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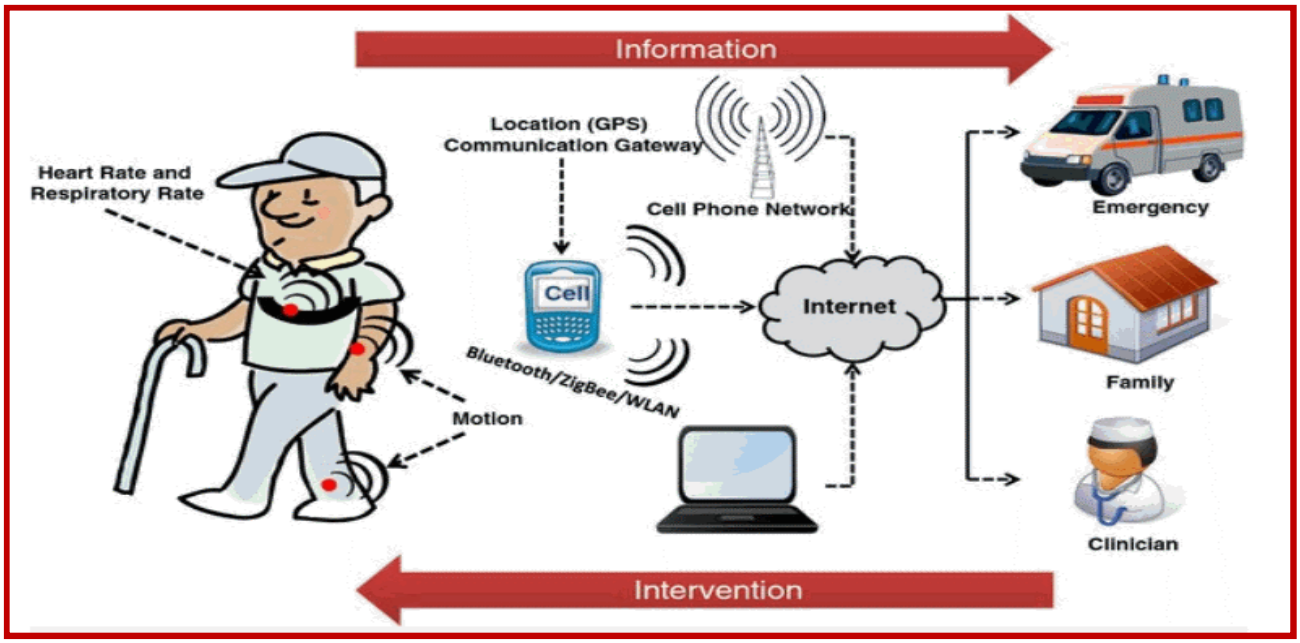
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

IoT TECHNICIAN (SMART HEALTHCARE)
(INTERNET OF THINGS)

(Duration: One year)

CRAFTSMEN TRAINING SCHEME (CTS)
NSQF LEVEL- 4



SECTOR – IT & ITES

IoT TECHNICIAN (SMART HEALTHCARE)

(INTERNET OF THINGS)

(Non-Engineering Trade)

(Designed in 2018)
Version: 1.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 4

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Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training
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1. COURSE INFORMATION

During the one-year duration of IoT Technician (Smart Healthcare) trade a candidate is trained on professional skill, professional knowledge and Employability skill. In addition to this a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered related to the trade are categorized in two semester of six months duration each. The semester wise course coverage is categorized as below:-

1st Semester - In the first semester, 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.

2nd Semester - In the second semester 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 aboutremote health monitoring and Tele-health. The trainees will identify and select different Robots used in healthcare.

2. TRAINING SYSTEM

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of the economy/ labour market. The vocational training programs are delivered under the aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programs of NCVT for propagating 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 (02 semester) duration. It mainly consists of Domain area and Core area. In the Domain area (Trade Theory & Practical) impart professional skills and knowledge, while Core area (Employability Skills) impart requisite core skill, knowledge and life skills. After passing out the training program, the trainee is awarded National Trade Certificate (NTC) by NCVT 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.

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2.2 CAREER PROGRESSION PATHWAYS

- 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.

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year (02 semesters): -

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	1350
2	Professional Knowledge (Trade Theory)	270
3	Employability Skills	110
4	Library & Extracurricular activities	70
5	Project work	120
6	Revision & Examination	160
	Total	**2080**

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of the course and at the end of the training program as notified by the Government of India (GoI) from time to time. The employability skills will be tested in the first two semesters itself.

a) The **Internal Assessment** 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 template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by NCVT at the end of each semester as per the guideline of Government of India. The pattern and marking structure is being notified by Govt. of India 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

The minimum pass percentage for practical is 60% & minimum pass percentage of theory subjects is 40%. For the purposes of determining the overall result, 50% weightage is applied to the result of each semester examination.

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 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

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examining body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage 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	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • Below 70% tolerance dimension achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
(b) Weightage 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	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% tolerance dimension achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the	• High skill levels in the use of hand tools,

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.	machine tools and workshop equipment. • Above 80% tolerance dimension achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

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3. JOB ROLE

Brief description of job role:

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 softwares. 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 wearable's 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 visualisation. Executes remote health monitoring and Tele-health. Identifies and selects different Robots used in healthcare.

Reference NCO-2015:- NIL (To be prepared)

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4. GENERAL INFORMATION

Name of the Trade	**IoT TECHNICIAN (SMART HEALTHCARE)**
NCO - 2015	Not Available
NSQF Level	Level-4
Duration of Craftsmen Training	One Years (2 Semesters)
Entry Qualification	Passed 10th class examination under 10+2 system of education with Science and Mathematics
Unit Strength (No. Of Student)	20 (Max. supernumeraries seats: 6)
Space Norms	70 Sq. metres
Power Norms	3.45 KW
Instructors Qualification for	
1. IoT Technician (Smart Healthcare)Trade	Degree in Electronics / Electronics and Telecommunication/ Electronics and communication Engineering/ Bio medical Engineering from recognized Engineering College/ university with one year experience in the relevant field **OR** Diploma in Electronics / Electronics and telecommunication/ Electronics and communication/ Bio medical Engineering from recognized board of technical education with two years experience in the relevant field. **OR** NTC/NAC passed in the Trade With 3 years' post qualification experience in the relevant field. **Desirable: -** Preference will be given to a candidate with CIC (Craft Instructor Certificate) in the trade. ***Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.***
2. Employability Skill	MBA OR BBA with two years experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years experience OR Graduate/ Diploma with Two years experience and trained in Employability Skills from DGT institutes. ***AND*** Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above. ***OR*** **Existing Social Studies Instructors duly trained in Employability Skills from DGT institutes.**
List of Tools & Equipment	As per Annexure-I

Distribution of training on Hourly basis: (Indicative only)				
Total Hrs /week	**Trade Practical**	**Trade Theory**	**Employability Skills**	**Extra-Curricular Activity**
40 Hours	30 Hours	6 Hours	2 Hours	2 Hours

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5. NSQF LEVEL COMPLIANCE

NSQF level for **IoT Technician (Smart Healthcare)** trade under CTS: **Level 4**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

a. Process
b. professional knowledge
c. professional skill
d. core skill
e. Responsibility

The Broad Learning outcome of **IoT Technician (Smart Healthcare)** trade under CTS mostly matches with the Level descriptor at Level- 4.

The NSQF level-4 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 4	Work in familiar, predictable, routine, situation of clear choice	Factual knowledge of field of knowledge or study	Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts	Language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment	Responsibility for own work and learning.

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6. LEARNING/ ASSESSABLE OUTCOME

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

6.1 GENERIC LEARNING OUTCOME

1. Apply safe working practices.
2. Comply with environment regulation and housekeeping.
3. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.
4. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
5. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
6. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.

6.2 SPECIFIC LEARNING OUTCOME

SEMESTER-I

7. Select and perform electrical/ electronic measurement of meters and instruments.
8. Test various electronic components using proper measuring instruments and compare the data using standard parameter.
9. 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.
10. Construct, test and verify the input/ output characteristics of various analog circuits.
11. Assemble, test and troubleshoot various digital circuits.
12. Install, configure, interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications.
13. Develop troubleshooting skills in various standard electronic circuits using Electronic simulation software.
14. Apply the principle of sensors and transducers for various IoT applications.
15. 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.
16. Identify, Test and troubleshoot the various families of Microcontroller.
17. Plan and Interface input and output devices to evaluate performance with Microcontroller.

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18. Identify different IoT Applications with IoT architecture.
19. Identify, test and interconnect components/parts of IoT system.

SEMESTER-II

20. Identify and Select various types of sensors used in Smart Healthcare.
21. Position the appropriate sensors and collect the information required in Smart Healthcare.
22. Identify, select different wireless communication modules and topology to generate and record the data.
23. Identify and test Wired & Wireless communication medium such as RS232, RS485, Ethernet, Fiber Optic, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol.
24. Perform Installation, configuration and ensure working of IOT devices, network, database, app and web services.
25. Establish and troubleshoot IoT connectivity of devices to cloud having multiple communication medium, protocols, device management and monitoring
26. Demonstrate and Deploy responsive Web Application using APIs and generate reports using templates.
27. Monitor health parameters like Blood Pressure, ECG, EMG, Heart rate, EEG, SPO2 etc. by suitable sensors (PHMS).
28. Apply the sensor output data for further computing, analyzing and visualisation.
29. Identify, select and Execute remote health monitoring and Tele-health.
30. *Identify, select different Robots used in healthcare.

Note: *Can be carried out with the help of industry.

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7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING/ ASSESSABLE OUTCOME	
LEARNING / ASSESSABLE OUTCOME	**ASSESSMENT CRITERIA**
1. Apply safe working practices.	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy.
	1.2 Recognize and report all unsafe situations according to site policy.
	1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1.4 Identify, handle and store / dispose off dangerous goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures in regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1.8 Identify and observe site evacuation procedures according to site policy.
	1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1.10 Identify basic first aid and use them under different circumstances.
	1.11 Identify different fire extinguisher and use the same as per requirement.
2. Comply with environment regulation and housekeeping.	2.1 Identify environmental pollution & contribute to the avoidance of instances of environmental pollution.
	2.2 Deploy environmental protection legislation & regulations
	2.3 Take opportunities to use energy and materials in an environmentally friendly manner
	2.4 Avoid waste and dispose waste as per procedure
	2.5 Recognize different components of 5S and apply the same in the working environment.
3. Work in a team, understand and practice soft skills, technical English to	3.1 Obtain sources of information and recognize information.
	3.2 Use and draw up technical drawings and documents.
	3.3 Use documents and technical regulations and occupationally related provisions.

communicate with required clarity.	3.4 Conduct appropriate and target oriented discussions with higher authority and within the team.
	3.5 Present facts and circumstances, possible solutions &use English special terminology.
	3.6 Resolve disputes within the team
	3.7 Conduct written communication.
4. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	4.1 Explain the concept of productivity and quality tools and apply during execution of job.
	4.2 Explain basic concept of labour welfare legislation, adhere to responsibilities and remain sensitive towards such laws.
	4.3 Knows benefits guaranteed under various acts.
5. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	5.1 Explain the concept of energy conservation, global warming, pollution and utilize the available resources optimally & remain sensitive to avoid environment pollution.
	5.2 Explain standard procedure for disposal of waste.
6. Explain entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	9.1 Explain entrepreneurship.
	9.2 Explain role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the policies/ programmes, procedure & the available scheme.
	9.3 Prepare a report to become an entrepreneur for submission to financial institutions.

SPECIFIC LEARNING/ ASSESSABLE OUTCOME	
LEARNING / ASSESSABLE OUTCOME	**ASSESSMENT CRITERIA**
SEMESTER-I	
7. Select and perform electrical/ electronic measurement of meters and instruments.	7.1 Plan work in compliance with standard safety norms.
	7.2 Identify the type of electronic instruments.
	7.3 Measure the value of resistance, voltage and current using digital multimeter.
8. Test various electronic components using proper measuring instruments and compare the data using standard parameter.	8.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	8.2 Plan work in compliance with standard safety norms.
	8.3 Identify the different types of resistors.
	8.4 Measure the resistor values using colour code and verify the reading by measuring in multi meter.
	8.5 Identify the power rating using size.
	8.6 Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter.
	8.7 Identify different inductors and measure the values using LCR meter.
	8.8 Identify the different capacitors and measure capacitance of various capacitors using LCR meter.
9. 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.	9.1 Identify the various crimping tools for various IC packages.
	9.2 Identify different types of soldering guns and choose the suitable tip for the application.
	9.3 Practice the soldering and de-soldering the different active and passive components, IC base on GPCBs using solder, flux, pump and wick.
	9.4 Make the necessary setting on SMD soldering station to solder and de-solder various IC's of different packages by following the safety norms.
	9.5 Identify SMD components, de-solder and solder the SMD components on the PCB.
	9.6 Check the cold continuity, identify loose/dry solder and broken track on printed wired assemblies and rectify the defects.
	9.7 Avoid waste, ascertain unused materials and components for safe disposal.
10. Construct, test and verify the input/ output characteristics of various analog circuits.	10.1 Ascertain and select tools and instruments for carrying out the jobs.
	10.2 Plan and work in compliance with standard safety norms.
	10.3 Practice on soldering components on lug board with safety.
	10.4 Identify the passive /active components by visual appearance, Code number and test for their condition.

	10.5 Construct and test the transistor based switching circuit
	10.6 Construct and test CE amplifier circuit
	10.7 Ascertain the performance of different oscillator circuits.
	10.8 Construct and test Clipper, Clamper circuit.
11. Assemble, test and troubleshoot various digital circuits.	12.1 Illustrate to practice the digital trainer kit with safety.
	12.2 Identify various digital ICs, test IC using digital IC tester and verify the truth table.
	12.3 Test and verify the truth table of all gates using NOR and NAND gates.
	12.4 Test a decoder and encoder, multiplexer and de-multiplexer circuits and verify the truth table.
	12.5 Test a multiplexer and de-multiplexer and verify the truth table.
	12.6 Construct and verify the truth table of various flip flop, counter and shift register circuits.
12. Install, configure, interconnect given computer system(s) and networking to demonstrate & utilize application packages for different applications.	13.1 Plan, work in compliance with standard safety norms.
	13.2 Select hardware and software component.
	13.3 Install and configure operating systems and applications.
	13.4 Integrate IT systems into networks.
	13.5 Deploy tools and test programmes.
	13.6 Avoid e-waste and dispose the waste as per the procedure.
13. Develop troubleshooting skills in various standard electronic circuits using Electronic simulation software.	14.1 Identify & Select the component
	14.2 Prepare simple digital and electronic circuits using the software.
	14.3 Test the simulation circuit.
	14.4 Convert the circuit into layout diagram.
	14.5 Follow the instruction manual.
14. Apply the principle of sensors and transducers for various IoT applications.	16.1 Identify the sensor.
	16.2 Select the sensor for proper applications.
	16.3 Check the functioning of the sensor.
	16.4 Measure the voltage of LVDT.
	16.5 Measure the voltage output of Thermocouple , Resistance of RTD
	16.6 Measure the voltage output of Load Cell/Strain Gauge, Smoke
	16.7 Test Digital Output of Speed Sensor ,Limit Switch, Optocoupler, Photo and Proximity Sensor
	16.8 Follow instruction manual.
15. Identify, select and test different signal conditioning and converter circuits.	17.1 Explore different driving circuits used for sensors.
	17.2 Explore different converters like V/I, I/V, F/V and V/F.
	17.3 Explore low pass and high pass filter.
	17.4 Explore analog to digital and digital to analog converter ICs like

		ADC0808, DAC0808.
Check the specifications, connections, configuration, calibration and measurement of various type of sensor inputs as well as control outputs.	17.5	Connect and measure AC/DC Analog Input such as voltage / current / RTD two-three-four wire AC mV etc signals.
	17.6	Configure Electrical zero/span – mV, 0-10VDC, 4-20mA, 0-20mA
	17.7	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.
	17.8	Test the Analog Input as per configuration and sensor selection.
	17.9	Generate 0-10VDC and measure analog outputs to operate control valves and actuators
	17.10	Connect and measure Digital Inputs of various voltage level such as TTL (0-5V), 24VDC (0-24 VDC) and verify the expected output.
	17.11	Connect and measure Pulse Inputs of various frequency ranging from 10 Hz to 1 KHz and configure the filters and verify the expected output.
	17.12	Select, Configure and Connect Digital Outputs and Relay Outputs to take On and Off action for various actuators and verify the expected output.
16. Identify, Test and troubleshoot the various families of Microcontroller.	18.1	Understand and interpret the procedure as per manual of Micro controller.
	18.2	Identity various ICs & their functions on the given Microcontroller Kit.
	18.3	Identify the address range of RAM & ROM.
	18.4	Write data into RAM & observe its volatility.
	18.5	Identify the port pins of the controller & configure the ports for Input & Output operation.
	18.6	Demonstrate entering of simple programs, execute & monitor the results.
17. Plan and Interface input and output devices to evaluate performance with Microcontroller.	19.1	Use 8051 microcontroller, connect 8 LED to the port, blink the LED with a switch
	19.2	Use 8051 microcontroller, connect LCD, Relay, Keypad and seven segments
	19.3	Perform the use of a ADC and DAC to read input voltage and provide output voltage
	19.4	Perform the use of RS232 and USB interface with Computer interface.
	19.5	Demonstrate entering of simple programs, execute & monitor the results.
18. Identify different IoT Applications with IoT architecture.	18.1	Identify various IoT Applications in smart city viz. smart environment, smart street light and smart water & waste management.

	18.2 Recognise the functions of various IoT Technician (Smart City) (IoT) applications & their distinctive advantages.
	18.3 Identify and explore different functional building blocks of IOT enabled system / application.
	18.4 Explore signal flow into IOT enabled system/application as per the IOT architecture.
19. Identify, test and interconnect components/parts of IoT system.	19.1 Connect and test Arduino board to computer and execute sample programs from the example list.
	19.2 Write and upload computer code to the physical Arduino board Micro controller to sound buzzer.
	19.3 Set up & test circuit to interface potentiometer with Arduino board and map to digital values.
	19.4 Rig up the circuit and upload a program to interface temperature sensor – LM35 with a controller to display temperature on the LCD.
	19.5 Set up Circuit and upload program to Interface DC motor (actuator) with microcontroller to control on/off/forward/reverse operations.
SEMESTER-II	
20. Identify and Select various types of sensors used in Smart Healthcare.	20.1 Identify & Select biomedical sensor (including wearable sensors) as per requirement.
	20.2 Identify various leads of standard bipolar lead configuration.
	20.3 Explore various leads of Standard Augmented Uni-polar leads configuration.
	20.4 Identify various Chest leads of Standard Uni-polar lead Configuration.
	20.5 Explore all the standard ECG leads (12 leads), Unipolar and Bipolar configurations simultaneously.
	20.6 Apply Smartphone & Smart watch for Diabetes monitoring by Daily activity data.
	20.7 Measure Physiological data of elderly patients by bio signals like Oxygen saturation level, Heart Rate from biomedical sensors & Smartphone.
	20.8 Use Wearable ECG sensors and Cloud processing for ECG Smart Healthcare monitoring by ECG bio signals.
	20.9 Apply different sensors and actuators for Mobile medical computing systems by medical signal and context information.
	20.10 Observe Mobile healthcare (m-health) in the pervasive environment by bio signals like Pulse rate, blood pressure, level of alcohol etc.
21. Position the appropriate sensors and collect the information required in Smart Healthcare.	21.1 Identify sensor node block diagrams and its components.
	21.2 Connect with sensors and send data wirelessly to a central data logger at program.
	21.3 Select and Install sensors like ECG,EEG, EMG, temperature, humidity, moisture, etc.

	21.4 Check Sensor node configuration using USB and over the air programming.
	21.5 Explore the battery level and solar panel connection with sensor node.
22. Identify, select different wireless communication modules and topology to generate and record the data.	22.1 Apply the interfacing of Zigbee module to create Wireless sensor network.
	22.2 Demonstrate M2M Wireless Sensor Network (WSN) in IoT Study of Zigbee router, end device and coordinator configuration.
	22.3 Create local sensor network by interfacing Bluetooth module.
	22.4 Make node as a gateway by interfacing of GSM module.
	22.5 Apply IoT Gateway using WiFi and Ethernet.
	22.6 Explore the Wi-Fi module and lua script for data communication.
	22.7 Apply GPS satellites in Location Sensors.
	22.8 Explore USB and Ethernet connectivity for data communication.
	22.9 Synchronize the different bio-signals in wireless Body Area Network (BAN) of sensors or wearables to obtain an integrated profile of the user.
	22.10 Connect set of devices to LAN.
	22.11 Form a wireless local area network (WLAN) among LAN devices.
23. Identify and test Wired & Wireless communication medium such as RS232, RS485, Ethernet, Fiber Optic, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol.	23.1 Cable selection and Termination for Wired Communication Mediums : Pin Diagram, Cable Core, characteristics and specifications, Connector and crimping of various RJ9/RJ11/RJ45 connectors
	23.2 Frequency Band, Gain, Antenna and Modulation selection for wireless communication Mediums
	23.3 Basic Network Configuration of Local Area Networks - Ethernet, Wi-Fi,
	23.4 Basic Configuration of Cellular Wide Area Networks - GSM, GPRS
	23.5 Basic Configuration of Personal Area Networks - RF, Zigbee
24. Perform Installation, configuration and ensure working of IOT devices, network, database, app and web services.	24.1 Install Linux Operating System porting.
	24.2 Configure Local cloud & server.
	24.3 Configure over the air (OTA) node.
	24.4 Explore GUI based parameter configuration & GUI based IoT application.
	24.5 Manage user access and data security (Cyber security) by Cryptography.
	24.6 Create Shell Scripts.
	24.7 Configure Cloud and Server for IoT.
	24.8 Test Web and Application Development Tools for IoT.
25. Establish and troubleshoot IoT	25.1 Configure and integrate multiple devices with serial protocol working on RS485 MODBUS Master –Slave architecture such as

connectivity of devices to cloud having multiple communication medium, protocols and networking topology and device management and monitoring.	Solar Inverter, Solar Pump Controller, Energy Meter etc.
	25.2 Configure and integrate multiple devices with serial protocol working on RS232 DLMS Server – Client architecture
	25.3 Configure Wired and Wireless Local Area Networks (Ethernet and Wi-Fi) for MODBUS over MQTT in IoT Applications
	25.4 Configure cellular IoT Connectivity using GSM/GPRS networks for MODBUS over MQTT in IoT Applications
	25.5 Select, Configure and Acertain various media converters to convert serial devices to Ethernet, Wi-Fi and GPRS Devices
	25.6 Select, Configure and Acertain various protocol converters to convert serial as well as networking devices to IoT Devices
	25.7 Create / Modify and Configure IoT Devices and its parameters on cloud platform
	25.8 Monitor and Diagnose IoT Devices on cloud platform
	25.9 Configure parameters, alarms, notifications on cloud platform
	25.10 Create / Modify organization and users to access device data with user management roles and security
26. Demonstrate and Deploy responsive Web Application using APIs and generate reports using templates.	26.1 Develop and Deploy web application using ready to use API of IoT platform or architecture
	26.2 Display and Configure graphs, charts and other ready to use controls and widgets
	26.3 Generate reports using readily available API, templates and to export it to excel, word pdf and other required formats
27. Monitor health parameters like Blood Pressure, ECG, EMG, Heart rate, EEG, SPO2 etc. by suitable sensors (PHMS).	27.1 Analyse respiration real time using piezoelectric sensor.
	27.2 Explore respiration system, exchange of gases in alveoli of lungs.
	27.3 Explore apnea (Slow rate of Respiration),tachypnea (Fast rate of Respiration), electrocardiogram, cardiovascular abnormality like Bradycardia, Tachycardia, real time ECG.
	27.4 Check Software analysis of real time ECG data.
28. Apply the sensor output data for further computing, analyzing and visualisation.	28.1 Observe the biomedical data.
	28.2 Check the data with standard parameters.
	28.3 Record the data for further analysis.
29. Identify, select and Execute remote health monitoring and Tele-health.	29.1 Monitor EMG signals, ECG signals, Snore signals.
	29.2 Check Airflow control of user.
	29.3 Check Body temperature data.
	29.4 Measure Galvanic skin response.
	29.5 Detect Body position.
	29.6 Use Internet, video chats, smart phones and Electronic Medical Record (EMR) clouds for Tele Health.
30. Identify, select different Robots used	30.1 Interface RC servo motor with microcontroller.
	30.2 Interface & control Stepper motor and Servo motor and DC

in healthcare.	motor.
	30.3 Plan Programmable tasks.
	30.4 Record and Play capability.
	30.5 Apply Sensor interface and control Gyroscope, Accelerometer.
	30.6 Set up robotic ARM for Patient help.
	30.7 Apply vision based Humanoid for patient health monitoring.

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8. SYLLABUS

SYLLABUS - IoT TECHNICIAN (SMART HEALTHCARE)			
FIRST SEMESTER – 06 Months			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
1	Apply safe working practices	**Trade and Orientation** 1. Visit to various sections of the institute and identify location of various installations. (06 hrs) 2. Identify safety signs for danger, warning, caution & personal safety message. (04 hrs) 3. Use of personal protective equipment (PPE). (06 hrs) 4. Practice elementary first aid. (06 hrs) 5. Preventive measures for electrical accidents & steps to be taken in such accidents. (03 hrs) 6. Use of Fire extinguishers. (05 hrs)	Familiarization with the working of Industrial Training Institute system. Importance of safety and precautions to be taken in the industry/shop floor. Introduction to PPEs. Introduction to First Aid. Response to emergencies e.g. power failure, fire, and system failure. Importance of housekeeping & good shop floor practices. Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable.
2-3	Select and perform electrical/ electronic measurement of meters and instruments.	**Basics of AC and Electrical Cables** 7. Identify the Phase, Neutral and Earth on power socket, use a testers to monitor AC power. (08 hrs) 8. Construct a test lamp and use it to check mains healthiness. Measure the voltage between phase and ground and rectify earthing. (10 hrs) 9. Prepare terminations, skin the electrical wires /cables using wire stripper and cutter. (08 hrs) 10. Measure the gauge of the wire using SWG and outside micrometer. (05 hrs) 11. Crimp the lugs to wire end. (06 hrs) 12. Measure AC Voltage in three	Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC. Various terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, Instantaneous value. Single phase and Three phase supply. Different type of electrical cables and their Specifications. Types of wires & cables, standard wire gauge (SWG). Classification of cables according to gauge (core size), number of conductors, material, insulation strength, flexibility etc. Introduction to electrical and electronic measuring instruments.

		phase , Three phase star and delta correction , Three phase power measurement. (08 hrs) 13. Demonstrate various test and measuring instruments (08 hrs) 14. Measure voltage and current using clamp meter. (07 hrs)	
4-5	Test various electronic components using proper measuring instruments and compare the data using standard parameter.	**Active and Passive Components** 15. Identify the different types of active and passive electronic components. (02 hrs) 16. Measure the resistor value by colour code, SMD Code and verify the same by measuring with multimeter. (02 hrs) 17. Identify resistors by their appearance and check physical defects. (02 hrs) 18. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources. (03 hrs) 19. Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law. (03 hrs) 20. Verify laws of series and parallel circuits with voltage source in different combinations. (03 hrs) 21. Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter. (04 hrs) 22. Identify different inductors and measure the values using LCR meter. (03 hrs) 23. Identify the different capacitors and measure capacitance of various capacitors using LCR meter. (03 hrs) 24. Identify and test the circuit breaker and other protecting devices (Fuse). (03 hrs)	Ohm's law. Resistors; types of resistors, their construction & specific use, color-coding, power rating. Equivalent Resistance of series parallel circuits. Distribution of V & I in series parallel circuits. Principles of induction, inductive reactance. Types of inductors, construction, specifications, applications and energy storage concept. Capacitance and Capacitive Reactance, Impedance. Types of capacitors, construction, specifications and applications. Dielectric constant. Significance of Series parallel connection of capacitors. Properties of magnets and their materials, preparation of artificial magnets, significance of electro Magnetism, types of cores. Relays, types, construction and specifications etc. Multi meter, use of meters in different circuits. Use of DSO, Function generator, Arbitrary Waveform Generator ,LCR meter

		25. Dismantle and identify the different parts of a relay. (04 hrs) 26. Connect a timer relay in a circuit and test for its working. (03 hrs) 27. Test Step-up, Step-down, Isolation Transformer. (03 hrs) **AC & DC measurements** 28. Use the multi meter to measure the various functions (AC V, DC V, DC I, AC I, R). (02 hrs) 29. Identify the different controls on the Digital Storage Oscilloscope front panel and observe the function of each control. (03 hrs) 30. Measure DC voltage, AC voltage, time period, sine wave parameters using DSO. (02 hrs) 31. Identify and use different mathematical functions +,-,X, diff, intg, AND, OR of DSO on the observed signal. (03 hrs) 32. Identify and use different acquisition modes of normal, average, persistence mode. (03 hrs) 33. Understand the difference of low memory and high memory DSO and relation with real time sampling of DSO. (02 hrs) 34. Identify the different controls on the Arbitrary Waveform Generator front panel and observe the different signals to be derived from Arbitrary Waveform Generator. (05 hrs) 35. Identify the different controls on the power supply and to understand CV/CC Mode, Dual Tracking Mode. (02 hrs)	

6-7	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.	**Soldering/ De-soldering** 36. Practice soldering on different electronic components, small transformer and lugs. (03 hrs) 37. Practice soldering on IC bases and PCBs. (03 hrs) 38. Practice Soldering on various SMD Components including SMD IC packages. (05 hrs) 39. Practice de-soldering using pump and wick. (02 hrs) 40. Practice Desoldering of SMD Components using SMD Hot Air Gun. (03 hrs) 41. Join the broken PCB track and test. (03 hrs) **Basic SMD (2, 3, 4 terminal components** 42. Identification of 2, 3, 4 terminal SMD components. De-solder the SMD components from the given PCB. (05 hrs) 43. Solder the SMD components in the same PCB. Check for cold continuity of PCB. (05 hrs) 44. Identification of loose /dry solder, broken tracks on printed wired assemblies. (04 hrs) **SMD Soldering and De-soldering** 45. Identify various connections and setup required for SMD Soldering station. (05 hrs) 46. Identify crimping tools for various IC packages. (04 hrs) 47. Make the necessary settings on SMD soldering station to de-solder various ICs of different packages (at least four) by choosing proper crimping tools (06 hrs) 48. Make the necessary settings on SMD soldering station to solder various ICs of	Different types of soldering guns, related to Temperature and wattages, types of tips. Solder materials and their grading. Use of flux and other materials. Selection of soldering gun for specific requirement. Soldering and De-soldering stations and their specifications. Different switches, their specification and usage. Introduction to SMD technology Identification of 2, 3, 4 terminal SMD components. Advantages of SMD components over conventional lead components. Introduction to Surface Mount Technology (SMT). Advantages, Surface Mount components and packages. Cold/ Continuity check of PCBs. Identification of lose / dry solders, broken tracks on printed wiring assemblies.

		different packages (at least four) by choosing proper crimping tools (06 hrs) 49. Make the necessary setting rework of defective surface mount component used soldering / de-soldering method. (06 hrs)	
8-9	Construct, test and verify the input/ output characteristics of various analog circuits.	50. Identify and test different types of diodes, diode modules using multi meter and determine forward to reverse resistance ratio. Compare it with specifications. (07 hrs) 51. Measure the voltage and current through a diode in a circuit and verify its forward/Reverse characteristic. (08 hrs) 52. Construct and test a half wave, full wave and Bridge rectifier circuit. (06 hrs) 53. Measure ripple voltage, ripple frequency and ripple factor of rectifiers. (06 hrs) 54. Construct and test shunt clipper and clamper circuits using diodes. (06hrs) 55. Identify and test Zener diode and construct peak clipper. (06 hrs) 56. Identify different types of transistors and test them using digital multimeter. (06 hrs) 57. Measure and plot input and output characteristics of a CE amplifier. (08 hrs) 58. Construct and test a transistor based switching circuit to control a relay. (07 hrs)	Semiconductor materials, components, number coding for different electronic components such as Diodes and Zeners etc. PN Junction, Forward and Reverse biasing of diodes. Interpretation of diode specifications. Forward current and Reverse voltage. Working principle of a Transformer, construction, Specifications and types of cores used. Step-up, Step down and isolation transformers with applications. Losses in Transformers. Phase angle, phase relations, active and reactive power, power factor and its importance. Construction, working of a PNP and NPN Transistors, purpose of E, B & C Terminals. Significance of α, β and relationship of a Transistor. Transistor applications as switch and CEamplifier. Transistor input and output characteristics. Transistor power ratings & packaging styles and use of different heat sinks.
10-11	Assemble, test and troubleshoot various digital circuits.	59. Identify different Logic Gates (AND, OR, NAND, NOR, EX-OR, EX-NOR, NOT ICs) by the	Introduction to Digital Electronics. Difference between analog and digital signals.

		number printed on them. (04 hrs) 60. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. (02 hrs) 61. Use digital IC tester to test the various digital ICs (TTL and CMOS). (03 hrs) 62. Construct and Test a 2 to 4 Decoder. (02 hrs) 63. Construct and Test a 4 to 2 Encoder. (02 hrs) 64. Construct and Test a 4 to 1 Multiplexer. (02 hrs) 65. Construct and Test a 1 to 4 De Multiplexer. (02 hrs) 66. Verify the truth tables of Flip-Flop ICs (RS, D, T, JK, MSJK) by connecting switches and LEDs. (05 hrs) 67. Construct and test a four bit asynchronous binary counter (05 hrs) 68. Construct and test a four bit Synchronous binary counter. (04 hrs) 69. Construct and test synchronous Decade counter. (04 hrs) 70. Construct and test an up/down synchronous decade counter and monitor the output on LEDs. (03 hrs) 71. Identify and test common anode and common cathode seven segment LED display using multi meter. (04 hrs) 72. Test the shift register using IC 7495. (05 hrs) 73. Construct and test four bit SIPO register. (05 hrs) 74. Construct and test four bit PIPO register. (04 hrs) 75. Construct and test bidirectional shift registers. (04 hrs)	Logic families and their comparison, logic levels of TTL and CMOS. Number systems (Decimal, binary, octal, Hexadecimal). BCD code, ASCII code and code conversions. Various Logic Gates and their truth tables. Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders, 2-bit and four bit full adders. Magnitude comparators. Half adder, full adder ICs and their applications for implementing arithmetic operations. Concept of encoder and decoder. Basic Binary Decoder and four bit binary decoders. Need for multiplexing of data. 1:4 line Multiplexer / De-multiplexer. Introduction to Flip-Flop. S-R Latch, Gated S-R Latch, D-Latch. Flip-Flop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop. Master-Slave flip flops and Timing diagrams. Basic flip flop applications like data storage, data transfer and frequency division. Types of seven segment display. BCD display and BCD to decimal decoder. BCD to 7 segment display circuits. Basics of Register, types and application of Registers.
12-13	Install, configure, interconnect given computer system(s) and	76. Identify various indicators, cables, connectors and ports on the computer cabinet. (03	Basic blocks of a computer, Components of desktop and motherboard.

	networking to demonstrate & utilize application packages for different applications.	hrs) 77. Demonstrate various parts of the system unit and motherboard components. (05 hrs) 78. Identify various computer peripherals and connect it to the system. (05 hrs) 79. Disable certain functionality by disconnecting the concerned cables SATA/ PATA. (05 hrs) 80. Replace the CMOS battery and extend a memory module. (05 hrs) 81. Test and Replace the SMPS. (05 hrs) 82. Replace the given DVD, RAM and HDD on the system. (05 hrs) 83. Boot the system from Different options and install OS in a desktop computer. (05 hrs) 84. Install antivirus software, printer, scan the system and explore the options in the antivirus software. (04 hrs) 85. Browse search engines, create email accounts, practice sending and receiving of mails and configuration of email clients. (04 hrs) 86. Identify different types of cables and network components e.g. Hub, switch, router, modem etc. (05 hrs) 87. Prepare terminations, make UTP and STP cable connectors and test. (03 hrs) 88. Connect network connectivity hardware and check for its functioning. (03 hrs) 89. Configure a wireless Wi-Fi network. (03 hrs)	Hardware and software, I/O devices, and their working. Different types of printers, HDD, DVD. Various ports in the computer. Working principle of SMPS, its specification. Windows OS MS widows: Starting windows and its operation, file management using explorer, Display & sound properties, screen savers, font management, installation of program, setting and using of control panel., application of accessories, various IT tools and applications. Concept of Internet, Browsers, Websites, search engines, email, chatting and messenger service. Downloading the Data and program files etc. **Computer Networking:-** Network features - Network medias Network topologies, protocols- TCP/IP, UDP, FTP, models and types. Specification and standards, types of cables, UTP, STP, Coaxial cables. Network components like hub, Ethernet switch, router, NIC Cards, connectors, media and firewall. Difference between PC & Server.
14	Develop	90. Prepare simple digital and	

	troubleshooting skills in various standard electronic circuits using Electronic simulation software.	electronic circuits using the software. (06 hrs) 91. Simulate and test the prepared digital and analog circuits. (06 hrs) 92. Create fault in particular component and simulate the circuit for it's performance. (06 hrs) 93. Convert the prepared circuit into a layout diagram. (06 hrs) 94. Prepare simple, power electronic and domestic electronic circuit using simulation software. (06 hrs)	Study the library components available in the circuit simulation software. Various resources of the software.
15	Apply the principle of sensors and transducers for various IoT applications.	95. Identify and test RTDs, Temperature ICs and Thermo couples. (06 hrs) 96. Identify and test proximity switches (inductive, capacitive and photoelectric). (06 hrs) 97. Identify and test, load cells, strain gauge, LVDT, PT 100 (platinum resistance sensor). (06 hrs) 98. Detect different objectives using capacitive, Inductive and photo electric proximity sensors. (12 hours)	Basics of passive and active transducers. Role, selection and characteristics. Sensor voltage and current formats. Thermistors / Thermocouples - Basic principle, salient features, operating range, composition, advantages and disadvantages. Strain gauges/ Load cell – principle, gauge factor, types of strain gauges. Inductive/ capacitive transducers - Principle of operation, advantages and disadvantages. Principle of operation of LVDT, advantages and disadvantages. Proximity sensors – applications, working principles of eddy current, capacitive and inductive proximity sensors.
16-18	Identify, select and test different signal conditioning and converter circuits. Check the specifications, connections, configuration and measurement of	99. Explore different driving circuits used for sensors. (12 hrs) 100. Amplification of low power signals using current, power, instrumentation, differential, inverting, non-inverting and buffer amplifier circuits.(12 hrs)	Working principle of different types of control circuits and their applications for sensors. Principle of operation of signal generator, distinguish between voltage and power amplifier. Working principle of different

	various types of sensor inputs as well as control outputs.	101. Identify analog to digital and digital to analog converter ICs like ADC0808, DAC0808.(12 hrs) 102. Explore different converters like V/I, I/V, F/V and V/F.(12 hrs) 103. Explore low pass and high pass filter. (10 hrs) **Integration of Analog sensors** 104. Identify various Analog sensors. (02 hrs) 105. Identify Roles and Characteristics of each sensor. (02 hrs) 106. Select appropriate Analog sensor. (02 hrs) 107. Connect & measure AC/DC Analog Input such as voltage / current / RTD two-three-four wire AC mV signal etc. (02 hrs) 108. Configure Engineering & Electrical zero/span configuration mV, 0-10VDC, 4-20mA, 0-20mA. (02 hrs) 109. Understand various units and zero span configuration as per sensor datasheet such as temperature, pressure, flow, level, lux level, environment, soil, moisture etc. (02 hrs) 110. Measure the Analog Input as per configuration and sensor selection. (02 hrs) 111. Generate and measure Analog Output to operate control valves and actuators. (02 hrs) **Integration of Digital sensors** 112. Identify various Digital sensors. (02 hrs) 113. Identify Roles and Characteristics of each sensor. (02 hrs)	converters. Demonstrate different types of filter circuits and their applications. The specification and working of Analog sensor inputs as well as Analog control outputs. The specifications and working of Digital sensor inputs, Pulse Input as well as Digital control outputs.

		114. Select appropriate Digital sensor. (03 hrs) 115. Connect and Measure Digital Inputs of various voltage level such as TTL (0-5V), 24VDC (0-24 VDC) signals. (03 hrs) 116. Connect Pulse Inputs of various frequency ranging from 10 Hz to 1 KHz and configure the filters. (03 hrs) 117. Select, Configure and acertain of Digital Outputs and Relay Outputs to take On and Off action for actuators. (03 hrs)	
19	Identify, Test and troubleshoot the various families of Microcontroller.	118. Explore different microcontroller families' architecture like 8051, AVR, PIC, ARM, Raspberry pi and Arduino. (06 hrs) 119. Explore the different Software IDE used for microcontroller. (06 hrs) 120. Explore ICs & their functions on the given Microcontroller Kit. (06 hrs) 121. Identify the port pins of the controller & configure the ports for Input & Output operation. (06 hrs) 122. Explore Universal IC programmer to program burn output file on different ICs. (06 hrs)	Introduction Microprocessor &8051Microcontroller, architecture, pin details & the bus system. Function of different ICs used in the Microcontroller Kit. Differentiate microcontroller with microprocessor. Interfacing of memory to the microcontroller. Internal hardware resources of microcontroller. I/O port pin configuration. Different variants of 8051 & their resources. Register banks & their functioning. SFRs & their configuration for different applications. Comparative study of 8051 with 8052. Introduction to PIC Architecture. Introduction to ADC and DAC, schematic diagram, features and characteristic with the applications.
20	Plan and Interface input and output devices to evaluate performance with Microcontroller.	123. Use 8051 microcontroller, connect 8 LED to the port, blink the LED with a switch. (05 hrs) 124. Perform with 8051 microcontroller assembling language program, check the reading of an input port and sending the received bytes to the output port of the microcontroller, used switches and LCD for the input and output. (05 hrs) 125. Use 8051 microcontroller,	

		connect LCD, Relay, Keypad and seven segments. (05 hrs) 126. Use 8051 microcontroller, connect servo, DC and stepper motor. (05 hrs) 127. Perform the use of a ADC and DAC to read input voltage and provide output voltage. (05 hrs) 128. Perform the use of RS232 and USB interface with Computer interface.(03 hrs) 129. Demonstrate entering of simple programs, execute & monitor the results. (02 hrs)	
21	Identify different IoT Applications with IoT architecture.	130. Identify various IoT Applications in smart city viz. smart environment, smart street light and smart water & waste management. (07 hrs) 131. Recognise the functions of various Internets of Things (Smart City) (IoT) applications & their distinctive advantages. (08 hrs) 132. Identify and explore different functional building blocks of IOT enabled system / application. (08 hrs) 133. Test signal flow into IOT enabled system/application as per the IOT architecture. (07 hrs)	Introduction to Internet of Things applications in smart city& their distinctive advantages - smart environment, smart street light and smart water & waste management. What is an IOT? What makes embedded system an IOT? Role and scope of IOT in present and future marketplace. Smart objects, Wired – Cables, hubs etc. Wireless – RFID, WiFi, Bluetooth etc. Different functional building blocks of IOT architecture.
22	Identify, test and interconnect components/parts of IoT system.	134. Connect and test Arduino board to computer and execute sample programs from the example list. (04 hrs) 135. Upload computer code to the physical board (Microcontroller) to blink a simple LED. (02 hrs) 136. Write and upload computer code to the physical Arduino board Micro controller to sound buzzer. (02 hrs) 137. Circuit and program to	Arduino development board, Pin diagram, Functional diagram, Hardware familiarization and operating instructions. Integrated development Environment, Running Programs on IDE, simple Programming concepts.(10 Hours)

		Interface light sensor – LDR with aarduino to switch ON/OFF LED based on light intensity. (03 hrs) 138. Set up & test circuit to interface potentiometer with Arduino board and map to digital values for eg. 0-1023. (03 hrs) 139. 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. (03 hrs) 140. Rig up the Circuit and upload a program to Control a relay and switch on/off LED light using Arduino. (02 hrs) 141. Make Circuit and upload a program to Interface of LCD display with a microcontroller to display characters. (03 hrs) 142. Rig up the circuit and upload a program to interface temperature sensor – LM35 with a controller to display temperature on the LCD. (02 hrs) 143. Set up Circuit and upload program to Interface DC motor (actuator) with microcontroller to control on /off /forward/reverse operations. (03 hrs) 144. Rig up Circuit and upload program micro-controller to switch on/off two lights using relay. (03 hrs)	
23-24	**Project Work / Industrial Visit (Optional)** **Broad Area:-** a) Full wave Voltage rectifier with indicator. b) Flashing LEDs. c) Visit to IoT Lab of different industries.		
25	**Revision**		

26	**Examination**

Note: -

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*

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SYLLABUS - IoT TECHNICIAN (SMART HEALTHCARE)			
SECOND SEMESTER – 06 Months			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
27-29	Identify and Select various types of sensors used in Smart Healthcare.	145. Identify and select appropriate sensor as per requirement. (10 hrs) 146. Identify the lead I, lead II, lead III of Standard Bipolar lead configuration. (10 hrs) 147. Select and test avR, avL , avF lead of Standard Augmented Uni-polar leads configuration.(15 hrs) 148. 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.(40 hrs) 149. Measure of Normal Heart-Rate. (05 hrs) 150. Measure the heart abnormality conditions (Tachycardia, Bradycardia). (10 hrs)	Concept of Generic Biomedical sensors - Real-time streaming data in healthcare applications through Generic Biomedical Sensor signals. Working Principle & Application of Smart phones & wearable sensor devices - Recognition of activities and health monitoring by Heart biomedical signals, Active assistance by Activity and environment data. Principle of operation & Application of Textile-integrated non-contact sensors - Long-term monitoring of respiration and pulse by Respiration and pulse bio signals. Working Principle of Location sensor - Real time location Service. Use of Temperature Sensor - Environmental monitoring. Use of Smartphone & Smart watch - Diabetes monitoring by Daily activity data. Concept of Multi-sensor plethysmography device - Detection and prevention of venous stasis by Pulse and blood flow data. Working Principle & Application of Biomedical sensors & smartphone - Physiological data of elderly patients by bio signals like Oxygen saturation level, Heart Rate. Use of Wearable ECG sensors and Cloud processing for ECG Smart Healthcare monitoring by ECG bio

			signals. Concept of Different sensors and actuators - Mobile medical computing systems by Medical signal and context information. Concept of Mobile healthcare(m-health) - Applications in the pervasive environment by bio signals like Pulse rate, blood pressure, level of alcohol etc.
30-31	Position the appropriate sensors and collect the information required in Smart Healthcare.	151. Identify sensor node block diagrams and its components. (05 hrs) 152. Connect with sensors and send data wirelessly to a central data logger at program. (10 hrs) 153. Interface of wireless modules with IoT platform. (10 hrs) 154. Select and Install sensors like ECG,EEG, EMG, temperature, humidity, moisture, etc. (20 hrs) 155. Check the data packet and sensor node configuration tool. (05 hrs) 156. Check Sensor node configuration using USB and over the air programming. (05 hrs) 157. Check the battery level and solar panel connection with sensor node. (05 hrs)	Concept of sensors node blocks diagram and its components. Connection with sensors and send data wirelessly to a central data logger at program. Principles of interfacing of wireless modules with IoT platform. Selection and Installation of sensors. Knowledge of the data packet and sensor node configuration tool using USB and Over the air programming. Study the battery level and solar panel connects with sensor node.
32-34	Identify, select different wireless communication modules and topology to generate and record the data.	158. Identify the interfacing of Zigbee module to create wireless sensor network. (05 hrs) 159. Check the M2M Wireless Sensor Network (WSN) in IoT Zigbee router, end device and coordinator configuration. (07 hrs) 160. Identify the interfacing of Bluetooth module to create local sensor network. (05 hrs) 161. Check the interfacing of GSM module to make node as a	Concept & interfacing of Zigbee module to create Wireless sensor network. M2M Wireless Sensor Network (WSN) in IoT. Study Zigbee router, end device and coordinator configuration. Interfacing of Bluetooth module to create local sensor network. Principle of operation & Application ofIoT Gateway Using WiFi and Ethernet. UART Communication, RS485 Communication,I2C Protocol device

		gateway. (05 hrs) 162. Apply IoT Gateway using WiFi and Ethernet. (05 hrs) 163. Check UART Communication, RS485 Communication,I2C Protocol device interfacing SPI Protocol device interfacing, Ethernet configuration, Zigbee interfacing, Wi-Fi AP and Router interfacing. (10 hrs) 164. Identify the Wi-Fi module and lua script for data communication. (07 hrs) 165. Explore the application of GPS satellites in Location Sensors. (07 hrs) 166. Check USB and Ethernet connectivity for data communication. (05 hrs) 167. Synchronize the different bio-signals in wireless Body Area Network (BAN) of sensors or wearables to obtain an integrated profile of the user. (10 hrs) 168. 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). (07 hrs) 169. Create the IoT communication network by interconnecting the computing elements. (04 hrs) 170. Connect set of devices to LAN. (03 hrs) 171. Form a wireless local area network (WLAN) among them for bringing connectivity anywhere and improving the performance of the network. (10 hrs)	interfacing, SPI Protocol device interfacing, Ethernet configuration, Zigbee interfacing, Wi-Fi AP and Router interfacing. Wi-Fi module and lua script for data communication. Study the application of GPS satellites in Location Sensors. USB and Ethernet connectivity for data communication. Introduction to modern communication capabilities - wireless Body Area Network (BAN) of sensors or wearablesto synchronize the different bio-signals to obtain an integrated profile of the user. Concept of things with only sensing features (i.e., biosensors), things with only computing features (i.e., smartphones) and things withboth sensing and computing features (i.e.smart watches). Basics of are interconnection ofthe 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.
35	Identify and test Wired	172. Identify Cable and its Pin	Basic blocks of networking,

	& Wireless communication medium such as RS232, RS485, Ethernet, Fiber Optic, Wi-Fi, GSM, GPRS, RF etc. and Communication protocol.	Mapping. (04 hrs) 173. Crimp and Test RJ9 / RJ11 / RJ45 connectors. (04 hrs) 174. Understand Frequency Band, Gain, Antenna and Modulation for WiFi. (04 hrs) 175. Understand Frequency Band, Gain, Antenna and Modulation for GPRS. (04 hrs) 176. Understand Frequency Band, Gain, Antenna and Modulation for RF. (03 hrs) 177. Design and Test Local Area Networks over Ethernet & Wi-Fi. (04 hrs) 178. Design and Test Cellular Wide Area Networks over GSM & GPRS. (03 hrs) 179. Design and Test Personal Area Networks over RF. (04 hrs)	- Specifications, Standards and types of cables, - Concept of wired or wireless communication medium - Different types of networks - Design and establish networks
36-37	Perform Installation, configuration and ensure working of IoT devices, network, database, app and web services.	180. Install Linux Operating System porting. (04 hrs) 181. Configure Local cloud & server. (03 hrs) 182. Configure over the air (OTA) node. (04 hrs) 183. Configure the parameter GUI. (04 hrs) 184. Manage user access and data security (Cyber security) by Cryptography. (08 hrs) 185. Set up a Linux file system. (03 hrs) 186. Perform system initialization. (04 hrs) 187. Connect a system to the network. (03 hrs) 188. Install and Configure Linux. (04 hrs) 189. Create Shell Scripts, flow control in the Shell, Advanced Shell features. (06 hrs) 190. Apply Database management system. (06 hrs) 191. Configure Cloud and Server for IoT. (04 hrs) 192. Test Qt based GUI. (04 hrs) 193. Test Web and Application Development Tools for IoT. (03	Principle of Installation of Linux Operating System porting. Local cloud & server configuration Over the air (OTA) node configuration GUI based parameter configuration & GUI Base IoT application Study user access and data security management (Cyber security) by Cryptography. Concept of Working with the command line and the Shell, Managing directories and files, Managing user access and security, Setting up a Linux file system Understand system initialization, Connecting a system to the network. Principle of Installing and Configuring Linux, Creating Shell Scripts, Flow control in the Shell Advanced Shell features. Study Database management system, Cloud and Server Configuration for IoT. Concept of Qt based GUI, IoT Web and Application Development Tools for IoT.

		hrs)	
38-40	Establish and troubleshoot IoT connectivity of devices to cloud having multiple communication medium, protocols, device management and monitoring.	194. Power up the device as per the device manual. (03 hrs) 195. Integrate the device with serial protocol working on Modbus RTU. (04 hrs) 196. Communicate and Verify the parameters on Modbus Master Software (05 hrs) 197. Power up the DLMS device as per the device manual. (03 hrs) 198. Integrate the device with serial protocol working DLMS protocol. (04 hrs) 199. Communicate and Verify the parameters on DLMS server software. (05 hrs) 200. Setup wired Local Area Network and wireless network. (04 hrs) 201. Setup environment for Modbus TCPIP server client testing. (04 hrs) 202. Communicate and Configure Modbus devices through GSM GPRS network (05 hrs) 203. Setup Serial to Ethernet protocol converter and verify. (05 hrs) 204. Setup Serial to WiFi protocol converter and verify. (05 hrs) 205. Setup Serial to GPRS protocol converter and verify. (05 hrs) 206. Setup Ethernet IoT Data Acquisition system, connect to cloud and verify. (04 hrs) 207. Setup WiFi IoT Data Acquisition system, connect to cloud and verify. (06 hrs) 208. Setup Cellular (GSM / GPRS) IoT Data Acquisition system, connect to cloud and verify. (03 hrs) 209. Explore IoT Cloud Configuration utility. (02 hrs) 210. Create / modify organization, Connect devices over cloud. (04 hrs) 211. Configuration of parameters,	- Basics of Industrial protocols Modbus RTU, Modbus TCP, DLMS - Client server communication Basics of Protocol Converters. Basics of IoT Data Acquisition System. Device connectivity over cloud and troubleshooting. GUI based IoT Cloud Configuration utility. IoT device and its parameter configuration Cloud Device Management and troubleshooting.

		alarms, notifications on cloud platform. (06 hrs) 212. Explore user management roles and security. (03 hrs) 213. Observer Device Diagnostics for troubleshooting. (04 hrs) 214. Setup Environment for embedded SCADA testing. (05 hrs)	
41-42	Demonstrate and Deploy responsive Web Application using APIs and generate reports using templates.	215. Explore Web API, required input parameters and output. (10 hrs) 216. Map Web API to Widget / Control / Plugin. (20 hrs) 217. Display and configure graphs, charts and other ready to use controls and widgets. (20 hrs) 218. To generate reports using readily available API, templates and to export it to excel, word pdf and other required formats. (10 hrs)	Usage of Web Services / Web API Development of Sample Web Application. Generation and export of Reports User access and rights management.
43-44	Monitor health parameters like Blood Pressure, ECG, EMG, Heart rate, EEG, SPO2 etc. by suitable sensors (PHMS).	219. Analyse respiration real time using piezoelectric sensor. (15 hrs) 220. Identify and select respiration system, exchange of gases in alveoli of lungs. (15 hrs) 221. Identify apnea (Slow rate of Respiration), tachypnea (Fast rate of Respiration), electrocardiogram, cardiovascular abnormality like Bradycardia, Tachycardia, real time ECG. (15 hrs) 222. Check Software analysis of real time ECG data. (15 hrs)	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. Principle of operation & Application of Software requirements like Raspbian OS, Python IDLE, Server Study real time analysis of respiration using piezoelectric sensor.
45-46	Apply the sensor output data for further computing, analyzing and visualisation.	223. Observe the biomedical data. (20 hrs) 224. Check the data with standard parameters.(20 hrs) 225. Record the data for further analysis.(20 hrs)	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). 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. 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.
47	Identify, select and Execute remote health monitoring and Tele-health.	226. Monitor EMG signals, ECG signals, Snore signals. (03 hrs) 227. Check Airflow control of user. (02 hrs) 228. Check Body temperature data. (02 hrs) 229. Measure Galvanic skin response. (04 hrs) 230. Detect Body position. (04 hrs) 231. Observe Pulse and oxygen functions. (05 hrs) 232. Use Blood pressure control device. (03 hrs) 233. Apply Glucometer monitor. (03 hrs) 234. Use Spirometer monitor. (02 hrs) 235. Use Internet, video chats, Smartphone and Electronic Medical Record (EMR) clouds for Tele-Health. (02 hrs)	Principle of operation of TeleHealth - 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.
48-49	Identify, select different Robots used in healthcare. (can be achieved by industrial visit)	236. Interface RC servo motor with microcontroller. (10 hrs) 237. Interface & control Stepper motor and Servo motor and DC motor. (10 hrs) 238. Plan Programmable tasks. (10 hrs) 239. Record and Play capability.(10 hrs) 240. Apply Sensor Interface and control Gyroscope, Accelerometer.(10 hrs) 241. Set up robotic ARM for Patient help.(04 hrs) 242. Apply vision based Humanoid for patient health monitoring. (06 hrs)	Basics of Tele Surgery: Enabling the surgeon to perform an operation on a patient from a distant location using Tele Robotics technology. Study Tele Robotics technology tools – demonstrate different types of servo motor, basic functions of Gyroscope, Accelerometer, Sensor Interface and control. Concept of Pick and Place Robot. Functions of color sensor. Principle of vision based Humanoid for patient health monitoring. Introduction to Artificial Intelligence & machine Learning. Application of Artificial Intelligence & machine Learning.
50	**Project Work/Industrial Visit (Optional)** **Broad Area:-**		

	a) Develop a system to measure and record ECG signals b) Develop a wireless system to monitor patient health status using different sensors. c) Develop a tele-health check up system.
51	**Revision**
52	**Examination**

Note: -

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*

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9. SYLLABUS - CORE SKILLS

CORE SKILL – EMPLOYABILITY SKILL	
First Semester	
1. English Literacy	**Duration : 20 hrs** **Marks : 09**
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking/ Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on known people, picture reading, gain confidence through role-playing and discussions on current happening, job description, asking about someone's job, habitual actions. Cardinal (fundamental) numbers, ordinal numbers. Taking messages, passing on messages and filling in message forms, Greeting and introductions, office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. IT Literacy	**Duration : 20 hrs** **Marks : 09**
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of the computer.
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc. Use of Common applications.
Word Processing and Worksheet	Basic operating of Word Processing, Creating, Opening and Closing Documents, Use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion &Creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.

Computer Networking and Internet	Basic of Computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Webs Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
3. Communication Skills	**Duration : 15 hrs** **Marks : 07**
Introduction to Communication Skills	Communication and its importance Principles of effective communication Types of communication - verbal, non-verbal, written, email, talking on phone. Non-verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening, guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active listening skills.
Motivational Training	Characteristics essential to achieving success. The power of positive attitude. Self awareness Importance of commitment Ethics and values Ways to motivate oneself Personal goal setting and employability planning.
Facing Interviews	Manners, etiquettes, dress code for an interview Do's &don'ts for an interview
Behavioral Skills	Problem solving Confidence building Attitude
Second Semester	
4. Entrepreneurship Skills	**Duration : 15 hrs** **Marks : 06**
Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises: Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance &record, Role &function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.

Project Preparation & Marketing Analysis	Qualities of a good entrepreneur, SWOT and risk analysis. Concept &Application of PLC, Sales &Distribution management. Difference between small scale &large scale business, Market survey, Method of marketing, Publicity and advertisement, Marketing mix.
Institution's Support	Preparation of project. Role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the policies / programmes, procedure & the available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop act, Estimation &costing, Investment procedure - Loan procurement - Banking processes.
5. Productivity	**Duration : 10 hrs** **Marks : 05**
Benefits	Personal/ Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working aids, Automation, Environment, Motivation - How it improves or slows down productivity.
Comparison with Developed Countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in select industries, e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and insurance.
6. Occupational Safety, Health and Environment Education	**Duration : 15 hrs** **Marks : 06**
Safety & Health	Introduction to occupational safety and health Importance of safety and health at workplace.
Occupational Hazards	Basic hazards, chemical hazards, vibro acoustic hazards, mechanical hazards, electrical hazards, thermal hazards. occupational health, occupational hygiene, occupational diseases/ disorders & its prevention.
Accident &Safety	Basic principles for protective equipment. Accident prevention techniques - control of accidents and safety measures.
First Aid	Care of injured &sick at the workplaces, First-aid &transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. Safety, health, welfare under legislative of India.

Ecosystem	Introduction to environment. Relationship between society and environment, ecosystem and factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of energy, re-use and recycle.
Global Warming	Global warming, climate change and ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and harvesting of water.
Environment	Right attitude towards environment, Maintenance of in-house environment.
7. Labour Welfare Legislation	**Duration : 05 hrs** **Marks : 03**
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's Compensation Act.
8. Quality Tools	**Duration : 10 hrs** **Marks : 05**
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality circle, Roles and function of quality circles in organization, Operation of quality circle. Approaches to starting quality circles, Steps for continuation quality circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of housekeeping, Practice of good housekeeping.
Quality Tools	Basic quality tools with a few examples.

List of Tools & Equipment			
IoT TECHNICIAN (SMART HEALTHCARE)			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit sl. 1-12 is required additionally)			
1.	Connecting screwdriver	10 X 100 mm	10 Nos.
2.	Neon tester 500 V.	500 V	6 Nos.
3.	Screw driver set	Set of 7	10 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	10 Nos.
8.	Electrician knife	100 mm	6 Nos.
9.	Tweezers	150 mm	10 Nos.
10.	Digital Multimeter	(3 3/4 digit) ,4000 Counts	10 Nos.
11.	Soldering Iron Changeable bits	15 Watt, 240 Volt	6 Nos.
12.	De- soldering pump electrical heated, manual operators	230 V, 40 W	10 Nos.
B. SHOP TOOLS, INSTRUMENTS – For 2 (1+1) units no additional items are required			
Lists of Tools:			
13.	Steel rule graduated both in Metric and English Unit	300 mm,	4 Nos.
14.	Precision set of screw drivers	T5, T6, T7	2 Nos.
15.	Tweezers – Bend tip		2 Nos.
16.	Steel measuring tape	3 meter	4 Nos.
17.	Tools makers vice	100mm (clamp)	1 No.
18.	Tools maker vice	50mm (clamp)	1 No.
19.	Crimping tool (pliers)	7 in 1	2 Nos.
20.	Magneto spanner set	8 Spanners	2 Nos.
21.	File flat bastard	200 mm	2 Nos.
22.	File flat second cut	200 mm	2 Nos.
23.	File flat smooth	200 mm	2Nos.
24.	Plier - Flat Nose	150 mm	4 Nos.
25.	Round Nose pliers	100 mm	4 Nos.
26.	Scriber straight	150 mm	2 Nos.
27.	Hammer ball pen	500 grams	1 No.
28.	Allen key set (Hexagonal -set of 9)	1 - 12 mm, set of 24 Keys	1 No.
29.	Tubular box spanner	Set - 6 - 32 mm	1 set.
30.	Magnifying lenses	75 mm	2 Nos.
31.	Continuity tester	With 4 ½ Digit Display and 20k Count	6 Nos.
32.	Hacksaw frame adjustable	300 mm	2 Nos.
33.	Chisel - Cold - Flat	10 mm X 150 mm	1 No.
34.	Scissors	200mm	1 No.

35.	Handsaw 450mm	Hand Saw - 450 mm	1 No.
36.	Hand Drill Machine Electric with Hammer Action	13 mm	2 Nos.
37.	First aid kit		1 No.
38.	Bench Vice	Bench Vice - 125 mm Bench Vice - 100 mm Bench Vice - 50 mm	1 No. each
List of Equipments			
39.	Multiple Output DC regulated power supply	0-30V, 2 Amps, ± 15V Dual Tracking ,5V/5A, Display digital, Load & Line Regulation: ± (0.05 %+100 mV), Ripple & Noise: 1 mVrms. Constant Voltage & Current operation	4 Nos.
40.	DC Regulated Variable Programmable DC Power Supply	0-30V/3A with numeric keypad, PC interface and LCD for Voltage, Current & Power	2 Nos.
41.	LCR meter (Digital) Handheld	It can Measure six basic parameters R,C,L equipped with SMD Component Test Fixture	1 No.
42.	70 MHz Mixed Signal Oscilloscope (4 Analog + 16 Digital Channel)	With more than 20Mpt memory Real time Sampling 1GSa/sec , having LAN Interface with, I2C , SPI, Runt etc .. And RS232/UART, I2C and SPI trigger decoding functions , two channel 25MHz awg plus math functions like differentiation, integration, abs, AND,OR,NOT etc..an	1 No.
43.	25 MHz Arbitrary Waveform Generator with Digital Display for Frequency and Amplitude	Two Channel , 200MSa/Sec and 2Mpt memory with more than 150 different arbitrary waveforms and built-in 8th order harmonic generation and 150MHz Frequency counter PC Connectivity USB Device/Host and LAN	1 No
44.	6 1/2 Digit Digital Multimeter	Measurement Functions: DC &AC Voltage, DC&AC Current, 2-wire & 4-wire Resistance, CAP, Diode, Connectivity, Frequency,	1 No.

		Period, Any Sensor. Temperature: RTD, THERM,TC (B/E/J/K/N/R/S/T) PC Interface USB Host, USB Device, LAN(LXI-C) Measurement Speed 10k readings/sec	
45.	3GHz Spectrum Analyzer with built-in Tracking Generator	Frequency Range 9 kHz to 3.2 GHz Resolution Bandwidth(-3 dB): 10 Hz to 1 MHz Built in tracking generator Min. -148 dBm DANL Display 8" TFT or more PC Interface: USB Host & Device, LAN(LXI)	1 No
OR Electronics Workbench		**Item no. 39, 41, 42, 43, 44 and 45 can be preferred in the form of workbench.**	**1 No.**
46.	Multi Function Test & Measuring Tool for Field Applications and Testing compatible with Laptop	300 MHz Bandwidth 2 Channel Digital Storage Oscilloscopes, Spectrum Analyzer. Arbitrary Waveform Generator Sine 50MHz ,Square 15MHz,Triangle 100KHz , AM –FM Modulation, 16 Channel Logic Analyzer Frequency and Phase Meter USB 2.0/ 3.0 Interface	1 No.
47.	Electrical Safety Trainer	Demonstration of importance of earthing in any electrical device. Arrangement to study role of fuse and types of slow blow, high blow fuse in any electronic circuit. Arrangement to study the importance of MCB and it's working.	1 No.
48.	Analog Component Trainer with following Seven Basic Modules • Diode Characteristics (Si,Zener,LED) • Rectifier Circuits • Diode as Clipper Circuit • Diode as Clamping Circuit	Breadboard for Circuit design DC power supply: +5V,1A (Fixed); +12V, 500mA (Fixed); ±12V, 500mA (Variable) AC power Supply: 9V-0V-9V, 500mA Function Generator: Sine, Square, Triangle (1Hz to	1 No.

	• Zener as voltage regulator. • Transistor Type NPN & PNP and CE Characteristics • Transistor as a switch	100KHz) Modulating Signal Generator: Sine, Square, Triangle (1Hz to 10KHz). Voltage, current and frequency on board LCD display. PC Interface – Acquisition from two analog input channel Simulation Software	
49.	Digital IC Trainer	Breadboard: Regular DC Supply: +5 V/1 A +12V/1A Clock Frequency 4 different steps from 1Hz – 100KHz Amplitude: (TTL), 128x64 Graphical LCD, Pulser Switches, Data Switches: 8 Nos, LED: 8 Nos. (TTL),Seven Segment Display, Teaching & Learning Simulation Software	1 No.
50.	IT Workbench for computer hardware and networking	The bench comprises with Computer Hardware Training System (02 Nos.) The different circuit boards of PC/AT Computer are exposed on a PCB, LAN Training System with Wireless LAN as well to study Peer to Peer, STAR, RING Topology. Protocols: CSMA /CD, CSMA /CA, Stop N Wait, Go back to N, Selective repeat, Sliding Window, Token Bus, Token Ring, Colored representation of data in transmission & reception. Data transmission speed: 10/100 Mbps, Smart managed 3 Layer and 2 Layer Switch, Media converter, POE Switch, Wi-Fi LAN card, IP Camera, Energy meter, LED tube light, Voltmeter and Ammeter will be fitted. Networking Fundamentals Teaching Simulation Software DSO 50MHz 4 Channel , 1GSa/Sec ,more than 20 Mpt	1 No.

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		memory DSO DMM : $4^{1/2}$ Digit with LCD Display	
51.	Laptop latest configuration		1 No.
52.	Laser jet Printer		1 No.
53.	INTERNET BROADBAND CONNECTION		1 No.
54.	Electronic circuit simulation software with five user licenses	Circuit Design and Simulation Software with PCB Design with Gerber and G Code Generation, 3D View of PCB, Breadboard View, Fault Creation and Simulation.	1 No.
55.	Different types of electronic and electrical cables, connectors, sockets, terminations.		As required
56.	Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB		As required
57.	SMD Soldering & De soldering Station with necessary accessories	SMD Soldering &Desoldering Station Digitally Calibrated Temperature Control SMD Soldering &Desoldering Power Consumption : 60 Watts I/P Voltage : 170 to 270 V De-soldering : 70 Watt Temperature Range : 180 to 480º Centigrade Power Consumption : 270 Watts Hot Air Temperature : 200 to 550º Centigrade	1 No.
58.	SMD Technology Kit	SMD component identification board with SMD components Resistors, Capacitors, Inductors, Diodes, Transistors & IC's packages. Proto boards with readymade solder pads for various SMD Components. SMD Soldering Jig.	1 No.
59.	Microcontroller kits (8051) along with programming software (Assembly level Programming)	Core 8051 MCU clocked at 11.0592 MHz., supporting both programming modes	1 No.

	With six important different application modules 1. Input Interface Switch, Matrix Keypad, ASCII Keypad 2. Display LCD, Seven Segment, LED Matrix 3. ADC & DAC 4. PC Interface module 5. Motor DC, Stepper, Servo 6. DAQ	Keypad and computer ,LCD for both programming and run mode, ready to run programmer to support family of controllers AT89C52 ,DC Power Supplies +12V, -12V, +5V & -5V, Breadboard to make circuits, Learning content through simulation Software and following application modules 1. Input Interface : 4x4 Matrix Keypad, ASCII Key PAD, Four Input Switch 2. Display 16X2 LCD, Seven Segment, LED Bar Graph 3. ADC/DAC with ADC/DAC0808 4. PC Interface: RS232 & USB 5. Motor Drive: DC, Servo, Stepper 6. DAQ: 4ch analog 10bit, 22 DIO resolution,6MHz Frequency Counter (square wave), DAQ with PC interface software	
60.	Sensor Trainer Kit Containing following Sensors a) Air humidity and Temperature b) RTD c) Atmospheric Pressure d) Air Quality e) Smoke Detector Sensors f) Limit Switch g) Photo sensors h) Capacitive displacement	IoT enabled Android based 7" Graphical touch LCD with inbuilt cortex processor & DAQ for acquiring analog data and software for viewing the output waveforms with USB storage and HDMI output. Ethernet port to connect real world. Inverting, Non – Inverting, Power, Current, Instrumentation and Differential Amplifier, F to V, V to F, I to V, V to I Converter, High Pass and Low Pass Filter, Buffer, LED, Buzzer, LED Bar Graph, Touch Switch Included Sensors :RTD,NTC Thermistor,LM35,Photovoltic, Air humidity and Temperature, Gas(Smoke), Air Quality, Atmospheric Pressure, Limit switch,	2 Nos.

		Capacitive displacement	
61.	Different types of electronic and electrical cables, connectors, sockets, terminations.		As required
62.	Different Microcontroller/Processor Training and Development Platform for AVR, PIC, ARM and Arduino.	MCU PIC16F877A , 4MHz, Onboard programmer will program PIC Devices, USB Port MCU ATMEGA8515 ,8MHz, onboard programmer will program ATMEGA series microcontroller, USB Port MCU LPC2148 , 12MHz,LED 8Nos, ADC 10 bit 10Nos, DAC 10bit ,USB and RS232, RTOS support, JTAG Connector, USB2.0,Onboard Zigbee, I2C,SPI,RTC,DC motor, PWM, Sensor LM35 , Display 16X2 LCD Display , Motor Drive: L293D 600mA (5-12V),Programmer USB Interface. Microcontroller ATmega328p (**Arduino Based**), 16MHz, Digital I/O Pins : 14 (of which 6 provide PWM output) , Flash Memory : 16KB (of which 2KB used by boot loader) Each platform should have Bread DC Power Supplies +12V, -12V, +5V & - 5V, Breadboard to make circuits.	1 No.
63.	Internet of Things Explorer	Processor : 64bit ARMv7 with 1GB RAM , Memory 32GB ,OS: Open source Linux, Connectivity: Wireless LAN, Bluetooth, Zigbee, USB & Ethernet, HDMI interface, 1.77” Color TFT LCD , Driver for Stepper and DC Motor,	1 No.

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

		field simulation devices 4. Required Connectors, Switches and LED indicators for Field Interface circuits such as Digital Inputs, Relay Outputs, Analog Inputs, Analog Outputs, Pulse Signals 5. Software 1. Communication with simulation device on ethernet MODBUS TCP Protocol 2. Field Interface simulation using HMI replica of Console for easy understanding of students 3. Port Simulation – Serial Port Terminal, TCP/IP, UDP, HTTP 4. Protocol Simulation – MODBUS RTU Master/Slave, MODBUS TCP Master/Slave, DLMS Client IoT Protocol Simulations – MQTT topic publish subscribe simulation	
TOOL LIST FOR SEMESTER – II			
65.	Wireless Communication modules for interfacing with microcontrollers a) RFID Card Reader b) Finger Print c) Zigbee d) GPS e) GSM f) Bluetooth g) WiFi	Core 8051 MCU clocked at 11.0592 MHz, supporting both programming modes Key Pad and PC ,LCD for both programming mode and run mode, ready to run programmer to support family of controllers AT89C51/52 & 55 ,DC Power Supplies +12V, -12V, +5V & -5V,Breadboard to make circuits, detailed learning content through simulation Software and following application modules : RFID Card Reader ,Finger Print, Zigbee, GPS, GSM, Bluetooth	1 No.

		and WiFi	
66.	Sensors for Biomedical Application	All should be compatible with Sensor Training Platform ECG Sensor, Heart Rate Sensor, GSR, Temperature	1 No.
67.	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	1 No.
68.	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) Low pass Filter 5KHz Cutoff frequency	1 No.
69.	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	1 No.
70.	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	1 No.
71.	Patient Health Monitoring Development Platform	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	1 No.

		visualize and storage in real time by sending the data directly to a iPhone and Android Applications With CE / FCC / IC Certifications Sensors Includes :SPO2 Sensor, ECG Sensor, Airflow Breathing, Blood Pressure, Glucometer, Spirometer, Body Temperature, EMG Sensor, Galvanic Skin Response, Body Position, Snore Sensor, etc.	
72.	Robots used in healthcare **(optional)**	MCU : ATMega128, 16MHz DC Power Supplies : +8.4V Charger Supply : 9V/1A Battery Power : 8.4V / 4400mAh 160x128 TFT Color LCD interface 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	1 No.
73.	Humanoid **(optional)**	Intelligent Robot Control test by 32bit Embedded System Biped Robot Basic Control, Controlling Operation of Intelligent Robot Optimized Robot motion program environment using ROBO Basic and ROBO Script, High-resolution CCD camera (Robot Vision) Real Time Image Processing and Monitoring, Total Pixels : 542(H) x 492(V) (270,000 pixels) Electronic Iris : PAL :1/50-1/100,000	1 No.
74.	IoT Data Acquisition Systems & Protocol Converters	Connectivity to Cloud (IBM, Microsoft, Amazon) 24 VDC Isolated Supply, 4 Analog Inputs (0.1% FSR), 8 Pulse Inputs (up to 1 kHz), 8 Digital Inputs, 4 Relay Outputs	1 set

		Ethernet IOT DAQ WiFi IoT DAQ Cellular (GSM / GPRS) IoT DAQ MODBUS RTU to MODBUS TCP 24 VDC Isolated Power Supply, 4 Isolated MODBUS RTU Master Port Serial to Ethernet Serial to Wi-Fi 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	1 No.
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 No.
C. Shop Floor Furniture and Materials - For 2 (1+1) units no additional items are required.			
77.	Instructor's table		1 No.
78.	Instructor's chair		2 Nos.
79.	Metal Rack	100cm x 150cm x 45cm	4 Nos.
80.	Lockers with 16 drawers standard size		2 Nos.
81.	Steel Almirah	2.5 m x 1.20 m x 0.5 m	2 Nos.
82.	Interactive Smart Board with Projector		1 No.
83.	Fire Extinguisher		2 Nos.
84.	Fire Buckets		2 Nos.

TOOLS & EQUIPMENT FOR EMPLOYABILITY SKILLS		
S No.	**Name of the Equipment**	**Quantity**
1	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 Nos.
2	UPS - 500Va	10 Nos.
3	Scanner cum Printer	1 No.
4	Computer Tables	10 Nos.
5	Computer Chairs	20 Nos.
6	LCD Projector	1 No.
7	White Board 1200mm x 900mm	1 No.
Note: Above Tools & Equipments not required, if Computer LAB is available in the institute.		

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ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor:			**Year of Enrollment:**
Name & Address of ITI (Govt./Pvt.):			**Date of Assessment:**
Name & Address of the Industry:			**Assessment location: Industry/ ITI**
Trade Name:	**Semester:**		**Duration of the Trade/course:**
Learning Outcome:			

S No.	**Maximum Marks (Total 100 Marks)**		**15** Safety Consciousness	**5** Workplace Hygiene	**10** Attendance/ Punctuality	**5** Ability to Follow Manuals/ Written Instructions	**10** Application of Knowledge	**10** Skills to Handle Tools & Equipment	**5** Economical Use of Materials	**10** Speed in Doing Work	**15** Quality in Workmanship	**15** VIVA	**Total Internal Assessment Marks**	**Result (Y/N)**
	Candidate Name	**Father's/Mother's Name**												
1														
2														