



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

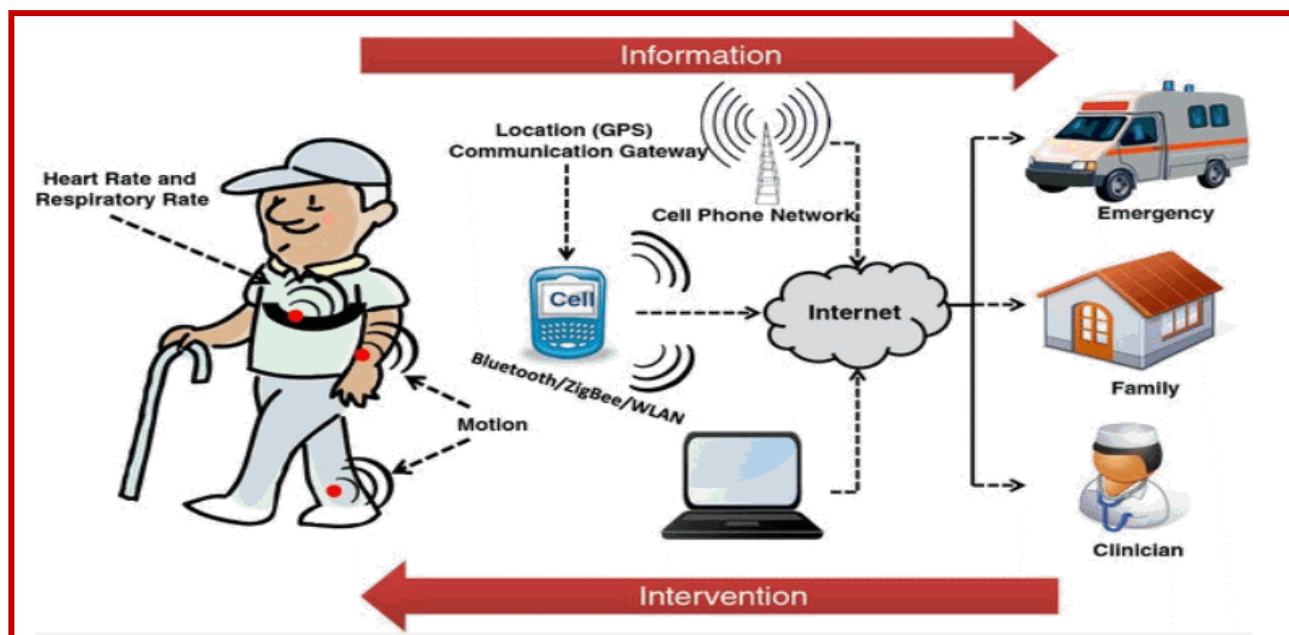
**COMPETENCY BASED CURRICULUM**

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

(Duration: One year)

**CRAFTSMEN TRAINING SCHEME (CTS)**

**NSQF LEVEL- 3.5**



**SECTOR –IT & ITES**



Directorate General of Training

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

(Non-Engineering Trade)

(Revised in March 2023)

Version: 2.0

**CRAFTSMEN TRAINING SCHEME (CTS)**

**NSQF LEVEL – 3.5**

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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## 1. COURSE INFORMATION

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

During the one-year duration 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 trainee will be able to identify different IoT Applications with IoT architecture and also be able to select various types of sensors used in Healthcare. They will position the appropriate sensors and collect the information required in Healthcare. The trainees will be also able to identify, select different wireless communication modules and topology to generate and record the data. They will demonstrate Installation, configuration and working of IOT devices, network, database, app and web services. The trainees will also acquire the knowledge of monitoring health parameters like Blood Pressure, ECG, EMG, Heart rate, EEG, SPO2 etc. by suitable sensors (PHMS). They will be able to apply the sensor output data for further computing, analyzing and visualisation. The trainees will learn about remote health monitoring and Tele-health. The trainees will identify and select different Robots used in healthcare.

### 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 the economy/ labour market. The vocational training programs are delivered under the aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variants and Apprenticeship Training Scheme (ATS) are two pioneer programs of DGT for strengthening vocational training.

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

#### **Trainee needs to demonstrate broadly that they are able to:**

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

### 2.2 PROGRESSION PATHWAYS

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

## 2.3 COURSE STRUCTURE

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

| S No. | Course Element                        | Notional Training Hours |
|-------|---------------------------------------|-------------------------|
| 1.    | Professional Skill (Trade Practical)  | 840                     |
| 2.    | Professional Knowledge (Trade Theory) | 240                     |
| 3.    | Employability Skills                  | 120                     |
|       | <b>Total</b>                          | <b>1200</b>             |

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

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

Trainees of one-year or two-year trade can also opt for optional courses of up 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](http://www.bharatskills.gov.in).

b) The final assessment will be in the form of summative assessment. The All India Trade Test for awarding NTC will be conducted by 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 the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising 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 examining 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 should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices | <ul style="list-style-type: none"> <li>• Demonstration of good skills and accuracy in the field of work/ assignments.</li> <li>• A fairly good level of neatness and consistency to accomplish job activities.</li> <li>• Occasional support in completing the task/ job.</li> </ul> |

| (b) Marks in the range of 75%-90% to be allotted during assessment                                                                                                                                                                                   |                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices                                                        | <ul style="list-style-type: none"> <li>• Good skill levels and accuracy in the field of work/ assignments.</li> <li>• A good level of neatness and consistency to accomplish job activities.</li> <li>• Little support in completing the task/job.</li> </ul>         |
| (c) Marks in the range of more than 90% to be allotted during assessment                                                                                                                                                                             |                                                                                                                                                                                                                                                                       |
| For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship. | <ul style="list-style-type: none"> <li>• High skill levels and accuracy in the field of work/ assignments.</li> <li>• A high level of neatness and consistency to accomplish job activities.</li> <li>• Minimal or no support in completing the task/ job.</li> </ul> |



**IoT Technician (Smart Healthcare);** 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 technician in this job identifies different internet based advanced Healthcare Applications and Solutions for better healthcare experience such as patient health monitoring system (PHMS), Tele-Health, Tele-Medicine, Tele-Monitoring, Mobile Health Things (m-health) etc. Selects, tests, troubleshoots and positions various types of sensors to collect the information required in Healthcare. Identifies and selects different wireless communication modules and topology to generate and record required data. Monitors health parameters like Blood Pressure, ECG, EMG, Heart rate, EEG, SPO2 etc. by suitable PHMS sensors. Synchronizes the different bio-signals in wireless Body Area Network (BAN) of sensors or wear ables to obtain an integrated profile of the user. Applies **things with only sensing features** (i.e., biosensors like Pulse Oximetry Sensor, Inertia Sensor, Blood Pressure Sensor and Chest Strap Sensor etc.), **things with only computing features** (i.e., smart phones) and **things with both sensing and computing features** (i.e. smart watches). Applies the sensor output data for further computing, analyzing and visualization. Executes remote health monitoring and Tele-health. Identifies and selects different Robots used in healthcare.

**Information and Communications Technology Installers and Servicers, Other;** include installers and servicers who install, repair and maintain telecommunications equipment, data transmission equipment, cables, antennae and conduits and repair, fit and maintain computers not elsewhere classified

**Reference NCO-2015:** 7422.9900

**Reference NOS: ---**

|                 |                  |
|-----------------|------------------|
| I. ELE/N9401    | X. SSC/N9447     |
| II. ELE/N7001   | XI. SSC/N9448    |
| III. ELE/N7812  | XII. SSC/N8239   |
| IV. ELE/N5804   | XIII. SSC/N9451  |
| V. SSC/N9408    | XIV. SSC/N9452   |
| VI. ELE/N1201   | XV. SSC/N9458    |
| VII. SSC/N9444  | XVI. SSC/N9459   |
| VIII. SSC/N9445 | XVII. SSC/N9460  |
| IX. SSC/N9446   | XVIII. SSC/N9461 |

## 4. GENERAL INFORMATION

| Name of the Trade                           | IoT TECHNICIAN (SMART HEALTHCARE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NCO - 2015                                  | 7422.9900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| NOS Covered                                 | ELE/N9401, ELE/N7001, ELE/N7812, ELE/N5804, SSC/N9408, ELE/N1201, SSC/N9444, SSC/N9445, SSC/N9446, SSC/N9447, SSC/N9448, SSC/N8239, SSC/N9451, SSC/N9452, SSC/N9458, SSC/N9459, SSC/N9460, SSC/N9461                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| NSQF Level                                  | Level-3.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Duration of Craftsmen Training              | One Years (1200 Hours 150 Hours OJT/Group project)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Entry Qualification                         | Passed 10th class examination with Science and Mathematics or with vocational subject in same sector or its equivalent.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Minimum Age                                 | 14 years as on first day of academic session.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Eligibility for PwD                         | LD, LC, DW, AA, LV, DEAF, AUTISM, SLD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Unit Strength (No. Of Student)              | 24 (There is no separate provision of supernumerary seats)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Space Norms                                 | 70 Sq. metres                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Power Norms                                 | 3.45 KW                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Instructors Qualification for               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| (i) IoT Technician (Smart Healthcare) Trade | <p>B.Voc/Degree in Electronics/ Electronics and Telecommunication/ Electronics and communication Engineering/ Bio medical Engineering from AICTE/ UGC recognized Engineering College/ university with one-year experience in the relevant field</p> <p style="text-align: center;"><b>OR</b></p> <p>Diploma (Minimum 2 years) in Electronics/ Electronics and telecommunication/ Electronics and communication/ Bio medical Engineering from AICTE/recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/NAC passed in the Trade of "IoT Technician (Smart Healthcare)" With 3 years' experience in the relevant field.</p> <p><b><u>Essential Qualification:</u></b><br/>Relevant Regular / RPL variants of National Craft Instructor Certificate (NCIC) under DGT.</p> <p><b><u>Note:</u></b> - Out of two Instructors required for the unit of 2 (1+1), one</p> |

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                         | <b>must have Diploma, and other must have NTC/NAC qualifications. However, both of them must possess NCIC in any of its variants.</b>                                                                                                                                                                                                                                                            |
| <b>(ii) Employability Skill</b>         | <p>MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills.<br/>(Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above)</p> <p style="text-align: center;">OR</p> <p>Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills.</p> |
| <b>(iii) Minimum Age for Instructor</b> | 21 Years                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>List of Tools &amp; Equipment</b>    | As per Annexure-I                                                                                                                                                                                                                                                                                                                                                                                |

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

### 5.1 LEARNING OUTCOMES

1. Select 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. Identify, test and interconnect components/parts of IoT system. (NOS: SSC/N9446)
12. Identify and Select various types of sensors used in Smart Healthcare. (NOS: SSC/N9447)
13. Identify, select different wireless communication modules and topology to generate and record the data. (NOS: SSC/N9448)
14. 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)
15. Perform Installation, configuration and ensure working of IOT devices, network, database, app and web services. (NOS: SSC/N8239)
16. Establish and troubleshoot IoT connectivity of devices to cloud having multiple communication medium, protocols, device management and monitoring. (NOS: SSC/N9451)

17. Demonstrate and Deploy responsive Web Application using APIs and generate reports using templates. (NOS: SSC/N9452)
18. \*Monitor health parameters like Blood Pressure, ECG, EMG, Heart rate, EEG, SPO2 etc. by suitable sensors (PHMS). (NOS: SSC/N9458)
19. \*Apply the sensor output data for further computing, analyzing and visualisation. (NOS: SSC/N9459)
20. \*Identify, select and Execute remote health monitoring and Tele-health. (NOS: SSC/N9460)
21. \*Identify, select different Robots used in healthcare. (NOS: SSC/N9461)

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

## 6. ASSESSMENT CRITERIA

| LEARNING OUTCOMES                                                                                                                                                                       | ASSESSMENT CRITERIA                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Select and perform electrical/ electronic measurement of meters and instruments following safety precaution. (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.                                                                     |
| 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. |
|                                                                                                                                                                                         | 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.                                                                                             | 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                                                                       |

|                                                                                                                                                                        |                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| (NOS: ELE/N5804)                                                                                                                                                       | number and test for their condition.                                                            |
|                                                                                                                                                                        | Construct and test the transistor based switching circuit                                       |
|                                                                                                                                                                        | Construct and test CE amplifier circuit                                                         |
|                                                                                                                                                                        | Ascertain the performance of different oscillator circuits.                                     |
|                                                                                                                                                                        | Construct and test Clipper, Clamper circuit.                                                    |
|                                                                                                                                                                        |                                                                                                 |
| 5. Assemble, test and troubleshoot various digital circuits. (NOS: ELE/N7812)                                                                                          | Illustrate to practice the digital trainer kit with safety.                                     |
|                                                                                                                                                                        | Identify various digital ICs, test IC using digital IC tester and verify the truth table.       |
|                                                                                                                                                                        | Test and verify the truth table of all gates using NOR and NAND gates.                          |
|                                                                                                                                                                        | Construct and verify the truth table of various flip flop, counter and shift register circuits. |
|                                                                                                                                                                        |                                                                                                 |
| 6. Install, configure, interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications. (NOS: SSC/N9408) | Plan, work in compliance with standard safety norms.                                            |
|                                                                                                                                                                        | Select hardware and software component.                                                         |
|                                                                                                                                                                        | Install and configure operating systems and applications.                                       |
|                                                                                                                                                                        | Integrate IT systems into networks.                                                             |
|                                                                                                                                                                        | Deploy tools and test programmes.                                                               |
|                                                                                                                                                                        | Avoid e-waste and dispose the waste as per the procedure.                                       |
|                                                                                                                                                                        |                                                                                                 |
| 7. Develop troubleshooting skills in various standard electronic circuits using Electronic simulation software. (NOS: ELE/N1201)                                       | Identify & Select the component                                                                 |
|                                                                                                                                                                        | Prepare simple digital and electronic circuits using the software.                              |
|                                                                                                                                                                        | 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.                                              |
|                                                                                                                                                                        | Follow instruction manual.                                                                      |
|                                                                                                                                                                        |                                                                                                 |
| 9. Identify, select and test                                                                                                                                           | Explore different driving circuits used for sensors.                                            |

|                                                                                                                                                                                                                       |                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 converters like V/I, I/V, F/V and V/F.                                                                                                                                                  |
|                                                                                                                                                                                                                       | Explore low pass and high pass filter.                                                                                                                                                                    |
|                                                                                                                                                                                                                       | 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.                                                                                                                                 |
|                                                                                                                                                                                                                       | Identify various ICs & their functions on the given Microcontroller Kit.                                                                                                                                  |
|                                                                                                                                                                                                                       | Identify the address range of RAM & ROM.                                                                                                                                                                  |
|                                                                                                                                                                                                                       | Write data into RAM & observe its volatility.                                                                                                                                                             |
|                                                                                                                                                                                                                       | Demonstrate entering of simple programs, execute & monitor the results.                                                                                                                                   |
|                                                                                                                                                                                                                       |                                                                                                                                                                                                           |
| 11. 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.                                                                     |
|                                                                                                                                                                                                                       |                                                                                                                                                                                                           |
| 12. Identify and Select                                                                                                                                                                                               | Identify & Select biomedical sensor (including wearable sensors) as                                                                                                                                       |



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| various types of sensors used in Smart Healthcare. (NOS: SSC/N9447)                                                                    | per requirement.                                                                                                                                                                          |
|                                                                                                                                        | Identify various leads of standard bipolar lead configuration.                                                                                                                            |
|                                                                                                                                        | Explore various leads of Standard Augmented Uni-polar leads configuration.                                                                                                                |
|                                                                                                                                        | Identify various Chest leads of Standard Uni-polar lead Configuration.                                                                                                                    |
|                                                                                                                                        | Explore all the standard ECG leads (12 leads), Unipolar and Bipolar configurations simultaneously.                                                                                        |
|                                                                                                                                        | Apply Smartphone & Smart watch for Diabetes monitoring by Daily activity data.                                                                                                            |
|                                                                                                                                        | Measure Physiological data of elderly patients by bio signals like Oxygen saturation level, Heart Rate from biomedical sensors & Smartphone.                                              |
|                                                                                                                                        | Use Wearable ECG sensors and Cloud processing for ECG Smart Healthcare monitoring by ECG bio signals.                                                                                     |
|                                                                                                                                        | Apply different sensors and actuators for Mobile medical computing systems by medical signal and context information.                                                                     |
|                                                                                                                                        | Observe Mobile healthcare (m-health) in the pervasive environment by bio signals like Pulse rate, blood pressure, level of alcohol etc.                                                   |
|                                                                                                                                        |                                                                                                                                                                                           |
| 13. Identify, select different wireless communication modules and topology to generate and record the data. (NOS: SSC/N9448)           | Apply the interfacing of Zigbee module to create Wireless sensor network.                                                                                                                 |
|                                                                                                                                        | Demonstrate M2M Wireless Sensor Network (WSN) in IoT Study of Zigbee router, end device and coordinator configuration.                                                                    |
|                                                                                                                                        | Create local sensor network by interfacing Bluetooth module.                                                                                                                              |
|                                                                                                                                        | Make node as a gateway by interfacing of GSM module.                                                                                                                                      |
|                                                                                                                                        | Apply IoT Gateway using WiFi and Ethernet.                                                                                                                                                |
|                                                                                                                                        | Explore the Wi-Fi module and lua script for data communication.                                                                                                                           |
|                                                                                                                                        | Apply GPS satellites in Location Sensors.                                                                                                                                                 |
|                                                                                                                                        | Explore USB and Ethernet connectivity for data communication.                                                                                                                             |
|                                                                                                                                        | Synchronize the different bio-signals in wireless Body Area Network (BAN) of sensors or wear ables to obtain an integrated profile of the user.                                           |
|                                                                                                                                        | Connect set of devices to LAN.                                                                                                                                                            |
|                                                                                                                                        | Form a wireless local area network (WLAN) among LAN devices.                                                                                                                              |
|                                                                                                                                        |                                                                                                                                                                                           |
| 14. Identify and test Wired & Wireless communication medium such as RS232, RS485, Ethernet, Fiber Optic, Wi-Fi, GSM, GPRS, RF etc. and | 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.                                                                                                                     |

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| Communication protocol. (NOS: SSC/N9448)                                                                                                                                                           | Basic Configuration of Cellular Wide Area Networks - GSM, GPRS.                                                                                                                   |
|                                                                                                                                                                                                    | Basic Configuration of Personal Area Networks - RF, Zigbee.                                                                                                                       |
|                                                                                                                                                                                                    |                                                                                                                                                                                   |
| 15. Perform Installation, configuration and ensure working of IOT devices, network, database, app and web services. (NOS: SSC/N8239)                                                               | Install Linux Operating System porting.                                                                                                                                           |
|                                                                                                                                                                                                    | Configure Local cloud & server.                                                                                                                                                   |
|                                                                                                                                                                                                    | Manage user access and data security (Cyber security) by Cryptography.                                                                                                            |
|                                                                                                                                                                                                    | Create Shell Scripts.                                                                                                                                                             |
|                                                                                                                                                                                                    | Configure Cloud and Server for IoT.                                                                                                                                               |
|                                                                                                                                                                                                    | Test Web and Application Development Tools for IoT.                                                                                                                               |
|                                                                                                                                                                                                    |                                                                                                                                                                                   |
| 16. 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 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 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.                                                                             |
|                                                                                                                                                                                                    |                                                                                                                                                                                   |
| 17. 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.                                                           |
|                                                                                                                                                                                                    |                                                                                                                                                                                   |
| 18. Monitor health parameters like Blood Pressure, ECG, EMG, Heart rate, EEG, SPO2 etc. by suitable sensors (PHMS). (NOS: SSC/N9453)                                                               | Analyse respiration real time using piezoelectric sensor.                                                                                                                         |
|                                                                                                                                                                                                    | Explore respiration system, exchange of gases in alveoli of lungs.                                                                                                                |
|                                                                                                                                                                                                    | Explore apnea (Slow rate of Respiration), tachypnea (Fast rate of Respiration), electrocardiogram, cardiovascular abnormality like Bradycardia, Tachycardia, real time ECG.       |
|                                                                                                                                                                                                    | Check Software analysis of real time ECG data.                                                                                                                                    |

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| SSC/N9458)                                                                                            |                                                                                                     |
|                                                                                                       |                                                                                                     |
| 19. Apply the sensor output data for further computing, analyzing and visualisation. (NOS: SSC/N9459) | Observe the biomedical data.                                                                        |
|                                                                                                       | Check the data with standard parameters.                                                            |
|                                                                                                       | Record the data for further analysis.                                                               |
|                                                                                                       |                                                                                                     |
| 20. Identify, select and Execute remote health monitoring and Tele-health. (NOS: SSC/N9460)           | Monitor EMG signals, ECG signals, Snore signals.                                                    |
|                                                                                                       | Check Airflow control of user.                                                                      |
|                                                                                                       | Check Body temperature data.                                                                        |
|                                                                                                       | Measure Galvanic skin response.                                                                     |
|                                                                                                       | Detect Body position.                                                                               |
|                                                                                                       | Use Internet, video chats, smart phones and Electronic Medical Record (EMR) clouds for Tele Health. |
|                                                                                                       |                                                                                                     |
| 21. Identify, select different Robots used in healthcare. (NOS: SSC/N9461)                            | Interface RC servo motor with microcontroller.                                                      |
|                                                                                                       | Interface & control Stepper motor and Servo motor and DC motor.                                     |
|                                                                                                       | Plan Programmable tasks.                                                                            |
|                                                                                                       | Record and Play capability.                                                                         |
|                                                                                                       | Apply Sensor interface and control Gyroscope, Accelerometer.                                        |
|                                                                                                       | Set up robotic ARM for Patient help.                                                                |
|                                                                                                       | Apply vision based Humanoid for patient health monitoring.                                          |
|                                                                                                       |                                                                                                     |

| SYLLABUS FOR IoT TECHNICIAN (SMART HEALTHCARE) TRADE            |                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                        |
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| DURATION: ONE YEAR                                              |                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                        |
| Duration                                                        | Reference Learning Outcome                                                                                   | Professional Skills (Trade Practical)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Professional Knowledge (Trade Theory)                                                                                                                                                                                                                                                                  |
| Professional Skill 30Hrs.;<br><br>Professional Knowledge 12Hrs. | Select and perform electrical/ electronic measurement of meters and instruments following safety precaution. | <b>Trade and Orientation</b> <ol style="list-style-type: none"> <li>1. Visit to various sections of the institute and identify location of various installations.</li> <li>2. Identify safety signs for danger, warning, caution &amp; personal safety message.</li> <li>3. Use of personal protective equipment (PPE).</li> <li>4. Practice elementary first aid.</li> <li>5. Preventive measures for electrical accidents &amp; steps to be taken in such accidents.</li> <li>6. Use of Fire extinguishers.</li> </ol>                                                                                            | Familiarization with the working of Industrial Training Institute system.<br>Introduction to IoT techniques.<br>Explain each block of the IoT block diagram.<br>Brief on opportunities in the applications of IoT.<br>Introduction to Safety and PPEs.                                                 |
|                                                                 |                                                                                                              | <b>Basics of AC and Electrical Cables</b> <ol style="list-style-type: none"> <li>7. Identify the Phase, single Phase and three phase, Neutral and Earth on power socket, use a testers to monitor AC power.</li> <li>8. Construct a test lamp and use it to check mains healthiness. Measure the voltage between phase and ground and rectify earthing.</li> <li>9. Prepare terminations, skin the electrical wires /cables using wire stripper and cutter.</li> <li>10. Measure the gauge of the wire using SWG and outside micrometer.</li> <li>11. Demonstrate various test and measuring instruments</li> </ol> | Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance.<br>Basics of AC & DC.<br>Various terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, Instantaneous value.<br>Single phase and Three phase supply.<br>Different type of electrical cables. |

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|                                                                 |                                                                                                                      | 12. Measure voltage and current using clamp meter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                   |
| Professional Skill 34Hrs.;<br><br>Professional Knowledge 12Hrs. | Test various electronic components using proper measuring instruments and compare the data using standard parameter. | <p><b>Active and Passive Components</b></p> <p>13. Identify the different types of active and passive electronic components including SMD.</p> <p>14. Measure the resistor value by colour code, SMD Code and verify the same by measuring with multimeter.</p> <p>15. Identify resistors by their appearance and check physical defects.</p> <p>16. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources.</p> <p>17. Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law.</p> <p>18. Verify laws of series and parallel circuits with voltage source in different combinations.</p> <p>19. Identify different inductors and measure the values using LCR meter. Identify the different capacitors and measure capacitance of various capacitors using LCR meter.</p> <p>20. Identify and test the circuit breaker and other protecting devices (Fuse).</p> <p>21. Test Step-up, Step-down, Isolation Transformer.</p> <p><b>AC &amp; DC measurements</b></p> <p>22. Use the multi meter to measure the various functions (AC V, DC V, DC I,</p> | <p>Ohm's law. Resistors; types of resistors, their construction &amp; specific use, color-coding, power rating.</p> <p>Equivalent of series circuits. Distribution of V &amp; I in series parallel circuits.</p> <p>Principles of induction, inductive reactance.</p> <p>Capacitance and Capacitive Reactance &amp; types. Functions of DSO, Regulated power supply multimeter and LCR meter.</p> |

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|                                                                         |                                                                                                                                                                            | <p>AC I, R).</p> <p>23. Identify the different controls on the Digital Storage Oscilloscope front panel and observe the function of each control.</p> <p>24. Measure DC voltage, AC voltage, time period, sine wave parameters using DSO.</p> <p>25. Identify and use different mathematical functions +, -, X, diff, intg, AND, OR of DSO on the observed signal.</p> <p>26. Identify and use different acquisition modes of normal, average, persistence mode.</p> |                                                                                                                                                                                                                  |
| <p>Professional Skill 60 Hrs.;</p> <p>Professional Knowledge 12Hrs.</p> | <p>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.</p> | <p><b>Soldering/ De-soldering</b></p> <p>27. Practice soldering on different electronic components, small transformer and lugs.</p> <p>28. Practice soldering on IC bases and PCBs.</p> <p>29. Practice de-soldering using pump and wick.</p> <p>30. Check for cold continuity of PCB.</p>                                                                                                                                                                           | <p>Soldering and De-soldering stations and and procedure.</p>                                                                                                                                                    |
| <p>Professional Skill 18 Hrs.;</p> <p>Professional Knowledge 08Hrs.</p> | <p>Construct, test and verify the input/ output characteristics of various analog circuits.</p>                                                                            | <p>31. Identify and test different types of diodes, diode modules using multi meter and determine forward to reverse resistance</p> <p>32. Construct instrumentation amplifier using OPAMP.</p>                                                                                                                                                                                                                                                                      | <p>Semiconductor materials, components, number coding for different electronic components such as Diodes and Zeners etc. PN Junction, Forward and Reverse biasing of diodes.</p>                                 |
| <p>Professional Skill 17Hrs.;</p> <p>Professional Knowledge 12Hrs.</p>  | <p>Assemble, test and troubleshoot various digital circuits.</p>                                                                                                           | <p>33. Identify and verify different Logic Gates (AND, OR, NAND, NOR, EX-OR, EX-NOR, NOT ICs) by the number printed on them.</p> <p>34. Identify and test common anode and common cathode seven segment LED display</p>                                                                                                                                                                                                                                              | <p>Introduction to Digital Electronics.</p> <p>Difference between analog and digital signals.</p> <p>Number systems (Decimal, binary, octal, Hexadecimal).</p> <p>BCD code, ASCII code and code conversions.</p> |

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|                                                                 |                                                                                                                                                    | using multi meter.                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p>Various Logic Gates and their truth tables.</p> <p>Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders, 2-bit and four bit full adders.</p> <p>Magnitude comparators.</p> <p>Half adder, full adder ICs and their applications for implementing arithmetic operations.</p> <p>Concept of encoder and decoder. Basic Binary Decoder and four bit binary decoders.</p> <p>Need for multiplexing of data.</p> <p>1:4 line Multiplexer / De-multiplexer.</p> <p>Introduction to Flip-Flop data transfer and frequency division.</p> <p>Types of seven segment display.</p> <p>BCD display and BCD to decimal decoder.</p> <p>BCD to 7 segment display circuits.</p> |
| Professional Skill 24Hrs.;<br><br>Professional Knowledge 12Hrs. | Install, configure, interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications. | 35. Identify various indicators, cables, connectors and ports on the computer cabinet.<br>36. Demonstrate various parts of the system unit and motherboard components.<br>37. Identify various computer peripherals and connect it to the system.<br>38. Boot the system from Different options and install OS in a desktop computer.<br>39. Browse search engines, create email accounts, practice sending and receiving of mails and configuration of email clients. | <p>Basic blocks of a computer, Components of desktop and motherboard.</p> <p>Hardware and software, I/O devices, and their working.</p> <p>Various ports in the computer.</p> <p>Working principle of SMPS, its specification.</p> <p>Windows OS</p> <p>MS widows: Starting windows and its operation, file management using explorer, Display &amp; sound properties, screen savers, font management, installation of program, setting and using of control panel., application of accessories, various IT tools and</p>                                                                                                                                                                          |

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|                                                                 |                                                                                                              | <p>40. Identify different types of cables and network components e.g. Hub, switch, router, modem etc.</p> <p>41. Configure a wireless Wi-Fi network.</p>                                                                        | <p>applications.</p> <p>Concept of Internet, Browsers, Websites, search engines, email, chatting and messenger service. Downloading the Data and program files etc.</p> <p><b>Computer Networking:-</b></p> <p>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.</p> <p>Difference between PC &amp; Server.</p> <p>Wifi and wireless network</p> |
| Professional Skill 30Hrs.;<br><br>Professional Knowledge 08Hrs. | Develop troubleshooting skills in various standard electronic circuits using Electronic simulation software. | 42. Prepare simple digital and analog electronic circuits using the software.                                                                                                                                                   | Circuit design software.<br>Design of any electronic circuit using the software.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Professional Skill 15Hrs.;<br><br>Professional Knowledge 08Hrs. | Apply the principle of sensors and transducers for various IoT applications.                                 | <p>43. Identify and test RTDs, Temperature ICs and Thermo couples.</p> <p>44. Identify and test proximity switches (inductive, capacitive and photoelectric).</p> <p>45. Identify and test, load cells, strain gauge, LVDT.</p> | <p>Basics of passive and active transducers.</p> <p>Role, selection and characteristics.</p> <p>Sensor voltage and current formats.</p> <p>Thermistors / Thermocouples - Basic principle, salient features, operating range, composition, advantages and disadvantages.</p> <p>Strain gauges/ Load cell –</p>                                                                                                                                                                                                                                                                |



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|                                                                  |                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p>principle, gauge factor, types of strain gauges.</p> <p>Inductive/ capacitive transducers - Principle of operation, advantages and disadvantages.</p> <p>Principle of operation of LVDT, advantages and disadvantages.</p> <p>Proximity sensors – applications, working principles of eddy current, capacitive and inductive proximity sensors.</p> |
| Professional Skill 27 Hrs.;<br><br>Professional Knowledge 12Hrs. | 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. | <p><b>Integration of Analog sensors</b></p> <p>46. Select appropriate Analog sensor.</p> <p>47. Connect &amp; measure AC/DC Analog Input such as voltage / current / RTD two-three-four wire AC mV signal etc.</p> <p>48. Configure Engineering &amp; Electrical zero/span configuration mV, 0-10VDC, 4-20mA, 0-20mA.</p> <p>49. Understand various units and zero span configuration as per sensor datasheet such as temperature, pressure, flow, level, lux level, environment, soil, moisture etc.</p> <p>50. Measure the Analog Input as per configuration and sensor selection.</p> <p>51. Generate and measure Analog Output to operate control valves and actuators.</p> <p><b>Integration of Digital sensors</b></p> <p>52. Identify various Digital sensors.</p> <p>53. Identify Roles and</p> | <p>Explain circuit diagram with controller and sensor.</p> <p>The specification and working of Analog sensor inputs as well as Analog control outputs.</p> <p>The specifications and working of Digital sensor inputs, Pulse Input as well as Digital control outputs.</p>                                                                             |

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|                                                                 |                                                                          | <p>Characteristics of each sensor.</p> <p>54. Select appropriate Digital sensor.</p> <p>55. Connect and Measure Digital Inputs of various voltage level such as TTL (0-5V), 24VDC (0-24 VDC) signals.</p> <p>56. Connect Pulse Inputs of various frequency ranging from 10 Hz to 1 KHz and configure the filters.</p> <p>57. Select, Configure and ascertain of Digital Outputs and Relay Outputs to take On and Off action for actuators.</p> |                                                                                                                                                                                                                                                                   |
| Professional Skill 30Hrs.;<br><br>Professional Knowledge 12Hrs. | Identify, Test and troubleshoot the various families of Microcontroller. | <p>58. Explore different microcontroller Raspberry pi, RP 2040 and Arduino.</p> <p>59. Explore the different Software IDE for IoT applications</p>                                                                                                                                                                                                                                                                                             | <p>Introduction to microprocessor and microcontroller.</p> <p>Difference between microprocessor and microcontroller.</p> <p>Raspberry Pi and RP2040</p> <p>Introduction to ADC and DAC, schematic diagram, features and characteristic with the applications.</p> |
| Professional Skill 30Hrs.;<br><br>Professional Knowledge 06Hrs. | Identify, test and interconnect components/parts of IoT system.          | <p>60. Connect and test Arduino with ESP-32 &amp; ESP-8266, RP-2040, Raspberry-pi board to computer and execute sample programs from the example list.</p> <p>61. Upload computer code to the physical board (Microcontroller) to blink a simple LED.</p> <p>62. Write and upload computer code to the physical Arduino board Micro controller to sound buzzer.</p> <p>63. Circuit and program to</p>                                          | <p>Arduino development board, Pin diagram, Functional diagram, Hardware familiarization and operating instructions.</p> <p>Integrated development Environment, Running Programs on IDE, simple Programming concepts.</p>                                          |

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|                            |                                      | <p>Interface light sensor – LDR with an arduino to switch ON/OFF LED based on light intensity.</p> <p>64. Set up &amp; test circuit to interface potentiometer with Arduino board and map to digital values for eg. 0-1023.</p> <p>65. 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.</p> <p>66. Rig up the Circuit and upload a program to Control a relay and switch on/off LED light using Arduino.</p> <p>67. Make Circuit and upload a program to Interface of LCD display with a microcontroller to display characters.</p> <p>68. Rig up the circuit and upload a program to interface temperature sensor – LM35 with a controller to display temperature on the LCD.</p> <p>69. Set up Circuit and upload program to Interface DC motor (actuator) with microcontroller to control on /off /forward/reverse operations.</p> <p>70. Rig up Circuit and upload program micro-controller to switch on/off two lights using relay.</p> |                                                             |
| Professional Skill 60Hrs.; | Identify and Select various types of | 71. Identify and select appropriate sensor as per                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Concept of Generic Biomedical sensors - Real-time streaming |

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| <p>Professional Knowledge<br/>18Hrs.</p> | <p>sensors used in Smart Healthcare.</p> | <p>requirement.</p> <p>72. Identify the lead I, lead II, lead III of Standard Bipolar lead configuration.</p> <p>73. Select and test avR, avL ,avF lead of Standard Augmented Uni-polar leads configuration.</p> <p>74. Select and test Chest lead V1, Chest lead V2, Chest lead V3. Chest lead V4, Chest lead V5, Chest lead V6 of Standard Uni-polar lead Configuration.</p> <p>75. Measure of Normal Heart-Rate. Measure the heart abnormality conditions (Tachycardia, Bradycardia).</p> | <p>data in healthcare applications through Generic Biomedical Sensor signals.</p> <p>Working Principle &amp; Application of Smart phones &amp; wearable sensor devices - Recognition of activities and health monitoring by Heart biomedical signals, Active assistance by Activity and environment data.</p> <p>Principle of operation &amp; Application of Textile-integrated non-contact sensors - Long-term monitoring of respiration and pulse by Respiration and pulse bio signals.</p> <p>Working Principle of Location sensor - Real time location Service.</p> <p>Use of Temperature Sensor - Environmental monitoring.</p> <p>Use of Smartphone &amp; Smart watch - Diabetes monitoring by Daily activity data.</p> <p>Concept of Multi-sensor plethysmography device - Detection and prevention of venous stasis by Pulse and blood flow data.</p> <p>Working Principle &amp; Application of Biomedical sensors &amp; smartphone - Physiological data of elderly patients by bio signals like Oxygen saturation level, Heart Rate.</p> |
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|                                                                        |                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>Use of Wearable ECG sensors and Cloud processing for ECG Smart Healthcare monitoring by ECG bio signals.</p> <p>Concept of Different sensors and actuators - Mobile medical computing systems by Medical signal and context information.</p> <p>Concept of Mobile healthcare(m-health) - Applications in the pervasive environment by bio signals like Pulse rate, blood pressure, level of alcohol etc.</p>                                                                                                                                                                                                                                   |
| <p>Professional Skill 73Hrs.;</p> <p>Professional Knowledge 18Hrs.</p> | <p>Identify, select different wireless communication modules and topology to generate and record the data.</p> | <p>76. Identify the interfacing of Bluetooth module to create local sensor network.</p> <p>77. Check the interfacing of GSM module to make node as a gateway.</p> <p>78. Apply IoT Gateway using WiFi and Ethernet.</p> <p>79. Check UART Communication, RS485 Communication, I2C Protocol device interfacing SPI Protocol device interfacing, Ethernet configuration, Wi-Fi AP and Router interfacing.</p> <p>80. Identify the Wi-Fi module and lua script for data communication.</p> <p>81. Check USB and Ethernet connectivity for data communication.</p> <p>82. Synchronize the different bio-signals in wireless Body Area Network (BAN) of sensors or wearables to</p> | <p>M2M Wireless Sensor Network (WSN) in IoT.</p> <p>Interfacing of Bluetooth module to create local sensor network.</p> <p>Principle of operation &amp; Application of IoT Gateway Using WiFi and Ethernet.</p> <p>UART Communication, RS485 Communication, I2C Protocol device interfacing, SPI Protocol device interfacing, Ethernet configuration, Wi-Fi AP and Router interfacing.</p> <p>Wi-Fi module and lua script for data communication.</p> <p>Study the application of GPS satellites in Location Sensors.</p> <p>USB and Ethernet connectivity for data communication.</p> <p>Introduction to modern communication capabilities -</p> |

|                                                                        |                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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|                                                                        |                                                                                                                                                                       | <p>obtain an integrated profile of the user.</p> <p>83. Identify and select the things with only sensing features (i.e., biosensors like Pulse Oximetry Sensor, Inertia Sensor, Blood Pressure Sensor, Chest Strap Sensor etc.), things with only computing features (i.e., smart phones) and things with both sensing and computing features (i.e. smart watches).</p> | <p>wireless Body Area Network (BAN) of sensors or wearables to synchronize the different bio-signals to obtain an integrated profile of the user.</p> <p>Concept of things with only sensing features (i.e., biosensors), things with only computing features (i.e., smartphones) and things with both sensing and computing features (i.e. smart watches).</p> <p>Basics of are interconnection of the computing elements creating the IoT communication network -the set of devices connected to a Local Area Network (LAN) in a wireless way – formation of a wireless local area network (WLAN) among them for bringing connectivity anywhere and improving the performance of the network.</p> |
| <p>Professional Skill 30Hrs.;</p> <p>Professional Knowledge 06Hrs.</p> | <p>Identify and test Wired &amp; Wireless communication medium such as RS232, RS485, Ethernet, Fiber Optic, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol.</p> | <p>84. Identify LAN Cable and its Pin Mapping.</p> <p>85. Crimp and Test RJ9 / RJ11 / RJ45 connectors.</p> <p>86. Design and Test Local Area Networks over Ethernet &amp; Wi-Fi.</p>                                                                                                                                                                                    | <p>Basic blocks of networking,</p> <ul style="list-style-type: none"> <li>- Specifications, Standards and types of cables,</li> <li>- Concept of wired or wireless communication medium.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p>Professional Skill 26Hrs.;</p> <p>Professional Knowledge 12Hrs.</p> | <p>Perform Installation, configuration and ensure working of IoT devices, network, database, app and web services.</p>                                                | <p>87. Install Linux Operating System porting.</p> <p>88. Configure Local cloud &amp; server.</p> <p>89. Configure Cloud and Server for IoT.</p> <p>90. Test Web and Application Development Tools for IoT.</p>                                                                                                                                                         | <p>IOT gateway with internet and wifi</p> <p>Installation of linux operating system porting.</p> <p>Cloud and Server Configuration for IoT.</p> <p>IoT Web and Application Development Tools for IoT.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Professional                                                           | Establish and                                                                                                                                                         | 91. Power up the device as per                                                                                                                                                                                                                                                                                                                                          | - Basics of Industrial protocols                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                                                                        |                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                   |
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| <p>Skill 86Hrs.;</p> <p>Professional Knowledge 18Hrs.</p>              | <p>troubleshoot IoT connectivity of devices to cloud having multiple communication medium, protocols, device management and monitoring.</p> | <p>the device manual.</p> <p>92. Integrate the device with serial protocol working on Modbus RTU.</p> <p>93. Communicate and Verify the parameters on Modbus Master Software</p> <p>94. Power up the DLMS device as per the device manual.</p> <p>95. Setup environment for Modbus TCP/IP server client testing.</p> <p>96. Communicate and Configure Modbus devices through GSM GPRS network</p> <p>97. Setup Ethernet IoT Data Acquisition system, connect to cloud and verify.</p> <p>98. Setup WiFi IoT Data Acquisition system, connect to cloud and verify.</p> <p>99. Setup Cellular (GSM / GPRS) IoT Data Acquisition system, connect to cloud and verify.</p> <p>100. Explore IoT Cloud Configuration utility.</p> <p>101. Create / modify organization, Connect devices over cloud.</p> <p>102. Configuration of parameters, alarms, notifications on cloud platform.</p> <p>103. Explore user management roles and security.</p> <p>104. Observer Device Diagnostics for troubleshooting.</p> | <p>Modbus RTU, Modbus TCP, DLMS</p> <p>- Client server communication</p> <p>Basics of Protocol Converters. Basics of IoT Data Acquisition System.</p> <p>Device connectivity over cloud and troubleshooting.</p> <p>GUI based IoT Cloud Configuration utility. IoT device and its parameter configuration</p> <p>Cloud Device Management and troubleshooting.</p> |
| <p>Professional Skill 60Hrs.;</p> <p>Professional Knowledge 12Hrs.</p> | <p>Demonstrate and Deploy responsive Web Application using APIs and generate reports using templates.</p>                                   | <p>105. Explore Web API, required input parameters and output.</p> <p>106. Map Web API to Widget / Control / Plugin.</p> <p>107. Display and configure</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>Usage of Web Services / Web API</p> <p>Development of Sample Web Application.</p> <p>Generation and export of Reports</p>                                                                                                                                                                                                                                      |

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|                                                                          |                                                                                                                        | <p>graphs, charts and other ready to use controls and widgets.</p> <p>108. To generate reports using readily available API, templates and to export it to excel, word pdf and other required formats.</p>                                                                                                                                                                                                            | <p>User access and rights management.</p> <p>IOT Security</p>                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p>Professional Skill 55Hrs.;</p> <p>Professional Knowledge 12Hrs.</p>   | <p>Monitor health parameters like Blood Pressure, ECG, EMG, Heart rate, EEG, SPO2 etc. by suitable sensors (PHMS).</p> | <p>109. Analyse respiration real time using piezoelectric sensor.</p> <p>110. Identify and select respiration system, exchange of gases in alveoli of lungs.</p> <p>111. Identify apnea (Slow rate of Respiration), tachypnea (Fast rate of Respiration), electrocardiogram, cardiovascular abnormality like Bradycardia, Tachycardia, real time ECG.</p> <p>112. Check Software analysis of real time ECG data.</p> | <p>Working Principle of Hardware requirements like Raspberry pi 2 model B, LM 35 temperature sensor, Heart Beat and Blood Pressure sensor, A to D converter (LTC2495), ECG sensor, LCD Display, Alarm, MAX 232, GSM Module, Wi-Fi Dongle.</p> <p>Principle of operation &amp; Application of Software requirements like Raspbian OS, Python IDLE, Server</p> <p>Study real time analysis of respiration using piezoelectric sensor.</p>                                                                 |
| <p>Professional Skill 45 Hrs.;</p> <p>Professional Knowledge 08 Hrs.</p> | <p>Apply the sensor output data for further computing, analyzing and visualisation.</p>                                | <p>113. Observe the biomedical data.</p> <p>114. Check the data with standard parameters.</p> <p>115. Record the data for further analysis.</p>                                                                                                                                                                                                                                                                      | <p>Study to establish a very diverse, distributed and complex series regarding the great diversity of sensors and other devices/sensing elements that collect data including social networks through their different application program interface (APIs).</p> <p>Concept of Information directly sent to the cloud, starting with the previous stages of processing, cleaning, transformation and normalization or Information pre processed in the available resources on current mobile devices.</p> |



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|                                                                   |                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Knowledge of last stage of analysis and visualization, the resources of the mobile devices play an important role to use their processing capabilities in these tasks.                                                                                                                                                                                                                                                                                             |
| Professional Skill 40 Hrs.;<br><br>Professional Knowledge 10 Hrs. | Identify, select and Execute remote health monitoring and Tele-health.                      | 116. Monitor EMG signals, ECG signals, Snore signals.<br>117. Check Airflow control of user.<br>118. Check Body temperature data.<br>119. Measure Galvanic skin response.<br>120. Detect Body position.<br>121. Observe Pulse and oxygen functions.<br>122. Use Blood pressure control device.<br>123. Apply Glucometer monitor.<br>124. Use Spirometer monitor.<br>125. Use Internet, video chats, Smartphone and Electronic Medical Record (EMR) clouds for Tele-Health. | Principle of operation of Tele-Health - delivery of healthcare services and clinical information to remote locations – interactive connections with patients through a nationwide network of licensed doctors 24/7 using Internet, Internet of Things (IoT), video chats, Smartphone and Electronic Medical Record (EMR) clouds. Study Services Under Tele-Health Umbrella–Tele-Medicine, Tele-Monitoring, Tele-Health Data Service, Remote Medical Education etc. |
| Professional Skill 50 Hrs.;<br><br>Professional Knowledge 12 Hrs. | Identify, select different Robots used in healthcare. (can be achieved by industrial visit) | 126. Interface RC servo motor with microcontroller.<br>127. Apply Sensor Interface and control Gyroscope, Accelerometer.                                                                                                                                                                                                                                                                                                                                                   | Basics of Tele Surgery: Enabling the surgeon to perform an operation on a patient from a distant location using Tele Robotics technology.<br>Study Tele Robotics technology tools – demonstrate different types of servo motor, basic functions of Gyroscope, Accelerometer, Sensor Interface and control.<br>Concept of Pick and Place Robot.<br>Functions of colour sensor.<br>Principle of vision-based Humanoid for patient health monitoring.                 |

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|                                                                                                                                                                                                                                                                                                                                               |  |  | <p>Introduction to Artificial Intelligence &amp; machine Learning.</p> <p>Application of Artificial Intelligence &amp; machine Learning.</p> |
| <p><b>Project Work/Industrial Visit (Optional)</b></p> <p><b>Broad Area:-</b></p> <ul style="list-style-type: none"> <li>a) Develop a system to measure and record ECG signals.</li> <li>b) Develop a wireless system to monitor patient health status using different sensors.</li> <li>c) Develop a tele-health check-up system.</li> </ul> |  |  |                                                                                                                                              |

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

1. Employability Skills (Common for all CTS trades) (120 Hrs.)

*Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in [www.bharatskills.gov.in](http://www.bharatskills.gov.in) / [www.dgt.gov.in](http://www.dgt.gov.in)*

## ANNEXURE-I

| List of Tools & Equipment                                                                                   |                                                        |                                      |          |
|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------|----------|
| IoT TECHNICIAN (SMART HEALTHCARE) (For batch of 24 candidates)                                              |                                                        |                                      |          |
| S. No.                                                                                                      | Name of the Tools and Equipment                        | Specification                        | Quantity |
| <b>A. TRAINEES TOOL KIT</b> ( 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                                | 6 Nos.   |
| 3.                                                                                                          | Screwdriver set                                        | Set of 7                             | 12 Nos.  |
| 4.                                                                                                          | Insulated combination pliers                           | 150 mm                               | 6 Nos.   |
| 5.                                                                                                          | Insulated side cutting pliers                          | 150mm                                | 8 Nos.   |
| 6.                                                                                                          | Long nose pliers                                       | 150mm                                | 6 Nos.   |
| 7.                                                                                                          | Soldering iron                                         | 25 Watt, 240 Volt                    | 12 Nos.  |
| 8.                                                                                                          | Electrician knife                                      | 100 mm                               | 6 Nos.   |
| 9.                                                                                                          | Tweezers                                               | 150 mm                               | 12 Nos.  |
| 10.                                                                                                         | Digital Multimeter                                     | (3 3/4 digit) ,4000 Counts           | 12 Nos.  |
| 11.                                                                                                         | Soldering Iron Changeable bits                         | 15 Watt, 240 Volt                    | 6 Nos.   |
| 12.                                                                                                         | De- soldering pump electrical heated, manual operators | 230 V, 40 W                          | 12 Nos.  |
| <b>B. SHOP TOOLS, INSTRUMENTS</b> – For 2 (1+1) units no additional items are required                      |                                                        |                                      |          |
| <b>Lists of Tools:</b>                                                                                      |                                                        |                                      |          |
| 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.   |

|                                 |                                                                                                |                                                                                                                                                                                                                                          |             |
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| 32.                             | Hacksaw frame adjustable                                                                       | 300 mm                                                                                                                                                                                                                                   | 2 Nos.      |
| 33.                             | Chisel - Cold - Flat                                                                           | 10 mm X 150 mm                                                                                                                                                                                                                           | 1 No.       |
| 34.                             | Scissors                                                                                       | 200mm                                                                                                                                                                                                                                    | 1 No.       |
| 35.                             | Handsaw 450mm                                                                                  | Hand Saw - 450 mm                                                                                                                                                                                                                        | 1 No.       |
| 36.                             | Hand Drill Machine Electric with Hammer Action                                                 | 13 mm                                                                                                                                                                                                                                    | 2 Nos.      |
| 37.                             | First aid kit                                                                                  |                                                                                                                                                                                                                                          | 1 No.       |
| 38.                             | Bench Vice                                                                                     | Bench Vice - 125 mm                                                                                                                                                                                                                      | 1 No. each  |
|                                 |                                                                                                | Bench Vice - 100 mm                                                                                                                                                                                                                      |             |
|                                 |                                                                                                | Bench Vice - 50 mm                                                                                                                                                                                                                       |             |
| 39.                             | Wire stripper                                                                                  |                                                                                                                                                                                                                                          | 12 Nos.     |
| <b>List of Equipments</b>       |                                                                                                |                                                                                                                                                                                                                                          |             |
| 40.                             | Multiple Output DC regulated power supply                                                      | 0-30V, 2 Amps, $\pm$ 15V Dual Tracking, 5V/5A, Display digital,                                                                                                                                                                          | 4 Nos.      |
| 41.                             | Regulated Variable DC Power Supply                                                             | 0-30V/3A with                                                                                                                                                                                                                            | 2 Nos.      |
| 42.                             | LCR meter (Digital) Handheld                                                                   |                                                                                                                                                                                                                                          | 1 No.       |
| 43.                             | Digital Storage Oscilloscope                                                                   |                                                                                                                                                                                                                                          | 1 No.       |
| 44.                             | Multi Waveform Signal Generators                                                               | 10 MHz                                                                                                                                                                                                                                   | 1 No        |
| 45.                             | 3GHz Spectrum Analyzer with built-in Tracking Generator                                        | Frequency Range 9 kHz to 3.2 GHz<br>Resolution Bandwidth(-3 dB): 10 Hz to 1 MHz                                                                                                                                                          | 1 No        |
| <b>OR Electronics Workbench</b> |                                                                                                | <b>Item no. 39, 41, 42, 43, 44 and 45 can be preferred in the form of workbench.</b>                                                                                                                                                     | <b>1No.</b> |
| 46.                             | Multi Function Test & Measuring Tool for Field Applications and Testing compatible with Laptop | 300 MHz Bandwidth 2 Channel Digital Storage Oscilloscopes, Arbitrary Waveform Generator Sine, Square Triangle AM –FM Modulation.                                                                                                         | 1No.        |
| 47.                             | Electrical Safety Trainer                                                                      | Demonstration of importance of earthing in any electrical device.<br>Arrangement to study role of fuse and types of slow blow, high blow fuse in any electronic circuit.<br>Arrangement to study the importance of MCB and it's working. | 1No.        |
| 48.                             | Analog Component Trainer with following Seven Basic                                            | Breadboard for Circuit design<br>DC power supply: +5V, 1A                                                                                                                                                                                | 1 No.       |

|     |                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                         |             |
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|     | <p>Modules</p> <ul style="list-style-type: none"> <li>• Diode Characteristics (Si,Zener,LED)</li> <li>• Rectifier Circuits</li> <li>• Diode as Clipper Circuit</li> <li>• Diode as Clamping Circuit</li> <li>• Zener as voltage regulator.</li> <li>• Transistor Type NPN &amp; PNP and CE Characteristics</li> <li>• Transistor as a switch</li> </ul> | <p>(Fixed); +12V, 500mA (Fixed); ±12V, 500mA (Variable)<br/>AC power Supply: 9V-0V-9V, 500mA<br/>Function Generator: Sine, Square, Triangle<br/>Modulating Signal Generator: Sine, Square, Triangle</p> |             |
| 49. | Digital IC Trainer                                                                                                                                                                                                                                                                                                                                      | <p>Breadboard: Regular<br/>DC Supply: +5 V/1 A +12V/1A<br/>Clock Frequency 4 different steps from 1Hz – 100KHz<br/>Amplitude: Seven Segment Display, Teaching &amp; Learning Simulation Software</p>    | 1 No.       |
| 50. | IT Workbench for computer hardware and networking                                                                                                                                                                                                                                                                                                       | As per Requirement                                                                                                                                                                                      | 1 No.       |
| 51. | Laptop latest configuration                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                         | 1 No.       |
| 52. | Desktop computer                                                                                                                                                                                                                                                                                                                                        | Latest configuration                                                                                                                                                                                    | 24+1 No.    |
| 53. | UPS                                                                                                                                                                                                                                                                                                                                                     | 5 KVA                                                                                                                                                                                                   | As required |
| 54. | Laser jet Printer                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                         | 1 No.       |
| 55. | INTERNET BROADBAND CONNECTION                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                         | 1 No.       |
| 56. | Electronic circuit design software with five user licenses                                                                                                                                                                                                                                                                                              | <p>Circuit Design and Simulation Software with PCB Design with Gerber and G Code Generation, 3D View of PCB, Breadboard View, Fault Creation and Simulation.</p>                                        | 1 No.       |
| 57. | Different types of electronic and electrical cables, connectors, sockets, terminations.                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                         | As required |
| 58. | Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB                                                                                                                                                                                                                 |                                                                                                                                                                                                         | As required |
| 59. | SMD Soldering & De soldering Station with necessary accessories                                                                                                                                                                                                                                                                                         | <p>SMD Soldering &amp;Desoldering Station Digitally Calibrated Temperature Control SMD Soldering &amp;Desoldering Power Consumption: 60 Watts<br/>De-soldering: 70 Watt</p>                             | 1 No.       |

|     |                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                         |             |
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|     |                                                                                                                                                                                                                                                            | Power Consumption: 270 Watts<br>Hot Air Temperature: 200 to 550° Centigrade                                                                                                                                             |             |
| 60. | SMD Technology Kit                                                                                                                                                                                                                                         | SMD component identification board with SMD components Resistors, Capacitors, Inductors, Diodes, Transistors & IC's packages. Proto boards with readymade solder pads for various SMD Components.<br>SMD Soldering Jig. | 1 No.       |
| 61. | Arduino and Raspberry-pi based IoT system with cloud access, accessories, analog and digital ports, support for stepper motor, servo motors, UART port for serial data communication and separate port for I2C                                             | Arduino, Raspberry-pi and RP 2040 based IoT system with all accessories sensors and cloud access minimum 10 sensors                                                                                                     | 1 No.       |
| 62. | Sensor Trainer kit with sensor<br>Containing following Sensors<br>a) Air humidity and Temperature<br>b) RTD<br>c) Atmospheric Pressure<br>d) Air Quality<br>e) Smoke Detector Sensors<br>f) Limit Switch<br>g) Photo sensors<br>h) Capacitive displacement | Interfacing all listed sensors and test their working status                                                                                                                                                            | 2 Nos.      |
| 63. | Different types of electronic and electrical cables, connectors, sockets, terminations.                                                                                                                                                                    |                                                                                                                                                                                                                         | As required |
| 64. | Internet of Things Explorer                                                                                                                                                                                                                                | System with attached and database modules for sensors, controllers, gateway and application control facility                                                                                                            | 1 No.       |
| 65. | Field Interface and Protocol Simulation Kit                                                                                                                                                                                                                | A console including :Any Branded Desktop Computer with Windows Operating System<br>1. Ethernet Devices with Isolated Supply and port                                                                                    | 1 No.       |

|                                      |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         |
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|                                      |                                                                                                 | <ol style="list-style-type: none"> <li>1. 4 AI(0.1% FSR), 4 AO Ethernet Port – Qty 1</li> <li>2. 8 Relay Outputs, Ethernet Port – Qty 1</li> <li>3. 8 Pulse Outputs, Ethernet Port – Qty 1</li> <li>4. 8 Digital Inputs, Ethernet Port – Qty 1</li> <li>5. 4 RS485 Slave ports, 1 Ethernet Port – Qty 4</li> <li>2. 16 Port Ethernet Switch for networking of field ethernet devices</li> <li>3. SMPS to power up multiple ethernet based field simulation devices</li> <li>4. Required Connectors, Switches and LED indicators for Field Interface circuits such as Digital Inputs, Relay Outputs, Analog Inputs, Analog Outputs, Pulse Signals</li> <li>5. Software <ol style="list-style-type: none"> <li>1. Communication with simulation device on ethernet MODBUS TCP Protocol</li> <li>2. Field Interface simulation using HMI replica of Console for easy understanding of students</li> <li>3. Port Simulation – Serial Port Terminal, TCP/IP, UDP, HTTP</li> <li>4. Protocol Simulation – MODBUS RTU Master/Slave, MODBUS TCP Master/Slave.</li> </ol> </li> </ol> |         |
| <b>TOOL LIST FOR LAST SIX MONTHS</b> |                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         |
| 66.                                  | Wireless Communication modules for interfacing with microcontrollers<br><br>a) RFID Card Reader | Programmable controller supporting both programming modes Key Pad and PC ,LCD for both programming mode and run                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 12 Nos. |



|     |                                                                |                                                                                                                                                                                                                                                                                               |         |
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|     | b) Finger Print<br>c) GPS<br>d) GSM<br>e) Bluetooth<br>f) WiFi | mode, ready to run programmer to support family of controllers Breadboard to make circuits, detailed learning content through simulation Software and following application modules: RFID Card Reader, Finger Print, GPS, GSM, Bluetooth and WiFi                                             |         |
| 67. | Sensors Trainer Kit for Biomedical Application                 | All should be compatible with Sensor Training Platform ECG Sensor, Heart Rate Sensor, GSR, Temperature                                                                                                                                                                                        | 12 Nos. |
| 68. | ECG cum Heart Rate Monitor                                     | Heart Rate Display 16x2 LCD Display , Measuring Range 30-300 heartbeats per minute, Real time ECG acquisition with 200 samples/sec 8-bit A/D                                                                                                                                                  | 12 Nos. |
| 69. | 12 Lead ECG Simulator                                          | ECG Amplitude Range: 200mV- 4V DC, Support Bipolar leads Lead I, Lead II, Lead III , Unipolar Leads avR, avL, avF, Chest leads (V1-V6) Separate output channels Left arm (LA), Right arm (RA), Left leg (LL), Right leg (RL) and Chest Leads (V1-V6)<br>Low pass Filter 5KHz Cutoff frequency | 12 Nos. |
| 70. | Respiration Rate Monitor                                       | Respiration-Rate Display 16 x 2 LCD display, Piezo Electric Transducer, On board visual and audible Tachypnea and Apnea indicator, User selectable Apnea period control On board Respiration event indicator                                                                                  | 12 Nos. |
| 71. | Understanding of Electro-Myograph                              | Filter (Band Pass) 1 Hz – 10 KHz Notch Filter 50Hz, Normal EMG Excited EMG Raw EMG Filtered EMG, Surface Electrodes (Ag-AgCl) information about 10 simulated EMG outputs                                                                                                                      | 12 Nos. |

|     |                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |         |
|-----|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 72. | Patient Health Monitoring Development Platform     | <p>IoT Based Platform to measure 20 different biometric parameters and wireless sent using two connectivity options available: Wi-Fi or Bluetooth Low Energy 4.0. Data can be visualized in standalone color display mode and sent to the Cloud in order to perform permanent storage or visualize and storage in real time by sending the data directly to a iPhone and Android Applications With CE / FCC / IC Certifications</p> <p>Sensors Includes : SPO2 Sensor, ECG Sensor, Airflow Breathing, Blood Pressure, Glucometer, Spirometer, Body Temperature, EMG Sensor, Galvanic Skin Response, Body Position, Snore Sensor, etc.</p> | 12 Nos. |
| 73. | Robots used in healthcare <b>(optional)</b>        | <p>MCU : ATmega128, 16MHz<br/>DC Power Supplies : +8.4V<br/>Charger Supply : 9V/1A<br/>Battery Power : 8.4V / 4400mAh<br/>160x128 TFT Color LCD interface<br/>RC servo motors consists of 5 degree of freedom (DOF) Base : 0 to 180 o Shoulder (1 and 2) : 0 to 180 o Elbow : 0 to 180 o Wrist : 0 to 180 o o Grip : 50 to 90</p>                                                                                                                                                                                                                                                                                                         | 1 No.   |
| 74. | IoT Data Acquisition Systems & Protocol Converters | <p>Connectivity to Cloud (IBM, Microsoft, Amazon)<br/>24 VDC Isolated Supply, 4 Analog Inputs (0.1% FSR), 8 Pulse Inputs (up to 1 kHz), 8 Digital Inputs, 4 Relay Outputs<br/>Ethernet IOT DAQ<br/>Wi-Fi IoT DAQ<br/>Cellular (GSM / GPRS) IoT DAQ</p>                                                                                                                                                                                                                                                                                                                                                                                    | 12 set  |

|                                                                                                    |                                        |                                                                                                                                                                                                                                                 |                    |
|----------------------------------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
|                                                                                                    |                                        | MODBUS RTU to MODBUS TCP 24 VDC Isolated Power Supply, 4 Isolated MODBUS RTU Master Port<br>Serial to Ethernet<br>Serial to Wi-Fi<br>Serial to GPRS                                                                                             |                    |
| 75.                                                                                                | 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 | 12 Nos.            |
| 76.                                                                                                | 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 Nos.             |
| 77.                                                                                                | Arduino Board with accessories         | Arduino Module - latest specifications                                                                                                                                                                                                          | As required        |
| 78.                                                                                                | Raspberry-pi Board with accessories    | Raspberry Pi Module - latest specifications                                                                                                                                                                                                     | As required        |
| <b>C. Shop Floor Furniture and Materials - For 2 (1+1) units no additional items are required.</b> |                                        |                                                                                                                                                                                                                                                 |                    |
| 79.                                                                                                | Instructor's table                     |                                                                                                                                                                                                                                                 | 1 No.              |
| 80.                                                                                                | Instructor's chair                     |                                                                                                                                                                                                                                                 | 2 Nos.             |
| 81.                                                                                                | Computer Table                         |                                                                                                                                                                                                                                                 | 24+1 No.           |
| 82.                                                                                                | Computer Chair                         |                                                                                                                                                                                                                                                 | 24+1 No.           |
| 83.                                                                                                | Metal Rack                             | 100cm x 150cm x 45cm                                                                                                                                                                                                                            | 4 Nos.             |
| 84.                                                                                                | Lockers with 16 drawers standard size  |                                                                                                                                                                                                                                                 | 2 Nos.             |
| 85.                                                                                                | Steel Almirah                          | 2.5 m x 1.20 m x 0.5 m                                                                                                                                                                                                                          | 2 Nos.             |
| 86.                                                                                                | Interactive Smart Board with Projector |                                                                                                                                                                                                                                                 | 1 No.              |
| 87.                                                                                                | Fire Extinguisher                      | Arrange all proper NOCs and equipment from municipal / competent authorities.                                                                                                                                                                   | As per requirement |

**Note: -**

1. Internet facility is desired to be provided in the classroom.

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities and all others who contributed in revising the curriculum.

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

| <b>List of Expert Members participated/ contributed for finalizing the course curriculum of IoT Technician (Smart Healthcare) trade held on 16.03.2023 at Bengaluru.</b> |                               |                                                           |                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-----------------------------------------------------------|----------------|
| <b>S No.</b>                                                                                                                                                             | <b>Name &amp; Designation</b> | <b>Organization</b>                                       | <b>Remarks</b> |
| 1.                                                                                                                                                                       | Shri. B.N. Sridhar            | Regional Director<br>RDSDE, Bengaluru                     | Chairman       |
| 2.                                                                                                                                                                       | Ms. Naina Nagpal              | Assistant Director<br>NSTI (W), Bengaluru                 | Co-ordinator   |
| 3.                                                                                                                                                                       | Shri. V.Babu                  | Principal/ Deputy Director<br>NSTI (W), Bengaluru         | Member         |
| 4.                                                                                                                                                                       | Shri M.J. Vijaya Raju         | Assistant Director<br>CSTARI, Kolkata                     | Co-ordinator   |
| 5.                                                                                                                                                                       | Shri. B.K. Nigam              | Training Officer<br>CSTARI, Kolkata                       | Member         |
| 6.                                                                                                                                                                       | Shri P.K. Bairagi             | Training Officer<br>CSTARI, Kolkata                       | Member         |
| 7.                                                                                                                                                                       | Ms. Pooja Singh               | Training Officer<br>NSTI, Bengaluru                       | Member         |
| 8.                                                                                                                                                                       | Shri. Rohit Prajapathi        | Technical Director<br>Digito AD Technologies<br>Bengaluru | Member         |
| 9.                                                                                                                                                                       | Shri N. Ramesh                | Taining Assistant Manager<br>BOSCH                        | Member         |
| 10.                                                                                                                                                                      | Girish. H                     | Engg. Head Phantan<br>BOSCH                               | Member         |
| 11.                                                                                                                                                                      | Shri Lohit. M.V               | Technology and Innovation Head<br>SIEMENS                 | Member         |
| 12.                                                                                                                                                                      | Shri Kondinya S.R             | Technology and Innovation AI/ML<br>SIEMENS                | Member         |

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

### **ABBREVIATIONS**

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

