOS: ELE/N7812)	48. Identify different Logic Gates (AND, OR, NAND, NOR, EX-OR, EX-NOR, NOT ICs) by the number printed on	Introduction to Digital Electronics. Difference between analog and digital signals. Logic families and their comparison, logic levels of TTL and CMOS. Number systems (Decimal, binary, octal, Hexadecimal).

		them. (02hrs.) 49. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. (02hrs.) 50. Use digital IC tester to test the various digital ICs (TTL and CMOS). (03hrs.) 51. Construct and Test a 2 to 4 Decoder. (02hrs.) 52. Construct and Test a 4 to 2 Encoder. (02hrs.) 53. Construct and Test a 4 to 1 Multiplexer. (02hrs.) 54. Construct and Test a 1 to 4 De Multiplexer. (02hrs.) 55. Identify and test common anode and common cathode seven segment LED display using multi meter. (02hrs.)	BCD code, ASCII code and code conversions. Various Logic Gates and their truth tables. Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders, 2-bit and four bit full adders. Magnitude comparators. Half adder, full adder ICs and their applications for implementing arithmetic operations. Concept of encoder and decoder. Basic Binary Decoder and four bit binary decoders. Need for multiplexing of data. 1:4 line Multiplexer / De-multiplexer. Introduction to Flip-Flop. S-R Latch, Gated S-R Latch, D- Latch. Flip-Flop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop. Master-Slave flip flops and Timing diagrams. Basic flip flop applications like data storage, data transfer and frequency division. Types of seven segment display. BCD display and BCD to decimal decoder. BCD to 7 segment display circuits. Basics of Register, types and application of Registers. (12 hrs.)
Professional Skill 24Hrs.; Professional Knowledge 12 Hrs.	Install, configure, interconnect given computer system(s) and networking to demonstrate &	56. Identify various indicators, cables, connectors and ports on the computer cabinet. (02hrs.)	Basic blocks of a computer, Components of desktop and motherboard. Hardware and software, I/O devices, and their working. Different types of printers, HDD, DVD. Various ports in the computer.

	utilize application packages for different applications. (MAPPED NOS: SSC/N9408)	57. Demonstrate various parts of the system unit and motherboard components. (03hrs.) 58. Identify various computer peripherals and connect it to the system. (02hrs.) 59. Install antivirus software, printer, scan the system and explore the options in the antivirus software. (04 hrs.) 60. Browse search engines, create email accounts, practice sending and receiving of mails and configuration of email clients. (04 hrs.) 61. Identify different types of cables and network components e.g. Hub, switch, router, modem etc. (04hrs.) 62. Configure a wireless Wi-Fi network. (03 hrs.)	Working principle of SMPS, its specification. Windows OS MS widows: Starting windows and its operation, file management using explorer, Display & sound properties, screen savers, font management, installation of program, setting and using of control panel., application of accessories, various IT tools and applications. Concept of Internet, Browsers, Websites, search engines, email, chatting and messenger service. Downloading the Data and program files etc. **Computer Networking:-** 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. Difference between PC & Server. (12 hrs.)
Professional	Develop	63. Prepare simple	Study the library components available in the

Skill 30 Hrs.; Professional Knowledge 06 Hrs.	troubleshooting skills in various standard electronic circuits using Electronic simulation software. (MAPPED NOS: ELE/N1201)	digital and electronic circuits using the software. (06 hrs.) 64. Simulate and test the prepared digital and analog circuits. (06 hrs.) 65. Create fault in particular component and simulate the circuit for it's performance. (06 hrs.) 66. Convert the prepared circuit into a layout diagram. (06 hrs.) 67. Prepare simple, power electronic and domestic electronic circuit using simulation software. (06 hrs.)	circuit simulation software. Various resources of the software. (06 hrs.)
Professional Skill 17Hrs.; Professional Knowledge 06 Hrs.	Apply the principle of sensors and transducers for various IoT applications. (MAPPED NOS: SSC/N9444)	68. Identify and test RTDs, Temperature ICs and Thermo couples. (03hrs.) 69. Identify and test proximity switches (inductive, capacitive and photoelectric). (04hrs.) 70. Identify and test, load cells, strain	Basics of passive and active transducers. Role, selection and characteristics. Sensor voltage and current formats. Thermistors/ Thermocouples - Basic principle, salient features, operating range, composition, advantages and disadvantages. Strain gauges/ Load cell – principle, gauge factor, types of strain gauges. Inductive/ capacitive transducers - Principle of operation, advantages and disadvantages. Principle of operation of LVDT, advantages and disadvantages. Proximity sensors – applications, working

		gauge, LVDT, PT 100 (platinum resistance sensor). (04hrs.) 71. Detect different objectives using capacitive, Inductive and photo electric proximity sensors. (06 hours)	principles of eddy current, capacitive and inductive proximity sensors.(06 hrs.)
Professional Skill 32Hrs.; Professional Knowledge 18 Hrs.	Identify, select and test different signal conditioning and converter circuits. Check the specifications, connections, configuration and measurement of various types of sensor inputs as well as control outputs. (MAPPED NOS: SSC/N9444)	**Integration of Analog sensors** 72. Identify various Analog sensors. (02 hrs.) 73. Identify Roles and Characteristics of each sensor. (02 hrs.) 74. Select appropriate Analog sensor. (02 hrs.) 75. Connect & measure AC/DC Analog Input such as voltage / current / RTD two-three-four wire AC mV signal etc. (02 hrs.) 76. Configure Engineering & Electrical zero/span configuration mV, 0-10VDC, 4-20mA, 0-20mA. (02 hrs.)	Working principle of different types of control circuits and their applications for sensors. Principle of operation of signal generator, distinguish between voltage and power amplifier. Working principle of different converters. Demonstrate different types of filter circuits and their applications. The specification and working of Analog sensor inputs as well as Analog control outputs. The specifications and working of Digital sensor inputs, Pulse Input as well as Digital control outputs. (18hrs.)

		77. Understand various units and zero span configuration as per sensor datasheet such as temperature, pressure, flow, level, lux level, environment, soil, moisture etc. (02 hrs.) 78. Measure the Analog Input as per configuration and sensor selection. (02 hrs.) 79. Generate and measure Analog Output to operate control valves and actuators. (02 hrs.) **Integration of Digital sensors** 80. Identify various Digital sensors.(02 hrs.) 81. Identify Roles and Characteristics of each sensor.(02 hrs.) 82. Select appropriate Digital sensor. (03hrs.) 83. Connect and Measure Digital Inputs of various voltage level such	

		as TTL (0-5V), 24VDC (0-24 VDC) signals. (03hrs.) 84. Connect Pulse Inputs of various frequency ranging from 10 Hz to 1 KHz and configure the filters. (03hrs.) 85. Select, Configure and ascertain of Digital Outputs and Relay Outputs to take On and Off action for actuators. (03hrs.)	
Professional Skill 30 Hrs.; Professional Knowledge 12 Hrs.	Identify, Test and troubleshoot the various families of Microcontroller. (MAPPED NOS: SSC/N9445) Plan and Interface input and output devices to evaluate performance with Microcontroller. (MAPPED NOS: SSC/N9445)	86. Explore different microcontroller families' architecture like 8051, AVR, PIC, ARM, Raspberry pi and Arduino. (06 hrs.) 87. Explore the different Software IDE used for microcontroller. (06 hrs.) 88. Explore ICs & their functions on the given Microcontroller Kit. (06 hrs.) 89. Identify the port pins of the controller & configure the	IntroductionMicroprocessor&8051Microcontroller, architecture, pin details & the bus system. Function of different ICs used in the Microcontroller Kit. Differentiate microcontroller with microprocessor. Interfacing of memory to the microcontroller. Internal hardware resources of microcontroller. I/O port pin configuration. Different variants of 8051 & their resources. Register banks & their functioning. SFRs & their configuration for different applications. Comparative study of 8051 with 8052. Introduction to PIC Architecture. Introduction to ADC and DAC, schematic diagram, features and characteristic with the applications. (12 hrs.)

		ports for Input & Output operation. (06 hrs.) 90. Explore Universal IC programmer to program burn output file on different ICs. (06 hrs.)	
Professional Skill 30 Hrs.; Professional Knowledge 12 Hrs.	Identify different IoT Applications with IoT architecture. (MAPPED NOS: SSC/N9462) Identify, test and interconnect components/parts of IoT system. (MAPPED NOS: SSC/N9446)	91. Connect and test Arduino board to computer and execute sample programs from the example list. (04hrs.) 92. Upload computer code to the physical board (Microcontroller) to blink a simple LED. (02hrs.)	Introduction to Internet of Things applications in smart city& their distinctive advantages - smart environment, smart street light and smart water & waste management. What is an IOT? What makes embedded system an IOT? Role and scope of IOT in present and future marketplace. Smart objects, Wired – Cables, hubs etc. Wireless – RFID, WiFi, Bluetooth etc. Different functional building blocks of IOT architecture. (06 hrs.)
		93. Write and upload computer code to the physical Arduino board Micro controller to sound buzzer. (02hrs.) 94. Circuit and program to Interface light sensor – LDR with arduino to switch ON/OFF LED based on light intensity. (03hrs.) 95. Set up & test	Arduino development board, Pin diagram, Functional diagram, Hardware familiarization and operating instructions. Integrated development Environment, Running Programs on IDE, simple Programming concepts.(10 Hours) (06 hrs.)

		circuit to interface potentiometer with Arduino board and map to digital values for e.g. 0-1023. (03hrs.) 96. 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. (03hrs.) 97. Rig up the Circuit and upload a program to Control a relay and switch on/off LED light using Arduino. (02hrs.) 98. Make Circuit and upload a program to Interface of LCD display with a microcontroller to display characters. (03hrs.) 99. Rig up the circuit and upload a program to interface temperature sensor – LM35	

		with a controller to display temperature on the LCD. (02hrs.) 100. Set up Circuit and upload program to Interface DC motor (actuator) with microcontroller to control on/off/forward/reverse operations. (03hrs.) 101. Rig up Circuit and upload program micro-controller to switch on/off two lights using relay. (03hrs.)	
Professional Skill 50Hrs.; Professional Knowledge 12Hrs.	Identify and test various parts of embedded system. (MAPPED NOS: SSC/N9463)	102. Test main heart of embedded system / micro controller and micro controller hardware board /Hardware platform of an embedded system such as Arduino-Uno. (04 hrs.) 103. Power up Arduino Uno board, and test its Analog, Digital and I/O pins. (03 hrs.) 104. Test and explore sensors and actuators such as	Fundamental idea of embedded system – with architecture and familiarization with different components. Aurduino-Uno board - simplest Boards such STM, NXP development board etc. Basics of development boards, Arduino Uno board its needs, hardware familiarization, pin diagram Other available development boards. Concept of integrated development platform (IDE), Its components and Serial Monitor. Concepts behind sensing light, temperature, Motion and other physical parameters. Familiarization with the Sensors/Actuators such as Light dependent resistor, LM35 temperature Sensors, 7 Segment display, 16x2 LCD display, Relays, DC motors (Actuators), Switches, buzzer

		LDR, temperature sensors, potentiometers, piezo-element, servo, relay and push buttons, LED, Tri colour LED. (04hrs.) 105. Download and install Arduino Software IDE in computer system. (03 hrs.) 106. Test and familiarize with different components of Arduino IDE/Sketch. (04 hrs.) 107. Rig up the circuit to test Light dependent resistor to switch ON/OFF based light intensity. (04hrs.) 108. Rig up a test circuit to display 0-9 Numbers on 7 segment display. (04hrs.) 109. Rig up test circuit to control the backlight 16x2 character display. (03 hrs.) 110. Rig up the test	and motion sensors, Gas Sensors(MQ2 sensor), rain sensor, IR/Obstacle/Proximity sensor, Ultrasonic/Distance measurement Sensors. Pin diagram / connection / Schematic diagrams /Functional Diagram of these Components. (12 hrs.)

		circuit to control the relay. (03hrs.) 111. Rig up the test circuit to control DC motor in Forward/Reverse operations using DPDT switch.(02hrs.) 112. Connect the test circuit to sound the Buzzer. (02 hrs.) 113. Connect and test the motion sensor along with light /Buzzer /Streetlight and also test for timer and area of motion detection. (03hrs.) 114. Set up a test circuit to test IR sensor. (04hrs.) 115. Set up test circuit to test rain sensor. (05hrs.) 116. Set up test circuit to test ultrasonic sensors. (05hrs.)	
Professional Skill 30 Hrs.; Professional Knowledge 06 Hrs.	Identify and select various types of sensors used in Smart City. (MAPPED NOS: SSC/N9447)	117. Identify various sensors used in Smart city. (03hrs.) 118. Identify Roles and characteristics of various sensors. (04hrs.)	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

		119. Select appropriate sensor as per requirement. (03hrs.) 120. Determine air quality and use noise pollution Sensors. (05hrs.) 121. Measure PM2.5 and PM10 levels using Electrochemical Sensors. (04hrs.) 122. Explore sensors used in weather monitoring system.(03hrs.) 123. Measure air temperature, humidity, atmospheric pressure and solar radiation. (04hrs.) 124. Measure and record Information such as air temperature, wind speed, dew point temperature, wind direction, relative humidity, solar radiation and atmospheric pressure at predetermined intervals by Weather	smart environment. Explore sensors used in weather monitoring system. Measurement and record of Information such as air temperature, wind speed, dew point temperature, atmospheric pressure etc. at predetermined intervals by Weather Stations. (06 hrs.)

		Stations. (04 hrs.)	
Professional Skill 30 Hrs.; Professional Knowledge 06 Hrs.	Position the appropriate sensors and collect the information required in Smart City. (MAPPED NOS: SSC/N9447)	125. Identify sensors node block diagram and its components. (05 hrs.) 126. Check connection with sensors and send data wirelessly to a central data logger at program.(05 hrs.) 127. Identify interfacing of wireless modules with IoT platform.(02 hrs.) 128. Select and Install sensors like NO2, PM2.5, PM10, CO2, O2, air temperature, humidity etc.(05 hrs.) 129. Configure sensor node using USB and over the air programming. (05 hrs.) 130. Check the battery level and solar panel connection with sensor node. (03 hrs.) 131. Control Variable rate controllers manually or automatically	Concept of sensor node blocks diagram and its components. Connection with sensors to send data wirelessly to a central data logger at program. Explore interfacing of wireless modules with IoT platform. Selection and Installation of sensors like NO2, 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 solar panel connects with sensor node. Control Variable rate controllers manually or automatically using an on-board computer guided by real GPS location. (06 hrs.)

		using an on-board computer guided by real GPS location. (05 hrs.)	
Professional Skill 60 Hrs.; Professional Knowledge 12 Hrs.	Identify and test Wired & Wireless communication medium such as RS232, RS485, Ethernet, Fiber Optic, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol. (MAPPED NOS: SSC/N9448)	132. Explore the interfacing of Zigbee module to create wireless sensor network. (02hrs.) 133. Check the M2M Wireless Sensor Network (WSN) in IoTZigbee router, end device and coordinator configuration. (02hrs.) 134. Identify the interfacing of Bluetooth module to create local sensor network. (02hrs.) 135. Explore the interfacing of GSM module to make node as a gateway. (02hrs.) 136. Apply IoT Gateway using WiFi and Ethernet. (02hrs.) 137. Check UART Communication, RS485 Communication,I2C Protocol device interfacing SPI	Introduction to Zigbee, Block diagram of Zigbee based sensor network. Introduction to wireless personal area network system. Introduction to Zigbee networking system. Concept of interfacing of Bluetooth module to local sensor network, interfacing of GSM module to make node as a gateway. IoT Gateway using WiFi and Ethernet. Application of GPS satellites in Location Sensors. Creation of a combine sensor appropriate for local climate monitoring. Concept of Weather Stations. Usage of signals from GPS satellites to determine latitude, longitude and altitude to within feet by Location Sensors for precise positioning. Principle of operation &Application of Global Positioning System (GPS): satellites broadcasting signals that allow GPS receivers to calculate their position. Working principle & Use of Geographical information system(GIS) consisting of a computer software data base system used to input, store, retrieve, analyze and display in map like form, spatially referenced geographical information for more detailed analysis of fields. Working principal of GPS module for vehicle speed measurement. Data Integration Through a Geographical Information System. Use of Computer Hardware and Software to analyze the data collected by GPS and supply it to

		Protocol device interfacing, Ethernet configuration, Zigbee interfacing, Wi-Fi AP and Router interfacing. (02hrs.) 138. Identify the Wi-Fi module and lua script for data communication. (02 hrs.) 139. Explore the application of GPS satellites in Location Sensors. (02 hrs.) 140. Check USB and Ethernet connectivity for data communication. (02 hrs.) 141. Create a combine sensor appropriate for local climatemonitoring . (02hrs.) 142. Use signals from GPS satellites to determine latitude, longitude and altitude to within feet by Location Sensors for precise positioning.	user in usable format – such as maps, graphs, charts or reports.Toothtechnology, operating modes, Pin configuration. Basics of Wi-fi Modules, Pin configurations, 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

		(02hrs.) 143. Operate Global Positioning System (GPS) & Apply satellites broadcasting signals that allow GPS receivers to calculate their position. (02hrs.) 144. Analyze the Vehicle Speed using Tacking system. (01 hr) 145. Use Geographical information system(GIS) consisting of a computer software data base system used to input, store, retrieve, analyze and display in map like form, spatially referenced geographical information for more detailed analysis of city roads, transport, traffic etc. (02hrs.) 146. Analyze the data collected by GPS and supply it to user in usable format such as maps, graphs,	

		charts or reports using suitable Computer Hardware and Software. (02hrs.) 147. Test the android phone and its features, use of sensors & usage. (02hrs.) 148. Check the blue tooth module along and explore the possibility of pairing with Android Smart Phone. (02hrs.) 149. Test Bluetooth module with a micro controller and Program to switch on/off an LED/Buzzer. (02hrs.) 150. Check the GSM Module and its interconnections. (02hrs.) 151. Download mobile app from play store and control (ON/OFF) a simple LED via Bluetooth. (02hrs.) 152. Test GPS module. (02hrs.) 153. Check Wifi module. (02hrs.)	

		154. Identify Cable and its Pin Mapping (02hrs.) 155. Crimp and Test RJ9 / RJ11 / RJ45 connectors (02hrs.) 156. Understand Frequency Band, Gain, Antenna and Modulation for Wi-Fi. (02hrs.) 157. Understand Frequency Band, Gain, Antenna and Modulation for GPRS. (02hrs.) 158. Understand Frequency Band, Gain, Antenna and Modulation for RF. (02hrs.) 159. Design and Test Local Area Networks over Ethernet & Wi-Fi. (03hrs.) 160. Design and Test Cellular Wide Area Networks over GSM & GPRS. (02hrs.) 161. Design and Test Personal Area Networks over RF.(02hrs.)	
Professional Skill 30 Hrs.;	Identify Solar Panel Basic	162. Explore and test series combination	Basics of solar Electricity, Working principle of PV panel, advantages of solar electricity and

Professional Knowledge 06 Hrs.	Testing, Characteristics, Charge Controller Circuit. (MAPPED NOS: SSC/N9449)	of Solar PV Modules. (02 hrs.) 163. Test parallel combination of Solar PV Modules. (02 hrs.) 164. Check series-parallel combination of Solar PV Modules. (02 hrs.) 165. Measure VI Characteristics of Solar PV Module. (02 hrs.) 166. Explore and test blocking diode and its working in Solar PV Module. (02 hrs.) 167. Observe bypass diode and its working in Solar PV Module. (04 hrs.) 168. Measure effect of inclination angle of Solar PV Module. (02 hrs.) 169. Explore and test different charging techniques. (02 hrs.) 170. Test Buck & Boost converter. (02 hrs.) 171. Check effect of change in solar	components of solar electricity, Various combinations, VI characteristics of solar PV module, effect of inclination angle on PV module, different battery charging techniques. (06 hrs.)

		radiation on Solar PV Module. (02 hrs.) 172. Explore and test running different applications i.e. LEDs, Dusk to Dawn sensing. (04 hrs.) 173. Explore the use of P V Analyzer. (02 hrs.) 174. On Grid Smart Energy Management. (02 hrs.)	
Professional Skill 42Hrs.; Professional Knowledge 12 Hrs.	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. (MAPPED NOS: SSC/N8239)	175. Install Linux Operating System porting. (02hrs.) 176. Configure Local cloud & server. (02hrs.) 177. Configure Over the air (OTA) node. (02hrs.) 178. Explore GUI based parameter configuration, GUI based IoT application. (03hrs.) 179. Check IoT Gateway using Wi-Fi and Ethernet. (02 hrs.) 180. Work with the command line and the Shell. (02	Installation of Linux Operating System porting. Configuration of Local cloud & server. Over the air (OTA) node configuration. GUI based parameter configuration, GUI based IoT application. IoT Gateway using Wi-Fi and Ethernet. User access and data security (Cyber security) by Cryptography. The command line and the Shell, directories and files. Linux file system, understanding system initialization. Connection of a system to the network. Installation and Configuration of Linux. Shell Scripts, flow control in the Shell, Advanced Shell features. Database management system. Cloud and Server Configuration for IoT. Qt based GUI, IoT Web and Application Development Tools for IoT. Principle of operation, selection and installation of Carbon dioxide sensors, Oxygen sensors.

		hrs.) 181. Manage directories and files. (02 hrs.) 182. Test Cloud and Server Configuration for IoT. (03 hrs.) 183. Test Qt based GUI for Sensor output. (02hrs.) 184. Test IoT Web and Application Development Tools for IoT. (02hrs.) 185. Select and Install Carbon dioxide sensors. (03hrs.) 186. Identify and Install Oxygen sensors. (02hrs.) 187. Select and Install Volatile organic compound sensor. (04hrs.) 188. Identify and Install Air temperature, Air humidity atmospheric pressure and UV sensor. (02hrs.) 189. Select and Install Nitric Oxide (NO), Hydrogen Sulphide, Sulphur Dioxide, Carbon	Volatile organic compound sensor 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. Study and test of Magnetic field for smart parking, IR for human presence. Study and test of Hall Effect (doors and windows openings), Water presence, Liquid level, Liquid flow, Temperature, Humidity for smart security. Calibration Kits testing for the sensor probes for water quality analysis. (12 hrs.)

		Monoxide, Ozone Soil Moisture and Soil Temperature sensor. (02hrs.) 190. Check Magnetic field for smart parking,IR for human presence. (03hrs.) 191. Measure Hall Effect (doors and windows openings), Water presence, Liquid level, Liquid flow, Temperature, Humidity for smart security. (02hrs.) 192. Test Calibration Kits for the sensor probes for water quality analysis. (02hrs.)	
Professional Skill 60 Hrs.; Professional Knowledge 12 Hrs.	Establish and troubleshoot IoT connectivity of devices to cloud having multiple communication medium, protocols, device management and monitoring. (MAPPED NOS: SSC/N9451)	193. Power up the Solar Inverter (similar device) as per the device manual. (02hrs.) 194. Integrate Solar Inverter(similar device) with serial protocol working on Modbus RTU. (02hrs.) 195. Communicate and Verify the	- Basics of Industrial protocols ModbusRTU, ModbusTCP, DLMS - Client server communication Basics of Protocol Converters. Basics of IoT Data Acquisition System. Device connectivity over cloud and troubleshooting. GUI based IoT Cloud Configuration utility. IoT device and its parameter configuration Cloud Device Management and troubleshooting.

		parameters on Modbus Master Software. (02hrs.) 196. Power up the Energy Meter (similar device) as per the device manual. (02hrs.) 197. Integrate Energy Meter(similar device) with serial protocol working DLMS protocol. (02hrs.) 198. Communicate and verify the parameters on DLMS server software. (04hrs.) 199. Setup wired Local Area Network and wireless network. (03hrs.) 200. Setup environment for Modbus TCPIP server client testing. (02hrs.) 201. Communicate and Configure Modbus devices through GSM GPRS network. (04hrs.) 202. Setup Serial to Ethernet protocol converter and verify. (02hrs.)	(12hrs.)

		203. Setup Serial to Wi-Fi protocol converter and verify. (02hrs.) 204. Setup Serial to GPRS protocol converter and verify. (02hrs.) 205. Setup Ethernet IoT Data Acquisition system, connect to cloud and verify. (02hrs.) 206. Setup WiFiIoT Data Acquisition system, connect to cloud and verify (04hrs.) 207. Setup Cellular (GSM / GPRS) IoT Data Acquisition system, connect to cloud and verify (04hrs.) 208. Explore IoT Cloud Configuration utility. (04hrs.) 209. Create / modify organization, Connect devices over cloud. (04hrs.) 210. Configuration of parameters, alarms, notifications on cloud platform.	

		(03hrs.) 211. Explore user management roles and security. (02hrs.) 212. Observer Device Diagnostics for troubleshooting. (04hrs.) 213. Setup Environment for embedded SCADA testing. (04hrs.)	
Professional Skill 50Hrs.; Professional Knowledge 12 Hrs.	Demonstrate and Deploy responsive Web Application using APIs and generate reports using templates. (MAPPED NOS: SSC/N9452)	214. Explore Web API, required input parameters and output (10 hrs.) 215. Map Web API to Widget / Control / Plugin. (10hrs.) 216. Display and configure graphs, charts and other ready to use controls and widgets. (20 hrs.) 217. Generate reports using readily available API, templates and to export it to excel, word pdf and other required formats. (10 hrs.)	Usage of Web Services / Web API Development of Sample Web Application. Generation and export of Reports User access and rights management. (12 hrs.)
Professional Skill 50Hrs.; Professional	Identify and test Smart Lighting system and its components.	218. Rig up circuit to lighting system and measure different	Fundamental science of lighting system. Different types of light Luminaries, Smart Light Drivers. Lumen, Lux, Wattage etc. Sensor integrated, Non-sensor integrated lighting System.

Knowledge 12 Hrs.	(MAPPED NOS: SSC/N9464)	parameter such as Voltage, current, Lux usingmultimeter and Lux Meter. (04 hrs.) 219. Test different types of Lighting System such as Outdoor, Indoor, street Light etc. (04hrs.) 220. Check circuits to test and troubleshoot Sensor integrated lighting System. (05hrs.) 221. Apply non-sensor integrated lighting System. (05 hrs.) 222. Test different dimming control methods in lighting system. (05 hrs.) 223. 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. (05hrs.)	Different dimming control methods in lighting system. Concept of dimming. Basics of interfacing micro controllers. Need of smart lighting. 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. Concept of Wired – DALI, GREENBUS2, etc. Wireless, Hybrid. (12 hrs.)

		224. Check Circuit to test and troubleshoot MQ135 pollution sensor module. (04hrs.) 225. Install CCTV Camera for building security and roadside safety. (06 hrs.) 226. 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. (06 hrs.) 227. Test System architecture of smart lighting and Identify • Wired–DALI, GREENBUS2, etc. • Wireless • Hybrid (06hrs.)	
Professional Skill 40Hrs.; Professional	Identify, select, install and troubleshoot different module /	228. Install, test and troubleshooting of Smart Light. (03hrs.)	Basic concepts of Smart Light- Working Principle of Solar street light, sensors used in street light like dusk to dawn, Temperature sensor. Solar battery management system - Basic concepts

Knowledge 12 Hrs.	devices used in SMART Street Light based on IoT and Cloud Technology. (MAPPED NOS: SSC/N9465)	229. Install and test Solar street light. (03hrs.) 230. Execute testing of sensors used in street light like dusk to dawn, Temperature sensor. (03hrs.) 231. Check solar battery management system. (05hrs.) 232. Check solar street light components. (05hrs.) 233. Test LED used on solar street light. (03hrs.) 234. Install Security camera on street light. (05hrs.) 235. Apply Smart embedded system that controls the street light based on detection of sunlight. (03 hrs.) 236. Configure and Communicate 3 Phase Modbus Energy Meter with IoT based Smart Streetlight Controller.(03hrs.) 237. Observe Over voltage protection and over current	battery, types, preventive maintenance, arrangement of battery and battery management. Solar street light components, LED used on solar street light, Security camera on street light. Smart embedded system that controls the street light based on detection of sunlight. Benefits - ensure safety and to prevent energy wastage. (12 hrs.)

		protection. (03hrs.) 238. Monitor Smart streetlight management system having with map view based dash board and individual system details. (04hrs.)	
Professional Skill 30 Hrs.; Professional Knowledge 06 Hrs.	Identify, select, install and troubleshoot different module / devices used in SMART Parking. (MAPPED NOS: SSC/N9466)	239. Install LED display board. (04 hrs.) 240. Test Magnetic field for smart parking. (10 hrs.) 241. Execute installation of proximity sensor for boom barrier, IR Sensor for presence. (06 hrs.) 242. 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. (10 hrs.)	Concept of Smart parking for better management of car park availability and 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, IR Sensor in smart parking. Full stack solution to deal with all aspects of parking.(06 hrs.)
Professional Skill 30 Hrs.; Professional	Identify, select, install and troubleshoot different module /	243. Use Location Sensors, GPS & GPS integrated circuits. (06 hrs.)	Concept of Smart Road & Traffic, Live & Connected roads - Benefits - experience of quicker, safer and more effective trips. Weather monitoring at risky points: Low cost

Knowledge 06 Hrs.	devices used in SMART Traffic. (MAPPED NOS: SSC/N9467)	244. Apply Solar panel, Antenna &Radio Technology. (06 hrs.) 245. Use scanner for real-time traffic and pedestrian estimation. (06 hrs.) 246. Carry out Smartphone Detection (Bluetooth, Wifi, 3G/4G-GPRS etc.). (04 hrs.) 247. Detect liquid presence over road by Liquid presence sensor for Smart Security. (04 hrs.) 248. Apply Linear displacement sensor for Structural Crack monitoring. (04 hrs.)	weather station(Rainfall, Temperature + Humidity, Wind speed & direction), Pluviometer, Vane sensor, Anemometer, Temperature+ Humidity, Liquid presence sensor. Smartphone Detection (Bluetooth, Wifi, 3G/4G-GPRS etc.). Structural Crack monitoring. (06 hrs.)
Professional Skill 30 Hrs.; Professional Knowledge 06 Hrs.	Apply IoT Application for Water & Waste Management. (MAPPED NOS: SSC/N9468)	249. Select and install pH, Cupric (Cu2+), Silver (Ag+), Lithium (Li+), Conductivity, Temperature for maintenance of water quality. (06 hrs.) 250. Install Smart dustbin. (06 hrs.)	Smart Waste Management system: Definition, Application, working, 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, Wifi module &Thingspeak (IoT Platform) cloud. (06 hrs.)

		251. Install GPS based tracking system for smart bin. (06 hrs.) 252. Maintain dry waste and wet waste separately. (06 hrs.) 253. Install, test & apply different components like Ultrasonic sensors, Wifi module &Thingspeak (IoT Platform) cloud. (06 hrs.)	

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) (120hrs.)

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

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 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.
28.	Allen key set (Hexagonal - set of 9)	1 - 12 mm, set of 24 Keys	1 No.
29.	Tubular box spanner	Set - 6 - 32 mm	1 set.
30.	Magnifying lenses	75 mm	2 Nos.
31.	Continuity tester	With 4 ½ Digit Display and 20k Count	6 Nos.
32.	Hacksaw frame adjustable	300 mm	2 Nos.
33.	Chisel - Cold - Flat	10 mm X 150 mm	1 No.
34.	Scissors	200mm	1 No.
35.	Handsaw 450mm	Hand Saw - 450 mm	1 No.
36.	Hand Drill Machine Electric with Hammer Action	13 mm	2 Nos.
37.	First aid kit		1 No.
38.	Bench Vice	Bench Vice - 125 mm	1 No. each
		Bench Vice - 100 mm	
		Bench Vice - 50 mm	
List of Equipments			
39.	Multiple Output DC regulated power supply	0-30V, 2 Amps, ± 15V Dual Tracking ,5V/5A, Display digital, Load & Line Regulation: ± (0.05 %+100 mV), Ripple & Noise: 1 mVrms. Constant Voltage & Current operation	4 Nos.
40.	DC Regulated Variable Programmable DC Power Supply	0-30V/3A with numeric keypad, PC interface and LCD for Voltage, Current & Power	2 Nos.
41.	LCR meter (Digital) Handheld	It can Measure six basic parameters R,C,L equipped with SMD Component Test Fixture	1 No.
42.	70 MHz Mixed Signal Oscilloscope (4 Analog + 16 Digital Channel)	With more than 20Mpt memory Real time Sampling 1GSa/sec , having LAN Interface with, I2C , SPI, Runt etc .. And RS232/UART, I2C and SPI trigger decoding functions , two channel 25MHz awg plus math functions like differentiation, integration, abs,	1 No.

		AND,OR,NOT etc.	
43.	25 MHz Arbitrary Waveform Generator with Digital Display for Frequency and Amplitude	Two Channel , 200MSa/Sec and 2Mpt memory with more than 150 different arbitrary waveforms and built-in 8th order harmonic generation and 150MHz Frequency counter PC Connectivity USB Device/Host and LAN	1 No.
44.	6 1/2 Digit Digital Multimeter	Measurement Functions: DC &AC Voltage, DC&AC Current, 2-wire & 4-wire Resistance, CAP, Diode, Connectivity, Frequency, Period, Any Sensor. Temperature: RTD, THERM,TC (B/E/J/K/N/R/S/T) PC Interface USB Host, USB Device, LAN(LXI-C) Measurement Speed 10k readings/sec	1 No.
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 Built in tracking generator Min. -148 dBm DANL Display 8” TFT or more PC Interface: USB Host & Device, LAN(LXI)	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, Spectrum Analyzer. Arbitrary Waveform Generator Sine 50MHz ,Square 15MHz,Triangle 100KHz , AM –FM Modulation, 16 Channel Logic Analyzer Frequency and Phase Meter USB 2.0/ 3.0 Interface	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.	1No.

		Arrangement to study the importance of MCB and it's working.	
48.	Analog Component Trainer with following Seven Basic Modules • Diode Characteristics (Si,Zener,LED) • Rectifier Circuits • Diode as Clipper Circuit • Diode as Clamping Circuit • Zener as voltage regulator. • Transistor Type NPN & PNP and CE Characteristics • Transistor as a switch	Breadboard for Circuit design DC power supply: +5V,1A (Fixed); +12V, 500mA (Fixed); ±12V, 500mA (Variable) AC power Supply: 9V-0V-9V, 500mA Function Generator: Sine, Square, Triangle (1Hz to 100KHz) Modulating Signal Generator: Sine, Square, Triangle (1Hz to 10KHz). Voltage, current and frequency on board LCD display. PC Interface – Acquisition from two analog input channel Simulation Software	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: (TTL), 128x64 Graphical LCD, Pulser Switches, Data Switches: 8 Nos, LED: 8 Nos. (TTL),Seven Segment Display, Teaching & Learning Simulation Software	1 No.
50.	IT Workbench for computer hardware and networking	The bench comprises with Computer Hardware Training System (02 Nos.) The different circuit boards of PC/AT Computer are exposed on a PCB, LAN Training System with Wireless LAN as well to study Peer to Peer, STAR, RING Topology. Protocols: CSMA /CD, CSMA /CA, Stop N Wait, Go back to N, Selective repeat, Sliding Window, Token Bus, Token Ring, Colored representation of data in transmission	1 No.

		&reception. Data transmission speed: 10/100 Mbps, Smart managed 3 Layer and 2 Layer Switch, Media converter, POE Switch, Wi-Fi LAN card, IP Camera, Energy meter, LED tube light, Voltmeter and Ammeter will be fitted. Networking Fundamentals Teaching Simulation Software DSO 50MHz 4 Channel , 1GSa/Sec ,more than 20 Mpt memory DSO DMM : $4^{1/2}$ Digit with LCD Display	
51.	Laptop latest configuration		1 No.
52.	Laser jet Printer		1 No.
53.	Internet Broadband Connection		1 No.
54.	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.
55.	Different types of electronic and electrical cables, connectors, sockets, terminations.		As required
56.	Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB		As required
57.	SMD Soldering & De soldering Station with necessary accessories	SMD Soldering &Desoldering Station Digitally Calibrated Temperature Control SMD Soldering &Desoldering Power Consumption: 60 Watts I/P Voltage : 170 to 270 V De-soldering : 70 Watt Temperature Range : 180 to 480º Centigrade	1 No.

		Power Consumption : 270 Watts Hot Air Temperature : 200 to 550º Centigrade	
58.	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.
59.	Microcontroller kits (8051) along with programming software (Assembly level Programming) With six important different application modules 1. Input Interface Switch, Matrix Keypad, ASCII Keypad 2. Display LCD, Seven Segment, LED Matrix 3. ADC & DAC 4. PC Interface module 5. Motor DC, Stepper, Servo 6. DAQ	Core 8051 MCU clocked at 11.0592 MHz., supporting both programming modes Keypad and computer ,LCD for both programming and run mode, ready to run programmer to support family of controllers AT89C52 ,DC Power Supplies +12V, -12V, +5V & -5V, Breadboard to make circuits, Learning content through simulation Software and following application modules 1. Input Interface : 4x4 Matrix Keypad, ASCII Key PAD, Four Input Switch 2. Display 16X2 LCD, Seven Segment, LED Bar Graph 3. ADC/DAC with ADC/DAC0808 4. PC Interface: RS232 & USB 5. Motor Drive: DC, Servo, Stepper 6. DAQ: 4ch analog 10bit, 22 DIO resolution,6MHz Frequency Counter (square wave), DAQ with PC interface software	1 No.
60.	Sensor Trainer Kit Containing following Sensors a) Air humidity and Temperature b) RTD c) Atmospheric Pressure	IoT enabled Android based 7" Graphical touch LCD with inbuilt cortex processor &DAQ for acquiring analog data and software for viewing the output waveforms with USB storage and HDMI output. Ethernet port to connect real world.	2 Nos.

	d) Air Quality e) Smoke Detector Sensors f) Limit Switch g) Photo sensors h) Capacitive displacement	Inverting, Non – Inverting, Power, Current, Instrumentation and Differential Amplifier, F to V, V to F, I to V, V to I Converter, High Pass and Low Pass Filter, Buffer, LED, Buzzer, LED Bar Graph, Touch Switch Included Sensors:RTD,NTC Thermistor,LM35,Photovoltic, Air humidity and Temperature, Gas(Smoke), Air Quality,Atmospheric Pressure, Limit switch, Capacitive displacement	
61.	Different types of electronic and electrical cables, connectors, sockets, terminations.		As required
62.	Different Microcontroller/Processor Training and Development Platform for AVR, PIC, ARM and Arduino.	MCU PIC16F877A , 4MHz, Onboard programmer will program PIC Devices, USB Port MCU ATMEGA8515 ,8MHz, onboard programmer will program ATMEGA series microcontroller, USB Port MCU LPC2148 , 12MHz,LED 8Nos, ADC 10 bit 10Nos, DAC 10bit ,USB and RS232, RTOS support, JTAG Connector, USB2.0,Onboard Zigbee, I2C,SPI,RTC,DC motor, PWM, Sensor LM35 , Display 16X2 LCD Display , Motor Drive: L293D 600mA (5-12V),Programmer USB Interface. Microcontroller ATmega328p (**Arduino Based**), 16MHz, Digital I/O Pins : 14 (of which 6 provide PWM output) , Flash Memory : 16KB (of which 2KB used by boot loader) Each platform should have Bread DC Power Supplies +12V, -12V, +5V & - 5V, Breadboard to make circuits.	1 No.
63.	Internet of Things Explorer	Processor : 64bit ARMv7 with 1GB RAM , Memory 32GB ,OS: Open source Linux,	1 No.

		Connectivity: Wireless LAN, Bluetooth, Zigbee, USB & Ethernet, HDMI interface, 1.77" Color TFT LCD , Driver for Stepper and DC Motor, six 16 bit Analog Input, RTC and 4-20mA input. Zigbee: 2.4GHz, Sensors: Temperature and Humidity, Air Quality, Soil Moisture, Ambient Light, Soil/Water temperature, PIR Sensor. GSM IoT Gateway - Quad-Band 850/900/1800/1900 MHz - GPRS multi-slot class, Control via AT commands. Explore physical and application layer protocols like RS232, RS485, GSM, Ethernet and MQTT, CoAP, HTTP, FTP. Cloud/server configuration includes HTML, Java, php and mySQL. IoT Node: Wireless 2.4GHz Zigbee, 5 Analog Inputs and at least 3 Digital Outputs, At least one I2C Channel, support OTA. Online Cloud/Server Services for 2 years.Battery 3.7V/4400mAH with Solar Panel, USB interface.	
64.	Field Interface and Protocol Simulation Kit	A console including :Any Branded Desktop Computer with Windows Operating System 1. Ethernet Devices with Isolated Supply and port ▪ 4 AI(0.1% FSR), 4 AO (0-10VDC), Ethernet Port – Qty 1 ▪ 8 Relay Outputs, Ethernet Port – Qty 1 ▪ 8 Pulse Outputs, Ethernet Port – Qty 1 ▪ 8 Digital Inputs, Ethernet Port – Qty 1 ▪ 4 RS485 Slave ports, 1 Ethernet Port – Qty 4 2. 16 Port Ethernet Switch for networking of field ethernet devices 3. SMPS to power up multiple ethernet based field simulation devices 4. Required Connectors, Switches and LED indicators for Field Interface circuits	1 No.

		such as Digital Inputs, Relay Outputs, Analog Inputs, Analog Outputs, Pulse Signals 5. Software ▪ Communication with simulation device on ethernet MODBUS TCP Protocol ▪ Field Interface simulation using HMI replica of Console for easy understanding of students ▪ Port Simulation – Serial Port Terminal, TCP/IP, UDP, HTTP ▪ Protocol Simulation – MODBUS RTU Master/Slave, MODBUS TCP Master/Slave, DLMS Client IoT Protocol Simulations – MQTT topic publish subscribe simulation	
LIST OF THE MACHINERIES			
65.	Solar Power Lab	Solar PV Modules. Open Circuit Voltage Voc 10V, Short Circuit Current Isc.60m A 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	1 No.
66.	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 DCV Range 0-50V, DCA Range 10A	1 No.
67.	Wireless Communication modules for interfacing with microcontrollers a) RFID Card Reader	Core 8051 MCU clocked at 11.0592 MHz, supporting both programming modes Key Pad and PC ,LCD for both programming mode and run mode, ready to run programmer to support family of controllers	1 No.

	b) Finger Print c) Zigbee d) GPS e) GSM f) Bluetooth g) WiFi	AT89C51/52 & 55 ,DC Power Supplies +12V, -12V, +5V & - 5V,Breadboard to make circuits, detailed learning content through simulation Software and following application modules: RFID Card Reader,Finger Print, Zigbee, GPS, GSM, Bluetooth and WiFi	
68.	Sensors for Smart EnvironmentApplication	All should be compatible with Sensor Training Platform & IOT Explorer mentioned above: CO2: Range: (0-2000ppm), O2 Range: (0-25%), Air Temperature & Humidity, Atmospheric Pressure, PM2.5 and PM10(UART and PWM output), Solar Radiation, UV Index, All Sensors should in IP65 Packing	1 No.
69.	Sensors for Smart Parking	All should be compatible with Sensor Training Platform & IOT Explorer mentioned above: CCTV Camera , Motion Sensor, RFID, Relays, Hooter, Magnetic Hall Sensor, Ultrasonic, Application Software for SMART Dashboard	1 No.
70.	Sensors for Smart Water & Waste water Management & Monitoring	All should be compatible with Sensor Training Platform & IOT Explorer mentioned above: Conductivity Sensor, PH Sensor Cupric (Cu2+), Silver (Ag+), Lithium (Li+) with 10, 100 and 1000 ppm solution calibration kit. Level Sensor, Flow Sensor, Ultrasonic Sensor & Temperature.	1 No.
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,	1 No.

		Solar Radiation, UV Index, Atmospheric Pressure, Air Quality PM2.5, GSM based cloud connectivity, Application Software for Dashboard for remote monitoring and analysis. Power Supply Battery : 12V/42AH Solar Panel : 100W	
72.	Smart Solar Street Lighting Training Platform	Microcontroller based Wireless connectivity using WiFi TFT LCD Display to display various parameters Connectivity: USB (04 nos.) The system should come with following Sensors Temperature, Humidity, Air Quality, PIR, and Auto diming 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) Application Software for SMART Street Light Dashboard	1 No.
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/GPRSModule 2. Overvoltage protection 3. Over current protection 4. Three phase MODBUS energy meter with class 1.0 accuracy and IS13779 certification 5. SMC box with IP65 and IK10 ratings Responsive Web application for Smart	1 No.

		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 Input Supply : 12V DC software Front End : Zend Framework 1.12.1(php) Back End : mySQL OS : Windows and Linux Compatible	1 No.
75.	Sensors for Smart Building	All should be compatible with Sensor Training Platform & IOT Explorer mentioned above: CCTV Camera , Motion Sensor RFID, Smoke, Fire, LPG Gas, Air Quality, Ambient Temperature & Humidity, CO_2, Light, Relays, Hooter, Touch Panel Smart Capacitive Touch Switch Board with 3 Light controls, 1 humming free FAN control, 1 16A AC control, 3 IR Channels for controlling IR appliances, 8 Capacitive Touch Buttons, 2 Digital Sensor Inputs, 1 Digital Output Application Software for SMART Building Dashboard	1 No.
76.	IoT Data Acquisition Systems & Protocol Converters	Connectivity to Cloud (IBM, Microsoft, Amazon)24 VDC Isolated Supply, 4 Analog Inputs (0.1% FSR), 8 Pulse Inputs (up to 1 kHz), 8 Digital Inputs, 4 Relay Outputs Ethernet IOT DAQ, WiFiIoT DAQ, Cellular (GSM / GPRS) IoT DAQ MODBUS RTU to MODBUS TCP 24 VDC Isolated Power Supply, 4 Isolated MODBUS	1 set

		RTU Master Port Serial to Ethernet, Serial to Wi-Fi, Serial to GPRS	
77.	IoT EDGE Computing Device	Embedded SCADA for 500 Tags, 24 VDC Isolated Power Supply, 4 MODBUS RTU Master, 32 GB Built in SD Card, 1 Wi-Fi Port, 1 Ethernet Port, 1 GPRS Port, 4 Analog Inputs (0.1% FSR), 8 Pulse Inputs (up to 1 kHz), 8 Digital Inputs, 4 Relay Outputs	1 No.
78.	Cloud Based IoT SCADA	1000 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.
D. Shop Floor Furniture and Materials - For 2 (1+1) units no additional items are required.			
79.	Instructor's table		1 No.
80.	Instructor's chair		2 Nos.
81.	Metal Rack	100cm x 150cm x 45cm	4 Nos.
82.	Lockers with 16 drawers standard size		2 Nos.
83.	Steel Almirah	2.5 m x 1.20 m x 0.5 m	2 Nos.
84.	Interactive Smart Board with Projector		1 No.
85.	Fire Extinguisher	Arrange all proper NOCs and equipments from Municipal/Competent authorities.	
Note: *1. Internet facility is desired to be provided in the class room.*			

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


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