



**Skill India**  
कौशल भारत - कुशल भारत



सत्यमेव जयते  
GOVERNMENT OF INDIA  
MINISTRY OF SKILL DEVELOPMENT  
& ENTREPRENEURSHIP



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National  
Skill Development  
Corporation

Transforming the skill landscape



# Facilitator Guide



Sector  
**Telecom**

Sub-Sector  
**Network Managed Services**

Occupation  
**Network Operation and Maintenance**

Reference ID: **TEL/Q6210, Version 1.0**  
NSFQ Level: **4**

**Telecom Technician -  
IoT Devices/Systems  
(Installation & M2M  
Communication  
Setup)**





**Shri Narendra Modi**  
Prime Minister of India

“

Skilling is building a better India.  
If we have to move India towards  
Development then Skill Development  
Should be our mission.

”

## Acknowledgement

Telecom Sector Skill Council would like to express its gratitude to all the individuals and institutions who contributed in different ways towards the preparation of this “Facilitator Guide”. Without their contribution it could not have been completed. Special thanks are extended to those who collaborated in the preparation of its different modules. Sincere appreciation is also extended to all who provided peer review for these modules.

The preparation of this guide would not have been possible without the Telecom Industry's support. Industry feedback has been extremely encouraging from inception to conclusion and it is with their input that we have tried to bridge the skill gaps existing today in the Industry.

This Facilitator guide is dedicated to the aspiring youth who desire to achieve special skills which will be a lifelong asset for their future endeavours.

## About this Guide

In the last five years, the growth of the Indian telecommunications sector has outpaced the overall economic growth. This sector is poised for strong growth of about 15 percent in short term during 2013–17, driven by growth in organised retail, technological advancements, changing consumer preferences and government support. With over 1000 million subscribers, India is the second largest telecom market in the world.

The sector currently employs over 2.08 million employees and is slated to employ more than 4.16 million employees by 2022. This implies additional creation of ~2.1 million jobs in the nine-year period.

This Facilitator Guide is designed to impart theoretical and practical skill training to students for becoming a Telecom Technician – IoT Devices/Systems. Telecom Technician in the Telecom industry is also known as IoT installation and service technician.

IoT installation and service technician is responsible for on-site installation and configuration of IoT devices (nodes), setup of communication links between nodes and controller (gateway) and further to central servers or devices through external communication links on Wi-Fi, 3G/4G networks on GSM/CDMA. The technician also undertakes first level of troubleshooting.

This Facilitator Guide is based on Telecom Technician – IoT Devices/Systems Qualification Pack (TEL/Q6210) & includes the following National Occupational Standards (NOSs)

1. Installation of IoT devices at customer premise/equipment (TEL/N6234)
2. Configuring IoT devices and establishing communication links (TEL/N6235)
3. Undertake Level 1 Troubleshooting of IoT devices (TEL/N6236)
4. Health and Safety (TEL/N2509)

The Key Learning Outcomes and the skills gained by the participant are defined in their respective units.

Post this training, the participant will be able to keep sites live 24x7 through site maintenance.

We hope that this Facilitator Guide will provide a sound learning support to our young friends to build an attractive career in the telecom industry.

## Symbols Used



Ask



Demonstrate



Facilitation Notes



Learning Outcomes



Notes



Objectives



Do



Practical



Summary



Activity



Explain



Say



Example



Resources

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# 1. Introduction to Internet of Things (IoT) and Telecom

Unit 1.1 – Basics of Micro-processor Boards and Microcontroller Units

Unit 1.2 – Functioning of Sensors and Actuators

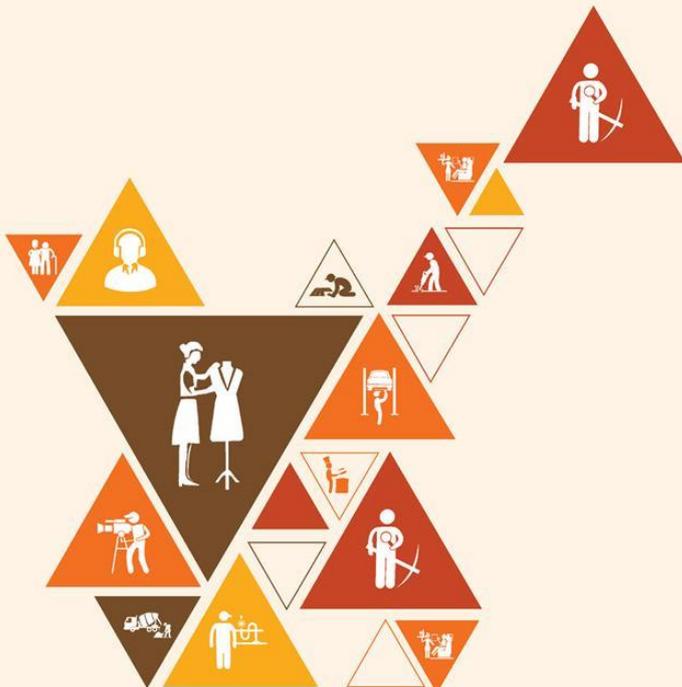
Unit 1.3 – Application of Communication Protocols in Internet of Things

Unit 1.4 – Micro-controller Boards, PIN Configurations and Their Interconnectivity

Unit 1.5 – Understand Edge Devices

Unit 1.6 – Nodes and Gateways

Unit 1.7 – Cloud Computing



TEL/N6234

## Key Learning Outcomes



By the end of this module, the trainees will be able to:

- Explain the basics of IoT
- Identify the applications of IoT in current world
- Explain the basics of microprocessors and microcontrollers
- Describe different processor boards and their applications
- Explain how IoT works for roadside assistance and smart cities
- List various types of sensors
- Identify the importance of actuators
- Explain the basic programming of a microcontroller board
- List various short-range wireless communications systems
- Identify the protocols used for communication in IoT
- Compare different communication technologies
- Identify the components of a microcontroller board
- Describe the layout of various development board
- Explain the functions of edge devices
- Identify the different types of edge devices
- Explain nodes
- Describe gateway architecture
- List the steps in setting up an IoT framework
- Explain the concept of cloud computing
- List the characteristics of cloud computing
- Explain how cloud computing is related to business analytics
- Explain the advantages of cloud utilization

## UNIT 1.1: Basics of Micro-Processor Boards and Microcontroller Units

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the basics of IoT
- Identify the applications of IoT in current world
- Explain the basics of microprocessors and microcontrollers
- Describe different processor boards and their applications
- Explain how IoT works for roadside assistance and smart cities

### Resources to be Used

- Objects such as a duster, pen, notebook and so on
- Microprocessor chip
- Arduino and Raspberry Pi board

### Ask

- Ask the participants whether they have heard about Internet of Things (IoT).
- Ask them, if they know about the IoT initiatives taken by the Government.

### Notes for Facilitation

- Start the session by telling the participants about the Digital India program. Tell them that the campaign was launched by the Government of India to make the Government services electronically available to the citizens by increasing Internet connectivity, providing advanced online infrastructure and empowering the people in the field of technology.
- Tell them what Internet of Things is.
- Explain that IoT is a network of small devices enabling people to exchange data. This also results in improved data collection and management.
- Explain the IoT concept as shown in the following image and tell that the small devices such as cameras, watches, laptops, and other devices are interconnected and can be controlled by a mobile device:



Fig. 1.1.1: IoT concept

- Also, tell them that the 'things' in IoT, may include smart phones, sensors built into vehicles, radio-frequency identification (RFID) chips, medical devices, buildings or anything that needs to be monitored.
- Tell them that the initiatives taken by the Government include setting up of 100 smart cities and automating the industries such as energy, health and so on by means of remotely connected devices.
- Tell them how telecom sector is involved in implementing the IoT infrastructure.

## Explain

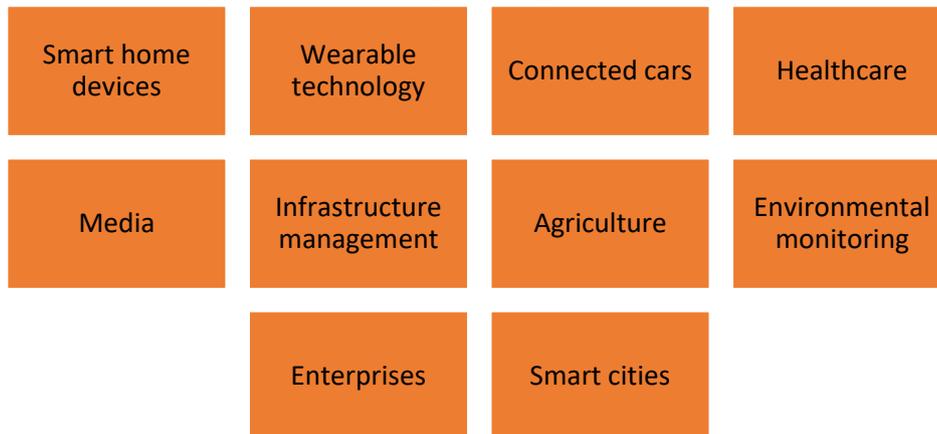


- Explain the IoT applications one by one.

## Notes for Facilitation



- Tell them about the applications of IoT by drawing the following figure on the board:



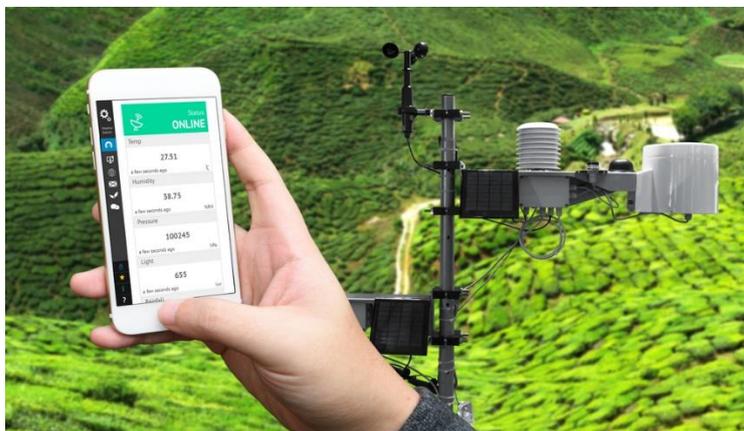
*Fig 1.1.2: Various applications of IoT*

- Explain the applications one by one with examples.
- Tell them that smart home technology provides security, comfort and convenience to the owners of the home by enabling them to control the active devices via a smart home app on their smartphones or any other device connected to the network. The following image shows a home automation app on the screen of a tablet:



*Fig 1.1.3: Home automation app on a tablet*

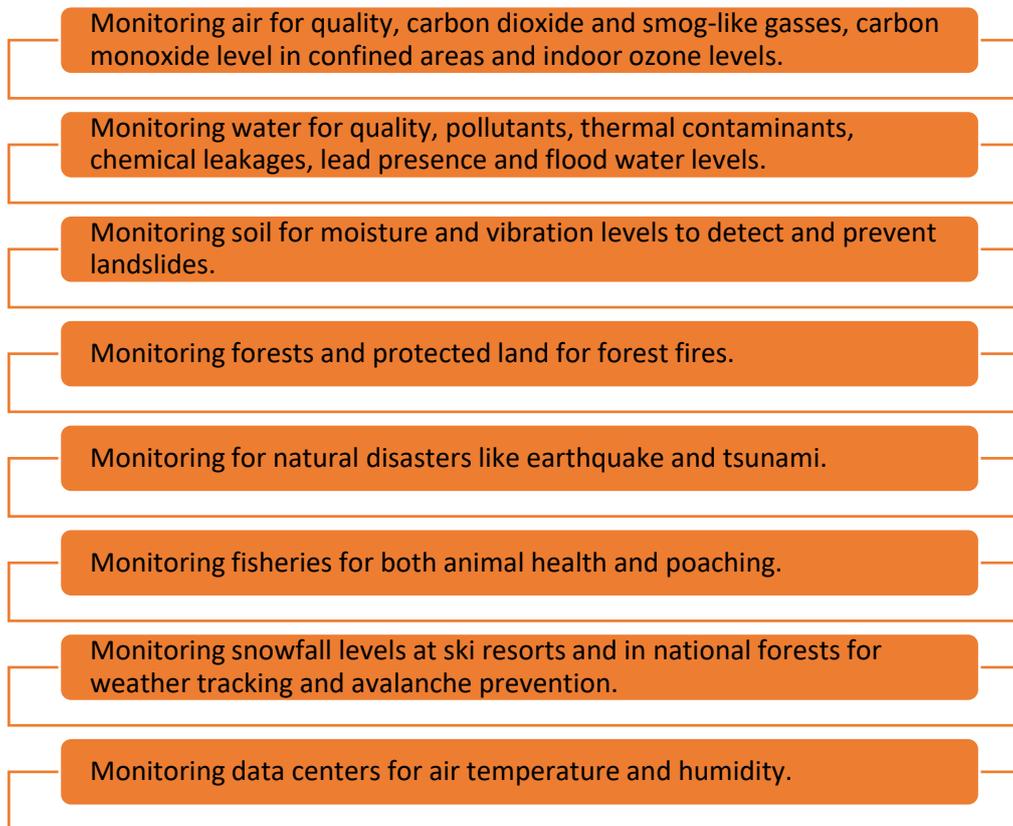
- Explain to them some examples of smart home technologies:
  - Smart TVs can be controlled through applications like music and on-demand video by connecting them to the Internet. Some smart TVs can also be controlled by voice or gesture.
  - Smart lighting systems can adjust lighting by detecting the occupants in the room.
  - Residents can monitor their homes from a distance with smart security cameras.
- Tell them that most of the organisations monitor customer data and marketing trends through mobile apps. IoT applications are used in production and distribution operations for tracking the product flow and business locations.
- Also, explain to them how infrastructure is controlled and managed by IoT applications.
- Tell them that IoT also provides productive ways to cultivate soil and increase livestock level by offering data. The applications can deliver information about factors such as follows:
  - 24x7 visibility into soil and crop health
  - Storage conditions
  - Energy consumption level
  - Machinery in use
  - Animal behaviour
- Also, explain the benefits of using IoT apps as follows:
  - Farmers can be alerted of irregular conditions such as high acidity of the soil. It gives the farmer the time to produce better crops.
  - Farmers gain knowledge about the soil moisture and nutrients, and determine the fertilizer profiles based on soil chemistry as shown in the following image:



*Fig 1.1.4: Knowledge of moisture and nutrients in the soil through mobile phone*

- Self-driving tractors can be controlled remotely, which provides significant savings in labour costs.
- IoT involves everything from monitoring levels of ozone in a meat packing facility to monitoring national forests for smoke.

- Tell them the use cases of IoT environment monitoring with the help of the following figure:



*Fig 1.1.5: IoT use cases in environment monitoring*

- Tell them that IoT applications are used in enterprises in tracking assets, managing quality, operating the automated assembly line and optimizing the resource and the process.
- Explain to the participants about the wearable technologies. Also, give them an example by telling them that a customer can pay bills via the smart phones. The following image shows a customer making a payment using a smart phone:



*Fig 1.1.6: A customer making payment using a smart phone*

- Tell the participants that patient and capital equipment tracking through the use of IoT tagging is one example of IoT use case utilized in health care facilities. Using low-cost tags can improve health outcomes and operational efficiency.

For example, if a patient X is physically in the hospital, the health care providers and the hospital staff can immediately know where the patient is at all times and seamlessly associate that patient with his/her medical information.

- Give them another example. Tell that if people want to improve their fitness or lose weight in a sustainable way, an IoT-enabled device will help them to do so. They may wear smart glasses that record their food choices, the portion size and the calories; which are then automatically sent as data to an app or to their health care provider. The app or the provider can take this information and either run it through data processing or analyse it further to create a plan unique to the individual. The doctor may note, for example, that a patient is eating too few leafy greens and too many carbs. Suggestions for different and healthier choices can be sent regularly to a smartphone or an email account to nudge the patient's behaviour in a different direction. Using IoT-enabled devices in this process saves time and hassle for the patient, and it allows the health care apps or the doctors to prescribe actionable steps to keep the patient on track toward his or her goals.
- Explain the role of IoT in telecom sector.

### Ask

- Ask the participants what they know about microprocessors and microcontrollers.
- Ask them to tell one application of each of them.
- Ask them if they have heard about Arduino and Raspberry Pi boards.

### Explain

- Explain microprocessors and microcontrollers.
- Explain various processor boards.

### Notes for Facilitation

- Show the participants a microprocessor chip and tell that it is a complete computation engine, fabricated on a single chip.
- Tell them that the processing power of a microprocessor depends on characteristics such as clock speed, instruction set and word size.
  - **Clock Speed** – The speed of execution of instructions
  - **Word Size** – Single instruction number of bit processed by a processor
  - **Instruction Set** – Set of commands for the digital machine to perform certain operation. Every microprocessor has three important components which determine the overall functioning of the computer/mobile device/machine.
- Tell them that the following are the components which are vital for the smooth functioning of any microprocessor chip.
  - **CPU** – Very Large Scale Integrated Circuit (VLSI) which decodes and performs arithmetic, logical and memory sequencing operations
  - **Bus** – Internal connections of microprocessor chip which carry data

- **Memory** – Microprocessor has volatile Random-Access Memory (RAM) and non-volatile Read Only Memory (ROM).
- Also, tell that some known brands of microprocessors are Pentium, K6, PowerPC, Sparc and so on.
- Tell them about the basic components of a microprocessor with the help of the following figure:

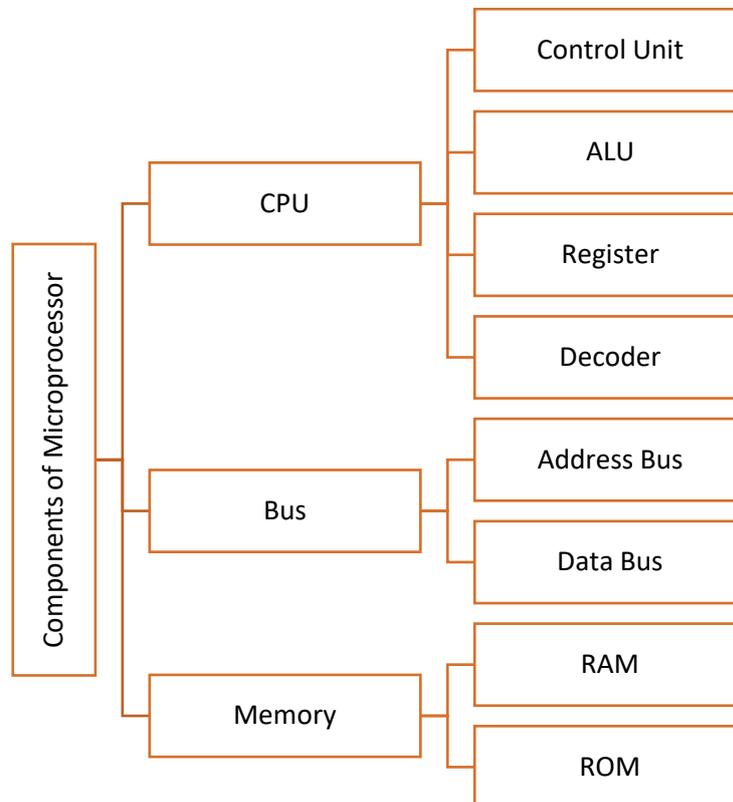


Fig 1.1.7: Basic components of microprocessor

- Tell them about the components of a microcontroller.
- Also, explain various types of microcontrollers.
- Tell the participants that generally, a microcontroller comprises of the following components:
  - **CPU**– Microcontroller’s brain which retrieves, decodes and processes the information
  - **Memory**– ROM/RAM (EPROM or EEPROM) to store data and information in an understandable format
  - **I/O Ports**– To create an interface between peripheral devices such as printers
  - **Timers** – To control timing operations such as clock functions, frequency modulations, generating oscillations and so on.
- Explain to them that depending on the architecture and memory requirements, a microcontroller can be classified as follows:
  - **8-bits** – Intel 8031/8051 microcontroller capable of executing logic and arithmetic operations
  - **16-bits** – Higher performance microcontroller with more accuracy in performing operations; example, Intel 8096
  - **32-bits** – Microcontroller for automatic actuated hardware like automated machines in office.

- Tell them the types of microcontrollers can be classified as follows:
  - **8051 Microcontroller** – This has universally accepted 8-bit microcontroller configuration which uses Flash, NV-RAM and UV-EEPROM. It has an on-chip crystal oscillator and a 2-pin input-output port.
  - **Peripheral Interface Controller (PIC) Microcontroller** - PIC developed by Microchip Technology earlier had ROM or EPROM for program storage. The current generation models have flash memory which can be reprogrammed. The microcontroller comes in 8-bit, 16-bit and 32-bit models.
  - **Advanced Virtual RISC (AVR) Microcontroller** – AVR microcontroller is an 8-bit solitary chip microcontroller having non-volatile programmable flash memory. To eliminate requirement of external memory, the AVR microcontroller has SRAM, flash and EEPROM integrated in a single chip
- Tell them the differences between microprocessors and microcontroller boards.
- Explain to them about the processor boards and show them the Arduino and Raspberry Pi board.
- Tell them about the customized single board platform. Also, tell them the difference between single board computer and the microcontroller board.
- Tell that a single board computer (SBC) is a printed circuit board (PCB), combined with a microcontroller as processor, and many other components, required to work like a small computer. Microcontrollers require external hardware and interfacing chipsets for communication whereas SBCs have them built on their PCBs.
- Explain the architecture of Intelligent Transport System (ITS).
- Tell them that IoT framework is fundamentally built on a data centric architecture called Data Tweet Framework. This helps in disengaging the dependency of the data silos in the end user IoT network.
- Give them an example of the on-board unit (OBU) of a vehicle which includes a software module to initiate specific user requests. The handing out and storage layer mechanism are positioned in the Road Side Unit (RSU), which is then connected to a cloud for long-term data storage and automatic service supervision.
- Tell them that to make roadside assistance system a practical solution, there can be three main layers for connected vehicle solutions. The same are as follows:
  - **Sensing Layer** – Interact with the driver and act as an interface for in-vehicle interaction with speed sensors, RFID, cameras, microwave detection technology, infrared sensing equipment or payment gateways
  - **Communication Layer** – For real-time secure communication from vehicle terminal to the service layer on public or private networks like 3G/4G, Wi-Fi or optical fibre
  - **Service Layer** – Usage of applications by means of cloud computing technologies, data analytics and data and information processing. Huge amount of data and information pertaining to commercial vehicle scenario and transportation information is processed.

- Show them the following figure which shows the components of an intelligent roadside assistance framework:



#### Application Layer

- Resource discovery
- Actuation/sensing
- Query/push/security



#### Processing and Storage Layer/Access Control

- Data processing
- Resource registration and management
- Data dissemination



#### Perception Layer

- RFID
- Sensor
- Global positioning system (GPS) and ZigBee

*Fig 1.1.8: Intelligent roadside assistance framework*

- Tell them about some examples of ITS in India with the help of the following figure:

Advanced Traffic Management System (ATIS), a fully automated traffic regulatory management system incorporates the use of automatic number plate readers and surveillance cameras.

The Traffic People provides real time traffic updates to the users.

Advanced Public Transportation System monitors the frequency of the transports, delay, arrival time and so on, so that the passengers need not wait for transport.

Electronic Toll Collection removes the toll payment violation. If a car is registered in a toll payment program, the account related to the card is automatically debited when it crosses the toll.

Advanced Parking Management tells a car about the vacant place for parking and the way to it.

*Fig 1.1.9: Some examples of ITS in India*

- Exercise Handling Strategy:

1. Ask any two of the participants randomly to answer the question. The answers may be:

- Health Monitoring Application
- Home Alarm System

2. Ask any two of the participants randomly to tell the differences. The differences are:

<b>Microprocessor</b>	<b>Microcontroller</b>
Microprocessors have only few integrated circuits or CPU units.	Microcontrollers have a processor core, ROM, RAM, I/O pins and so on.
Processing speed of microprocessors is above 1 GHz.	Processing speed of microcontrollers is about 8 MHz to 50 MHz.
No power saving system with external components, so power consumption is high.	Power saving system, like idle mode or power saving mode for low consumption of power.
Bulky and preferred for larger applications.	Compact, favourable and efficient system for small products and applications.
Tasks performed are software development.	Tasks performed are limited and generally less complex.
Based on von Neumann model where program and data are stored in same memory module.	Based on Harvard architecture where program memory and data memory are separate.

3. Randomly ask any two of the participants to tell examples one by one. The suggestions are:

- Healthcare: Use of smart pills (or ingestible sensors), insulin delivery devices, connected inhalers, smart beds, robotic surgeons, fitness trackers and biosensors.
- Enterprise: RFID tags to manage inventory, driverless trucks, robotic assembly and so on.

## UNIT 1.2: Functioning of Sensors and Actuators

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List various types of sensors
- Identify the importance of actuators
- Explain the basic programming of a microcontroller board

### Resources to be Used

- Available objects such as a duster, pen, notebook and soon
- Different sensors and actuators

### Ask

- Ask the participants if they can tell some applications of a sensor.
- Ask them whether they can name 2-3 types of sensors.

### Explain

- Explain to the participants about different types of sensors.

### Notes for Facilitation

- Start the session by asking the participants about sensors.
- Tell them that a sensor is a device that detects any change in the various factors of physical environment and responds to it. The factors could be motion, light, heat, moisture, pressure or any other environmental phenomena.
- Explain that a signal is generated from the sensor as an output which is transmitted over a network electronically, for further processing.
- Tell them about the applications of different types of sensors and their applications. The following figure shows some types of sensors:

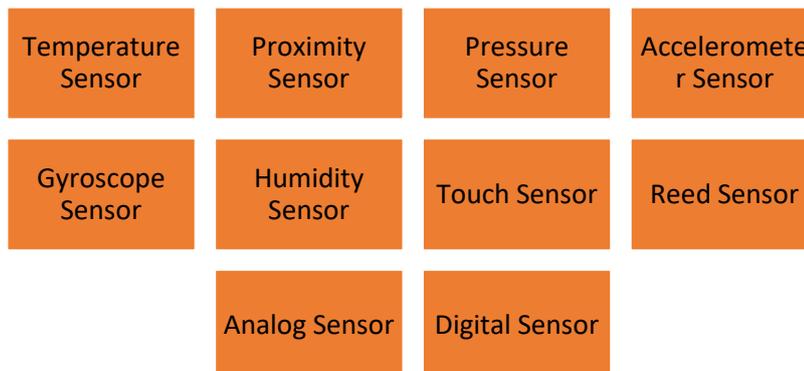


Fig 1.2.1: Some types of sensors

- Briefly explain different types of the temperature sensors, such as follows:
  - Thermocouples
  - Resistive Temperature Sensors
  - Infrared Sensors
  - Thermometers
  - Change of State Sensors
  - Silicone Diode Sensors.
- Tell them that the different types of temperature sensors used these days are as follows:
  - Thermocouples – These sensors measure temperature change with change in output voltage.
  - Resistive Temperature Sensors – These sensors measure temperature change due to variation in resistance level.
  - Infrared Sensors – These are non-contact sensors which detect temperature by beaming IR light on the desired object.
  - Thermometers – These are liquid expansion sensors that use mercury to measure the temperature levels.
  - Change of State Sensors – These measure change in state of material due to temperature variation.
  - Silicone Diode Sensors – These measure temperature changes at a very low range.
- Tell them that proximity sensors include the following:
  - **Inductive Sensors** – Used for non-contact detection of metallic objects; these types of sensors detect ferrous targets which are thicker than 1mm by creating a symmetrical magnetic field radiating from the ferrite core
  - **Capacitive Sensors** – To detect metallic and non-metallic objects (liquid, solid or in powder form) using conductive plates
  - **Photoelectric Sensors** – To detect target objects having 1mm or less thickness at a maximum distance of 60m. The emitter sends an infrared light or visible light to the receiver, and based on the amount of light received the output is determined
  - **Through Beam Sensors** – Uses photoelectric signal to detect any object in between the emitter and the receiver
  - **Retro Reflective Sensors** – Directs a laser, infrared or visible light at the reflector which beams it back at the receiver; If there is any object in between, it is detected as the light path is broken
  - **Diffuse Sensors** – Beam of light is directed and diffused in all directions, and when any object comes in the range, the desired action is initiated by the sensor
  - **Ultrasonic Sensors** – Use sound waves to detect objects in long range detection; typically used in automated production processes to detect glass, plastic, continuous fluid, sheet metal or wood stacks
- Tell them that different types of pressure measurement devices can be classified as follows:
  - **Absolute Pressure Measurement** – Measurement of pressure level in vacuum conditions; used for determining the barometric or altitude pressure measurements

- **Differential Pressure Measurement** – Measuring pressure of two varied positions measured in pound per square inch; used for monitoring pressure level of fluid in manufacturing industry to maintain the homogeneity of flow
- **Gauge Pressure Measurement** – To measure the pressure at a specific point as compared to the atmospheric pressure; for example, it is used to measure air pressure in car tires or blood pressure levels in human body
- Explain them that ultrasonic sensor is used to evaluate the attributes of a target. It generates high-frequency-sound waves by interpreting the echoes from radio waves or sound waves from the target.
- Also, tell them that, ultrasonic transducer is used for converting energy into ultrasound waves which are above human hearing range.
- Explain the applications of pressure sensors and accelerometer sensors. Tell them about the types of accelerometer sensors
- Accelerometer sensors are based on either capacitive sensing or piezoelectric effect which measures the displacement of the mass proportional to acceleration. The difference in both are as follows:
  - **Capacitive** – Known for high accuracy, this sensing mechanism uses electrically charged plates to measure the voltage output
  - **Piezoelectric** – Compressing crystal resulting in accumulation of charge on opposite polarity which can be measured.
- Explain to them, the difference between gyroscope and accelerometer sensor. Gyroscope sensors can be of the following types:
  - **Rotary Gyroscope** – Uses law of conservation of angular momentum to measure angular velocity
  - **Vibration Structure Gyroscope** – Microelectromechanical (MEMS) devices which use multiple rotating systems to detect directional and angular velocity
  - **Optical Gyroscope** – Contains no moving parts and uses a light source to emit two beams positioned on a circle to detect angular motion
- Tell them that the main difference lies in their application. The gyroscope can sense rotation, whereas the other cannot. Accelerometer can measure the orientation of a stationary item with relation to Earth's surface. When accelerating in a particular direction, the accelerometer is unable to distinguish between that and the acceleration provided through Earth's gravitational pull.
- Also, explain that the gyroscope maintains its level of effectiveness by being able to measure the rate of rotation around a particular axis. When gauging the rate of rotation around the roll axis of an aircraft, it identifies an actual value until the object stabilizes out. Using the key principles of angular momentum, the gyroscope helps indicate orientation. In comparison, the accelerometer measures linear acceleration based on vibration.
- Explain humidity sensors and touch sensors.
- Humidity sensors can be classified into the following three types:
  - **Capacitive** – Relative humidity is measured by detecting the metal oxide level changes on a metal oxide strip placed between two electrodes

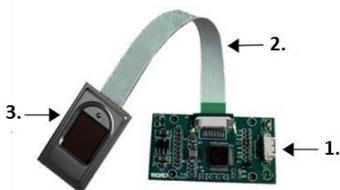
- Resistive - With ions in salts the electrical impedance of atoms is measured, which in turn reflects the changing humidity level(s)
- Thermal – Thermal sensors conducting electricity are used which calculate the difference between dry nitrogen in one sensor and ambient air in the other
- Tell them that touch sensors can be classified as follows:
  - **Resistive** – Relies on changing voltages on application of pressure on the surface to register a touch input
  - **Capacitive** – Has a glass overlay with conductive material which creates electrostatic charge on contact to perform the intended function
  - **Surface Acoustic Wave** – Uses two transducers and reflector on glass surface to beam waves which are detected to register touch input
  - **Infrared** – Uses LEDs and phototransistors to detect the absence of light from a particular coordinate to detect touch
  - **Optical Imaging** – Are infrared imaging sensors which detect the blocked light due to touch to locate the exact position of touch.
- Also, tell them that an oxygen sensor in the emission control system of a car detect the gasoline/oxygen ratio and generates a voltage. The voltage signal is read by a computer in the engine, and the balance of the mixture is adjusted, if required.
- Tell them that a photo sensor can detect the presence of ultraviolet (UV) energy and visible light.
- Tell that a motion detector is an electronic device which is used to detect the physical movement (motion) in a given area and it transforms motion into an electric signal; motion of any object or motion of human beings. Motion sensors in various systems including home security lights, automatic doors and bathroom fixtures typically send out some type of energy, such as microwaves, ultrasonic waves or light beams and detect the interruption in the flow of energy if something enters its path.

## Explain

- Explain the working of sensors with actuators.
- Explain the importance of accuracy of sensors.

## Notes for Facilitation

- Tell the participants that a sensor converts a physical parameter to an electrical signal and an actuator converts an electrical signal to a physical output.
- Show the following image which shows a fingerprint scanner on a PCB:



1. PCB for finger print sensing control
2. Wire for sensor and PCB connection
3. Finger print scanner plate

Fig 1.2.2 Finger print sensor PCB

- Briefly explain how a sensor works with an actuator. The following figure shows the sensor to actuator flow for a smoke detection system:

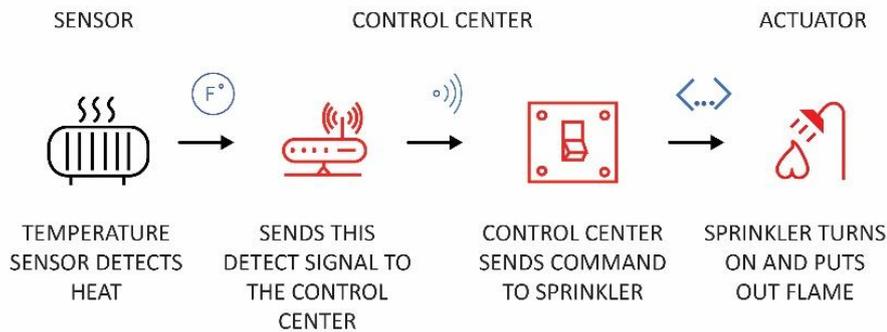


Fig 1.2.3: Sensor to actuator flow for a smoke detection system

- Tell them about the importance of accuracy and precision of a sensor with examples. For example, a temperature sensing system displays 22.0, 22.1 or 21.9 °C in three consecutive measurements, when the ambient temperature is 21.0 °C. The measurement is precise. But, if it displays 21.5, 21.0 and 20.5 °C, it will not be considered so precise, although the values are closer to the actual one.
- Tell them that accuracy of sensed data is paramount because critical decisions are made based on the analysis of this data. If there are more than acceptable errors in this data, the sensor data holds no value for the intended purpose.
- Tell them that factors that can affect sensor accuracy determine the amount of calibration needed for the sensor. These factors, also known as application variables, include temperature, gravity, obstructions (such as foam and dust) and turbulence.
- Briefly discuss about Arduino and Raspberry Pi board, related to the following points:
  - GPIO Pins
  - Processor speed
  - Power supply
  - Programming
  - Connectivity
- Also, tell them about the basics of programming and how to download and install Python.
- Exercise Handling Strategy:
  - Ask the participants one by one to tell one application area of the given sensors. The application areas are:

Temperature Sensor	Food processing HVAC environmental control Medical devices Chemical handling
Pressure Sensor	Leak testing Level / depth sensing Flow sensing Altitude sensing

Touch Sensor	Mobile phones Laptops Musical instruments Foot pronation monitoring
Accelerometer Sensor	Measurement vibration on cars, machines, buildings, process control systems and safety installations
Proximity Sensor	Object detection Velocity measurements Positioning objects / containers Detection of liquid levels Distance measuring Machine Protection Edge detection of an object Detection of metal objects Positioning of equipment in stock Detection and filling quantities Obstacle detection Detection of materials Positioning fork lift truck

2. Ask a few participants one by one to tell the difference. Tell them the following differences:
- The main difference lies in their application.
  - The gyroscope can sense rotation, whereas the other cannot. Accelerometer can measure the orientation of a stationary item with relation to Earth's surface. When accelerating in a particular direction, the accelerometer is unable to distinguish between that and the acceleration provided through Earth's gravitational pull.
  - A proximity sensor senses presence of an object in an area without any physical contact.

## UNIT 1.3: Application of Communication Protocols in Internet of Thing

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List various short-range wireless communications systems
- Identify the protocols used for communication in IoT
- Compare different communication technologies

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on
- A Bluetooth module and a wi-fi module if available

### Ask

- Ask the participants if they know about wireless communication system.

### Notes for Facilitation

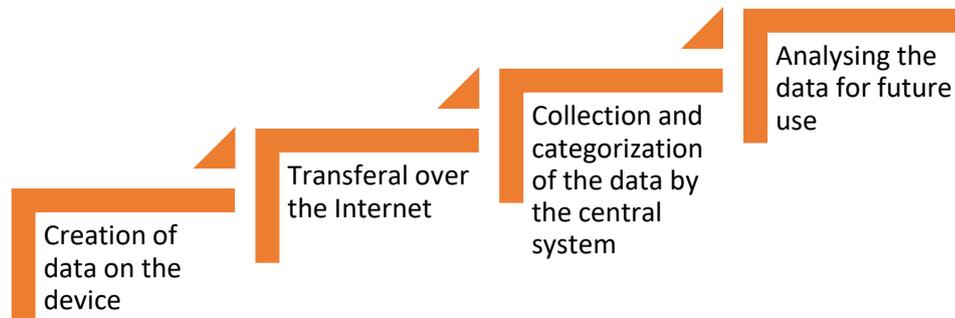
- Start the session by giving an example of Bluetooth headphones. Tell them that this an example of short range wireless communication system.
- Briefly explain about short range wireless communication system.
- Tell them about various wireless communication technologies and their operating ranges. The following figure shows some common short range wireless technologies used these days:



*Fig 1.3.1: Some common short range wireless technologies*

- Briefly, explain the architecture of short range communication network which are as follows:
  - Point-to-point (P2P)
  - Star
  - Mesh.
- Tell them that P2P is a link between two endpoints that allow devices to communicate on a dedicated channel. Star network configurations include multiple nodes that connect to a central device; each node is unable to directly communicate with others only through the central device. These networks are easy to setup but if the central device fails than the network also fails.
- Also, tell that mesh networks consist of multiple nodes, each connecting to each other. This can be used for establishing consistent connection but there is a high amount of redundancy.

- Tell that hybrid networks are simply combinations of different topologies, but they are often very complex and expensive to setup.
- Briefly explain about various data transfer types and protocols used in IoT.
- Tell them about the flow of data collection with the help of the following figure:

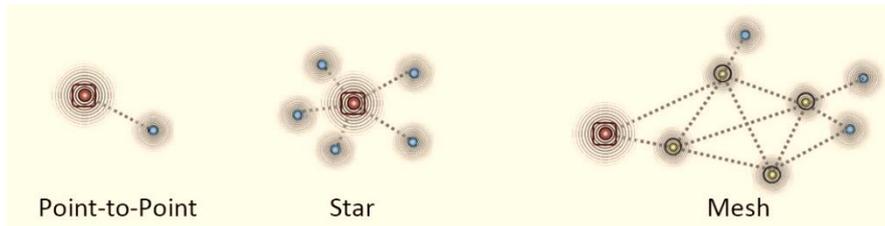


*Fig 1.3.2: Flow of data collection*

- Tell them that the most important IoT protocols are:
  - Constrained Application Protocol (CoAP): It is designed to be used between devices on the same constrained network, between devices and general nodes on the Internet and between devices on different constrained networks—both joined on the Internet. This protocol is especially designed for IoT systems based on HTTP protocols.
  - Message Queue Telemetry Transport (MQTT): It is mostly used for remote monitoring in IoT. Its primary task is to acquire data from many devices and transport it to the IT infrastructure. MQTT connects devices and networks with applications and middleware. A hub-and-spoke architecture is natural for MQTT. All the devices connect to data concentrator servers like IBM’s new MessageSight appliance. MQTT protocols work on top of TCP to provide simple and reliable streams of data.
- Explain different wireless technologies and their characteristics, such as follows:
  - Band
  - Range
  - Standard
  - Power
  - Data Rate
  - Applications
- Tell them that Jaap Haartsen invented Bluetooth. Devices in which it is used widely include mobile phones, computers, and entertainment systems.
- Explain that every Bluetooth-enabled device has a built-in microchip that is capable of sending both voice and data signals. In this short-range communication system, one device functions as the master, while one or more other devices act like slaves. The master device uses link manager software to locate other Bluetooth devices in the vicinity and connects with them to send and receive data.

- Exercise Handling Strategy:

1. Ask one of the participants to draw the following diagram on the board and write the name of the type of network. The types are as follows:



2. Ask one participant to tell the difference. The differences between RFID and NFC are:
  - RFID refers to a communication technology in which digital data encoded in the RFID tag is identified by a device via radio waves. NFC is a communication technology that enables two or more electronic devices, like smartphones, to interact with each other and perform simple, safe, contactless data transfers, transactions, and data access.
  - RFID systems includes a reader, an antenna and a transponder or tag. NFC device can act as a reader as well as a tag in case of card emulation mode.
  - NFC is based on the RFID protocols.
3. Draw a table on the board. Then ask the participants to fill the details one by one. The answer will be:

	Band	Data Rate
<b>Wi-Fi</b>	2.4 / 5 GHz	500Mbps-1Gbps
<b>Bluetooth</b>	2.4 GHz	1Mbps
<b>NFC</b>	13.56MHz	100–420kbps
<b>ZigBee</b>	2.4GHz	250kbps

## UNIT 1.4: Micro-controller Boards PIN Configurations and Their Interconnectivity

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify the components of a microcontroller board
- Describe the layout of various development boards

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on
- Arduino UNO and Raspberry pi board

### Ask

- Ask the participants whether they remember what a microcontroller is.

### Notes for Facilitation

- Tell the participants why a microcontroller is important for IoT.
- Tell them that a microcontroller provides better firmware security, handles Boolean functions and has a higher speed. In IoT applications, size of the computing chip is important, therefore, microcontrollers are preferred as they have all the components integrated on-board.
- Tell them the general components of a microcontroller board with the help of the following figure:

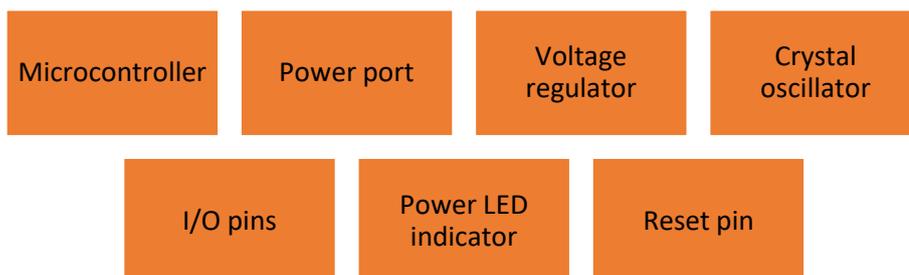
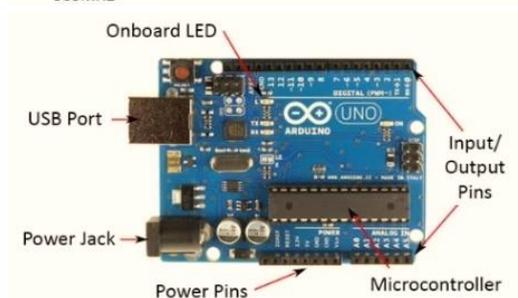
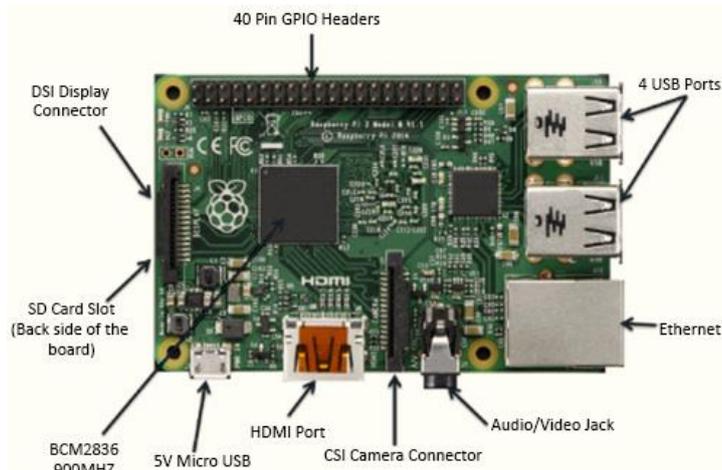


Fig 1.4.1: General components of a microcontroller board

- Explain the basic components of a microcontroller one by one.
- Tell them that the board can be powered by a USB cable or an external power cable.
- Tell them that there are two types of voltage regulators:
  - Linear voltage regulator
  - Switching voltage regulator
- Tell them that voltage regulators come in different types, ranging from ones that are affordable to ones that are efficient in their function over a long period of time.

- Tell them that the types of oscillators used for electronic components of IoT based device circuits are linear oscillators like Hartley oscillator, phase-shift oscillator and Armstrong oscillator or Colpitts oscillator. Other type of oscillators are relaxation oscillators such as Royer oscillator, ring oscillator and voltage-controlled oscillator.
- Explain the specific components of an Arduino board.
- Tell them about the TX and RX LEDs of the Arduino board.
- Also, tell them about the following characteristics of an Arduino UNO board:
  - Microcontroller: ATmega328P
  - Flash memory of 32 KB
  - Operating Voltage: 5V
  - Input Voltage: 6-20V
  - Digital I/O Pins: 14 pins, out of which 6 pins provide pulse width modulation (PWM) output
  - Analog Input Pins: 6
  - DC Current per I/O Pin: 40 mA.
- Also, tell that Arduino boards are used for the following purposes:
  - RFID Sensed Device Access
  - Underground Cable Fault Detection
  - Industrial Appliances Control System Used in Decoding Dual Tone Multi-Frequency Signals via Global Service for Mobile (GSM) Network
  - Home Automation.
- Tell them about the components of Raspberry Pi board.
- In addition, tell them about the following features of a Raspberry Pi 3 board:
  - 1.2GHz, 64-bit quad-core ARMv8 processor
  - Connectivity options such as 802.11n Wireless LAN, Bluetooth 4.1 and Bluetooth Low Energy (BLE)
  - 4 USB ports and 40 GPIO pins
  - 1GB RAM
  - Full HDMI port
  - Audio jack and composite video
  - Camera interface and display interface
  - Micro SD card slot.
- Tell the following applications of Raspberry Pi board:
  - As it can support all programming languages, it is used in launching weight web server.
  - Blogs/website can be managed as it can handle WordPress.
  - In automation industries, Raspberry Pi board-based robotics is used.
  - IOT applications are very easy to develop using Raspberry Pi.
- Tell them about Beagle Bone Black Development Board and tell the features of the board. The features are as follows:
  - 1GHz ARM Cortex-A8 processor
  - 512MB DDR3 RAM
  - 2GB on-board flash storage
  - NEON floating-point accelerator and 3D graphics accelerator

- 32-bit microcontrollers
- HDMI and 2x 46 pin headers
- USB client for power and communications
- USB host and Ethernet adapter
- Tell them that the main objective of the Adafruit Flora development board is to develop wearable electronic devices. The board is sewable, disk shaped and comprises of Arduino-compatible microcontroller.
- Further, tell them that the applications of Adafruit Flora development board are as follows:
  - Wearable thermometer
  - Electromagnetic field detecting dress, which is used to save from radiation by detecting EMF signals.
- Compare between the main types of microcontroller boards with respect to CPU, speed, memory, storage, power port, connectivity and so on.
- Exercise Handling Strategy:
  - For question 1 and 2: Ask the participants to label the parts in the notebook. Give them 15 minutes for each question. Then, tell the answers. The answers are as follows:



- For question 3: Randomly ask one participant to tell the use of voltage regulator. The answer is as follows:
  - Regardless of the input voltage, the voltage regulator provides a fixed output to prevent any short circuits.
  - It generates stable output of the circuit in response to fluctuating input voltage
  - It prevents any voltage spikes in the microcontroller to prevent damage

## UNIT 1.5: Edge Devices

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the functions of edge devices
- Identify the different types of edge devices

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on

### Ask

- Ask the participants if they have heard about edge devices.

### Notes for Facilitation

- Tell the participants that an edge device is a networking device which connects LAN with an external WAN or the Internet.
- In addition, tell them that edge devices serve as entry points into an enterprise's primary network or a service provider's network.
- Further, tell them the examples of edge devices are as follows:
  - Routers
  - Multiplexers
  - Network access devices
  - Routing switches
  - Integrated access devices (IADs)
- Explain the functions of edge devices with the help of the following figure:

They provide interconnectivity between different networks.

They enable local users to connect and transfer data to an external network.

They provide network translation between networks using different protocols.

*Fig 1.5.1: Functions of edge devices*

- Briefly explain about edge routers and show them the following figure:

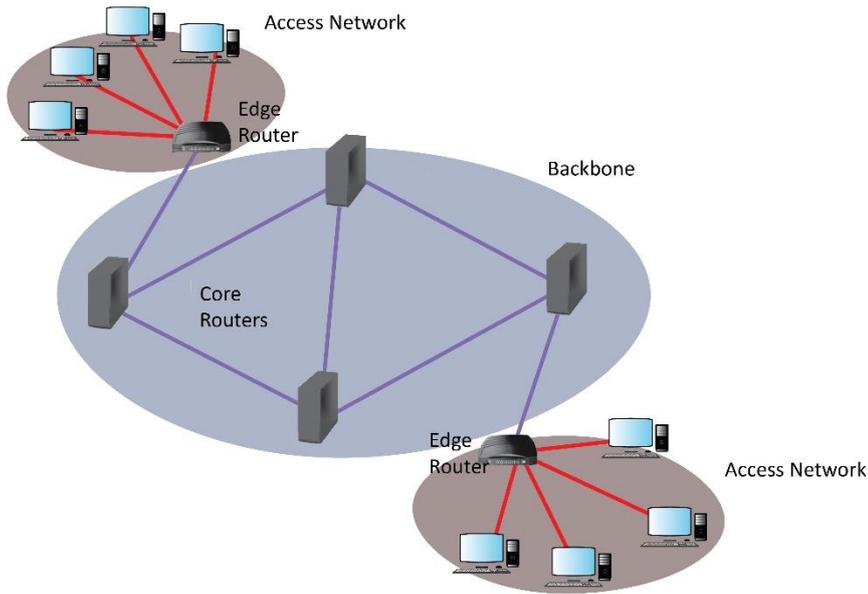


Fig 1.5.2: Concept of edge routers

- Also, tell them that there are two types of edge routers:
  - Subscriber edge router
  - Label edge router
- Explain multiplexer with the help of following figure:

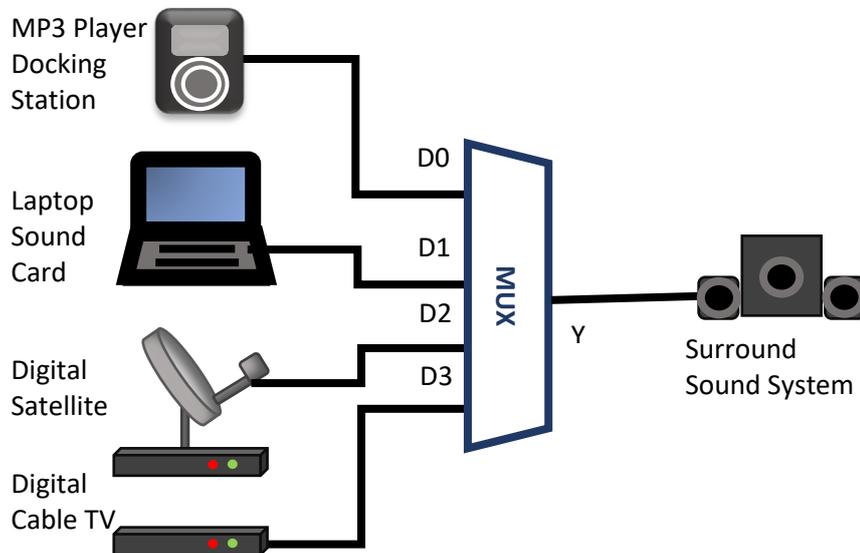


Fig 1.5.3: Concept of multiplexer

- Explain routing switch and its applications.
- Also, tell them about sensors and actuators as edge devices.
- Further, inform them how gateways work as edge devices.
- Tell them that a gateway works like an essential link in edge systems, between the external network and the local connection used by other devices in an environment, making it the key access point for network connectivity.
- Tell them that gateways connect legacy and new systems and enable data flow between edge devices and the cloud.

- Briefly, explain how the devices work as follows:
  - LAN edge
  - Service provider edge
  - Datacenter edge
- Explain the example of IoT- connected office building environment.

## UNIT 1.6: Nodes and Gateways

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain nodes
- Describe gateway architecture
- List the steps in setting up an IoT framework

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on

### Ask

- Ask the participants if they can remember anything about gateways.
- Ask them what they know about nodes.

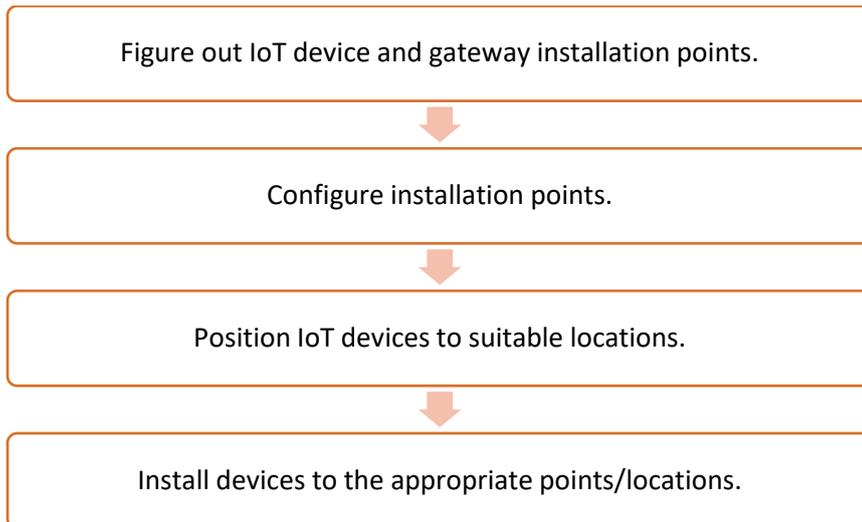
### Explain

- Explain nodes and gateways.
- Explain how they work in an IoT framework.

### Notes for Facilitation

- Start the session by asking questions about nodes and gateways.
- Tell the participants that in telecommunications network, gateway is the networking hardware which interfaces with other network using a different protocol. The gateway devices can be protocol translators, impedance matching devices or signal translators. A computer program also acts as a gateway which can operate at any network layer.
- Tell the participants that a node is a device within a network which has the ability to send, receive or forward data.
- Tell that gateway connects two dissimilar networks.
- Further, briefly explain the IoT gateway and IoT nodes.
- In addition, tell them that an IoT gateway bridges the communication gap between IoT devices, sensors and the cloud.
- Also, tell that IoT gateway devices offer local processing and storage solutions as well as the ability to autonomously control field devices based on data input by sensors by systematically connecting the field and the cloud.
- Further, tell them that an edge gateway is placed at the intersection of various edge devices, between the external network and the local intranet used by the devices. Hence, the gateway is the key access point for network connectivity.

- Also, tell them that it is important to calibrate the following items based on the requirement of the application:
  - Range of the IoT sensors
  - Power demands
  - Performance
  - Scalability and security
- Briefly, explain the basic steps of setting up an IoT framework with the help of the following figure:



*Fig 1.6.1: Basic steps of setting up an IoT framework*

- Exercise Handling Strategy:
  1. Randomly ask the participants one by one to tell the steps. The steps are:
    - Figure out IoT device and gateway installation points.
    - Configure installation points.
    - Position IoT devices to suitable locations.
    - Install devices to the appropriate points/locations.
- Exercise Handling Strategy:
  2. Randomly ask the participants one by one to tell the names of the devices. The devices may be:
    - Routers
    - Routing switches
    - Multiplexers
    - MAN and WAN
    - Sensors, actuators and devices for automation
  3. Randomly ask one participant to tell the functions. The functions are:
    - Edge devices provide interconnectivity between different networks.
    - They enable local users to connect and transfer data to an external network.
    - They provide network translation between networks using different protocols.

## UNIT 1.7: Cloud Computing

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the concept of cloud computing
- List the characteristics of cloud computing
- Explain how cloud computing is related to business analytics
- Explain the advantages of cloud utilization

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on

### Ask

- Ask the participants if they have heard anything about cloud computing.

### Explain

- Explain cloud computing and its characteristics.
- Explain the relation of cloud computing and business analytics.

### Notes for Facilitation

- Start the session by telling that a cloud provides remote access to a group of decentralized IT resources.
- Tell them that it refers to a distinct IT environment, designed to facilitate the remote provisioning of scalable and measured IT resources.
- In addition, tell them, how Internet and cloud are different. The following figure shows the differences between cloud and Internet:

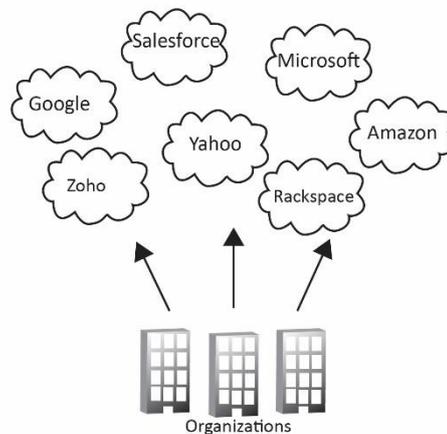
A cloud is privately owned and it provides metered access to IT resources, whereas the Internet allows open access to Web-based IT resources.

Basically, Internet provides the access of content-based IT resources published through the World Wide Web. Resources based on cloud supply back-end processing capabilities along with user-based access to them.

It is not necessary for clouds to be Web-based. They can be based on any protocol that facilitates remote access to the IT resources.

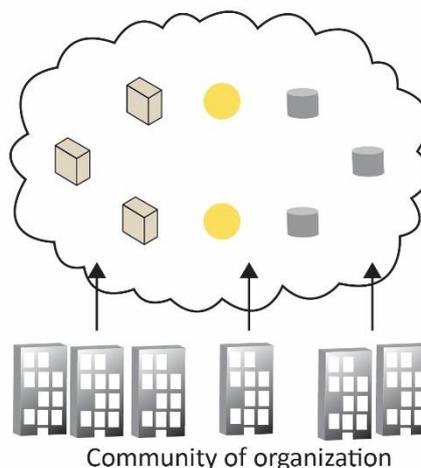
Fig 1.7.1: Differences between cloud and Internet

- Explain the characteristics of cloud computing.
- Tell them that a cloud deployment model represents a particular cloud environment, distinguished by size, ownership and access.
- Briefly, explain to them about different cloud deployment models as follows:
  - Private cloud
  - Public cloud
  - Community cloud
  - Hybrid cloud
- Inform them that a public cloud is owned by a third-party cloud provider and it is publicly accessible.
- Also, tell that the cloud provider is accountable for the creation and maintenance of its IT resources.
- Show them the following figure representing the concept of public cloud:



*Fig 1.7.2: Concept of public cloud*

- Explain that access to a community cloud is limited to a specific group of consumers. This may be jointly owned by the members or by a third-party cloud provider that is providing a public cloud with limited access.
- Show them the following figure representing the concept of community cloud:



*Fig 1.7.3: Concept of community cloud*

- Also, explain the concept of private cloud by showing the following figure:

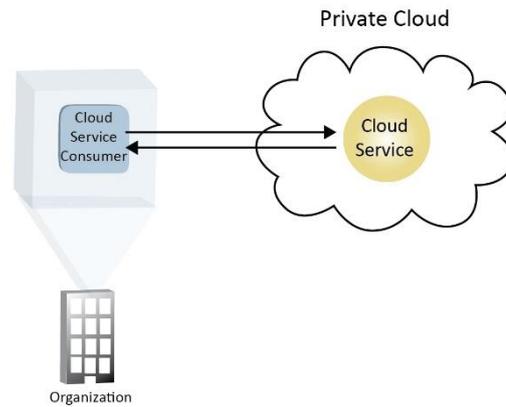


Fig 1.7.4: Concept of private cloud

- Tell them that the administration of a private cloud may be performed by internal or outsourced staff.
- Briefly, explain that a hybrid cloud is a combination of two or more different cloud deployment models.
- Also, show them a hybrid cloud model to explain its concept:

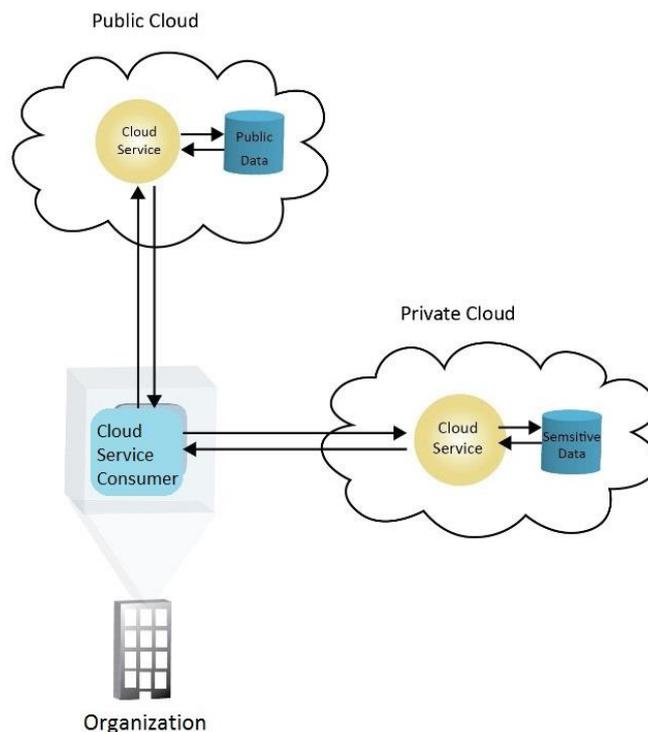


Fig 1.7.5: Concept of hybrid cloud

- Explain why cloud computing and storage is ideal for business analytics.
- Tell them the role of cloud in IoT framework.
- Briefly, explain the advantages of cloud.

- Exercise Handling Strategy:
  - Randomly ask the participants one by one to tell the characteristics.
    - Anytime access from anywhere
    - Data can be retrieved from any Internet enabled device
    - It allows resource pooling, means anyone can access and use the data for collaborating the information
    - It offers wide range of services as per the requirement
    - It is measurable in respect of storage, processing and users accessing data
  - Randomly ask any other participant, the advantages of cloud. The advantages are:
    - Fast, flexible deployment
    - Highly secure
    - Easy mobile access
    - Ease of sharing with customers and others outside the organization
- Practical solution:
  - Perform the prototyping of Raspberry Pi kit.  
**Solution:**
    1. Assemble the case and the Raspberry Pi that will provide an extra layer of physical protection.
    2. Attach the main female header socket to the Raspberry Pi.
      - a. Put the connector flat on the bench with the board resting on it.
      - b. Push the tack in the other side so it stays level and solder it.
      - c. Take care that the soldering iron touches a pin and the Pi HAT at the same time,
      - d. Repeat for the other 39 pins.
    3. Add the female pin header strips.
    4. Solder a couple of wires to connect the vertical headers to 5V and GND.
    5. Add the bread board to the top of the shield.



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## 2. Hardware and Protocol Requirements

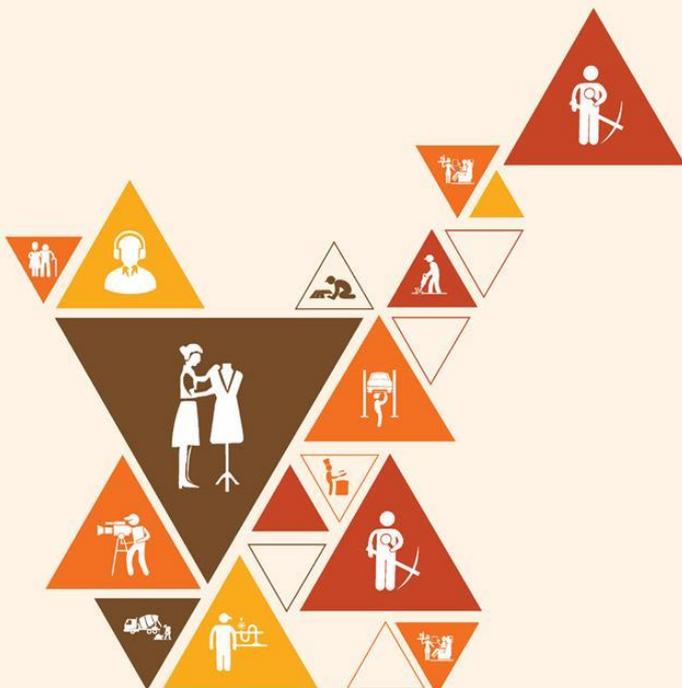
Unit 2.1 – Establishing Framework for Internet of Things

Unit 2.2 – Install Gateway as per the Power Supply Requirements

Unit 2.3 – Establishing Communication between Nodes, Gateway and Servers

Unit 2.4 – Establishing Ethernet Connectivity

Unit 2.5 – Authentication and Access Control Mechanism



TEL/N6234

## Key Learning Outcomes



By the end of this module, the trainees will be able to:

- List the steps of installation of IoT framework
- Explain how to collect data
- List the input parameters for a sensor
- List the characteristics of power sources available for the nodes and gateways
- Identify the characteristics of battery used for IoT framework
- Execute connection establishment between the nodes and gateways
- Explain the communication channels
- Describe wireless sensor network
- Explain sensor connectivity
- Identify the connectivity options
- Describe how to configure network setting
- List the steps of crimping
- Execute the establishment of Ethernet connection
- Identify the importance of authentication and authorization in IoT
- Explain access control system
- Identify the software interface characteristics
- List different software available for access control management
- Describe how to secure wireless connection
- Describe malware and DDoS attacks

## UNIT 2.1: Establish an IoT Framework

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the steps of installation of IoT framework
- Explain how to collect data
- List the input parameters for a sensor

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on

### Do

- Revise the learning of the previous sessions.
- Ask the participants if they have any doubts.

### Ask

- Ask the participants what they know about IoT.

### Explain

- Explain IoT framework.
- Explain the suitable locations for installation IoT devices.

### Notes for Facilitation

- Start the session by asking the participants some questions from the previous sessions.
- Tell them that, in simple terms, in IoT, the main concept is to connect an embedded system to the Internet.
- Tell that in an IoT framework, each device has a unique IP address. These devices or the endpoints are referred as 'things' and are located at the edge of an IoT network.

- Show them the following figure that is representing an embedded system in an IoT framework:

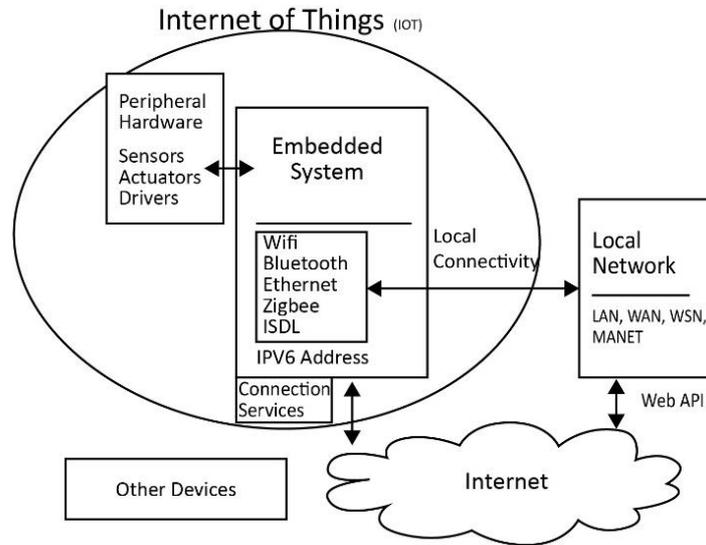


Fig 2.1.1: Embedded system in an IoT framework

- Tell them about motion sensor and show them one, if possible.
- Explain to them the steps of installing a framework for a sensor, one by one.
- Tell them the criteria for securing the IoT devices.
- Also, explain the constraints related to the installation of a motion sensor.
- In addition, tell them the location constraints for the installation of temperature sensors.
- Inform them about the constraints with the help of the following figure:

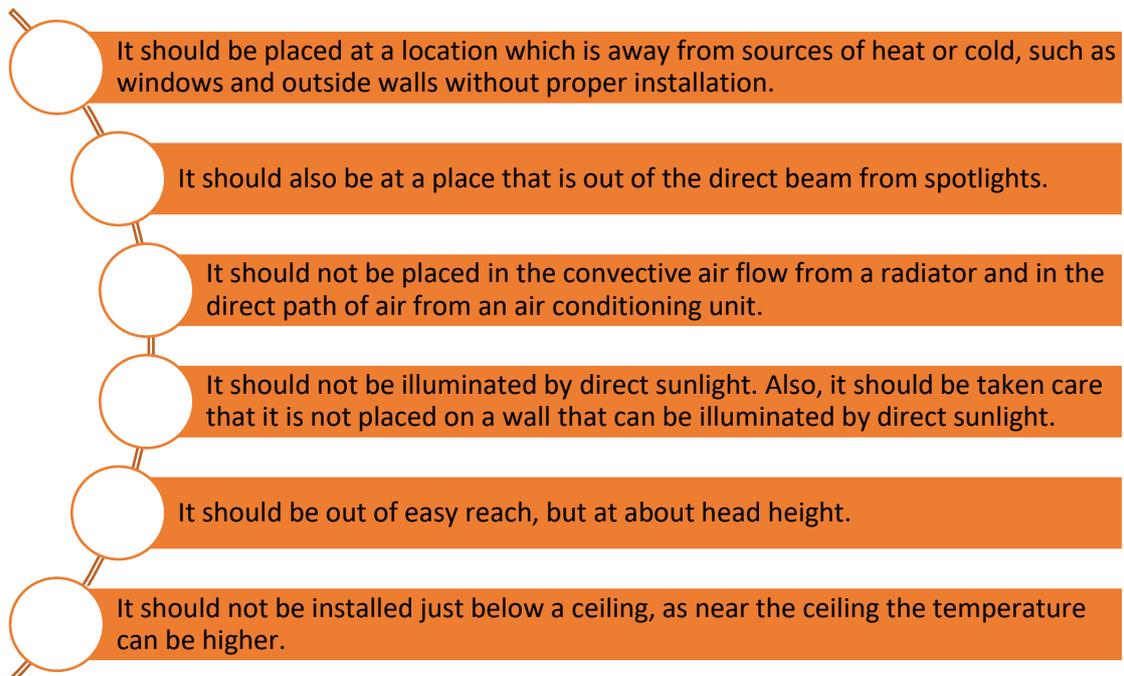


Fig 2.1.2: Location constraints for the installation of a temperature sensor

- Further, tell them that temperature and humidity sensors should be placed in open, centrally located spaces.

- Also, tell them that it is easier to detect objects that move sideways in front of a motion sensor, and more difficult to detect objects that move directly toward the front of the motion sensor. The following figure shows the direction of a motion sensor:

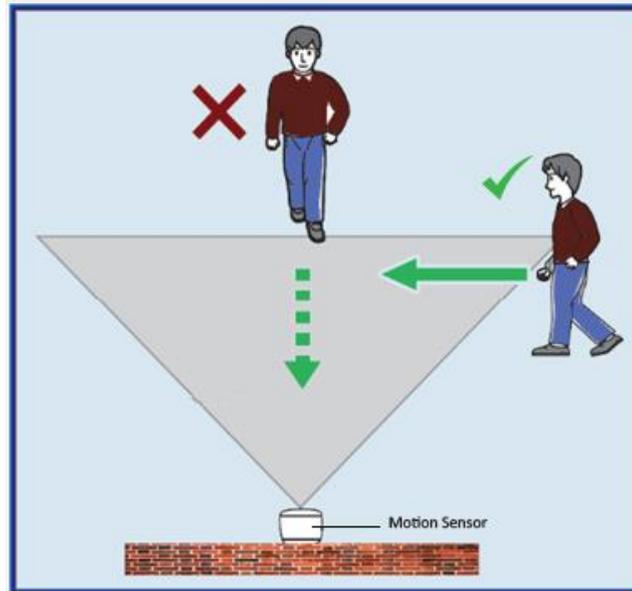


Fig 2.1.3: Direction of motion sensor

- Explain the steps for mounting a motion sensor.
- Also, inform them about the surfaces which should be avoided for mounting a sensor.
- Tell them how to connect the sensor to a power source. The power source may either be a battery or the main supply.
- Tell them that a technician needs to do the following actions:
  - Follow the electrical layout to connect the sensors
  - Make proper ground connection to the sensors
  - Secure the cables using cable trays
  - Ensure that the cable is not extended much for avoiding noise
  - Keep in mind that the sensors must be clipped round either the active or neutral AC wire, but not both of them. The following image shows the right and wrong way of clipping a sensor:

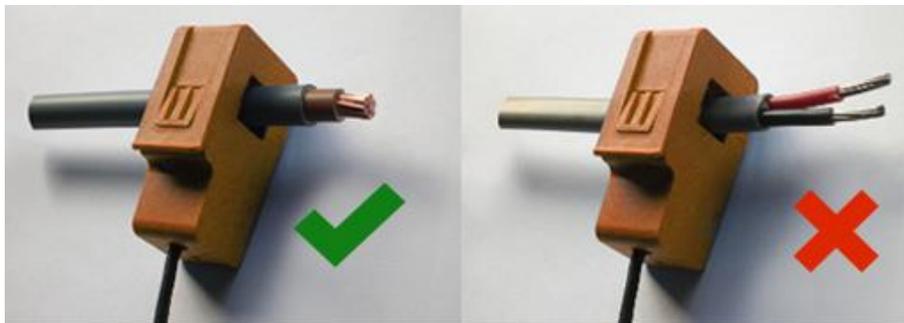


Fig. 2.1.4: Right and wrong way of clipping a sensor

- Explain how to connect the sensor with the system and also, tell them about configuring the sensors and testing them.

- Explain that the sensor must be tested from the desired location to check network status, before it gets fixed permanently. The following figure lists the checkpoints:

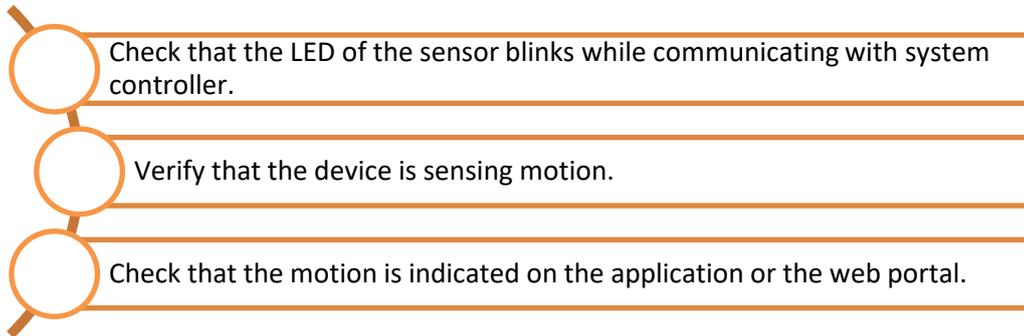


Fig. 2.1.5: Checkpoints for testing the sensor

- Tell them that they should check the indicators, signal strength and the network status visible on the sensor's display.

## Explain

- Explain collation of installation points.
- Explain the sensor input parameters.

## Notes for Facilitation

- Tell the participants that the data generated by the sensors must be collected at a common point, from where the data can be monitored and controlled.
- Explain the collation of installation points with the help of the following figure:

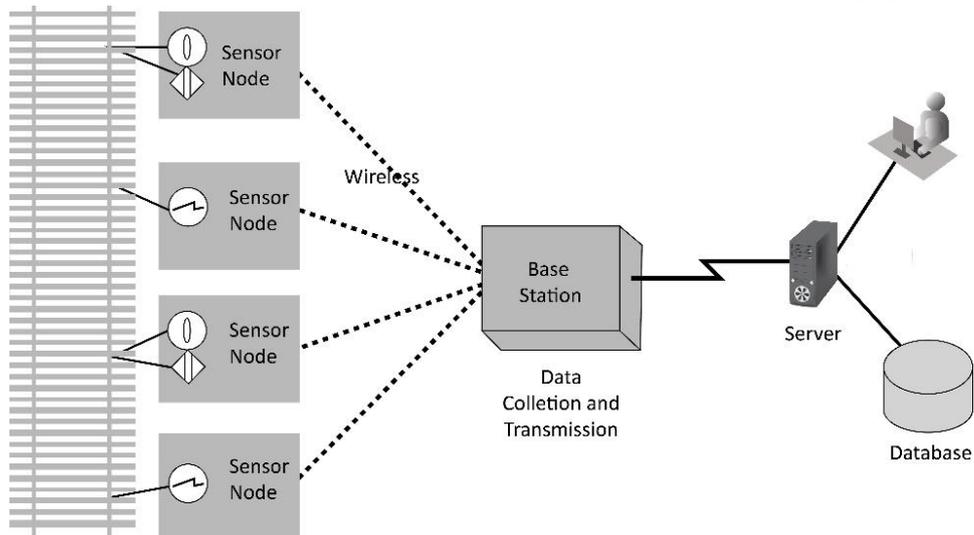


Fig 2.1.6: Collation of installation points

- Tell them that sensor nodes located in different places transmit the collected data to the base station via Bluetooth or Wi-Fi technology. The base station, then, forwards the data through general packet radio service (GPRS) or satellite to the central server.
- Explain the data creation stages and data collection systems briefly.

- Also, tell them about various input parameters of sensors such as the following:
  - ID
  - Description
  - Notification details
- Also, show them the following image which shows sensors input:

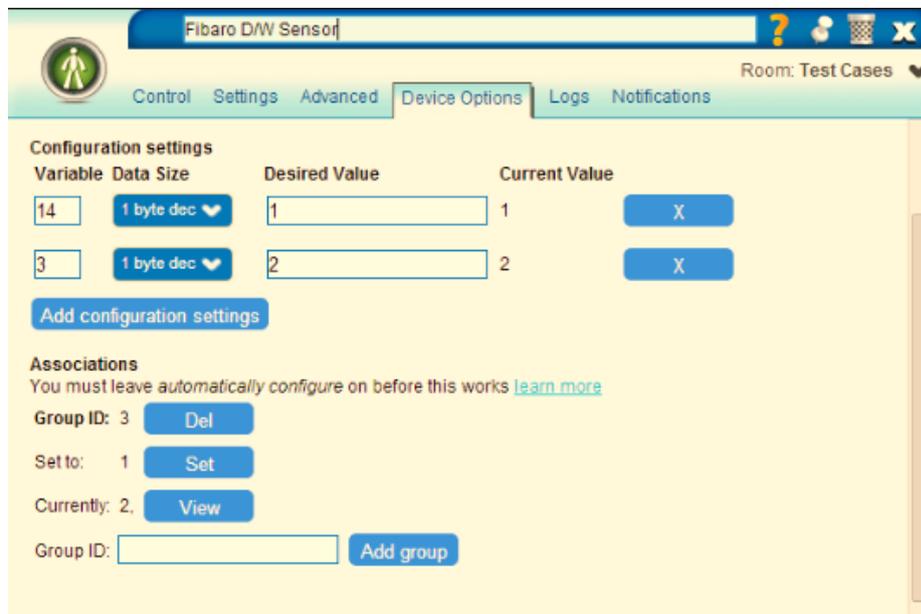


Fig 2.1.7: Sensor inputs

- Explain the importance of calibration of sensor data.
- Further, tell them that for temperature sensors, there are four adjustments that a good calibration can provide listed as follows:
  - Offset: All voltages are measured with respect to a reference. All devices operate at some operating voltage. Any displacements in these voltages, or any consistent errors during measurement, will produce consistent errors that affect all measurements. Offset corrections make these errors as small as possible.
  - Gain: The voltage that is measured is not really the voltage present on the sensor device. Amplifiers and attenuation between the sensor and the digitizing converter change the signal level. To recover the sensor information, restore the data to the original level accurately. Uncorrected gain errors tend to produce measurement errors that change consistently across the operating range.
  - Linearization: The relationship between measured voltage and sensed temperature is in general nonlinear and dependent on the physical properties of each sensor type. Over a limited range, a simple linear function is often a sufficient approximation, but a more complicated curve is necessary to describe the relationship accurately. For best accuracy, calibrate and adjust the coefficient values of the conversion function.
  - Unit Scaling: Convert the results to a common and useful representation. For example, present all temperature measurements in degrees C.

- Tell them that generally, two types of systems are there for data collection as shown in the following figure:

Proprietary Systems	Third-party Systems
<ul style="list-style-type: none"> <li>• These systems are used to collect users' data, analyze that and send the reports to the users and the authorised third party.</li> <li>• The systems are maintained by the wearable vendors.</li> </ul>	<ul style="list-style-type: none"> <li>• These systems are used to provide specific functionalities.</li> <li>• These systems can be developed and maintained by external entities.</li> </ul>

*Fig. 2.1.8: Data collection systems*

- Exercise Handling Strategy:
  - Ask the participants one by one to tell the answers.
    1. False, True, True
    2. The input parameters are:
      - Sensor ID
      - Sensor Description
      - Alarm Notification
      - Worker ID
    3. The location constraints for mounting a sensor are:
      - It should not be installed in areas exposed to direct heat source or direct sunlight.
      - It should not be installed near an air discharge grill.
      - The installation surface should be flat and clean.
      - It should be out of easy reach, but at about head height.
      - It should not be installed just below the ceiling, as near the ceiling the temperature can be higher.

## UNIT 2.2: Install Gateway as per the Power Supply Requirements

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the characteristics of power sources available for the nodes and gateways
- Identify the characteristics of battery used for IoT framework
- Execute connection establishment between the nodes and gateways

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on

### Do

- Revise the learning of the previous sessions and ask the participants if they have any doubts.

### Explain

- Explain different characteristics of power sources.
- Explain how to connect the nodes and gateways to power sources.

### Notes for Facilitation

- Start the session by explaining to the participants in brief about different power supply systems:
  - **DC Power Supply:** A power supply transmitting a constant voltage of DC current to its load is known as DC power supply. In power mains, depending on the design, an AC/DC source can power a DC power supply.
  - **AC Power Supply:** The wall outlet is the main supply that gives voltage to an AC power supply and brings it down to the required voltage along with some filtration. The division of AC supply is into three phase or single phase systems. The two differ in consistency of delivery between the two systems. Both frequency and voltage can be changed using an AC power supply.
- Explain to them that the devices in the IoT system and the gateway are powered by specialized batteries. The conventional batteries are not suitable for IoT devices as they have the following disadvantages:
  - Low power requirements
  - Various shapes and sizes
  - High range and frequency
  - Increasingly interconnected

- Tell them that power sources and the power supply circuit must have several key features to meet the criteria of the IoT devices as shown in the following figure:

#### Small Size and Flexible Shape

#### Wireless Connectivity

- Ability to charge a device on the go
- Ability to detect and select the energy resources that are available

#### Environment Friendly

#### Deep Drain Protection

- Ability to protect the battery from any damage; at the time, as soon as the battery charge level goes below the working voltage, the power supply circuit must cut off the connection between the battery and the device.

#### Over Current Protection

- Ability to provide overcurrent protection when the input current reaches beyond 1A.

#### Over-voltage Charging Protection

- Ability to protect the battery during charging and during transitions from constant-current to constant-voltage state.

#### Charging Status Indication

- A status indicator for charging / full charge must be provided by the charging circuit.
- LED can be used as a visual status indicator.

#### Range

- For wireless power, the range to devices needs to cover at least the entire room.

#### Frequency Choice

- The frequency needs to be compatible with electromagnetic interference charging standards and electromagnetic compatibility.

*Fig. 2.2.1: Key features of power supply source and circuit*

- Tell them that IoT devices are mainly powered by batteries.
- Tell them that it may be tempting to use a long-lasting battery. Every IoT gateway must have the ability to survive unpredictable power cycles and it must be able to restore itself to a minimum functional level afterward.
- Also, explain the selection criteria of a power source for the nodes and gateway devices in the IoT system.
- Further, tell them the features of a power supply source and a circuit.
- Tell them the characteristics of a battery.
- Explain how gateways are installed and connected to power sources.
- In addition, tell them the importance of choosing a suitable location for installing the gateway.
- Also, explain the criteria to remember while choosing the location of installing a gateway.
- Inform them that the nodes should be located within the range of the gateway, so that they can communicate together.

- Say, it is also important to install the node and gateways within a stable network connection. Otherwise, they may not work properly.
- Explain the steps of connecting a power adapter to the gateway device.
- Also, tell them the result of using an incorrect power supply.
- Tell them that it should be kept in mind that failure to use the correct power supply and cord may cause electric shock, fire or product damage.
- In addition, tell them that they should not connect the power cord when the power supply is on, as it may lead to electric shock. Also, tell that they should take care while doing any electric work and they should not touch any wire and switches with wet hands.
- Explain to them how to connect the gateways and other IoT devices to the Internet connection via wired or wireless connection.
- Tell them that the status indicator light blinks when the gateway recognizes the connection but gets steady after a while.
- Tell them the importance of installing gateway relays.
- Explain to them the connection of the sensor and relay modules by showing the following figure :

For the relay module, there are three pins:	For the current sensor module, there are three pins:
<ul style="list-style-type: none"> <li>•VCC to be connected to the Arduino voltage pin</li> <li>•GND to be connected to the Arduino ground pin</li> <li>•SIG to the specified pin number of the Arduino board.</li> </ul>	<ul style="list-style-type: none"> <li>•VCC to be connected to the Arduino voltage pin</li> <li>•GND to be connected to the Arduino ground pin</li> <li>•OUT to the analog pin of the Arduino board.</li> </ul>

*Fig. 2.2.2: Connection of the sensor and relay modules*

- Tell them the criteria for a node location and also, explain how nodes are connected together, to the gateways and also to the power sources.
- Explain the importance of a plug-in nodes.
- Tell them that a Plug-In node is inserted into an extension cord or an electrical wall outlet. It is best to install the nodes at 15 inches to 4.5 feet above the ground.
- Further, explain the steps to make wired connection of DC nodes.
- Show them the connection diagram of a gateway module and explain the location of internal nodes, power points in the gateway and how the cables for nodes and Ethernet ports are connected.

- Give them an example of a lamp which is to be connected to a sensor. The following figure shows the simple wire diagram of connecting the nodes:

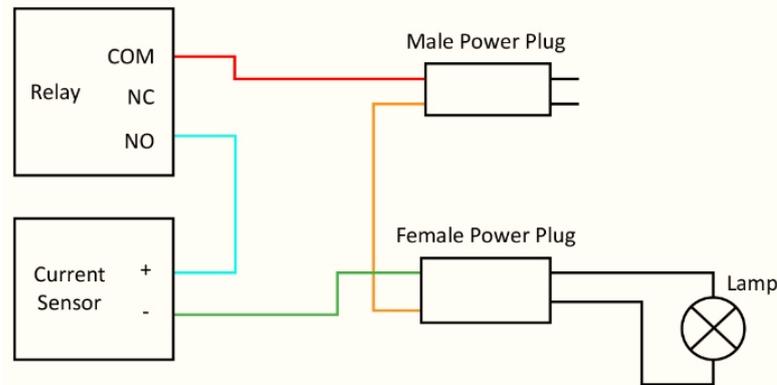


Fig. 2.2.3: Simple wire diagram of connecting the nodes

- Also, tell them to test the installation after the power source and Internet is connected to the nodes and gateways.
- Exercise Handling Strategy:
  - Ask the participants one by one to tell the answers.
    1. The characteristics of power source are:
      - Small Size and Flexible Shape
      - Wireless Connectivity
      - Environment Friendly
      - Deep Drain Protection
      - Over Current Protection
      - Over-voltage Charging Protection
      - Charging Status Indication and so on
    2. The steps to connect a device to the network are:
      - View the available Wi-Fi networks.
      - Select the Wi-Fi network name and connect.
      - Enter the Wi-Fi password.
    3. The places where a gateway device can be installed, are:
      - Within the range of the nodes
      - At least three feet away from the wireless devices
      - Discrete and locked locations to restrict physical access to the device
      - At least 4 feet off the ground
      - Near an Ethernet port or a Wi-Fi interface.

## UNIT 2.3: Establishing Communication between Nodes, Gateway and Servers

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the communication channels
- Describe wireless sensor network
- Explain sensor connectivity

### Ask

- Enquire from the participants if they remember about various wireless communication technologies.

### Notes for Facilitation

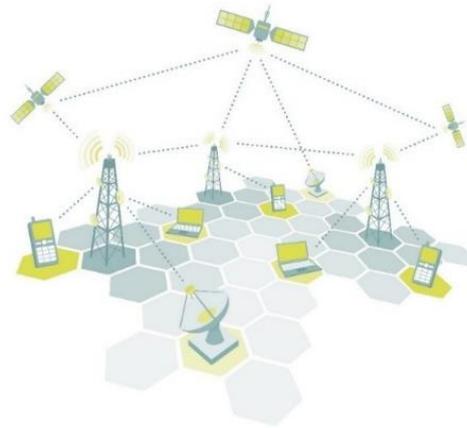
- Start the session by explaining to the participants about a network channel.
- Tell them about the following physical and wireless media:
  - **Wireless Local Area Network (WLAN)**  
A WLAN is used to connect two or more devices which are present over a short distance. WLAN is set up using a wireless distribution method. It provides a connection for Internet access through an access point. It is used in cities or towns to connect networks in two or more buildings without installing a wired link. The following figure shows a WLAN:



Fig. 2.3.1: WLAN

- **Cellular Network**  
A cellular or mobile network is a network that is served by fixed-location transceiver. The fixed location is known as base station. This network is distributed over land areas which are known as cells. To avoid any disturbance, each neighbouring cell uses a different frequency. When the cells are joined, these provide network coverage over wide geographic area. This enables a number of portable devices to connect with each other in any network through a base station.

The following figure shows a cellular network:



*Fig. 2.3.2: Cellular technology*

- **Bluetooth**

Bluetooth provides a wireless technology standard to exchange data from any fixed or mobile device over a short distance and thus build a personal area network (PAN).

The following figure shows a Bluetooth headset:



*Fig. 2.3.3: Bluetooth*

- **Near Field Communication (NFC)**

It is a set of communication protocols which enables communication between two devices in range. NFC devices are specially used in contactless payment systems and allow mobile payment.

NFC is a short-range wireless technology that requires a distance of 10 cm or less. It always involves an initiator that actively generates a radio-frequency field to power a passive target. NFC communication is possible when both the devices are powered.

The following image shows an example of NFC technology:



*Fig. 2.3.4: NFC technology*

- Tell that Zigbee is based on the Institute of Electrical and Electronics Engineers (IEEE) 802.15.4-based specification built for control and sensor networks. It is used in small, low-power digital radios, such as for home automation and other low-power low-bandwidth applications which are designed for small scale projects with wireless connection.
- Give the participants a brief overview of the evolution of the video surveillance technology.
- Explain that while choosing a channel, characteristics as shown in the following figure should be kept in mind:

Latency	Amount of time needed for information to propagate from source to destination through the channel.
Data Rate	Maximum rate (in bps) at which data can be transmitted over a given communication link, or channel.
Reliability	The probability that a data of size D is successfully transferred within a time period T.
Path Loss	Ratio of the power of the transmitted signal to the power of the same signal received by the receiver, on a given path.
Channel Bandwidth	Size of the range of frequencies that can be transmitted through a channel.
Channel Capacity	Amount of information per unit time handled by either a link or a node ( system element ). The messages transmitted may be either similar or different.

Fig 2.3.5: Characteristics of a communication channel

- Tell them about different cables used in communication networks with the help of the following figure:

Twisted pair	Coaxial/Heliox cable	Optical fibre cable
Single mode optical fibre cable	Multi-mode optical fibre cable	Cross over cable

Fig 2.3.6: Different cables used in communication networks

- Also, explain different types of channels:
  - Point-to-Point
  - Point-to-Multipoint
  - Multiple Access
  - Relay
  - Interference
  - Unicast

- Broadcast
- Multicast.
- Then, brief them about the cloud framework.
- Briefly, explain two examples of cloud framework used these days:
  - Microsoft Azure
  - IBM cloud.
- Tell them that Azure Stream Analytics (ASA) supports either stream data or reference data as inputs, from either Azure Event Hubs or files from Azure Blob Storage.
- Also, tell them that event Hubs is a data integrator which is capable of consuming large volumes of events per second, enabling Azure to process vast amounts of data from connected applications or devices.
- Explain that ASA supports different types of outputs, such as follows:
  - Blob Storage
  - SQL Database
  - Event Hub
  - Power BI
  - Table Storage.
- In addition, give them a few more examples of cloud framework as shown in the following figure:

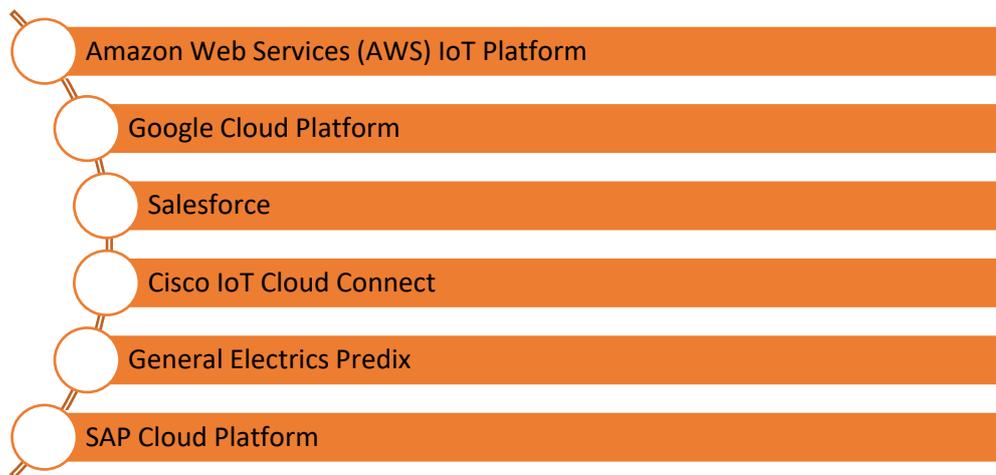


Fig 2.3.6: Examples of cloud framework

- Tell them that the IBM cloud framework includes several hardware and software coupled in Internet connected services. The following figure shows the contents of the package:

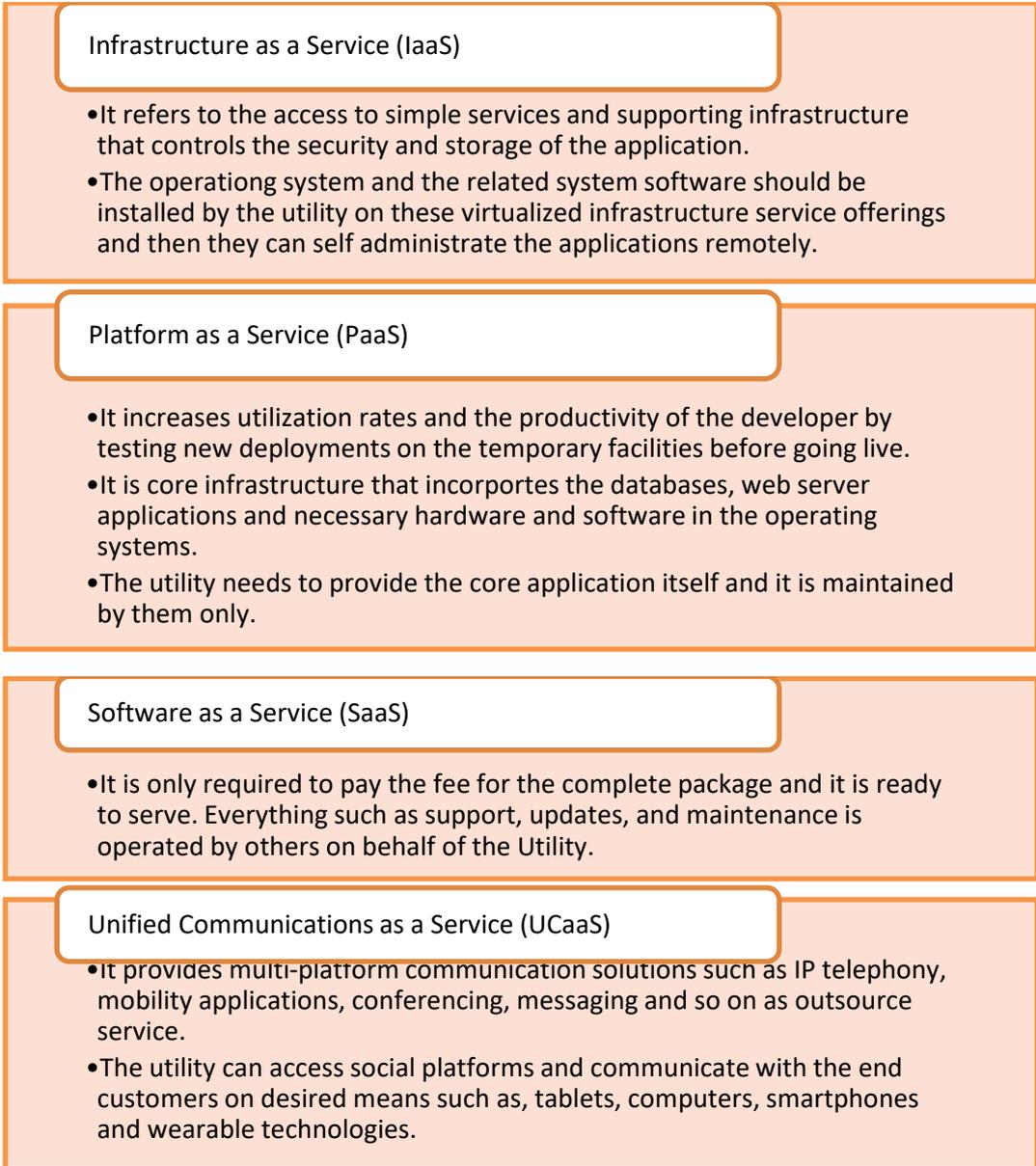


Fig. 2.3.7: Packages in the IBM cloud

- Also, explain how data management is done in cloud platforms.
- Tell them about wireless sensor nodes and its components. The following figure shows the components of a wireless sensor node:



Fig 2.3.8: Components of a wireless sensor nodes

- Tell them that there are different types of sensors as shown in the following figure:

#### Passive Sensors

- They sense the data but do not manipulate the environment by active probing.
- They are self-powered. Energy is only needed for amplification of their analog signal.

#### Active Sensors

- They manipulate the environment by actively probing it.
- They require energy from a power source.

#### Narrow-beam Sensors

- They have a well-defined direction of measurement, like a camera.

#### Omnidirectional Sensors

- They have no directions involved in the measurements.

*Fig. 2.3.9: Types of sensors*

- Briefly, tell them about different sensor channel settings, such as the following:
  - Name
  - Unit ID
  - Rendering
  - Line colour
  - Limits
  - Error and warning messages
- Lastly, tell them about sensor connectivity and various communication technologies used to connect the sensors to the network.
- Also, tell them about the following protocols used by the IoT framework:
  - HTTP
  - MQTT
  - CoAP.
- Exercise Handling Strategy:
  - Randomly choose participants to answer the given questions.
  - Then, give the solutions and ask the participants to check if they had given the right answers.
  - Different types of communication channels are:
    - Point-to-Point
    - Point-to-Multipoint
    - Multiple Access
    - Relay
    - Interference
    - Unicast
    - Broadcast
    - Multicast

- WSN: In a wireless sensor network (WSN), various sensor nodes are connected. The structure of a sensor node consists of a controller, a transceiver, external memory, power source and sensors. The applications areas are health care monitoring, area monitoring, Earth sensing, forest fire detection and so on.
- Ask the participants to fill the details in the table one by one:

	Range	Bandwidth	Battery Life
PAN	Short	Narrow	Long
LAN	Intermediate	Broad	Short
WAN	Long	Intermediate/Broad	Intermediate
Wired Network	Long	Intermediate	Short

## UNIT 2.4: Establishing Ethernet Connectivity

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify the connectivity options
- Describe how to configure network setting
- List the steps of crimping
- Execute the establishment of Ethernet connection

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on

### Do

- Revise the learning of the previous sessions and ask the participants if they have any doubts.

### Explain

- Explain various Ethernet connectivity options.

### Notes for Facilitation

- Start the session by asking the participants some questions related to previous sessions.
- Tell them about the characteristics of Ethernet connectivity.
- Also, tell them the different types of Ethernet.
- Tell them that the Institute for Electrical and Electronic Engineers (IEEE) developed an Ethernet standard known as IEEE Standard 802.3. The standard outlines configuration rules of an Ethernet network. It mentions interaction between the network and the elements of Ethernet. Abiding by standards of IEEE, network protocols and equipment communicate efficiently.
- In addition, tell them the speed of different types of Ethernet:
  - Fast Ethernet (speed limit range 10 - 100 Mbps)
  - Gigabyte Ethernet (10 times faster than 100Base-T)
  - 10 Gigabyte Ethernet (speed limit 10Gbps)
- Also, tell them about different types of cables needed for various Ethernet connections.
- Explain to them what the letters and numbers in the different types of Ethernet actually mean.

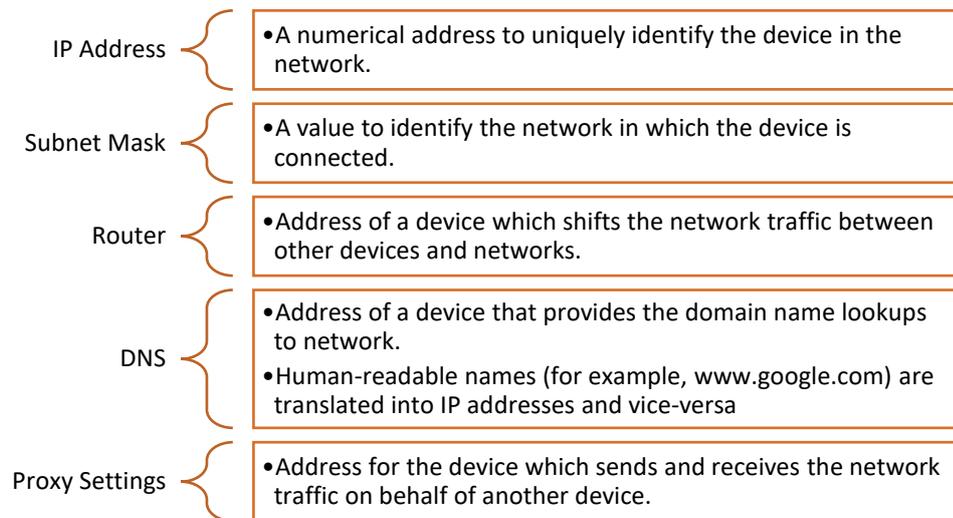
- Show them the following figure which shows the coding of the Ethernet options:

<b>10</b>	at the beginning means the network operates at 10Mbps.
<b>BASE</b>	means the type of signaling used is baseband.
<b>2 or 5</b>	at the end indicates the maximum cable length in meters.
<b>T</b>	the end stands for twisted-pair cable.
<b>X</b>	at the end stands for full duplex-capable cable.
<b>FL</b>	at the end stands for fiber optic cable.

*Fig. 2.4.1: Coding of Ethernet options*

- Introduce various WLAN standards to them that are as follows:
  - 802.11
  - 802.11a
  - 802.11b
  - 802.11g
  - 802.11n.
- Explain the standards one by one.
- Also, tell them that real-world speeds of Ethernet wired network are very close to the theoretical speeds.
- In addition, tell them, 100BASE-T wired networks offer reliable and consistent data-rates when the cable length is less than 100 metres.
- Further, inform them that, in real life applications, Wi-Fi 802.11n standard achieves the rate of 60 Mbps, which is less than 1/10 of its Gross rate.
- Tell them that the interference and the speed of the home Wi-Fi network depends on the number of Wi-Fi-enabled IOT devices.
- Further, tell them that in a home IOT environment, when Wi-Fi (802.11n, 2.4GHz) is compared to wired 100BASE-T, the latter one provides more speed, reliability and security.
- Tell them that Orthogonal Frequency Division Multiplexing (OFDM) means breaking up information signals to numerous sub-signals that are slower and shifted by different frequencies at the same time.
- Explain to them about the steps of connecting a device through wired Ethernet connection.
- Tell them that to prepare the cable for the connection, stripping of wires and crimping is required.
- Tell them about the process of crimping.
- Also, tell them the steps of preparing an RJ-45 cable.
- Explain the steps of connecting a wired device via a wired Ethernet connection.
- Further, tell them the process of configuring the network settings.

- Tell them that for configuring the network settings, the following information is needed:



*Fig. 2.4.2: Information needed for network settings*

- Tell them about the challenges of Ethernet connectivity.
- Also, tell them, how to overcome the challenges.
- Exercise Handling Strategy:
  - Ask the participants to write the answers in their notebook.
  - Tell the answers and tell them to match their answers.
  - The answers are:
    - IP Address: A numerical address to uniquely identify the device in the network.
    - Subnet Mask: A value to identify the network in which the device is connected.
    - Router: Address of a device which shifts the network traffic between other devices and networks.
    - Proxy Settings: Address for the device which sends and receives the network traffic on behalf of another device.
  - Answer for the 2<sup>nd</sup> question;

#### Advantages of wireless connection over wired one

- Users can move around freely within the area of the network with their devices.
- Devices are not required to be cabled to a port for the connection.
- No cabling is needed, so cost of cabling is nil.
- Wireless networks can handle a large number of users as they are not limited by a specific number of connection ports.

#### Disadvantages of wireless connection over wired one

- It can require extra costs and equipment to set up.
- Setting up a wireless network may not seem easier to the people who are not experienced with computers.
- File-sharing transfer speeds are normally slower as compared to wired network.
- Connections may get hampered by obstacles in between the connected devices and the network device.
- Wireless networks are less secure. If they is not secured with a password, anyone in the range can access them.

## UNIT 2.5: Authentication and Access Control Mechanism

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify the importance of authentication and authorization in IoT
- Explain access control system.
- Identify the software interface characteristics.
- List different software available for access control management.
- Describe how to secure wireless connection
- Describe malware and distributed denial of services (DDoS) attacks

### Resources to be Used

- Available objects such as a duster, pen, notebook and soon

### Do

- Revise the learning of the previous sessions and ask the participants if they have any doubts.

### Explain

- Explain authentication and authorization and the importance of the two.
- Explain access control system architecture.
- Explain different access control software.

### Notes for Facilitation

- Start the session by telling the participants that IoT is the future; it will be built to control everything from as insignificant as a thermostat to something as significant as a self-drive car. As the sheer number of IoT devices explodes in the business systems, companies /enterprises are becoming more vulnerable to cyber-attacks.
- Introduce the participants to authentication and authorization.
- Tell them that authentication is the process of proving the identity of a requester.
- Tell them that traditional security measures like firewalls and antimalware software are just not enough to protect this data, and they may not apply here. It is, therefore, vital to safeguard the collected data and IT professionals are more aware than ever before of the security risks surrounding the processing of data from the edge devices.
- Also, explain authentication with an example that, when a person logs in to a software after giving the username and password, it is authentication.

- Further, tell them that, for a biometric lock, a person puts his/her fingerprint on the system to enter into the room for which the lock is placed.
- Tell them that authorization is a process that verifies that a person has the specific access rights to a resource he/she has requested to use.
- Also, tell them that, for the biometric lock, the access is granted to the person, if he is authorised to it. Otherwise, the access is denied.
- Tell them why authentication and authorization process are important for the IoT devices.
- Explain how edge devices are authenticated.
- Also, tell them about the important points for securing the edge devices.
- Tell them that all the devices are connected through wireless networks to a mobile application or management software. The applications may be configured for the operations of various locks and controllers.
- Further, explain to them about the security challenges in authentication.
- In case of IoT, access control is needed to ensure that only authorized and trusted parties can:
  - access sensor data
  - update device software
- Explain that sensors command the actuators for performing any operation. Explain access control and how it works with the help of the following figure:

#### How access control works?

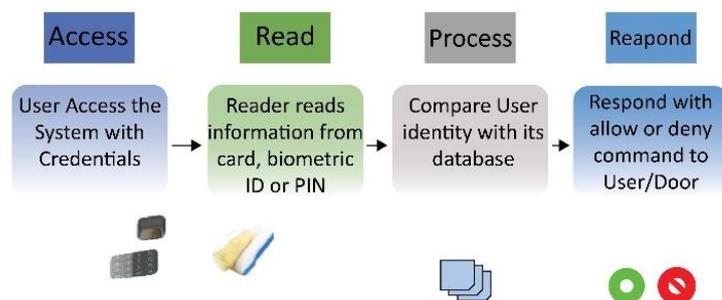


Fig 2.5.1: Working of access control system

- Tell them about the access control system architecture that can be of two types as follows:
  - Centralized
  - Distributed
- Explain the common features of access control systems.
- Also, tell them about the following tools and software available in the market:
  - Courion Access Assurance Suite
  - Oracle Identity Governance Suite
  - RSA Identity Management and Governance
  - SailPoint IdentityIQ
  - Identocard Access Control.
- Some other examples of access control system are as follows:
  - S2 Security Access Control
  - Salto Access Control

- Isonas Pure IP Access Control
- Bosch Access Control Systems
- ADT Access Control
- Kisi Access Control
- Explain the features of the third-party access control software one by one.
- Tell them that there are a lot of identity and access management (IAM) software available in the market. The common features of an access control solution are shown in the following figure:

The solution has the capability to address the security of IoT related data, including privacy invasion or damage to physical property. It should offer adaptive authentication, end-to-end data encryption, DOS /overload detection and so on for providing the security capabilities required for the advancement of IoT.

The solution supports adaptive authentication offering the organizations to modify the level of authentication for different devices and people.

The solutions may allow customers to self-manage the preferences such as granting their consent for sharing data and setting notification alerts.

It provides back up option to assure maximum security in case of a server hardware failure.

The interface may allow the monitors and the security cameras to be associated with selected alarms. In case of activation of the alarm, these provide real time video of the alarm occurrence.

It offers storage capabilities and reporting facilities for long-term events.

The solution may offer an optional feature for displaying messages when a request for access is made.

It should offer the operators to run a report for viewing the changes made to the records.

*Fig. 2.5.2: Common features of an access control solution*

- Tell them about the steps to be followed for installing the required software interface in the controlling device.
- Further, tell them how the wireless connection is secured by changing the configuration and settings.
- Tell them about malware and DDoS attacks.
- Tell them that malware is an inclusive term for all types of malicious software, such as viruses – programs that copy themselves throughout a computer or network.

- Tell them that the most common malwares which target the embedded devices are as follows:
  - Linux.Darlloz (aka Zollard)
  - Linux.Aidra / Linux.Lightaidra
  - Linux.Xorddos (aka XOR.DDoS)
  - Linux.Gafgyt (aka GayFgt, Bashlite)
  - Linux.Ballpit (aka LizardStresser)
  - Linux.Moose
  - Linux.Dofloo (aka AES.DDoS, Mr. Black)
  - Linux.Pinscan / Linux.Pinscan.B (aka PNScan)
- Also, tell them about the symptoms that indicate a device is malware affected.
- Lastly, tell about the steps to detect the DDoS attack in a system.
- Exercise Handling Strategy:
  - Ask the participants to write the answers in their notebook.
  - Tell the answers and ask them to match their answers.
  - Some symptoms that indicate the device is malware affected, are:
    - The system is slowing down or crashes.
    - Annoying advertisements or unusual error messages are displayed.
    - Pop-up messages and unusual messages show unexpectedly.
    - There is increase in the Internet traffic.
    - The browser homepage changes and the security solution is disabled.
    - Control panel cannot be accessed.
    - Unfamiliar icons are visible on the desktop.
  - Tell that the steps depend on the type of the access control system. The steps of installing an access control system in an office place are:
    - Install the software and open it.
    - Edit the controller settings by entering the network details and product details.
    - Edit the device or machine settings.
    - Create the time zone settings as per requirement.
    - Fill the employee records.
    - Click on a row to create or update the employee details.
    - Connect the device and select the time zone and upload it to the machine.
    - Upload the user rights to the device.
    - Generate report.
  - Practical solution:
 

Install a BMP280 temperature and pressure sensor on an Arduino.

    1. Connect the VCC to 3.3V, GND to GND, SCL to A5, and SDA to A4BMP280 pins to the Arduino respectively.
    2. Connect the Arduino to a PC.
    3. To begin reading sensor data, download Adafruit\_BMP280 libraries.
    4. Download the following libraries:
      - Adafruit Unified Sensors
      - Adafruit BMP 280 Library

5. Place the above downloaded libraries in the *Arduino>Libraries folder*.
  6. Restart the IDE
- Practical solution:  
Check the power supply connectivity to an IoT camera installed.
    1. Check the power usage of camera and use the AC-DC adaptor as per the camera power usage.
    2. Check the master module.
    3. Check the working of all the fuses in the master module.
    4. Check the polarity of the wiring as per the screw terminals in the master module.
    5. Ensure that right power channel is used for camera.
    6. Check the distance of camera from the power source.
  - Practical solution:  
Install a Viconics Wireless Gateway (VWG) and related wireless controllers, ensuring clear line of sight.
    1. Mount the VWG in a location that allows clearance for wiring, servicing, and antenna removal.
    2. Press in the four tabs on both ends of the unit and lift the VWG cover off.
    3. Remove the cover to connect the new battery unit.
    4. Make sure minimum spacing distance requirements is available to freely rotate wireless antenna in all possible orientations.
    5. Connect earth-grounding wire with spade connector from the earth ground lug on the VWG.
    6. Use an earth ground spade lug (0.187") on the base of the VWG for connection to earth ground.
    7. Prepare power wiring (leave the unit powered off). Only VWG-PS-DC and VWG-PS-AC power supply with factory installed ferrite on the power cord can be used with the VWG.
    8. Connect communications wiring.
    9. Connect communications wiring to the VWG using either Net1, Net2 or the RS-485 connection based on VWG model used and configuration.
    10. For ports on any installed option board (LON, RS-485, modem) see the specific mounting and wiring guide for any additional details.
    11. Connect the backup battery to the VWG battery connector and apply power to the unit.
  - Practical solution:  
Connect Raspberry Pi to another device through wired Ethernet.  
Connecting Raspberry Pi to laptop:
    1. Plug in the SD card with Raspbian OS inside a card reader.
    2. Connect the card reader to the laptop.
    3. Before powering on the Raspberry Pi turn on Internet connection sharing option from the laptop.
    4. Power up the Raspberry Pi.
    5. Plug in RJ45 cable to the laptop and connect it with Raspberry Pi.

6. Open the network setting window.
7. Click on the new network that appears on the network setting window.
8. Open the properties on this new network.
9. Open IP version 4 option and check the IP address allotted to the Pi.
10. Open the SD card connected to the Raspberry Pi from file explorer window.
11. Inside the boot folder, create a file named ssh from command prompt using command  
*echo>(Directory name of SD card)>ssh*
12. Remove the card reader and eject the SD card from it.
13. Plug in the SD card inside the Raspberry Pi.
14. Restart the Raspberry Pi.





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Transforming the skill landscape

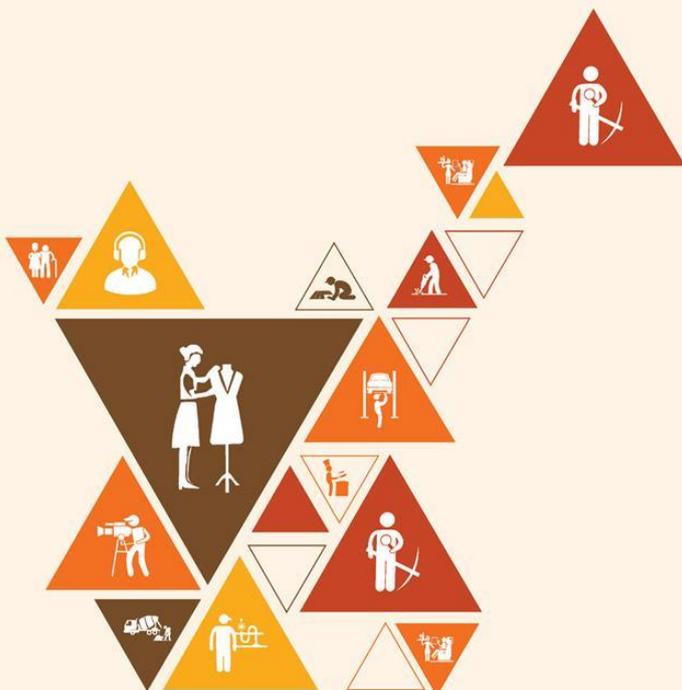


## 3. Establishing the IoT Framework

Unit 3.1 – Preparing for Installation of IoT Edge Devices

Unit 3.2 – Mounting the Devices at Desired Locations

Unit 3.3 – Performing Checks and Connections



TEL/N6234

## Key Learning Outcomes



By the end of this module, the trainees will be able to:

- List the pre-installation requirements for the software and tools
- Identify the tools and equipment
- Explain how to choose the correct location for mounting
- Explain how to select resources such as power supply
- Explain the steps for surface preparation while mounting devices
- Identify the correct distance between the devices
- Describe signal and power loss during inter-device communication
- Evaluate the resource consumption of the set-up
- Identify the correct set of sources for power and other utilities
- Explain the connectivity between the devices
- Describe preparation of devices for transmission of data
- Explain power supply selection and grounding
- Identify post commissioning checks

## UNIT 3.1: Preparation for Installation of IoT Edge Devices

### Unit Objectives

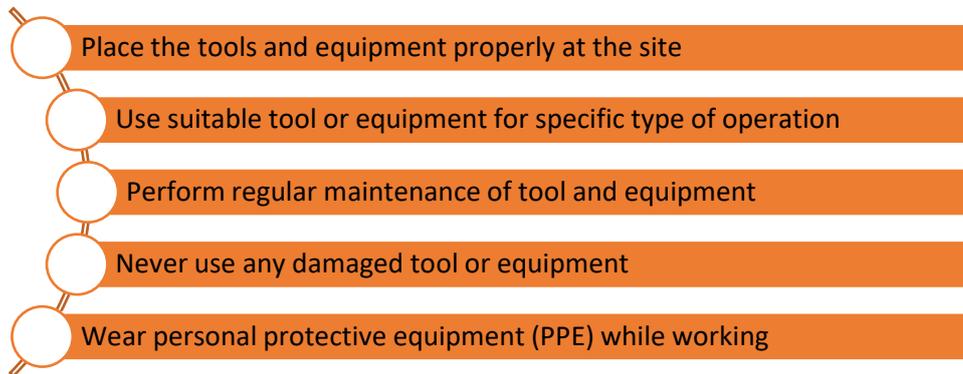
By the end of this unit, the trainees will be able to:

- List the pre-installation requirements for the software and tools
- Identify the tools and equipment
- Explain how to choose the correct location for mounting
- Explain how to select resources such as power supply

### Notes for Facilitation

- Tell the participants that preparation for the installation process is required for knowing the requirement for the installation.
- Preparation involves the following actions:
  - Inspecting the site
  - Collecting the required material, tools and other requirements
  - Checking that the devices and system are in good condition and also verifying that there are no missing parts
- Then, tell them that inspection of the site is done to achieve the following objectives:
  - Understand the requirement of customer
  - Identify the location of nodes and gateway
  - Locate the power points
  - Identify the power source requirements
  - Identify the network requirements and related information
- Also, tell them that it is important to note down the details of the site inspection to avoid any kind of confusion in future.
- Tell that they should know how to operate the specific tools and equipment safely.
- Explain the process of operating a drilling machine.
- Further, explain how to use a multimeter for measuring the electrical parameters such as the following:
  - Voltage
  - Current
  - Resistance
  - Power
- Tell them about the safety measures for handling the costly tools and equipment.
- Also, tell them about the following guidelines:
  - General safety instructions
  - Instructions for electrical safety
  - Safety measures regarding network devices

- Tell them that the the points a technician should keep in mind to use the tools and equipment effectively while working are shown in the following figure:



*Fig. 3.1.1: Safety measures to be taken while working with tools and equipment*

- Tell them about different tools used in installation process with the help of the following figure:

Angle finder	Spirit level	Tape	Cordless drill	Drill bits
Torque wrench	Wire strippers	Crimpers	Needle-nose pliers	Wire cutter
Multimeter	Tape measure	Heavy duty extension cords	Fuse pullers	Magnetic wristband

*Fig 3.1.2: Tools and equipment required for installation*

- In addition, tell them that they should use a network testing kit to check network performance, connectivity and speed.
- Ask them the criteria for the location of nodes and gateways.
- Explain the criteria one by one as follows:
  - Avoid direct sunlight
  - Keep the device in range of the network
  - Consider the surrounding
  - Place it on a height
- Also, tell them the criteria for choosing a proper power supply.
- Tell them about the following measures to be taken while wiring:
  - The wiring should not be hanging unsafely and should be properly secured with wall lining or any other structure.
  - The inner lining should be secured safely.
  - The connections should be tight and safe.
  - Proper Earthing connection should be made.
  - Right cable of the recommended standard should be used for the set up.

- Exercise handling strategy:
  - Ask the participants to write the answers in their notebook.
  - Tell the answers.
  - The steps of drilling are:
    - Mark the point of drill on the wall
    - Choose the drill bit and adjust the speed of the drill
    - Mark the required depth
    - Place the drill on the mark on the wall and start the machine at a low speed
    - Make a shallow hole to make a base for the drill and then set high speed for the drill
    - Stop drilling after reaching the desired depth
  - The tools and equipment are as follows:

Tool and equipment	Use	Image
Spirit level	Used for mounting the nodes and edge devices at accurate level	
Wire strippers	Used to strip the insulation part from electric wires	
Crimpers	Used to crimp the Ethernet cables while making network connection between nodes and gateways	
Tape measure	Used for measuring the distance of the node and gateway locations from the ground, ceiling and the neighbouring surfaces	

- The considerations for location of the IoT devices are as follows:
  - Avoid direct sunlight
  - Keep the device in range of the network
  - Consider the surrounding
  - Place it on a height
- The considerations for location of a power supply source are as follows:
  - The power point should be as close as possible to the IoT device.
  - The power supply should be near a dry ventilated area.
  - The power supply should be in a less active area to avoid damage from any movement of people.
  - The power supply should be at a place where all the indicators' lights can be seen easily from a distance.

- The power supply should be in the same building where the main electric distribution box is installed; not in any separate garage or store house.
- The tools with their uses are as follows:
  - Multimeter: Measuring resistance, voltage, current and other electrical parameters
  - Magnetic wristband: For holding magnetic components like small screws, nuts and so on
  - Wire cutter: For cutting electrical cable and wires upto appropriate length
  - Crimpers: Crimping the Ethernet cable
  - Wrench: For tightening screws and bolts
  - Spirit level: To check the inclination or declination of any surface
- Some points which are needed to be considered by the technician while choosing a location so that it does not affect the working and functioning of the IoT device are as follows:
  - Avoid direct sunlight
  - Keep the IoT device in range of Wi-Fi network
  - Keep obstacles away from the signal and mount the sensor on steady surface
  - Place the device on a certain height to get the signal appropriately and prevent any damage due to human movement

## UNIT 3.2: Mounting Devices at Desired Locations

### Unit Objectives

By the end of this unit, the trainees will be able to:

1. Explain the steps for surface preparation while mounting devices
2. Identify the correct distance between the devices
3. Describe signal and power loss during inter-device communication
4. Evaluate the resource consumption of the set-up
5. Identify the correct set of sources for power and other utilities

### Notes for Facilitation

- Tell the participants that the IoT devices should be mounted on a levelled surface. Hence, surface preparation is needed first for the mounting process.
- The next step is to mark the location and drill the surface to mount the device.
- Briefly, explain the steps of mounting a motion detector and a camera.
- In addition, tell them that a motion sensor can be mounted on the wall in the following ways:
  - Using rear cover to mount the sensor against the wall
  - Using wall mounting adaptor to mount the sensor in such a way that it faces 45° to its left or right
  - The following figure shows the two methods:

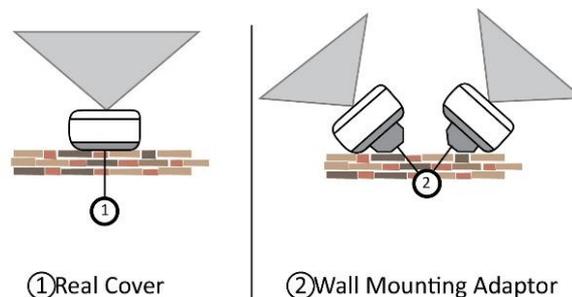


Fig 3.2.1: Methods of wall mounting of a motion sensor

- Further, tell them the steps of mounting using rear cover:
  - Press the upper sides of the rear cover and slide it down to remove the cover. The following figure shows the removing of the rear cover:

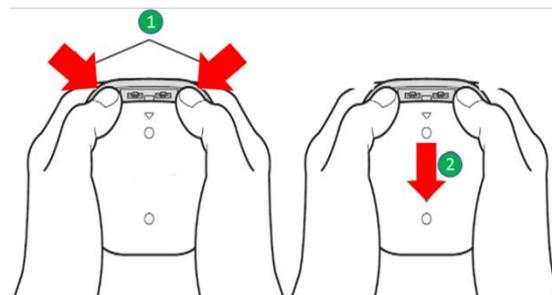


Fig 3.2.2: Removing of the rear cover

- Place the cover with “UP” mark facing upwards and fix it on the wall using screws as shown in the following figure:

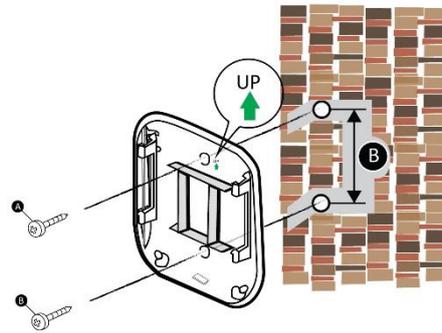


Fig 3.2.3: Fixing of the rear cover

- Attach the sensor to the rear cover by inserting its grooves on the rear cover, and pushing it down, as shown in the following figure:

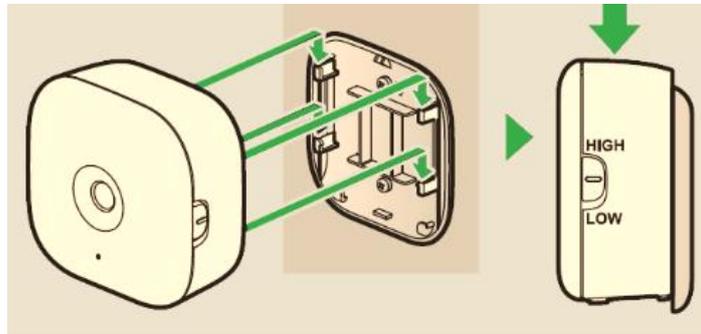


Fig 3.2.4: Attaching the sensor to the rear cover

- Also, tell them the steps of mounting using an adapter:
  - Press the upper sides of the rear cover and slide it down to remove the cover. The following figure shows the removing of the rear cover:

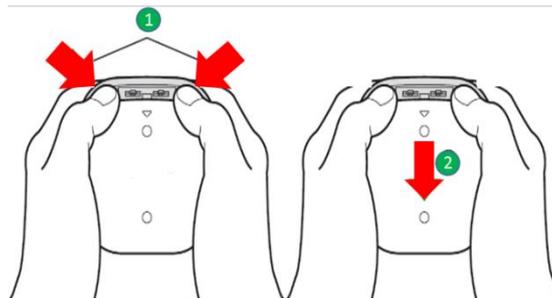


Fig 3.2.5: Removing of the rear cover

- Place the wall mounting adaptor with “UP” mark facing upwards and fix it on the wall using screws as shown in the following figure:

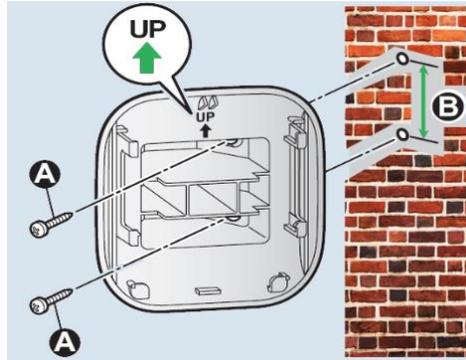


Fig 3.2.6: Attaching the wall mounting adaptor

- Attach the sensor to the adaptor by inserting its grooves on it, and pushing it down, as shown in the following figure:

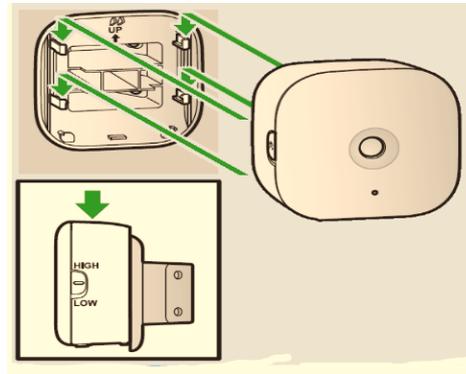


Fig 3.2.7: Attaching the sensor to the adaptor

- Inform the participants that they should remember the following points to mount the sensor:
  - Mount the motion sensor on the stable location where the motion sensor can be adequately supported when mounting.
  - Do not mount motion sensor on a soft material. It may fall down, break or cause injury.
  - Do not mount the motion sensor on surfaces such as gypsum board, an autoclaved lightweight cellular concrete (ALC), a concrete block, a plywood less than 25.4 mm (1 inch) thick and so on.
- Tell them about the distance between the network devices and the nodes.
- Also, explain the line of sight with an example.
- Explain the various factors which need to be considered for establishing a network connection with the help of the following figure:

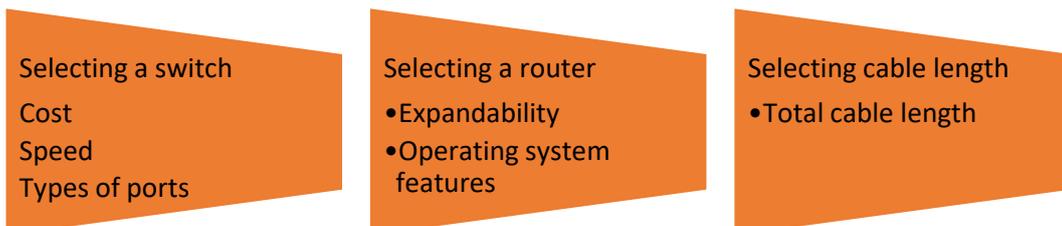


Fig 3.2.8: Factors to be considered for establishing the network connection

- Tell them that a glass surface does not affect the signal strength so much. The receiver of the signal needs to be attached to a window in line-of-sight to the camera through a glass surface.
- Explain to them about Wireless Signal Restriction: The preferred network as per the operating area of the IoT set up can be chosen on the basis as follows:
  - Personal Area Network (PAN): Few meters (within a room, home)
  - Local Area Network (LAN): Less than 1 km (intra-floor, building)
  - Campus Area Network (CAN): Between 5 to 10 kms (within a campus)
  - Metropolitan Area Network (MAN): Within 10 km (within a city)
  - Wide Area Network (WAN): The network range is greater than 10 kms (inter-city, inter-national, inter-continental).
- Further, explain to them the steps to be taken care of while connecting the cables in an IoT framework.
- Tell them about the safety rules for connecting the power cables to the device and wiring of an RGB cable.
- Tell them that while connecting the power cables to the device they must ensure the following points:
  - Take the power cord and check that the plug connections are properly done.
  - Wear the ESD strap and connect it to the ground.
  - Insert the coupler end of the device's power cord into the power supply input on the device.
  - Insert the power cord plug to the power supply outlet near the installation location.
  - Secure the power cord by using a retainer clip.
  - Ensure that the power cord is not hanging so that people do not trip.
  - Make sure the connections are tight.
  - Turn on the power supply and check the indication through the light.
- Tell them about signal and power loss that occurs during inter-device communication.
- Exercise Handling Strategy:
  - Write down the factors which needs to be considered while:
    - Selecting Switch:
      - Cost of Switch: As switch cost depends upon the number of ports, select a switch with appropriate number of ports.
      - Speed and Type of Ports: Choose a switch as per the requirement of speed and types of ports in the set-up which needs to be installed.
    - Selecting Router:
      - Expandability: While selecting a router, the number of devices to be connected in the entire network with the router should be checked. This will help in selecting the optimum router.
      - Operating System Features: Based on the type of security level, quality of service and the routing layer protocol, the router is chosen as per the best suitable version of router configuration for the network.

- **Selecting Cable Length:**
  - **Total Cable Length:** Cabling distance is a significant factor for loss of signal. So as per the suitable cabling distance, different types of cables are provided to avoid signal loss.
- Write down the points needs to be considered while choosing distance between network devices.
  - **Physical Obstructions:** In wireless signal set up, physical objects such as walls, buildings and other objects create hindrance in the wireless network. So the wireless device should be kept at a spot where the wireless signals cannot be obstructed.
  - **Network Range and Distance between Devices:** The network strength between the network devices drops by an inverse cube of the distance between the devices.

## UNIT 3.3: Performing Checks and Connections

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the connectivity between the devices
- Describe preparation of devices for transmission of data
- Explain power supply selection and grounding
- Identify post commissioning checks

### Ask

- Enquire from the participants if they have any doubts from the previous sessions.
- Ask them if they can tell about Earthing.

### Notes for Facilitation

- Tell the participants that they should ensure proper connectivity between the devices. Also, tell them about the steps for checking the connections.
- Tell them about the importance of grounding a device.
- Also, inform them how to select the power supply according to the power requirements and perform grounding of an electrical connection.
- Tell them about the basic steps for setting up IoT data transmission.
- Lastly, tell them about the various aspects of checking the connectivity between the IoT devices.
- Also, tell them about different types of testing for an IoT framework as shown in the following figure:

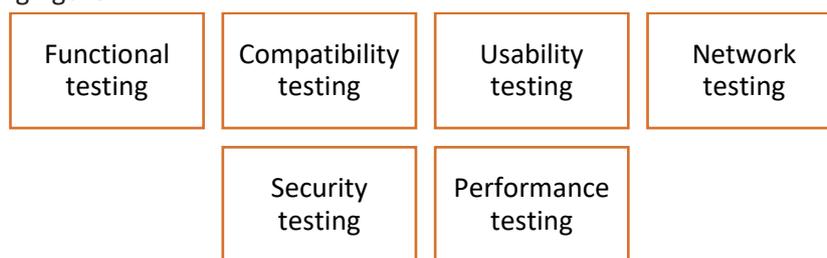


Fig 3.3.1: Different types of testing for an IoT framework

- Exercise Handling Strategy:
  - Randomly choose one of the participants to answer the following questions.
  - The purpose and importance of earthing is to:
    - Fix the potential of active conductors with respect to the earth
    - Limit the voltage in electrical system between non-current carrying parts and earth
    - Remove risk of electric shocks by implementing protection devices
    - Limit rise in potential because of medium voltage faults in network with low voltage

- Answer of the 2<sup>nd</sup> question:
  - Components validation
    - Device hardware
    - Embedded software
    - Network connectivity
  - Function validation
    - Interaction between devices
    - Basic device testing
  - Performance validation
    - Device performance
    - Data transmit frequency
  - Security and data validation
    - Validate data packets
    - Data encryption/decryption
- Answer of the 3<sup>rd</sup> question:
  - Create a checklist for tests performed in testing IoT setup.
    - Functional testing: This test is done to check whether the device is working as per the requirement of the customer, based on the inputs given.
    - Compatibility testing: In this, the version and compatibility between the devices are checked to make sure that they work well together. The protocols and versions of hardware and software of the device are checked.
    - Usability testing: This is done to check whether the customer can use the IoT devices and understand the controls. This includes usefulness, text and appeal of the controls.
    - Network testing: This test needs to be done to check whether all the network connections between the devices are working as required. There should be no log and the devices should perform in sync.
    - Security testing: This test is done to check the security of the network set up and data encryption. This performs verification and authentication of the data and verifies the same to follow security protocols.
    - Performance testing: After completing all the tests, the technician needs to perform a performance test of the setup. The working and functioning of the entire set up is checked to ensure that it is working as per the desired outcome and following all the protocols.
- Practical solution:

Test the speed of 3 Wire Speed Sensors using a multimeter.

  1. Provide power and ground to the sensor by connecting power and ground wire to it.
  2. Set the multimeter on DC voltage
  3. Take the red probe from multimeter and hook it to signal output wire of the sensor.
  4. Connect the black probe (ground) of the multimeter to a common ground.
  5. Now check the source and open voltage from the multimeter.

- Practical solution:  
Mount a security camera system and connect it to the monitor and the DVR. Also, perform Earthing connection of the same.
  1. Inspect the area where the camera needs to be mounted.
  2. Mark a hole for the camera's cable feed through and three holes for the camera's mounting screws.
  3. Run cable to each of the camera locations.
  4. Connect the camera to system ground.
  5. Connect one end of the cable to camera and another end to DVR box.
  6. Install the camera.
  7. Connect the Ethernet cable to the camera.
  8. Set up the user interface.



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## 4. Communication and Microprocessors

Unit 4.1 – Connecting Microcontroller Boards for Data Transfer

Unit 4.2 – Connecting the boards

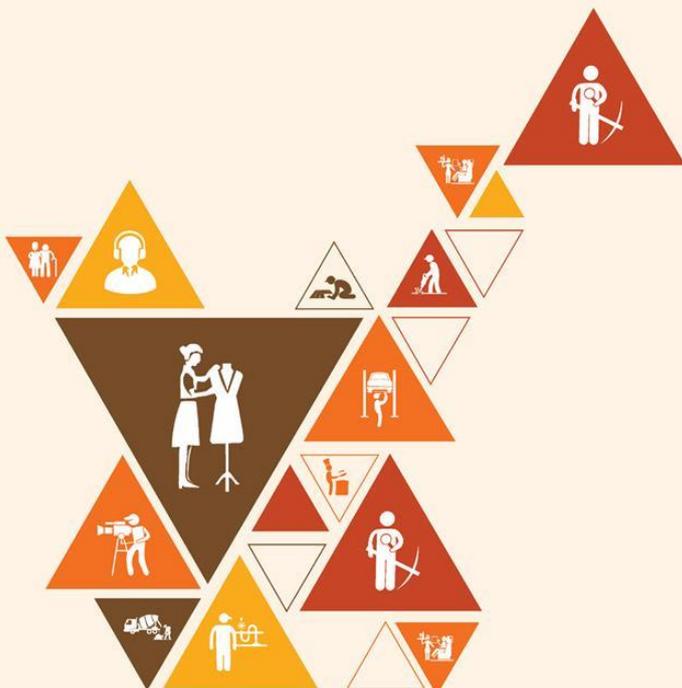
Unit 4.3 – Installing Suitable Framework

Unit 4.4 – Transferring Software Code to On-board  
Microprocessor

Unit 4.5 – Compiling Code On-board Microprocessor

Unit 4.6 – Understanding Error Codes and Debug Software

Unit 4.7 – Functioning of Micro-controller and Attached Devices



TEL/N6235

## Key Learning Outcomes



By the end of this module, the trainees will be able to:

- Identify the connectivity points in Arduino and Raspberry Pi
- List the connectivity options available for microcontroller
- List the types of cables and connectors
- Explain how to connect a device to the microcontroller board
- Execute the steps of connecting Arduino board to the PC
- Identify the nodes and gateways
- Explain the basic coding structure of microcontroller
- Identify the options to transfer codes
- Explain the challenges in transferring codes
- Explain how to compile a code
- List the types of compiler available
- Identify the ways of debugging a microcontroller code
- Explain the steps of setting the software in debug mode
- Interpret the error codes
- Explain the steps to check the microcontroller functions
- Describe how to use the Emulator to check the proper functioning of the devices
- List the communication hurdles

## UNIT 4.1: Connecting Microcontroller Boards for Data Transfer

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify the connectivity points in Arduino and Raspberry pi
- List the connectivity options available for microcontroller

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on

### Do

- Revise the learning of the previous sessions and ask them if they have any doubts.

### Ask

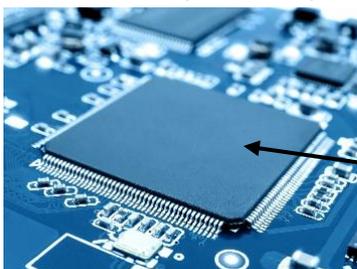
- Ask the participants if they can tell the differences between a microcontroller and a microprocessor.
- Ask them if they can remember the connectivity ports of an Arduino board.

### Explain

- Explain the connectivity ports on the Arduino and Raspberry Pi boards.
- Explain different connectivity options for the microcontroller boards.

### Notes for Facilitation

- Start the session by asking the participants the difference between microprocessors and microcontrollers.
- Tell them that a microprocessor is a standalone central processing unit which functions when external memory, clock interface, input/output devices and other peripherals are connected. That is why a microprocessor always has a lot of pins. The following image shows a micro-processor placed on a PCB:



Microprocessor

Fig. 4.1.1: Micro-processor

- Also, tell them that a microcontroller is a computer installed on a single chip. It runs specific, single program applications which perform a task which is defined by certain parameters. All the components like the RAM, CPU, input/output interfaces, memory clock and other peripherals are on-board as shown in the following image:

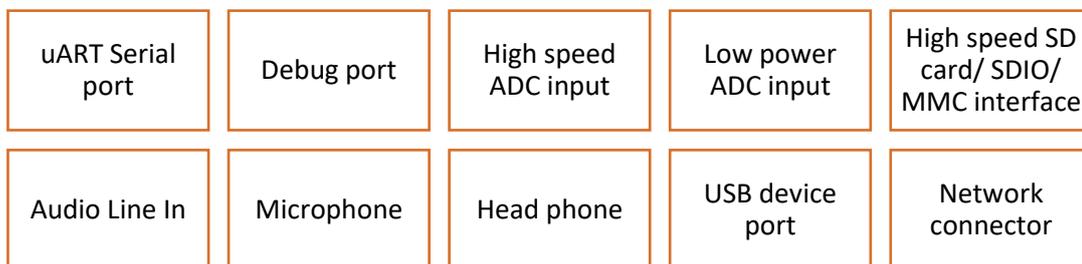


Fig. 4.1.2: Micro-controller

- Show them the following table which lists the differences between a microprocessor and a microcontroller:

Component	Microprocessor	Microcontroller
Chip	Is the heart of the computer system	Is the heart of an embedded system
Comprises	Contains CPU, general purpose registers, stack pointers, program counters, clock timing and interrupt circuits	Contains the circuitry of microprocessor and has built-in ROM, RAM, I/O devices, timers and counters
Data memory	Moves considerable instructions per second between memory and CPU	Only required to move one or two instructions between memory and CPU
Circuit	Large	Small
Overall cost	The cost of entire computer is high	Keeps the cost of entire system low
Bit instructions	Only has one or two bit handling instructions	Has to handle many bit instructions
Number of registers	Less number of registers - making the operations just memory based	Comparatively more number of registers - therefore programs are easier to write
Storage	Works on Von Neumann architecture. The program and data reside in the same memory module	Based on the Harvard architecture - the program memory and data memory are located separately
Time	Memory access time is more for I/O devices	Comparatively less access time for built-in memory and I/O devices
Hardware	Requires other hardware components	Doesn't require many hardware components

- Tell them the differences regarding the following:
  - Chip
  - Comprises
  - Data memory
  - Circuit
  - Overall cost
  - Bit instructions
  - Number of registers
  - Storage
  - Time
  - Hardware
- Tell them the different connectivity ports, a microcontroller may have, with the help of the following figure:



*Fig 4.1.3: Different connectivity ports of a microcontroller*

- Tell them that a technician needs to do the following actions:
  - Figure out the required transmitter (Wi-Fi, Bluetooth, NFC, or GSM Cellular) for wireless Arduino.
  - See if the adapter is compatible and also check its range.
- Explain the pin configuration and different ports in an Arduino board, one by one.
- Also, tell them about the pin configuration of a Raspberry Pi board.
- Explain that due to its popularity, Linux OS have a version optimized for the Raspberry Pi only.
- Tell them that out of the many versions of Raspberry Pi, version, B+ has improved form and functionality.
- Tell them that a Raspberry Pi board has the following features:
  - Squarely placed mounting holes
  - GPIO headers
  - USB Ethernet controller
  - USB ports to PC
  - Ethernet output port
  - Audio and composite output jack
  - Camera connector
  - HDMI out port
  - USB power port
  - Switching regulator
  - Display connector
  - Micro SD card slot.

- Inform them about different connectivity options for a microcontroller unit.
- Briefly explain the following:
  - Embedded Wi-Fi
  - Bluetooth
  - Low Power Wide Area Network
- Explain to them that wireless MCU Modules are low power, appropriately integrated, high performance MCUs. Embedded - ME series modules enable the end user to code applications directly on the device without the need for external MCU. The fully integrated ultra-low-power microcontroller acts as an application processor and a built-in wireless subsystem. These self-dependent modules with integrated wireless stack mean a seamless wireless connectivity.
- Tell them that the earlier modules of Raspberry Pi do not have an integrated Bluetooth module. Since almost every mobile device supports Bluetooth communication as standard, it is so easy to exchange files between the device and Raspberry Pi module.
- Further, tell them the applications of embedded wireless, such as the following:
  - Radio frequency (RF) remote
  - Sub-GHz
  - Radio-frequency identification (RFID)
- In addition, tell that Zigbee is good for supporting connections among multiple devices, which has helped it become ensconced in in-home automation systems. It has also become popular in remote controls. Zigbee has traditionally been the preference when support for faster data rates is desired.
- Also, tell that Z-Wave operates in different frequency bands in different countries, but in all instances, it avoids the unlicensed and consequently crowded 2.4 GHz band. Z-Wave tends to get chosen when farther connectivity reach is one of the design criteria.
- Inform them, how power consumption of a microcontroller is optimised. Tell them the following steps:
  - Optimise the Pull up Resistor
  - Back up the Powering Devices
  - Decrease the Needed Voltage
  - Alter the Clock Frequency
  - Choose the Right Oscillators
- Tell them about IP-enabled and non-IP-enabled devices.
- Also, tell them how to connect the IP-enabled and non-IP-enabled devices to the network.
- Exercise Handling Strategy:
  - Ask them to write the labels in their notebook.
  - Randomly ask them one by one to tell the answers.
  - The answers are:
 

1. Power USB	2. Barrel Jack	3. Voltage Regulator	4. Crystal Oscillator
5. Arduino Reset	6. 3.3V Pin	7. 5V	8. GND
9. Vin	10. Analog Pin	11. Main Microcontroller	12. ICSP Pin

13. Power LED Indicator      14. TX and RX LEDs      15. Digital I/O      16. AREF
17. Arduino Reset

- Ask one by one about the communication technologies such as Embedded Wi-Fi, Bluetooth, Low Power Wide Area Network and Embedded Wireless and let them discuss about them.
  - Embedded Wi-Fi: These Wi-Fi modules are plug and play devices like the embedded WLAN stack, TCP/IP (Network) stack and small-sized security supplicants. It is a self-contained solution actuated by simple 8/16/32 bit, low-cost, low-power MCU for Wi-Fi modules.
  - Bluetooth: These self-contained modules are low-power and used mainly for wearables or IoT devices which need Bluetooth Low Energy IP Stack or radio frequency (RF) experience.
  - Low Power Wide Area Network: This makes low power consuming long range high network capacity possible for more than 10 miles. For low power WAN's gateways and cloud systems need to be in place.
  - Embedded Wireless:
    - **RF Remotes**  
Unlicensed Sub-GHz radio frequency bands - Industrial, Scientific and Medical (ISM) are used for short-range, low-data-rate, and low-power wireless applications.
    - **Sub-GHz**  
License-free ISM frequency bands running at 2.4 GHz, 868 to 928 MHz, 433 MHz, and 315 MHz are used mainly for RF devices.
- Divide the number of participants in 2 groups, then ask one of them to tell about IP-enabled devices and ask the other one to tell about the non IP-enabled devices.

Non-IP enables Devices connection:

1. The control settings page of the ZigBee device gives an access to control panel which allows to control the devices.
2. The control panel should be accessed for addition of a new device.
3. Devices that are available for the required connections should be checked.
4. It should be ensured that the other device can be discovered and is ready for connection.
5. When the screen displays the other device, it should be selected for connection.
6. The indication that the device is paired confirms that the connection has been established.
7. Sometimes, password is required for pairing. If this is so, enter identical passwords on both of the devices.

#### IP Enabled Devices

1. The control panel should be accessed from one device.
2. The network and the sharing option should be opened.
3. The LAN, WAN connection across which the device has to be connected should be selected.
4. Then, properties window should be opened and IPv4 option should be selected.
5. "Use the following IP address" should be selected.
6. The IP address 192.168.127.XXX should be entered; XXX can have any value less than 254.
7. The subnet mask should be SET to default 255.255.255.0.
8. The settings should then be saved by selecting OK.
9. It should be ensured that the other device is discoverable and linked to the LAN or WAN.
10. It should be ensured that the IP settings of the first device is set close to that of the other device.

## UNIT 4.2: Connecting the Boards

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the types of cables and connectors
- Explain how to connect a device to the microcontroller board

### Resources

- Available objects such as a duster, pen, notebook and so on
- Different connectors

### Notes for Facilitation

- Tell the participants that different types of cables are required for communication. Hence, different types of connectors are also needed.
- Tell them about different types of connectors, such as:
  - CAT 5E Ethernet RJ 45 Connector
  - CAT 6 Ethernet RJ 45 Connector
  - CAT 6A Ethernet RJ 45 Connector
  - Telephone Network Connector
  - Coaxial Connector
  - Wire Connector and Terminal
  - RCA (Male and Female)
  - BNC (Male and Female)
  - F-Type
  - D-Type
  - RJ-45
  - Type C
- Explain that in the early days computers had serial and parallel ports which made it really easy to connect them to micro-controllers and FPGAs. But now, USB has its own data transfer protocols, and it is a bit difficult to implement different connections with parallel ports.
- Tell them that Cat-5 cable is widely used for 100Base-T and 1000Base-T networks. It allows data at 100 Mbps.
- In addition, tell them that Cat 5 cable is not recommended for new installations since it has become obsolete.
- Further, tell them that Cat-5e cable is recognised by the Electronic Industries Association and Telecommunications Industries Association (EIA/TIA). It offers higher frequency specification than Cat-5 cable and also allows data rate up to 125 Mbps.
- Inform them that Cat 6 cables are tightly wound and they often have a braided shielding or an outer foil.
- Further, tell them that Cat-6 cables can support speeds up to 10 Gbps, within 55 metres.

- Tell that Cat-6a are capable of supporting twice the maximum bandwidth and maintaining higher transmission speeds over longer cable lengths.
- Explain to them about the use of portable cord, AV cable, VGA cable, USB cable and HDMI cable.
- Exercise Handling Strategy:
  - Ask five participants to tell the name and the use of the cables, one by one.
  - The answers are as follows:

Name	Feature
<b>Portable cord</b>	The cord is used to supply power to the PCB's with microcontroller boards.
<b>AV</b>	These cables are used for audio and video signal transmission.
<b>VGA</b>	It is used to transfer picture signals from the microcontroller boards to the output devices such as screen, monitor.
<b>USB Cable</b>	These cables are used for low voltage DC power supply and connecting peripherals like microcontroller boards and sensors.
<b>HDMI Cable</b>	HDMI is used to connect any audio/video source, such as a set-top box, DVD player, or A/V receiver to an audio and/or video monitor, like digital television (DTV), with a single cable. HDMI has support for standard, enhanced, or high-definition videos. Multi-channel digital audio support is also there.

## UNIT 4.3: Installing Suitable Framework

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Execute the steps of connecting Arduino board to the PC

### Notes for Facilitation

- Tell the participants how to connect a microcontroller board to different electronic parts chips and devices.
- Tell them that Arduino board has limits on how much current can be sourced or sunk by its I/O pins.
- Also, tell that while interfacing the board with a hardware, it is to be ensured that the current limits are not exceeded. In general, for Arduinos based on the AVR microcontrollers, do not exceed 20 mA per pin.
- Further, tell them that they should not connect LEDs to Arduino outputs directly. They should always use a series resistor for it.
- Tell them how to download and install Arduino software in a device with the help of the steps shown in the following figure:

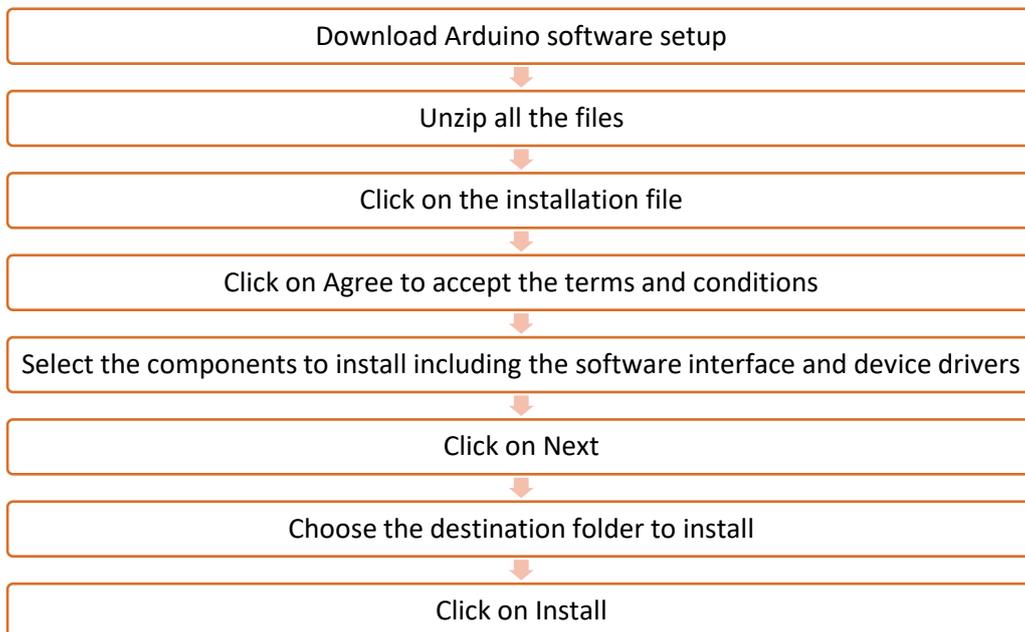


Fig 4.3.1: Steps for installing the Arduino software

- Inform them that the installation process also asks whether the device drivers for the hardware need to be installed.

- The following screenshot shows installation of device drivers:



Fig 4.3.2: Installation of device drivers

- Tell them that they need to connect the D cable to the Arduino board and the USB side of the cable to the electronic device. The following image shows how to connect cable to the Arduino board:



Fig 4.3.3: Connect cable to the Arduino board

- Tell that they have to double click on the Arduino IDE icon to open the software interface.
- Also, inform them that they need to select the types of an Arduino board from the list of boards. The list of boards is available in the Tools menu.
- Inform them that, they should know the port number of the board which is connected to the device, as the port number is selected.
- In addition, tell them the steps of finding the port numbers:
  - Open the "Device Manager" by right clicking on My Computer > Manage > Device Manager
  - Check "Ports (COM & LPT)"
  - Find "Arduino Uno(COM#)" with a port/COM number

The following screenshot shows finding of a port number of Arduino boards:

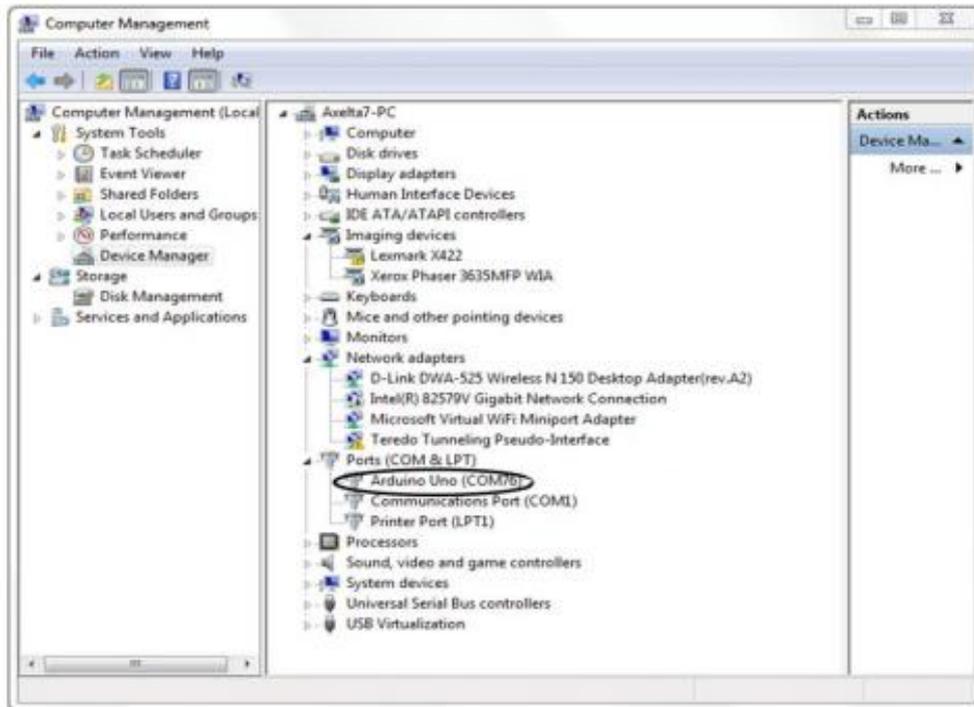
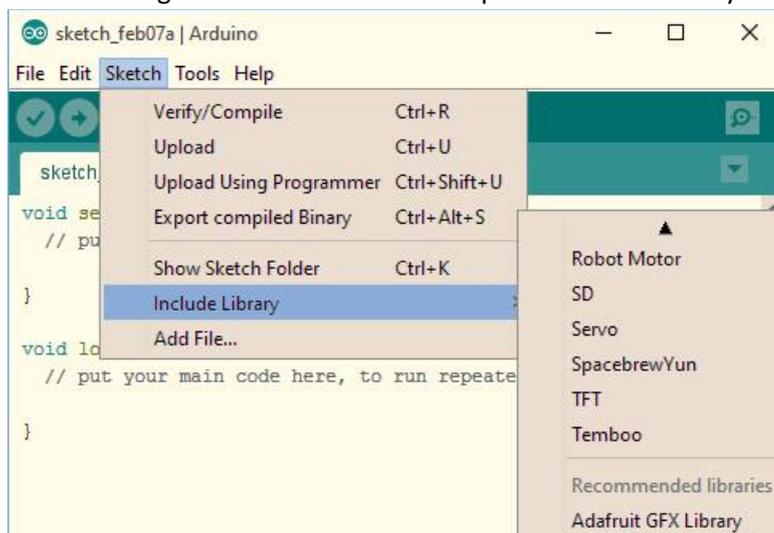


Fig 4.3.4: Finding of a port number of Arduino boards

- Tell them that they need to select a program from the Example and upload it to the Arduino board and check whether it is working perfectly.
- In addition, tell them the steps to import a library to the Arduino board:
  - Download the library file, for example DHT11.zip, where DHT11 is a temperature and humidity sensor.
  - In sketch, go to Include Library and then click on Add Library as shown in the following screenshot.
  - Browse to the folder DHT11 and select the folder and click open.

The following screenshots show the steps to include a library to the Arduino board:



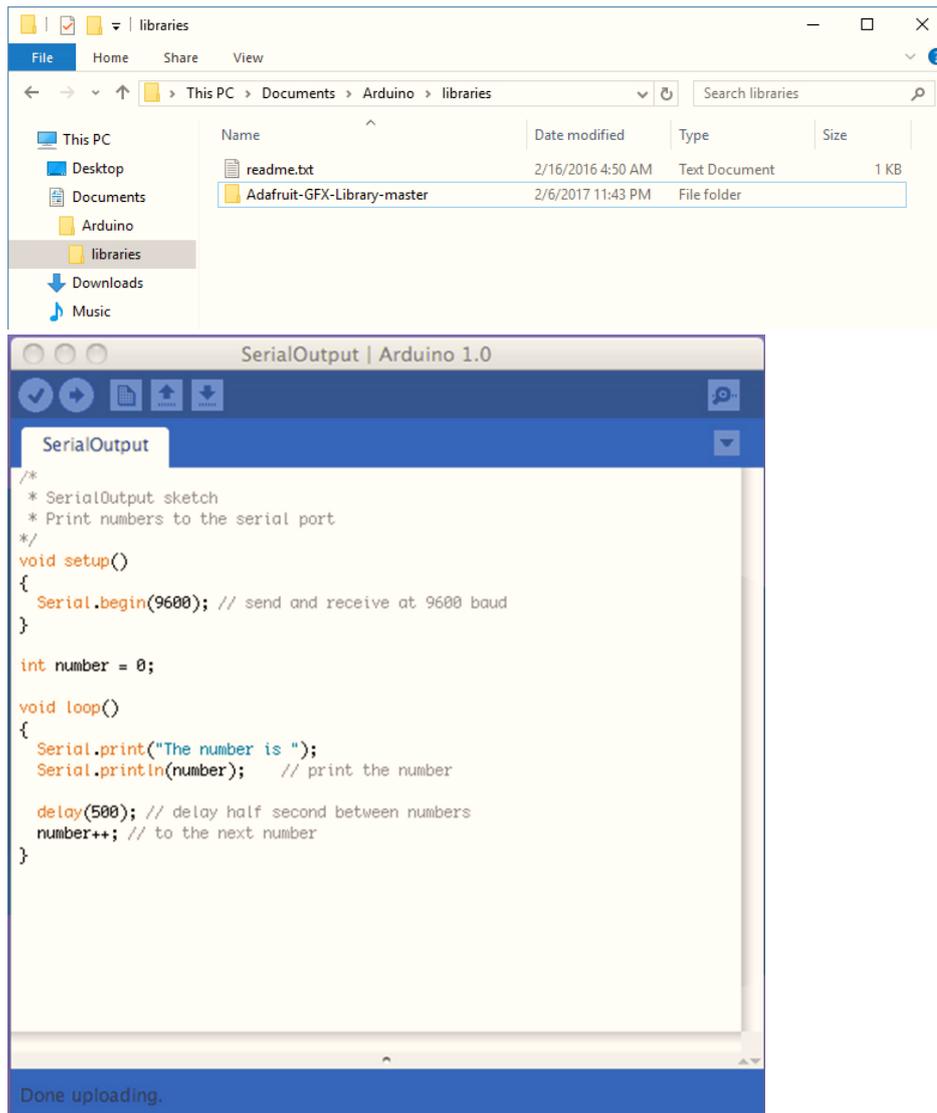


Fig 4.3.5: Steps to include a library to the Arduino board

- Further, tell that if they want to check whether the library is imported properly, they need to:
  - Go to Sketch > Include Library
  - Select DHT11 from the list of libraries
  - Check whether `#include <DHT11.h>` is added to the sketch.

The following screenshots shows that a library has been imported to the board:

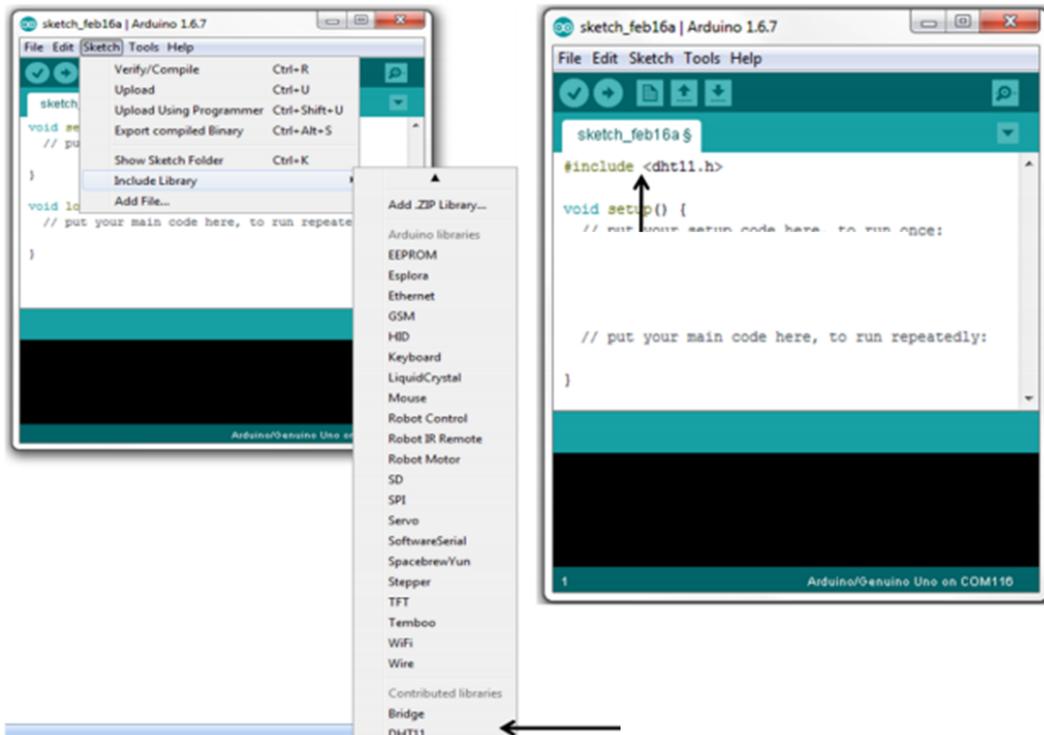


Fig 4.3.6: A library imported to the board

- Further, explain to them how to connect a device to a raspberry Pi microcontroller board.
- Exercise Handling Strategy:
  - Ask one participant randomly to identify the cables.
  - The cables are:
    - USB cable: For keyboard, mouse and power supply.
    - Ethernet cable: For internet connectivity.
    - HDMI cable: For high definition video output.

## UNIT 4.4: Transferring Software Code to On-board Microprocessor

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify the nodes and gateways
- Explain the basic coding structure of microcontroller
- Identify the options to transfer codes
- Explain the challenges in transferring codes

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on

### Do

- Revise the learning of the previous sessions and ask the participants if they have any doubts.

### Explain

- Explain the basic Arduino programming.
- Explain different challenges in transferring codes.

### Notes for Facilitation

- Start the session by asking the participants what they remember about nodes and gateways.
- Briefly explain a sensor node.
- Also, tell that, sensor node has a power unit, communication unit, processing unit and a sensing unit. The sensing unit of the node is the sensor.
- Show the following image of a sensor node:

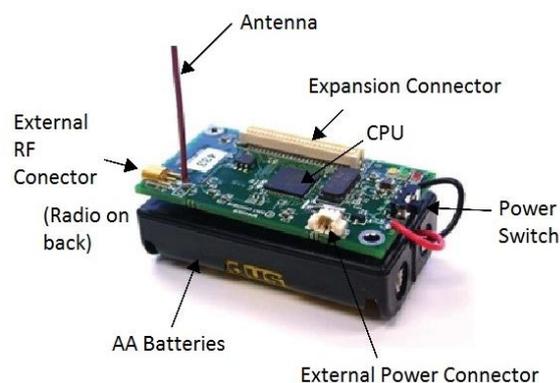


Fig 4.4.1: A sensor node

- Tell them about various communication links.

- Explain about, transparent mode: Data input to the Data IN (DIN) pin is transmitted over-the-air to the receiving radios without any modification. That's why XBee can be used in place of an RS-232 cable. In this mode the packets can be allocated to one target (point-to-point) or to multiple targets (star).
- Also, explain in brief about Power over Ethernet (PoE). Tell them that PoE allows a single cable for providing both data and electric power connection to devices such as IP cameras, VoIP phones and wireless access points. The following figure shows the concept of PoE:

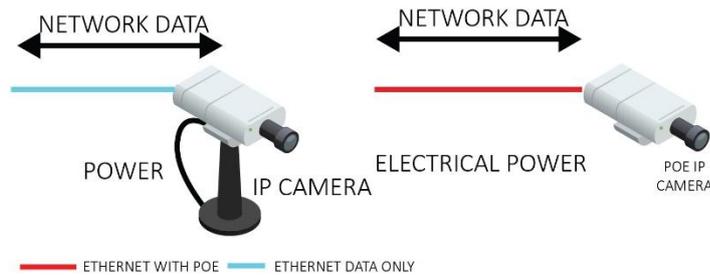


Fig 4.4.2: Concept of PoE

- Explain an IoT network and its working with an example of an IoT framework including the following:
  - PIR Motion sensor connected to a device with Arduino Uno board
  - Raspberry Pi board (Gateway)
  - Internal temperature sensor
  - LED as actuator connected to Arduino Uno
  - IoT cloud framework.
- Tell them that after the external application in Java (independent of Raspberry Pi and Arduino Uno) processes, the readings are taken by the IoT cloud platform. Any suitable IoT platform can be used for this function such as Windows Azure, AWS which are paid or Temboo, Carriot, Nearbus which are free in market. Whenever there is a movement detection, a command will be relayed to the Arduino through the Watson IoT Platform and Raspberry Pi Gateway to initiate blinking of the LED.
- Tell them about the basic structure of a program code. Tell that a program includes:
  - Statements or commands
  - Comments
  - Constants and variables
  - Labels
  - Symbols
- Also, tell them a few examples of commands of Arduino programming and their meaning.
- Also, explain to them how to load the code to a microcontroller board.
- Inform them that a code can be transferred via the following:
  - Serial cable interface
  - SD card
  - Wireless mode such as Bluetooth, ZigBee, WiFi

- Tell them that the latest controllers have bootloader memory for self-programming, that is, they do not need external programmer hardware. The only thing needed is API for shifting program to the target controller. The API can also be incorporated in the compiler, which allows direct burning.
- Explain various challenges in transferring the code, such as:
  - Power supply error
  - Choosing appropriate serial port
  - Installation of drivers
  - Pull ups
  - Microcontroller undetected by programming application.
- Exercise Handling Strategy:
  - Randomly ask the participants one by one to tell the answers.
  - The answers are:

<code>pinMode(n,INPUT)</code>	Set pin n to act as an input. One-time command at top of program.
<code>pinMode(n,OUTPUT)</code>	Set pin n to act as an output
<code>digitalWrite(n,HIGH)</code>	Set pin n to 5V
<code>digitalWrite(n,LOW)</code>	Set pin n to 0V
<code>delay(x)</code>	Pause program for x millisecond, x = 0 to 65,535
<code>tone(n,f,d)</code>	Play tone of frequency f Hz for dmillisecond on speaker attached to pin
<code>for()</code>	Loop. Example: <code>for (i=0;i&lt;3;i++){}</code> Do the instructions enclosed by <code>{}</code> three times
<code>if (expr) {}</code>	Conditional branch. If expr true, do instructions enclosed by <code>{}</code>
<code>while (expr) {}</code>	While expr is true, repeat instructions in <code>{}</code> indefinitely

- The steps that helps to load a software code from the nodes to the microcontroller board are:
  - With a serial cable interface, attach the programmer kit to the computer.
  - Then, put the microcontroller in the hardware's socket and push the lock button to ensure proper connection to the board.
  - Open the software on the computer. Then navigate to the menu bar and open File- functions-open-save-setting options.
  - Select 'Open' from the drop-down menu and select 'Load file'.
  - Then click 'Load' button to upload hex file into the microcontroller.

## UNIT 4.5: Compiling Code to On-board Microprocessor

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain how to compile a code
- List the types of compilers available

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on

### Do

- Revise the learning of the previous sessions and ask the participants if they have any doubts.

### Notes for Facilitation

- Introduce the participants to compilation of a code.
- Tell them that a compiler transforms a high-level code, known as source code into a machine code. The source code is understandable by humans.
- Also, tell them that a compiler ensures that the program is correct syntactically and there is no typing error.
- Explain to them the steps to compile a microcontroller code.
- Tell them that, when a fingerprint sensor is connected to the Raspberry Pi board, the board needs to be booted up first, using a configuration tool.
- After that, they need to run the program code for the fingerprint sensor.
- Also, tell that, they need to check whether the fingerprints are being recorded or not.
- Tell them about some of the common compilers:
  - MPLAB XC8 C pic microcontroller Compiler
  - MPLAB XC16 C pic microcontroller Compiler
  - MPLAB XC 32 C pic microcontroller Compiler
  - PIC CSS pic microcontroller Compiler.
- Exercise Handling Strategy:
  - Ask the participants to name some common compilers.
    - MPLAB XC8 C pic microcontroller Compiler: The MPLAB XC8 C Compiler is the best compiler of top series compiler and it only supports the 8 bit pic microcontrollers such as PIC 10, PIC 12 and PIC 18. It is also known as ANSI C compiler.
    - MPLAB XC16 C pic microcontroller Compiler: MPLAB XC16 C Compiler is version of MPLAB XC compiler but this version only supports the 16-bit pic microcontroller such as, PIC 24F, PIC 24H, PIC 24E, DSPIC 30F, DSPIC 33F and DSPIC 33E.

- MPLAB XC32 C pic microcontroller Compiler: The MPLAB XC32 C Compiler is also the version of MPLAB XC compiler but it is only used for support or to program the 32-bit microcontroller such as PIC32 MZ, PIC32 MX and PIC32 MM.

## UNIT 4.6: Understanding Error Codes and Debug Software

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify the ways of debugging a microcontroller code
- Explain the steps of setting the software in debug mode
- Interpret the error codes

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on

### Do

- Revise the learning of the previous sessions and ask them if they have any doubts.

### Ask

- Ask the participants if they know what debugging is.

### Explain

- Explain the ways of debugging a microcontroller.
- Explain some error codes.

### Notes for Facilitation

- Start the session by asking the participants about debugging.
- Tell them that debugging means identifying and removing the errors from a code segment.
- Inform them that a microcontroller code can be debugged in various ways, using the following:
  - In Circuit Emulator
  - ICD (PIC microcontroller)
  - Simulation
  - Serial RS232 Interface
  - Liquid Crystal Display (LCD)
  - Pin Debugging
  - Logic Analyser.
- Also, tell them how to set the microcontroller software in debugging mode.
- Tell them the following steps:
  - Go to Build Specification Properties window

- Set the properties and check if the Debugging option is on
- Select the debug mode from Serial port, TCP port and USB options.
- After setting the debugging mode, they should run the application.
- Tell them some examples of common errors in the code.
- Tell them that some of the most common errors are listed in the following table:

Code and Message	Interpretation
E2483: Array dimension 'specifier' could not be determined	This error occurs when an array dimension is dependent upon a template parameter. But an error occurs while it is being parsed and the template argument being substituted does not yield a legal constant expression.
E2509: Value out of range	The error here is because of numeric overflow in one of the expressions. Make sure all numbers fit in 32 bits.
E2100: Invalid template declarator list	It is illegal for a declarator list to follow a template class declaration.
E2249: = expected	In compiler, an error was reported but there was none. This is usually a syntax error or typo.
E2481: Unexpected string constant	The error occurs at times when the compiler is not expecting a string constant in the source input.
E2429: Not a valid partial specialization of 'specifier'	This is an internal compiler error.
F1003: Error directive: 'message'	This message is issued when an #error directive is processed in the source file. 'message' is the text of the #error directive.
F1004: Internal compiler error	An error occurs in the internal logic of the compiler.

- Also, explain to them some common examples of compilation error messages and their interpretations.
- Show them a code segment and tell them about the errors in the code.
- Exercise Handling Strategy:
  - Ask the participants to write the answers in the notebook.
  - Give a time limit of 20 minutes.
  - Tell the answers as follows:

Code and Message	Interpretation
E2483: Array dimension 'specifier' could not be determined	This error occurs when an array dimension is dependent upon a template parameter. But an error occurs while it is being parsed and the template argument being substituted does not yield a legal constant expression.
E2509: Value out of range	The error here is because of numeric overflow in one of the expressions. Make sure all numbers fit in 32 bits.
E2100: Invalid template declarator list	It is illegal for a declarator list to follow a template class declaration.
E2249: = expected	In compiler, an error was reported but there was none. This is usually a syntax error or typo.

- Tell them the ways for debugging a microcontroller code:
  - In Circuit Emulator
  - ICD (PIC microcontroller)
  - Simulation
  - Serial RS232 Interface
  - Liquid Crystal Display (LCD)
  - Pin Debugging
  - Logic Analyser

## UNIT 4.7: Functioning of Microcontroller and Attached Devices

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the steps to check the microcontroller functions
- Describe how to use the Emulator to check the proper functioning of the devices
- List the communication hurdles

### Resources to be Used

- Available objects such as a duster, pen, notebook and sonon

### Do

- Revise the learning of the previous sessions and ask the participants if they have any doubts.

### Notes for Facilitation

- Start the session by telling the participants that they should understand the framework well. It will help them to identify the locations, where they need to install the nodes and gateways.
- Say that, they should check all the connections properly, so that there is no disruption in the functioning of the devices due to any loose connections.
- Tell them that they need to perform some of the following tests to check the functioning of the microcontroller board:
  - Set the baud rate and reset the controller
  - Perform GPIO test
  - Run an LCD display test
  - Run a real-time clock test
  - Perform Analog-to-digital converter (ADC) test
  - Perform a keypad test
- Also, tell them to check whether the microcontroller board is connected to the network.
- Tell them the steps to test the device's connectivity to the network.
- Further, tell them that they can manually check Wi-Fi module connectivity to the microcontroller board using the following steps:
  - Pick the WiFi Module from the Kit.
  - Connect the Arduino to the computer and the WiFi Modem to Arduino Uno Shield.
  - Connect the power adaptor and check for power indication on the WiFi module.

The following image shows an Arduino Uno board:

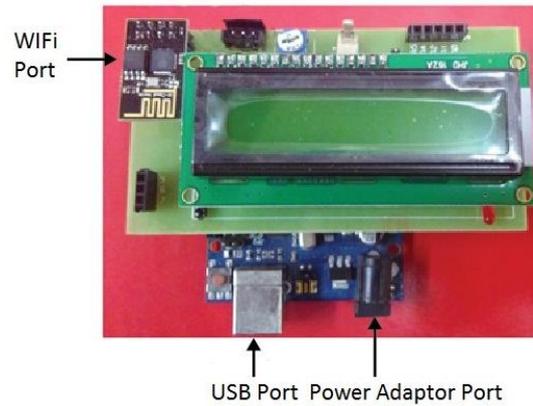


Fig 4.7.1: Arduino Uno board

- Download a demo code for the Wi-Fi module, say, WIFI Demo.txt file and copy the demo code to Arduino IDE.
- Change the “SSID” and “PASSWORD” from default to the ID and Password of the WiFi network being used.
- Upload the code in to Board from File > Upload.
- Check whether it is showing that the Wi-Fi module is connected to the Arduino board.
- Also, tell them that, if the board is not connected to the network, check whether the user ID and password are correct. The following screenshot shows setting the user ID and password:

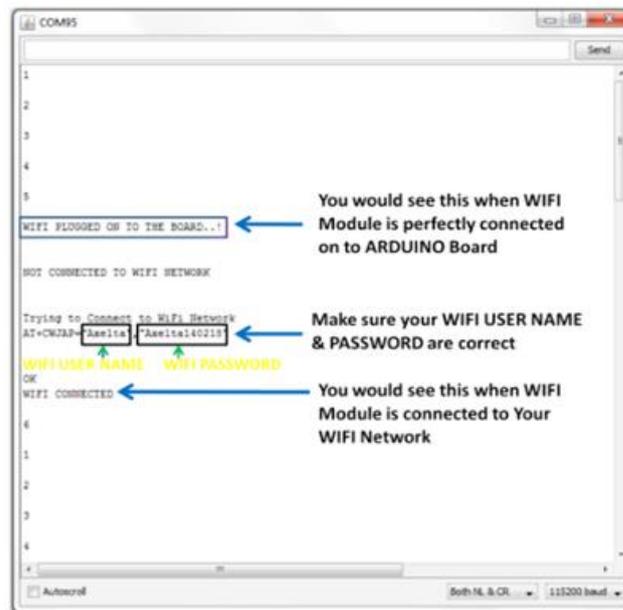


Fig 4.7.2: Setting the Wi-Fi user ID and password

- Further, tell them that, after code uploading is done:
  - Go to Sketch>Upload and save the code
  - Go to Tools > Serial Monitor
  - Change the settings such as BaudRate and format of the statements in serial monitor window

The following screenshot shows the serial monitor window:

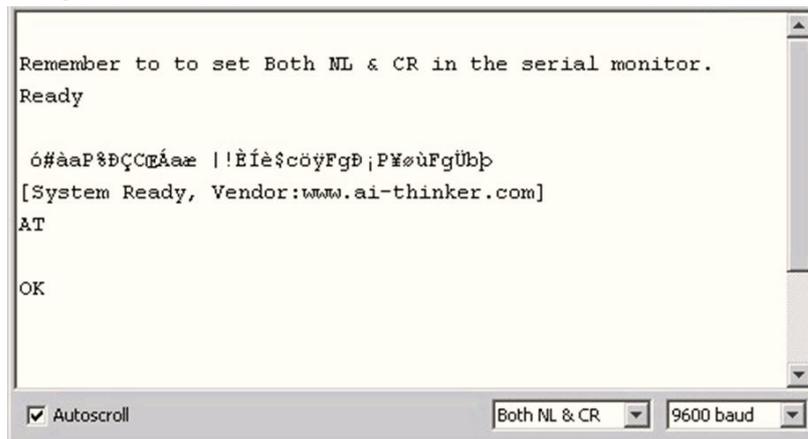


Fig 4.7.3: Serial monitor window

- Tell them that it will show a message “Board Working Fine” if the WIFI Module is working properly. Otherwise, it will give Garbage value errors. Also, tell them to contact the technical team to resolve any error. The following screenshot shows the monitor window with the Wi-Fi status:

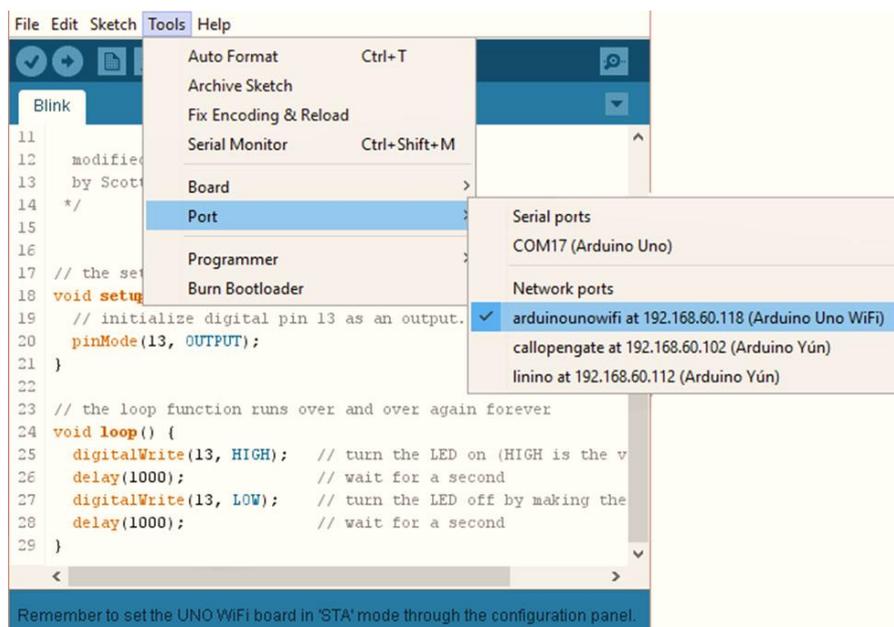


Fig 4.7.4: Serial monitor window with the Wi-Fi status

- Explain that there are three essential functions all emulators contain:
  1. The emulator control logic and emulation memory
  2. The actual emulation device
  3. The pinout adaptor
- Explain to them how to check the functioning of the microcontroller board using an emulator.

- Also, tell them that they should make sure that there are no communication hurdles and the connections are properly made.
- Exercise Handling Strategy:
  - Divide the number of participants into 2 groups.
  - Ask each group to answer the questions separately.
  - The answers are:
    - The following interactions can be enabled:
      - Change application settings, based on the current light conditions
      - Change the screen orientation (from portrait to landscape) as the device is flipped
      - Change alert mode in case of an incoming call; example: flip the device screen towards the table top to silence the device
      - Movement or gesture detection; example: a security camera with motion detection
      - Change the orientation of a map based on the device compass orientation.
- Exercise Handling Strategy:

Write down the steps to check the functioning of a Raspberry Pi microcontroller.

  - Connect the pins of the microcontroller.
  - Connect the controller board to the devices.
  - Connect the board to the monitoring system.
  - Upload the code to the microcontroller.
  - Check whether the display is working.
  - Check whether the display is showing the output properly.
- Practical solution:

Install and run a program on a Raspberry Pi board.

  1. Write the operating system image file onto the SD card.
  2. Select the image file extracted from the Raspbian ZIP file.
  3. Select the correct storage drive by choosing the drive letter in the dropdown menu below the device.
  4. Once the image is finished writing to the SD card, eject the drive.
  5. Insert it into the Raspberry Pi and power it on.
- Practical solution:

Install and run a program on an Arduino board.

  1. Download the Arduino software from its official site.
  2. Click on the downloaded installer file and install it.
  3. Connect the Arduino to the USB port.
  4. Run the Arduino software.
  5. Set the port to Arduino Uno.
  6. Set the COM port.
  7. Upload any sketch.

- Practical solution:  
Install an Arduino Uno software on a windows OS and configure for a fingerprint sensor.
  1. Download the Arduino software from its official site.
  2. Click on the downloaded installer file and install it.
  3. Connect the Arduino to the USB port.
  4. Run the Arduino software.
  5. Set the port to Arduino Uno.
  6. Now, hook up all the four wires of the fingerprint sensor to the breadboard.
  7. Connect power and ground.
  8. Hook up wires to digital pin 2 and 3 of Arduino board.
  9. Download the library for the fingerprint sensor.
  10. Once the library is loaded up go to Arduino software, click on the enrol option from the downloaded library option.
- Practical solution:  
Debug a Raspberry Pi board microcontroller.
 

**Step 1:** Establish connection between board and the computer system and then, access the serial terminal, set the baud rate at 9600 and reset the controller. Select fields for testing from the text menu.

**Step 2:** GPIO Test: Connect the LEDs, Buzzer and Relays to port pins and check if LEDs are blinking, buzzer is giving a beep sound, and Relay is chattering.

  - Press 1 to test GPIO pins
  - Press k key to run the code after connecting LEDs to the ports
  - Check if all LEDs are blinking or not

**Step 3:** LCD 8-bit Test: Connect the LCD pins.

  - Test LCD 8-bit mode by pressing '2' key
  - Establish connection as said before, followed by pressing 'k' to run the code

**Step 4:** Real-Time Clock (RTC) Test: Connect the RTC pins to P0 (SCL-P0.6, SDA-P0.7).

  - Press key 5 to run LCD 8-bit mode test
  - Establish connections as stated before followed by pressing 'k' key to run the code
  - After pressing 'k' key, an increase in RTC time and date is observed.

**Step 5:** Analog-to-digital converter (ADC) Test: The board houses temperature sensor, Pot and LDR. Values these sensors read and collect are sent on UART. Set all connection like before and press 'k' key to run the code.

**Step 6:** Keypad Test: Follow same procedure to set the connections and press 'k' key using the Hex keypad to run the code and check the output.

- Practical solution:

Perform cabling connection of a Raspberry Pi microcontroller board.

1. Take an add-on board like the Gertboard which has an Arduino compatible IC on it.
2. Plug a standard Arduino into the USB port of the Raspberry Pi.
3. Use a USB to Serial adapter with Arduino.
4. Use the Serial Pins on the Raspberry Pi to connect to Arduino.





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# 5. Interconnecting the Hubs and Edge Appliances

Unit 5.1 – Initializing Nodes and Gateways

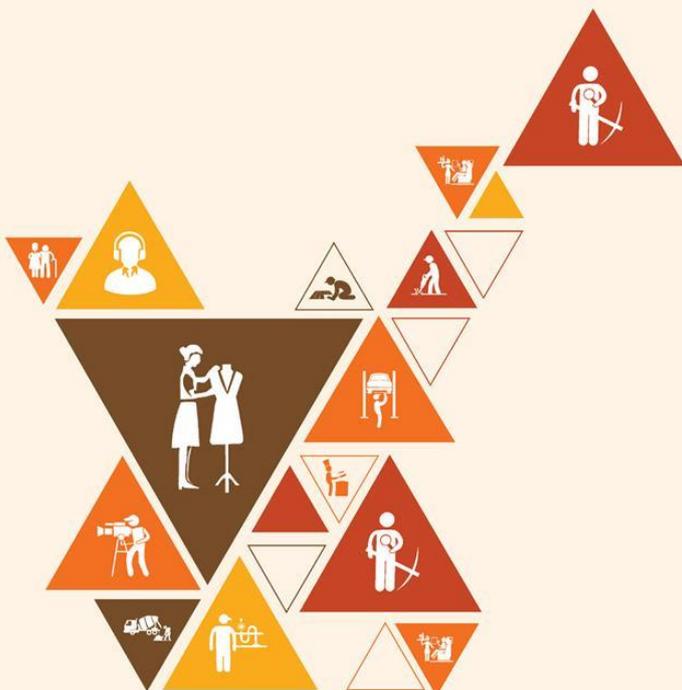
Unit 5.2 – Launching the Software on Nodes and Gateways

Unit 5.3 – Confirming Communication

Unit 5.4 – Establishing Connectivity

Unit 5.5 – Controlling Edge Appliances and Hubs

Unit 5.6 – Checking for Data Transfer and Confirming from the Server End



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## Key Learning Outcomes



By the end of this module, the trainees will be able to:

- Identify the prerequisites for initialization of nodes and gateways
- Explain the configuration of edge appliances
- Identify the steps of node and gateway initialization
- Describe how to check connectivity
- Explain the execution scenarios of software
- Identify the prerequisites for software installation
- Explain the challenges with launching software
- Explain the data transfer indicators
- Compare data transfer on various networks
- Explain different data transfer failure scenarios
- List the steps to connect to a network remotely
- Identify the steps to connect to short range networks
- Explain the configuration of a router
- Describe controlling of devices by connecting hub
- Explain the bypassing of a hub
- Explain the types of data transfer
- Identify various data transfer modes
- Explain how to control the data transfer

## UNIT 5.1: Initializing Nodes and Gateways

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify the prerequisites for initialization of nodes and gateways
- Explain the configuration of edge appliances
- Identify the steps of node and gateway initialization
- Describe how to check connectivity
- Explain the execution scenarios of software

### Resources

- IoT camera setup
- Related software
- Internet connection

### Ask

- Ask the participants about nodes and gateways for an IoT installation setup.
- Ask them whether they know about the different modes of network connection.

### Explain

- Explain to the participants the basic steps involved in installing an IoT camera set up, such as the following:
  - Basic hardware setup
  - Cable and power connection
  - Internet connection between the devices
  - Initialization of the devices

### Notes for Facilitation

- Start the session by asking the participants questions from previous lessons.
- Tell them about the steps and pre-installation activities.
- Tell them that they should identify the location of installation and check for the power points and network connectivity.
- Inform them that they must unpack the devices very carefully, and check if there is any missing or damaged item. If so, they should immediately report to the supervisor.
- Tell that, they should read the instructions for mounting the camera, since it depends on the type of the camera. The type of camera may be:
  - Box
  - Dome
  - PTZ.

- Further, say that, it is required to know the power requirements for the devices. The power requirements can be known from the power adapter specification label and the instruction manual.
- Tell them to check whether there is a network setup already installed or not. If there is none, tell them to install the network connection.
- Say that, they need to check whether the camera is connected to the network. For this, they need to:
  - Install the utility software, received with the package
  - Run the software
  - Find the camera along with its IP address and host name.
- Also, explain them the steps to configure the camera settings as shown in the following figure:

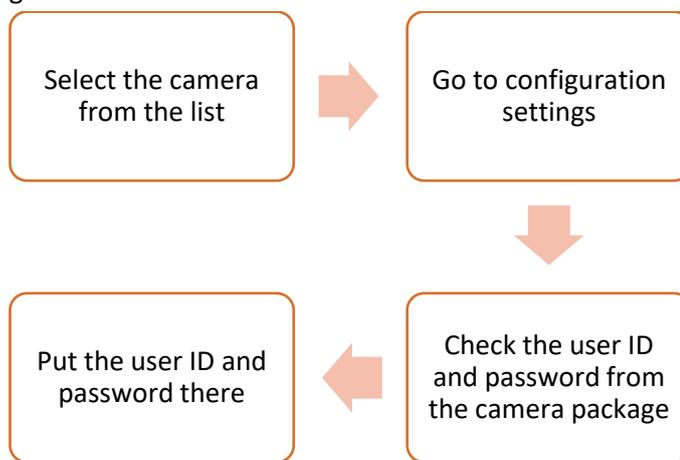


Fig 5.1.1: Configuring the camera

- Further, tell them to set the network connection mode.
- Tell them the steps for PPPoE settings with the help of the following figure:

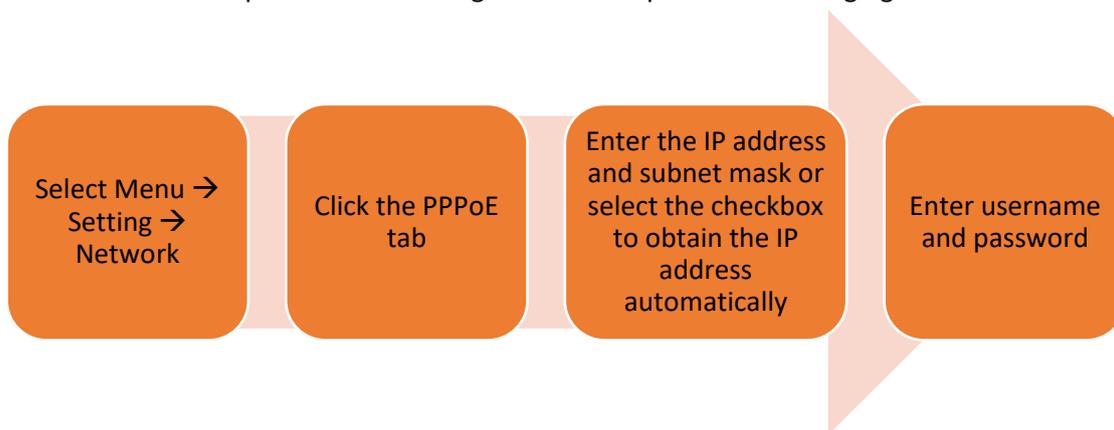


Fig 5.1.2: Steps for PPPoE settings

- Also, tell them if the user wants the Digital Video Recorder (DVR) to receive the IP address and network settings automatically from a Dynamic Host Configuration Protocol (DHCP) server, the DHCP checkbox should be selected.
- Also, explain the steps to install and configure the router.
- Tell them that they need to initialize all the devices to connect them to the network and enable them to be operated remotely.

- Explain the steps to install and configure the settings to connect network video recorder (NVR) to the network and also, to connect it to the cameras.
- In addition, tell them that, if it is required to connect the setup to an alarm system, the steps in the following figure need to be followed:

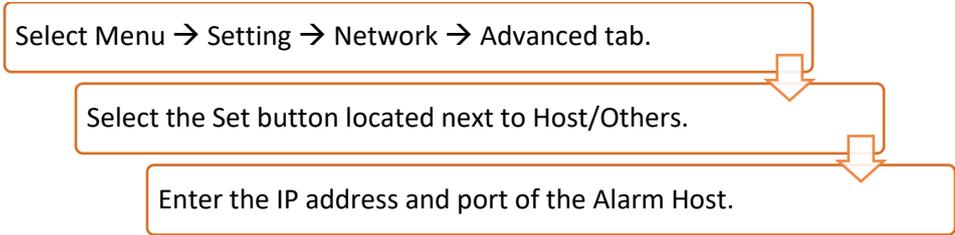


Fig. 5.1.3: Steps for setting up a remote alarm host

- Tell them to check the list of devices connected to the network to verify that all the nodes are connected and there are no such devices listed, which were not supposed to be.
- Briefly, explain the steps to initialize the gateway device.
- Also, inform them about the steps to secure the gateway and network, so that, no external body can access it.
- Also, tell them how to configure the gateway device so that the nodes can be accessed remotely.
- Tell them that they need to perform the following checks after the initialisation:
  - Test the network connectivity
  - Check the connection of the devices to the gateway
  - Connect a physical device to the gateway and test the connectivity
- Inform them about the parameters they need to know for the installation and configuration process.
- Tell them that the set up includes various types of IoT devices other than a camera and different manufacturers require different types of parameters to be filled in the configuration wizard of the IoT device. The following table shows the parameters:

Primary Interface	Hostname
	IP address
	Netmask
	Default gateway (the WAN gateway)
	DNS IP address
	Domain name for the device
	Administrator password
	SMTP server IP address
	Primary interface speed
In-Path Deployments	In-path interface IP address
	In-path netmask
	In-path gateway
	In-path: LAN interface speed and duplex
	In-path: WAN interface speed and duplex

- Show them different execution scenarios of related software.
- Exercise Handling Strategy:
  - Modes of network selection in setting up an IoT camera device:
    - **DHCP:** This option allows to connect to the network without providing any IP. The camera will automatically request the IP from the router.
    - **Manual:** In this option an IP address need to be provided in the TCP/IP section. Make sure that the IP is not used by some other network.
    - **PPPoE:** The camera can be directly connected with the modem using PPPoE protocol when the Internet service is using the PPPoE internet protocol. For this, the service provider need to be contacted to get the required details. The router uses the same PPPoE protocol setting; only the username and password is required.
- Exercise Handling Strategy:
  - Steps in gateway initialization:
    - Connect the power adapter to the back panel of the router.
    - Insert the Ethernet cable to the router and the computer system.
    - Configure the Internet connection and set up password.
    - Check the setup details as shows in the following screenshot:
    - Open Internet browser and type the default gateway address at the address bar.
    - Login to the account and the router details' window will open.
- Exercise Handling Strategy:
  - To test the network connectivity the steps given below are to be followed:
    - Open command prompt and type "ipconfig" and press enter. It shows the connection details and ensures that there is no problem in network connection.
    - Type "ping <gateway address>" to check there is no loss of packets and the router is working well.
  - To check the connection of the devices to the gateway, the steps given below are to be followed:
    - Launch the IoT device software installed on the laptop or desktop and open the default webserver page.
    - Check the status of each device and sensor to "OK". This means the devices are connected to the gateway or router.
  - To connect a physical device to the gateway and to test the connectivity, the steps given below are followed:
    - To do so in Microsoft azure suite, click on the devices to check the device parameters.
    - Click on "Add New"
    - Define the device ID
    - Configure the device ID and IoT hub name
    - Set the command for the device
    - Check whether the device is functioning according to the command

## UNIT 5.2: Launching the Software on Nodes and Gateways

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify the prerequisites for software installation
- Explain the challenges with launching software

### Resources

- IoT camera setup
- Related software
- Internet connection

### Ask

- Ask the participants if they can tell about the pre-requisites of launching a software interface on a device.

### Explain

- Explain the participants about the prerequisites of launching a software for the IoT framework.
- Explain to them that a software interface is required to control all the devices from a single device.
- Also, tell them that the software interface helps the operator to operate the devices easily and remotely.
- Tell them about various challenges faced in using the software interface:
  - Hardware-Software Compatibility
  - Device Interaction
  - Network Availability
- Exercise Handling Strategy:
  - Ask one participant randomly to tell the answers.
  - The prerequisites are: Cable connection, network connectivity, devices installed and related software.

## UNIT 5.3: Confirming Communication

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the data transfer indicators
- Compare data transfer on various networks
- Explain different data transfer failure scenarios

### Resources

- IoT camera setup
- Related software
- Internet connection

### Ask

- Ask the participants if they can tell the importance of indicators on the devices.
- Ask them if they remember various network communication technologies.

### Explain

- Explain to the participants how data transfer status can be understood from the indicators.
- Explain the comparison scenarios of data transfer via various networks.
- Explain to them the software used to test the data transfer.

### Notes for Facilitation

- Start the session by asking the participants the importance of indicators on the devices.
- Tell them about the common LED indications for:
  - WiFi
  - Ethernet
  - Online
  - Upstream
  - Downstream
  - Power
- Explain to them the comparison between the data transfer via Bluetooth and other communication methods regarding the following:
  - Frequency Bands
  - Channel Bandwidth
  - Data Rate

- Packet Length
- Power Consumption
- Also, tell them about the comparison between the data transfer over various networks regarding:
  - IEEE Specification
  - Frequency Band
  - Network Type
  - Power Consumption (mA)
  - Nominal Range (m)
  - Max. Signal Rate.
- Tell them that the mechanism and techniques of data transfer depend on the type of network. The different types of network are as follows:
  - Wi-Fi
  - Near Field Communication (NFC)
  - Z-Wave
  - Bluetooth LE
  - ZigBee
- Explain that the bluetooth, WI-Fi, ZigBee and cellular technologies are some popular standards. The wireless technologies support some remote data transfer, sensing and control on devices.
- Also, explain ZigBee is used in transmitting data between electronic devices within a short-distance. The transmission rate is not high. The applications that require low data rate as well as low power and are hard to replace or require charging of battery frequently, use ZigBee technology.
- Tell the participants that bluetooth LE has been designed for ultra- low-power applications. It can reuse classic Bluetooth circuitry components. The raw data rate of Bluetooth LE is 1 Mb/s. It has a range of up to few tens of meters. The following table lists the different Bluetooth technologies:

	<b>Bluetooth 4.2 LE</b>	<b>802.15.4</b>	<b>802.11</b>
<b>Frequency Bands</b>	2.4 GHz	900 MHz and 2.4 GHz	2.4 and 5 GHz
<b>Channel Bandwidth</b>	2 MHz	2 and 5 MHz	20.40.and 80 MHz
<b>Data Rate</b>	1 Mbps	Up to 250 Kbps	Up to 867 Mbps (2 antennas. 80 MHz); 72.2 Mbps for 1 antenna. 20 MHz channel
<b>Packet Length</b>	10-265 bytes	127 bytes	Up to 1.048.575 bytes
<b>Power Consumption</b>	< 10 mW	< 10 mW	> 100 mW

- Inform them about how to check the network status.
- Tell them that the network speed can also be checked by running a typical speed test on various websites. Besides, there are utility programs named "ping" for local networks. Versions of these programs are pre-installed in the desktop computers and laptops, and these are on the local network.
- Further, tell them some examples for testing the network speed and statistics:
  - LAN Speed Test (Lite)
  - LANBench
  - NetStress.
- **Explain NetStress as:**  
It is a simple network benchmarking tool that requires to be run on both the computers. It can find the receiver IP address automatically. It measures Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) throughput. The following screenshot shows a NetStress window:



Fig. 5.3.1: NetStress window

- Tell them that digital storage oscilloscope is used to check various events with time stamps, glitches in power supply and signal integrity check.
- Also, tell them software defined radio is used to emulate receiver and transmitter for a large range of wireless gateways.

- Explain different data transfer failure scenarios to them, such as:
  - Transferring data from a computer to cloud takes longer than expected time.
  - Device is not in range of network.
  - Faulty network hardware causes performance issues. It causes mismatch in network speeds.
  - Network hubs can cause auto-negotiation mismatches, network packet collisions and packet drops.
  - Outdated Firmware can affect network performance
  - Data transfer over 2.4 and 5 GHz Wi-Fi bands is much slower than wired Ethernet.
  - 3rd party applications contribute to network traffic by scanning and downloading content.
  - Backup functions consume CPU, memory and disk access resources and decrease data transfer rates.
- Exercise Handling Strategy:
  - Draw the table on the board and ask the participants to come to the board one by one and write the answers.

	ZigBee	Bluetooth LE	Z-Wave	NFC	Wi-Fi
IEEE Specification	802.15.4	802.15.1	ITU -T	ISO 13157	802.11 a/b/g
Frequency Band	868/915 MHz; 2.4 GHz	2.4 – 2.5 GHz	908.42 MHz	13.56 MHz	2.4 GHz; 5 GHz
Network Type	WPAN	WPAN	WPAN	P2P	WPAN
Power Consumption (mA)	40	12.5	2.5	50	116
Nominal Range (m)	10	50	30	.05	100
Max. Signal Rate	250 kbps	305 kbps	40-100 kbps	424 kbps	54 Mbps

- Ask any 5 participants to tell the answers one by one.

Issue	Cause / Solution
Faulty network hardware cause performance issues. It causes mismatch in network speeds.	<ul style="list-style-type: none"> <li>• USB 3.0 or higher port along with a high-quality USB cable should be used.</li> <li>• Faulty and outdated networking devices must be used.</li> </ul>
Network hubs can cause auto-negotiation mismatches, network packet collisions and packet drops.	Network hubs should be replaced with Gigabit switches.
Outdated firmware can affect network performance.	Network equipment firmware must be updated, and outdated hardware should be replaced.
Data transfer over 2.4 and 5 GHz Wi-Fi bands is much slower than wired Ethernet.	<ul style="list-style-type: none"> <li>• Direct connection using Ethernet cable is better than the wireless one.</li> <li>• If an Ethernet connection is not possible, connect using the 5 GHz band.</li> </ul>
3rd party applications contribute to network traffic by scanning and downloading content.	Ensure 3rd party applications are not indexing or virus scanning.

## UNIT 5.4: Establishing Connectivity

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the steps to connect to a network remotely
- Identify the steps to connect to short range networks

### Resources

- IoT camera setup
- Related software
- Internet connection

### Explain

- Explain to the participants how to access a device from an external network.
- Explain how to connect a device to different networks.

### Notes for Facilitation

- Start the session by telling the participants that a user may need to access the nodes when he/she is out of home. Hence, external connectivity is required, to access the devices from different networks.
- Explain how to access a router or any device remotely, with the help of the steps shown in the following figure:

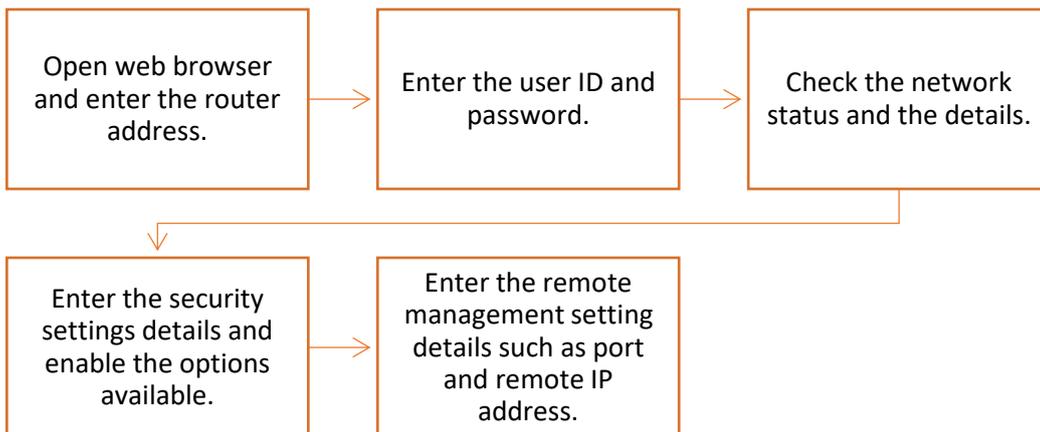


Fig. 5.4.1: Steps to access a router or any device remotely

- Explain the steps to connect a Raspberry Pi to another system via Bluetooth, with the help of the following figure:

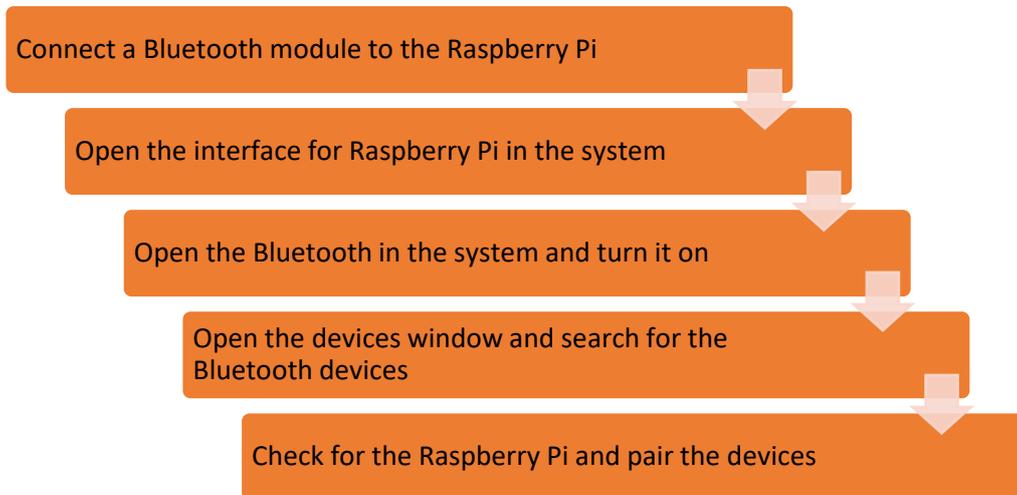


Fig. 5.4.2: Steps to connect a Raspberry Pi to another system via Bluetooth

- Explain the steps to connect an Arduino board to another system via ZigBee, with the help of the following figure:

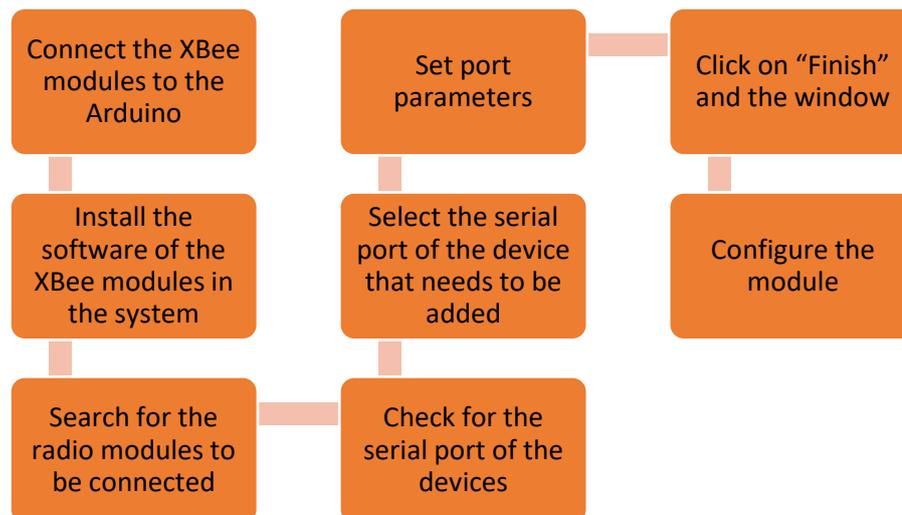


Fig. 5.4.3: Steps to connect an Arduino board to another system via ZigBee

- Exercise Handling Strategy:
  - Ask any two participants to mention the steps for connecting a Bluetooth using Raspberry Pi framework:
    - Step 1: Connect the XBee modules to the Arduino.
    - Step 2: Install the software of the XBee modules in the system.
    - Step 3: Search for the radio modules in the options
    - Step 4: Select the serial port of the device that needs to be added
    - Step 5: Click on "Finish"
    - Step 6: Configure the module

## UNIT 5.5: Controlling Edge Appliances and Hubs

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the configuration of a router
- Describe controlling of devices by connecting hub
- Explain the bypassing of a hub

### Resources

- Router
- Related software
- Internet connection
- Laptop, tablet or computer

### Ask

- Ask the participants if they can configure a router.

### Explain

- Explain the steps to configure a router.
- Explain a hub.

### Notes for Facilitation

- Start the session by asking the participants questions from previous lessons.
- Explain the steps to configure router settings.
- Tell them how to control the devices by connecting them to a hub. Show them how a hub looks like, with the help of the following image:

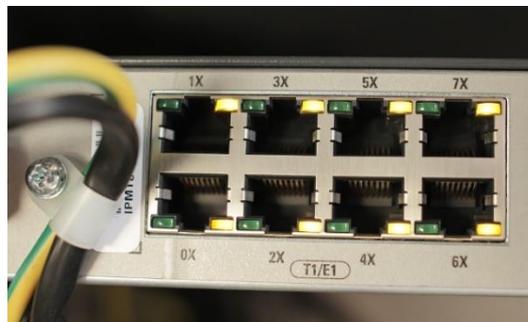


Fig. 5.5.1: A network hub

- Tell them that a technician needs to perform a regular check on the information, alerts, storage, and notifications send from the edge devices.
- A technician needs to keep a tab on the working of each edge device and gateway connected in a system network.

- Also, tell them that a hub is a hardware device that helps in data communication. It sends data packets to all devices on a network. It is used to connect segments of a LAN.
- Tell them how to bypass a hub.
- Also, tell them how to activate bridge mode to bypass a hub.
- Exercise Handling Strategy:
  - Ask any 2 participants to answer the questions.
  - Ask others, if the answers were correct.
    - The steps for configuring Bridge mode:
      - Connect to the router by entering its IP address in the browser's address bar. In most cases it'll be https://192.168.1.1
      - Login using the default username and password – generally, username will be “admin” and password will be “admin” or “password.” The default username and password would be mentioned in the router's manual, or may be printed on the router itself.
      - Next, click on Network and disable DHCP. Save.
      - Reconnect and remove the username and password. Save again.
    - The steps for configuring a router:
      - Access the router configuration page using a web browser on the computer.
      - Type in the username and password to arrive at the configuration settings page.
      - After gaining access on the router's management page, click on Network > WAN and change WAN connection type to PPPoE.
      - Change the settings as required.

## UNIT 5.6: Checking for Data Transfer and Confirming from the Server End

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the types of data transfer
- Identify various data transfer modes
- Explain how to control the data transfer

### Resources

- Router
- Related software
- Internet connection
- Laptop, tablet or computer

### Ask

- Ask the participants what they know about data transfer.

### Explain

- Explain the steps to configure a router.
- Explain a hub.

### Notes for Facilitation

- Tell the participants about different types of data transfer:
  - Interrupt Transfer
  - Bulk Transfer
  - Isochronous Transfer
  - Control Transfer
- Tell that Interrupt Transfer is intended for devices that send and receive small amounts of data infrequently or in an asynchronous time frame. This transfer type can be used for low-, full- and high-speed devices.
- Interrupt transfer type guarantees a maximum service period and that delivery will be re-attempted in the next period if there is an error on the bus. The interrupt transfer is unidirectional and periodical.
- Explain that bulk transfer is typically used for devices that transfer large amounts of non-time sensitive data, and that can use any available bandwidth, such as printers and scanners. This transfer type can be used by full-speed and high-speed devices, but not by low-speed devices.

- Bulk transfer allows access to the bus on an "as-available" basis, guarantees the data transfer but not the latency and provides an error check mechanism with retries attempts. If part of the USB bandwidth is not being used for other transfers, the system will use it for bulk transfer.
- Tell them that isochronous transfer is generally used for multimedia streams and telephony. This transfer type can be used by full-speed and high-speed devices, but not by low-speed devices.
- Also, tell that isochronous transfer is unidirectional. Bi-directional isochronous transfer requires two isochronous pipes, one in each direction.
- Since timeliness is more important than correctness in this type of transfer, no retries are made in case of error in the data transfer. However, the data receiver can determine that an error occurred on the bus.
- Tell them that control transfer is used for supporting configuration, command and status operations between the software on the host and the device. This transfer type is used for low-, full- and high-speed devices.
- In addition, tell that control transfer allows data flow in both directions.
- Explain to them about various data transfer modes:
  - Simplex
  - Half duplex
  - Duplex.
- Lastly, tell them how to control data transfer by changing the settings of the router.
- Exercise Handling Strategy:
  - Ask one participant to tell the type of data transfer.
  - Ask others to tell the features.
  - The types of transfers are:
    - Interrupt Transfer
    - Bulk Transfer
    - Isochronous Transfer
    - Control Transfer.

Practical solution:

Perform a Zigbee gateway set up for a smart home set up.

1. Connect the zigbee with Internet using the Ethernet cable.
2. Connect the power supply cable to the zigbee.
3. Connect the mobile phone to the same Wi-Fi.
4. An application will appear on the phone.
5. Open the application and pair up the gateway.
6. Now the home system can be operated using the application.

Practical solution:

Perform a Raspberry Pi board Bluetooth network configuration.

1. Power on the Raspberry Pi.
2. Go into "search or connect mode"
3. Connect the Bluetooth of the phone to the Raspberry Pi.

4. An app on the device will ask for WiFi name and WiFi password
5. The app generates the wpa\_supplicant.conf and writes the new wpa\_supplicant.conf to the /etc/wpa\_supplicant/ via Bluetooth

Practical solution:

Perform a Raspberry Pi serial console connection over Bluetooth.

On Android phone:

1. Open Settings
2. Select Bluetooth
3. This will make the phone “discoverable”

On Raspberry Pi:

1. Click Bluetooth ► Turn On Bluetooth
2. Click Bluetooth ► Make Discoverable
3. Click Bluetooth ► Add Device
4. Phone will appear in the list, select it and click Pair
5. Enter a PIN code

On Android phone again:

1. Enter the same PIN code when prompted
2. Touch “OK”.



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## 6. Configuring Devices

Unit 6.1 – Testing Connectivity between Devices

Unit 6.2 – Checking Connectivity between Devices

Unit 6.3 – Checking On-board Memory Storage Card

Unit 6.4 – Testing Working of Connectivity Modules

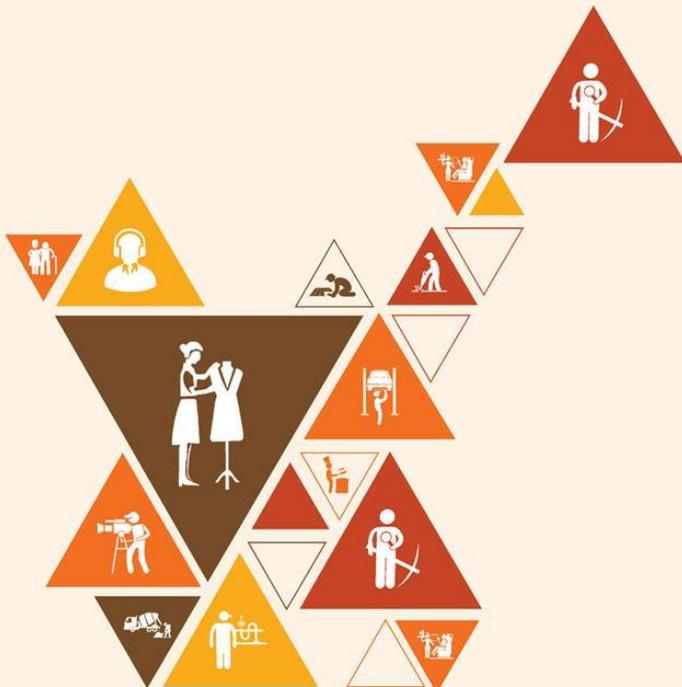
Unit 6.5 – Checking On-board Power Supply

Unit 6.6 – Checking Communication Link Performance Matrix

Unit 6.7 – Checking Data Transfer from Gateway to Server

Unit 6.8 – Checking Communication between Devices

Unit 6.9 – Setting Connectivity Credentials



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## Key Learning Outcomes



By the end of this module, the trainees will be able to:

- Identify the types of IOT testing
- Explain connectivity of IoT devices
- Explain the IoT test approaches
- List the IoT test challenges and IoT testing tools
- Describe testing pin configuration
- Explain the different ways of connecting the IoT gateway to the nodes
- List the tools to verify networking connectivity
- Explain the role of event viewer and hardware in verifying network connectivity
- Explain the role of local connectivity
- List the steps to check on-board memory storage card for storing node data in Raspberry Pi
- Explain the two ways to store data locally for the Arduino boards.
- List the parameters to check working of on-board Wi-Fi or a 3G, 4G connectivity module
- Explain the role of range, bandwidth, Intermittent connectivity and security
- List the steps to run Wireshark
- Explain the checking of on-board power supply
- Demonstrate checking of power supply at different hardware configurations
- List the parameters affecting the performance matrix of node and gateway connections
- Explain the role of Maximum transmission unit (MTU), data loss, delay and reliability
- Identify the basic troubleshooting steps to check the data transfer between the gateway and the server
- Identify the Secure Internal Communication (SIC) ports
- Explain the checking of SIC and gateway connectivity
- Identify the steps for loading software and testing the communication between devices
- Explain starting a node, checking active links and establishing a session
- Describe securing of devices using the MQTT protocol
- Explain device authentication based on user id/password
- Explain device authentication based on one-time password (OTP)

## UNIT 6.1: Testing Connectivity between Devices

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify the types of IOT testing
- Explain connectivity of IoT devices
- Explain the IoT test approaches
- List the IoT test challenges and IoT testing tools
- Describe testing pin configuration

### Ask

- Ask the participants if they know about IoT testing.

### Say

- Tell the participants that they should know about the testing of devices and connection that should be done after the installation activities.

### Notes for Facilitation

- Make the session interactive by involving the participants in a discussion and introduce the topics to them.
- Tell them that the various testing related to IoT are as follows:
  - Usability testing
  - Compatibility testing
  - Protocol and device interoperability testing
  - Security and privacy testing
  - Upgrade testing
  - Performance and real-time testing
  - End user application testing
  - Connectivity Testing
- Tell them that the devices should be configured in such a way that they can notify warning and error messages.
- Tell them that they should select the protocol correctly, as per the requirements. Also, they need to check the compatibility of the devices and communication technologies with the protocol being used.
- Explain to the participants about the security of IoT devices and also, tell them that they should configure the gateway devices and make them secure.
- They need to upgrade the software, if it is required.
- In addition, tell them that they should check the device connectivity, both offline and online.

- Tell them to check whether the indicators' lights are on and also, show the various execution scenarios. For example, if a motion detector and an alarm are installed, show the user that the motion is detected in the system, it is showing error messages and also it is raising alarms.
- Tell them about the following testing challenges:
  - Network availability
  - Device compatibility
  - Power problem
- Also, tell them about testing tools, such as:
  - Wireshark and Tcpdump software
  - JTAG (Joint Test Action Group) Dongle, Digital Storage Oscilloscope and Software Defined Radio
- Explain to them how to test the pin configuration of a microcontroller board.
- Exercise handling Strategy:
  - Ask them to write the types of testing in IoT. The solution is as follows:
    - a. Usability testing
    - b. Compatibility testing
    - c. Protocol and device interoperability testing
    - d. Security and privacy testing
    - e. Upgrade testing
    - f. Performance and real-time testing
    - g. End user application testing
    - h. Connectivity Testing
  - Ask them to write some basic points to remember for end user/pilot testing in IoT. The solution is as follows:
    - a. As far as the IoT is concerned, pilot testing is a must.
    - b. Testing only in a lab makes sure that the product/system works appropriately. But, this may backfire badly when exposed to real-time conditions/steps/scenarios.
    - c. During pilot testing, the system is exposed to a limited number of users in the real field. They use the application and give feedbacks on the system.
    - d. These comments come in handy to make rectifications so that the application becomes robust enough for production deployment.

## UNIT 6.2: Checking Connectivity between Devices

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the different ways of connecting the IoT gateway to the nodes
- List the tools to verify networking connectivity
- Explain the role of event viewer and hardware in verifying network connectivity
- Explain the role of local connectivity

### Ask

- Ask the participants if they know about the different ways the nodes and the gateway can be connected.

### Notes for Facilitation

- Make the session interactive by involving the participants in a discussion and introduce the topics to them.
- Tell them that nodes can be connected via a gateway device or directly.
- Tell them that they should check the network connectivity between the devices. The functioning of network may be checked using various tools, such as Event Viewer.
- The Event Viewer is a tool in Windows OS which displays detailed information about important events on the system. The events may be:
  - An application may not start as expected
  - An application has automatically downloaded updates
- Tell them that the Event Viewer is useful for troubleshooting application errors.
- In addition, tell them that Windows event log records the alerts and notifications in a computer.
- Say that, to use Event Viewer tool, they need to do the following:
  - Check the event log.
  - Check the system log folder and analyse the type of error warning lists
  - Visit the event properties page for each error warning
  - Use the nethelpmsg command to get the description of the error.
- Also, tell them to check the connectivity of hardware devices as follows:
  - Check the cables for their functionality.
  - Check the server operation guide to check hardware functionality.
  - Check the network adaptors and drivers' functionality through the control panel.
  - Select the device from the device box and check the property.
  - Troubleshoot a device, if it is not working properly.
- Tell them that for configuring the network they will require the following information:
  - IP address
  - Gateway address

- Protocol
- Subnet mask
- Tell them to use ping command to check the network connectivity. Also, show practically the use of ping command.
- Exercise handling Strategy:
  - Ask the participants to write the steps to configure IP details. The solution is as follows:
    1. Open the command prompt, type ipconfig and press ENTER
    2. In the output look for:
      - a. IP address
      - b. Default gateway
      - c. DHCP server
    3. Use ping tool to get the network connectivity between default gateway and DHCP server.
  - Ask the participants to write the steps to test TCP/IP connectivity by using ping command bare. The solution is as follows:
    1. Open the command prompt, type the following to ping the loopback address:  
127.0.0.1  
If it fails, then verify that the computer was restricted after TCP/IP was installed and configured.
    2. Ping the IP address of the computer.  
If the ping command fails, then restart the computer to check whether the computer is with TCP/IP installed and configured.
    3. Ping the IP address of default gateway.  
If the ping command fails, verify the default gateway IP and check if the router is operational.
    4. Ping the IP address of remote host.  
If the ping fails, check the correctness of remote host IP address; see that it is operational and the router between host and remote computer is operational.
    5. Ping the IP address of the DNS server.  
If the command fails then verify the DNS server IP address correctness; also check that the DNS server is operational and the router between the computer and the DNS server is operational.

## UNIT 6.3: Checking On-board Memory Storage Card

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List steps to check on-board memory storage card for storing node data in Raspberry Pi
- Explain the two ways to store data locally for the Arduino boards.

### Resources

- Raspberry pi and Arduino board
- Related software
- SD card
- Laptop, tablet or computer

### Notes for Facilitation

- Tell the participants that some microcontroller boards come with built-in secure digital (SD) drive and can work as storage devices.
- Also, tell them that Raspberry Pi has built-in storage, but Arduino board does not have. It requires an SD card shield to attach a local memory storage to it.
- Tell the steps to check the memory storage of the microcontroller boards.

## UNIT 6.4: Testing Working of Connectivity Modules

### Unit Objectives

By the end of this unit, the trainees will be able to:

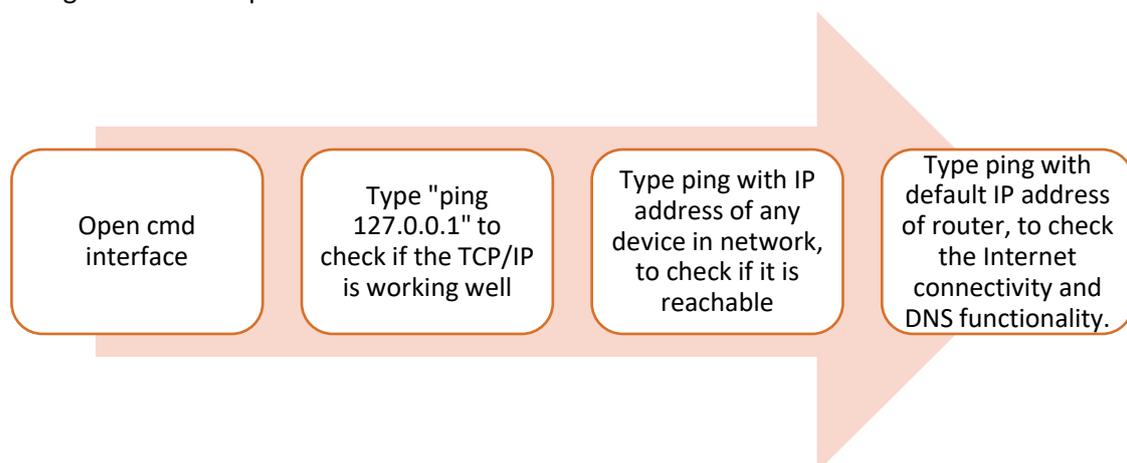
- List the parameters to check working of on-board Wi-Fi or a 3G, 4G connectivity module
- Explain the role of range, bandwidth, Intermittent connectivity and security
- List the steps to run Wireshark

### Ask

- Ask the participants if they know about the parameters that should be known while checking the on-board Wi-Fi or Bluetooth module.

### Notes for Facilitation

- Start the session by involving the participants in a discussion and asking questions from previous modules.
- Tell them that they need to know the range, bandwidth, intermittent connectivity and security details while working with the connectivity module.
- Tell them to check the indicators to get an idea about the signal strength and transmission.
- Say that, to test whether there is any loss of packets, the steps shown in the following figure should be performed:



*Fig. 6.4.1: Steps to test whether there is any loss of packets*

- Tell them the steps to check the bandwidth.
- Explain to them why it is important to check the intermittent connectivity. Tell them that it helps them to identify whether the fault is in wired or wireless connection.
- Also, tell the how to troubleshoot network issues using the Wireshark tool.
- Check that all the devices are listed in the network and are shown on the control device's interface.

- Exercise handling Strategy:
  - Ask the participants to write the steps involved in testing the packet loss in network. The solution is as follows:
    1. For windows, click start button and enter “cmd’ in search field section. Then, press ENTER.
    2. Type the ping followed by an IP address and then press ENTER. The following are some common ping commands:
      - Ping 127.0.0.1:** This is a “loopback ping” in which if the loopback step fails, then the TCP driver might be corrupted, the network adaptor might not be working or IP has been interfered by another service.
      - Ping:** This will ping IP address of a local computer of a remote server or any client that receives the IP address to verify that it is reachable. Example, ping 192.168.1.1 which is default IP address of NETGEAR router.
      - Ping:** This command will test the Internet connectivity and DNS functionality. Example, ping google.com.
  - Ask the participants to write the factors to be considered for testing the bandwidth of an lot network. The solution is as follows:
    1. The volume of data that each device is generating
    2. The number of devices that are deployed in a network
    3. The way the data is being sent; as a constant stream or in intermittent bursts, as the bandwidth that is available will need to cope with the peak periods

## UNIT 6.5: Checking the On-board Power Supply

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the checking of on-board power supply
- Demonstrate checking of power supply at different hardware configurations

### Notes for Facilitation

- Tell the participants to check the power requirements of the devices, nodes and gateways.
- Then, tell them the power requirements of a Raspberry Pi, with the help of the following figure:

Maximum power used by Raspberry Pi	○1 Amp
Power used by the GPIO pins	○50mA
Power used by an individual GPIO pin	○16mA
Power used by an HDMI port	○50mA
Power required by the camera module	○250mA
Power required by keyboards and mice	○100mA or over 1000mA

*Fig. 6.5.1: Power requirements of a Raspberry Pi*

- Tell them how to check the power supply of a microcontroller board using a multimeter.
- Tell them to check the power supply at different hardware configurations:
  - Normal Mode + WLAN + LAN
  - Normal Mode + WLAN
  - Normal Mode + LAN + USB Keyboard + Mouse
  - Normal Mode + LAN
  - Normal / Idle Mode
  - Power Down Mode
- Exercise Handling Strategy:
  - Ask the participants to write the different types of hardware considerations for IoT hardware power testing. The solution is as follows:
    - a. Normal Mode + WLAN + LAN
    - b. Normal Mode + WLAN
    - c. Normal Mode + LAN + USB Keyboard + Mouse
    - d. Normal Mode + LAN
    - e. Normal / Idle Mode
    - f. Power Down Mode

## UNIT 6.6: Checking Communication Link Performance Matrix

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the parameters affecting the performance matrix of node and gateway connections
- Explain the role of Maximum Transmission Unit (MTU), data loss, delay and reliability

### Ask

- Ask the participants if they can tell the parameters affecting the performance of node and gateway connections.

### Notes for Facilitation

- Start the session by asking questions to the participants regarding the previous sessions.
- Tell them that the parameters affecting the performance of a node and a gateway connection are:
  - Maximum transmission unit
  - Data loss
  - Delay
  - Reliability
- Explain the steps to check the transmission units through a network. Tell that from the output, they can get know the maximum unit that can be transmitted to a node over a network.
- Also, tell them the steps to know the amount of data loss and network latency.
- Explain to them how to test the delay in the network, using:
  - Ping
  - Traceroute
- Tell them that reliability of a network should be considered while working with IoT devices.
- Also, inform them that reliability is concerned with the ability of a network to carry out a desired operation such as "communication".
- Tell them that a network's reliability is measured on the following factors:
  - Downtime: The time it takes to recover.
  - Failure Frequency: The frequency when it fails to work the way it is intended.

- Exercise Handling Strategy:
  - Ask the participants to write down the steps to check the data loss in the network. The solution is as follows:
    - a. Begin the packet loss test. Open Windows menu to locate the command processor.
    - b. Identify the IP address of the gateway.
    - c. Now, ping the IP of the gateway.
    - d. To test the packet loss, ping a website from the network.
    - e. It will provide the network latency reported as round-trip time (RTT) in milliseconds (ms).

## UNIT 6.7: Checking Data Transfer from Gateway to Server

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify the basic troubleshooting steps to check the data transfer between the gateway and the server
- Identify the Secure Internal Communication (SIC) ports
- Explain the checking of SIC and gateway connectivity

### Notes for Facilitation

- Tell the participants that the IoT devices should be connected to the gateway and then to the server for the analytical process.
- Inform them that to connect the device to a cloud server, an account of the cloud platform is required. For example, Carriots is a freely accessible cloud platform.
- Before sending data to the cloud, the Carriots platform needs to be configured as per requirements, to manage the data. Carriots uses a hierarchical structure to group and manage devices. Therefore, create this structure before using the device.
- Tell them that the possible steps to configure the cloud server account as per requirements are as follows:
  - Create a project under which all the sensor data would be stored. The following screenshot shows creating a project:

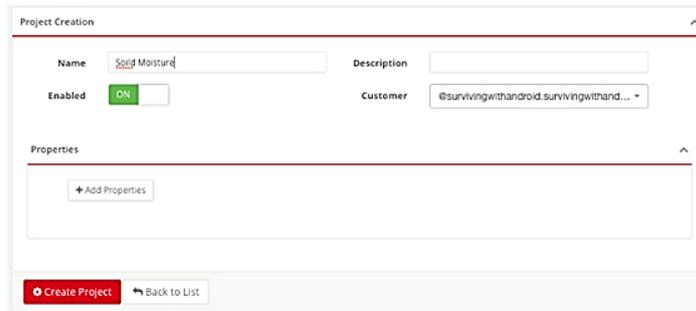


Fig. 6.7.1: Creating a project

- Fill the details of the devices which are in service, and then create a group for the devices:

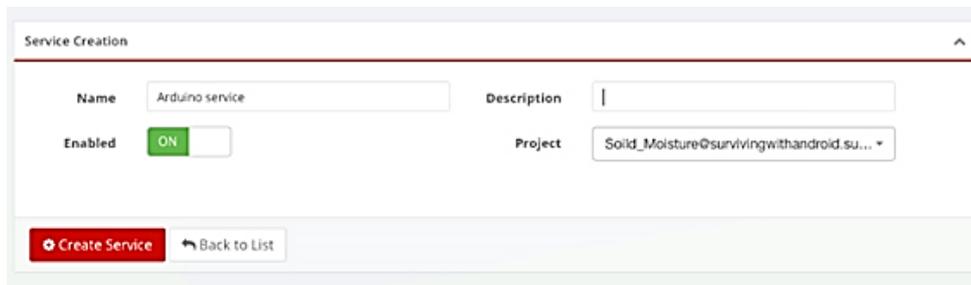


Fig. 6.7.2: Filling the details

- Configure the devices which are used to send the data. The following screenshot shows configuring the devices:

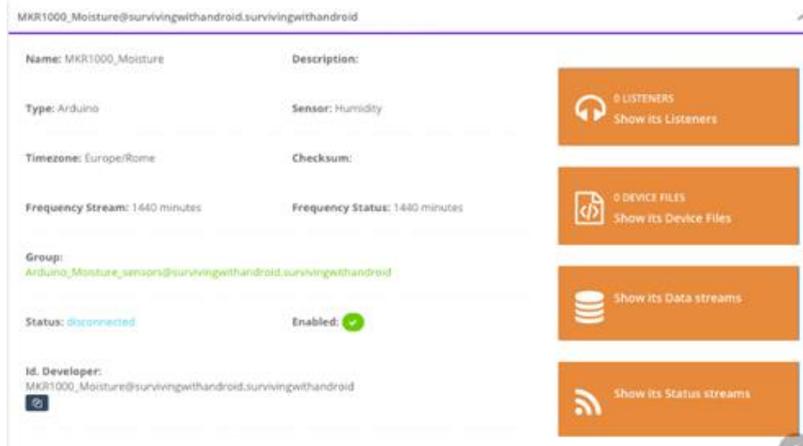


Fig. 6.7.3: Configuring the devices

- Tell them that, for the Carriots IoT system, it uses Carriots listener as a monitoring and alerting system.
- In addition, tell that a listener is a process that analyses the incoming values and applies a specific rule. When the rule is verified, then it invokes a script.
- Tell them about configuring triggers for the sensor devices and enabling messaging service by configuring all the required parameters such as the destination device identification and the message body as shown in the following figure:

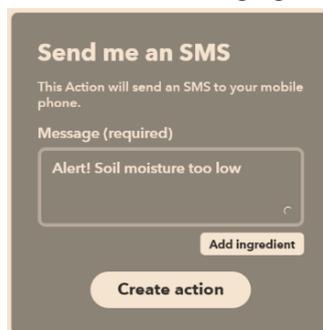


Fig. 6.7.4: Enable messaging service

- Tell them about the basic troubleshooting steps for the data transfer between the gateway and the server.
- Also, tell them to check whether both the server and the gateways are using the secure internal communication (SIC) activation keys.
- Exercise Handling Strategy:
  - Ask the participants to write the types of SIC ports that need to be checked while testing the network connectivity. The solution is as follows:
    - a. Port 18209: This port is used for communication between the VPN-1/Firewall-1 Module and the certificate authority (status, issue, revoke).
    - b. Port 18210: This port is used to pull certificate from the CA.
    - c. Port 18211: This port is used by the cpd daemon on the module to receive the certificate (when clicked on the initialize in the policy editor).

## UNIT 6.8: Checking the Communication between Devices

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify the steps for loading the software and testing the communication between the devices
- Explain starting a node, checking active links and establishing a session

### Notes for Facilitation

- Start the session by discussing about nodes and gateways.
- Tell them the basic steps to test the functioning of node and gateway software with the help of the following figure:



*Fig. 6.8.1: Test the functioning of node and gateway software*

- Exercise Handling Strategy:
  - Ask the participants to write down the steps taken to check the links in an IoT network. The solution is as follows:
    - a. Locate the host resource icon which is on the left side of the SNA node operation window. Select the “+” icon to expand the list of resources.
    - b. Click the connections (for CPI-C and APPC configurations, click peer connections).
    - c. Click on the details icon on the toolbar to get the details about the displayed links.

## UNIT 6.9: Setting Connectivity Credentials

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Describe securing of devices using the MQTT protocol
- Explain device authentication based on user id/password
- Explain device authentication based on one-time password (OTP)

### Ask

- Ask the participants if they know about the different ways the nodes and gateway can be connected.

### Notes for Facilitation

- Make the session interactive by involving the participants in a discussion about securing the devices.
- Tell them that in case of IoT, security of the devices is of utmost importance.
- Inform them that the devices connected to a network can be secured by the ways as shown in the following figure:



Fig. 6.9.1: Securing the devices

- Explain the process of authentication one by one.
- Explain the OTP authentication process with the help of the following figure:

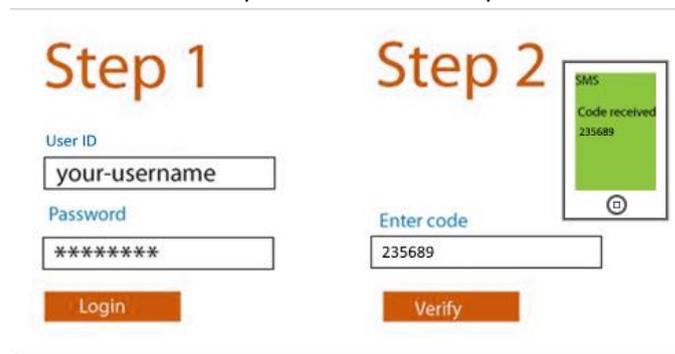


Fig. 6.9.2: OTP authentication process

- Exercise Handling Strategy:
  - Ask the participants to mention the methods of authentication of any IoT set up. The solution is:
    - a. Authenticating with a User Name and Password
    - b. Authenticating with OTP Authentication
- Practical Solution:
  - Check the on-board memory storage card for storing node data in Raspberry Pi.
    1. Open a new command line/terminal session
    2. Run the following command and press enter: Df
    3. This will display the total disk usage for the SD card in columns.
    4. To make it more readable, add the -h flag, which will add G and M units for gigabytes and megabytes: df -h
  - Run and capture data loss by using Wireshark in a network.
    1. Download and install the Wireshark
    2. Open the Wireshark on the system
    3. Click the gear icon on the top of the window
    4. Make sure that the monitor mode is enabled for en0 interface
    5. Click on the close icon and restart the Wireshark
    6. Start capture on en0, a beacon, control and management frame interspersed with data frames.
  - Perform test delay in a network.
    1. Enter the commands for testing network and Internet latency directly at the command line.
    2. Run a Ping loopback test. The Ping loopback test will test the computer's connection to verify that there are no local hardware problems causing the network or Internet latency issue.
    3. Type "Ping 127.0.0.1 -n 20". This IP address is the same for nearly all built in network connections. The "-n 20" extension will send 20 packets of data before terminating the test.
    4. View the statistics. The time it took for the packet of data to travel locally should be less than 5minutes and there should be zero packet loss.
    5. Run Ping to a remote server. Now that it has been verified that the local port is working, Ping remote servers to test the latency.
    6. Normal latency varies according to the type of connection from 5 - 40ms for cable modem, 10 - 70ms for DSL, 100 to 220ms for dial-up to 200 - 600 for cellular. The distance to the remote server also adds to latency.
    7. Type "Ping" followed by the IP address or site URL to be pinged and hit Enter.
    8. View the report. As the test pings the remote address, it will report back the results; the final number after the "time = "is the time it took, in milliseconds, for the packet to travel to the remote site and back to the computer.

9. Run the traceroute test. The traceroute test will show the path that data travels from the computer to the remote server and any delay in that path. This can be helpful in determining the source of network or Internet delays.
10. Type “tracert” followed by the IP address or site URL to route and hit Enter.
11. View the results. As the test traces the path, it will display each address along the way and the time it took for a data packet to travel to it, and it will acknowledge receipt for each “hop” along the path. The more “hops” or other devices the data packet needs to route through, the more delay will be experienced.



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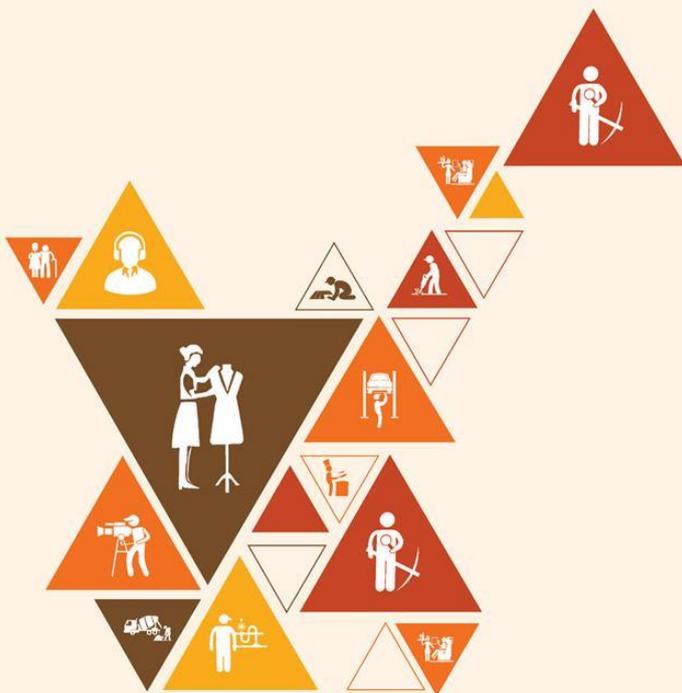
Transforming the skill landscape



# 7. Major Project Implementation

Unit 7.1 – Project on Humidity and Temperature Sensing Device

Unit 7.2 – Project on Air Pollution Sensing Device



TEL/N6234,  
TEL/N6235,  
TEL/N6236

## UNIT 7.1: Project on Humidity and Temperature Sensing Device

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Demonstrate the setting up of IoT hardware for obtaining humidity and temperature information from a sensor which would be analysed on cloud platform through wireless Internet.

### Ask

- Ask them if they have the knowledge to build an IoT project.
- Ask them if they know some of the requirement for completing the project.
- Ask them if they know how the project can be useful in real life scenarios.

### Notes for Facilitation

- Help the participants in understanding the objective of the project.
- Tell them the real-life application of the project.
- Discuss the feasibility and life of the project.
- Tell the participants to perform the practical with the help of the provided material
- Provide the required material for completing the product.
- Ask the participants to follow the safety rules and regulations while completing the project.
- Tell them to record the project in detail and create a report.

## UNIT 7.2: Project on Air Pollution Sensing Device

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Demonstrate the setting up of the hardware for IoT enabled air pollution meter which monitors air quality on a smartphone using a third-party app.

### Ask

- Ask the participants if they have the knowledge to build an IoT project.
- Ask them if they know some of the requirement for completing the project.
- Ask them if they know how the project can be useful in real life scenarios.

### Notes for Facilitation

- Tell them that third party tools like Blynk app can be used for this project.
- Tell them to follow all the safety rules and regulations while performing the project.
- Tell the participants to use the tools and equipment carefully.
- Tell the participants to note down the steps and procedure followed while completing the project in a formatted form.
- Explain to them about the importance of securing the devices by providing username and password.
- Tell them to demonstrate the project after completion.





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# 8. Understanding Organizational Policies

Unit 8.1 – Organizational Processes and Standards

Unit 8.2 – Project Handling Concepts and Applications

Unit 8.3 – Decision Making and Problem-Solving Process

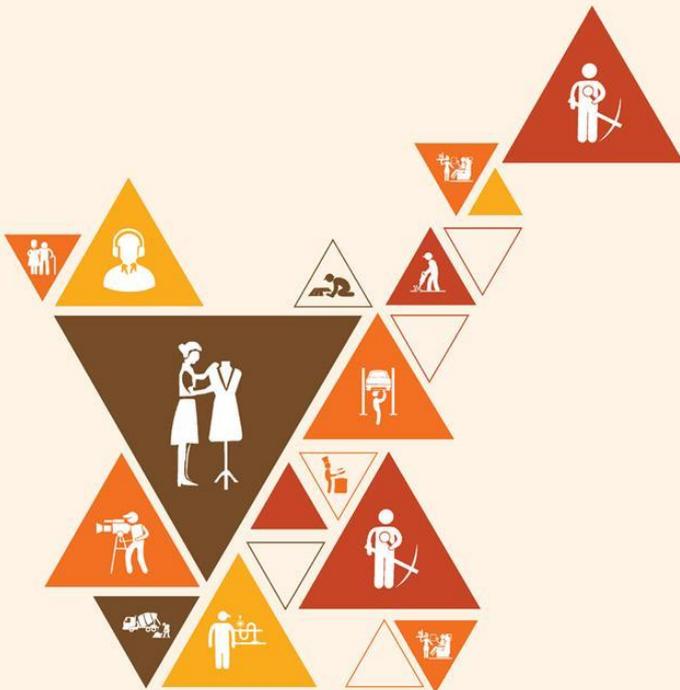
Unit 8.4 – Record Maintenance

Unit 8.5 – Record Performance/test Results

Unit 8.6 – Documentation

Unit 8.7 – Communication Skills

Unit 8.8 – Special Policies for Women Working on  
Monitoring Consoles



TEL/N6234,  
TEL/N6235,  
TEL/N6236,  
TEL/N2509

## Key Learning Outcomes



By the end of this module, the trainees will be able to:

- Define organizational processes
- Identify the elements and steps of an organizational process
- Explain the importance of organizational processes
- Identify the hierarchy in an organization
- Explain different project handling concepts
- List the steps of an IoT project implementation process
- Explain what decision is making
- Identify the steps involved in decision making
- Explain the techniques used in decision making
- List the advantages of decision making
- Identify the steps involved in a problem-solving process
- Identify business records
- Explain the methods of record maintenance
- Explain the importance of record maintenance
- Explain the significance of recording performance
- Analyse a technician's role in recording performance
- Identify methods used in recording performance
- Explain the importance of documentation
- Explain global format system used for documentation
- List the steps of document processing
- List the qualities required to do documentation
- Explain the importance of communication skills
- Explain the methods to improve reading skills
- Explain the methods for improving writing skills
- Explain the methods to develop interpersonal skills
- List the special safety policies for women
- Explain methods to improve women safety
- Explain the need of relaxation policies for women

## UNIT 8.1: Organizational Processes and Standards

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Define organizational processes
- Identify the elements and steps of an organizational process
- Explain the importance of organizational processes
- Identify the hierarchy in an organization

### Ask

- Enquire if anybody knows about organizational process.
- Ask the participants to tell some work ethics.
- Ask if anyone knows about the documentation process.
- Ask the participants to share their expectations from this course.

### Notes for Facilitation

- Tell the participants that any situation involving two or more persons working collectively requires organising. The act of organising involves integrating, balancing and coordinating the activities of people working together for seeking common goals.
- Also, tell that the organizing process, thus, establishes working relationship among employees by assigning tasks and giving them enough rights to perform those tasks.
- Explain to them about the concept of organising by telling that it refers to the process of identifying and grouping the activities to be performed and dividing them among the individuals. It involves creating the relationship of authority and responsibility among them for the accomplishment of organisational objectives.
- Tell the participants about the characteristics of organising which are listed as follows:
  1. **Organising is a basic function and a sub-process of management** - Organising constitutes an essential element in the main process of management. It is done in relation to all other functions of management. The organising function follows the function of planning and the other functions of management follow organising. Thus, organising is a sub-process of management.
  2. **Organising is a continuous process** - An organisation is a continuing entity. The need for organising function is felt whenever new activities or functions are introduced, or existing functions and activities are re-shuffled in the organisation.
  3. **Organising is a function of all managers** - The management function of organising is practised by all the managers in the organisation. The nature and the importance of the organising function, however, may vary with different managers. The middle-level managers are significantly involved in organising their departmental activities as a large number of members are involved in the performance of the activities.
  4. **Organising involves coordination** - To create a balance and structure in the organisation, the activities of members need to be well-coordinated.

5. **Goal-oriented** - Organising is designed on the basis of objectives and it aims at achieving them smoothly.
  6. **Group effort** - Organising deals with group efforts that are made for attaining common goals.
  7. **Establishes authority-responsibility relationship** - Organising establishes authority-responsibility relationship among the organisational members.
- Tell the participants that there are four basic elements of organisational structure which are listed in the following figure:

#### Functional Structure

- Under a functional organization structure, people who do similar tasks are grouped together, based on specialty. So, all the accountants are placed in the finance department and so on for the marketing, operations, senior management and human resources departments.

#### Divisional Structure

- In a divisional structure, the company groups workers into teams based on the products or projects that meet the needs of a certain type of customer. For example, a bakery with a catering operation might structure the workforce based on key clientele, such as a wedding department and a wholesale-retail department.

#### Matrix Structure

- A matrix structure combines elements of the functional and divisional models; so it's more complex. It groups people into functional departments of specialization, then further separates them into divisional projects and products.

#### Flat Structure

- A flat organizational structure attempts to disrupt the traditional top-down management system of most companies. Management is decentralized so there is no everyday "boss." Each employee is the boss of themselves, eliminating bureaucracy and red tape and improving direct communication.

*Fig 8.1.1 Elements of organisational structure*

- Explain to the participants about the importance of organizing process. Tell that it creates a network of roles and relationships and provides a framework within which each employee performs the activities that have been assigned to him/her. The role becomes more meaningful and he/she contributes effectively for achieving pre-determined objectives. Therefore, organising is regarded as a mechanism or means to achieve planned objectives.

- Further, tell them about the factors affecting the organizational structure which are listed in the following figure:

<b>Strategy</b>	Organisational structure to be used for an enterprise is the direct result of objectives to be achieved which are derived from strategy. Organizational structure of a manufacturing concern with assured market will be different from that of another concern operating under highly competitive situation.
<b>Nature of activities</b>	Organizational structure of a trading concern is different from that of an educational institution for the simple reason that activities of the two organizations are different.
<b>Size and life cycle</b>	Larger the organisation, the more will it tend to have work specialisation, horizontal and vertical differentiation, and rules and regulations. Organisational structure would be different at birth, youth, midlife and maturity stages.
<b>Culture</b>	Culture refers to a system of shared beliefs and values. A strong organisational culture means rules and regulations can be substituted by the culture. Stronger the culture, more the structure can be predictable, orderly and consistent with no written documentation.
<b>Technology</b>	Organisational structure of an enterprise using sophisticated capital-intensive mass-production technology will be different from the enterprise using labour-intensive small-scale production technology.
<b>Environment</b>	Organisational structure of an enterprise operating in the midst of a highly dynamic environment organic will be different from the enterprise operating in a stable environment mechanistic. Organisations operating in stable environment can gainfully employ a highly formalised structure.
<b>People</b>	People-structure relationship is important. A good organisational structure provides people with the supportive structures to attain organisational and individual objectives.

*Fig 8.1.2 Factors affecting organisational structure*

- Explain about the difference between formal and informal organisational structure as given in the following table:

Formal Organisation	Informal Organisation
<ul style="list-style-type: none"> <li>• A formal organisation is a consciously planned and a deliberately designed entity. It is based on superior-subordinate relationships which are created by assignment of work and delegation of authority.</li> </ul>	<ul style="list-style-type: none"> <li>• When people work together in a formal relationship of superior and subordinate, they come in contact with each other. This interaction provides them with an opportunity to know each other and develop personal and social relations.</li> </ul>

*Fig 8.1.3 Formal and informal organisation*

- Further, explain to them about the difference between organisation as a structure and organisation as a process. For example, in organisation as a structure, it is majorly concerned with the job. The design is mainly interested in job descriptions, functions and territories. The processes are not fully clear. Even though people have different jobs, they perform their jobs with limited responsibility and performance. These organizations are mainly vertical organizations divided into departments which have their own responsibilities and tasks. Whereas an organization as a process is mainly concentrated on how the job is done. It can be said that an organization is dealing with the design of processes in the terms of time, space, funds, materials and human resources, focusing on the outcome of the work.
- Exercise Handling Strategy:
  - To facilitate the exercise, ask the participants to form groups of 5 people and give them designation of manager, trainee, team lead, technician and CEO. Ask them to stand in an increasing order based on the position that they belong to. The correct order is:
 

Trainee – Technician – Team lead – Manager – CEO.
  - For the next exercise, ask them to arrange themselves according to the steps in an organisational process. The correct order is:
    - Analyze the target
    - Create a strategy
    - Categorize the work
    - Assign and give authorization
    - Co-ordinate and have perfect relationships

## UNIT 8.2: Project Handling Concepts and Applications

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain different project handling concepts
- List the steps of an IoT project implementation process

### Explain

- Explain to the participants that an IoT technician should be able to work in harmony with the colleagues or members in a team. In case of any conflict, the matter should be resolved by communicating with them. If the need for an intervention by a senior is felt, then the matter should be reported to the supervisor.
- Tell them that while doing work and any interaction related to work, the interest of the organization should be the focus.
- Tell that all the members may work together or may work on individual projects to fulfil the organizational goals.
- Inform them that it is important to understand the role and responsibility of each one of the team members and the task being performed by that person.
- Explain that teamwork is defined as coming together of people to achieve common goals. The goals here are the organizational goals. The daily tasks which are assigned are a part of the organizational goals. Team work means that each member in the team is contributing their bit to the overall tasks.
- Tell that in a team, all the members are important and might be dependent on each other for work. Sometimes, the members do the work individually. However, the collective result is a team effort, similar to what will be seen in a game of cricket, or during the construction of a building or building an aircraft. It is also important to understand that the work may depend on the completion of the tasks. Therefore, for smooth progress of work, the tasks should be completed on time.
- Tell the participants that every organization has its own defined work processes to manage IT operations at its facility. For an IoT technician, it is important to learn these work processes and follow them.
- Explain the work processes briefly. Tell them that generally, most of the work processes are automated by IT support software systems while others need to be performed manually or physically. An IoT technician should be aware of the common IT work processes of the organization he/she works in, to work efficiently.
- Tell the participants to consider a situation where a customer complains that a computer lost network connectivity. There can be numerous explanations for the problem such as:
  - Defect in physical component such as a cable break or a faulty router
  - A faulty configuration on the computer or a network device
  - Loss of network connectivity to one network resource such as email, which led the customer to assume that all network connectivity was lost

- A successful IoT technician uses critical thinking skills to isolate the real cause of the issue by formulating questions, gathering information, and determining what is relevant.
- Tell the participants that when on a visit to a customer site, to ensure good service, the customer's requirement should be understood, and a solution should be suggested.

## Notes for Facilitation

- Explain to them about Service Level Agreement (SLA) by saying that it is a formal contract between the service provider and the customer, defining services, responsibilities, scope and duties of both the parties.
- Then, tell them about the importance of an SLA.
- Explain to the participants that there is a formal process of addressing IT related issues and problems when they appear. This process is called as escalation process.
- Explain to them about functional and hierarchical escalation with the help of the following points:
  - Functional and hierarchical type of escalations can regularly be found inside the IT service managed condition when incident and problem management orders are executed.
  - With functional escalations, the incident/problem is routed to a more experienced level that can deliver the next level of support.
  - Hierarchical escalations act more as a correspondence and intend to caution both the staff and the administration, in a proactive way, of potential SLA breaches.
- In addition, tell them about the activities involved in an escalation management process such as initiating the escalation, logging the escalation and developing an escalation management action.
- Lastly, tell them about the importance of record keeping.
- Tell them that record keeping is very beneficial, especially in case of conflicts and contradictions in the work committed and the work done. It provides several benefits.
- Inform them that there is a written escalation process available at all IT departments and all the staff members are trained to its use. Under this process:
  - Priority levels are assigned to various issues
  - Delegated responsibilities are assigned to some particular personnel
- A particular time is allocated to some personnel to resolve the issue before escalation.

## Ask

- Ask the participants if they know about the personality traits and skills required for the job of an IoT technician.

## Say



- Tell the participants that they should know the right way to handle the customers, understand their needs and provide the right service to them as per the company's standards and policies.

## Explain



- Explain to the participants about the importance of communication with the customer to know their requirement.
- A technician should be able to understand the correct requirement in order to give the right kind of service. The complaints or work requirements will flow in from the customer care centre or from the supervisor.
- After a complaint has been lodged, the technician should have clarity about the work, the customer location and the details of the product's problem before going to visit the customer. There can be a situation when a technician might be able to understand the real problem only after physical examination, but it always helps to understand the problem briefly before a visit to the customer. This might save an extra visit which could happen because of incomplete information.
- Explain to the participants about the importance of personal grooming.
- Tell the participants that they represent the company in front of the customer and therefore, they should take care of personal grooming.
- Explain to the participants about the importance of personal hygiene, such as when they visit the customer their clothes should be neat and tidy, their hair should be trimmed and they must not smell of sweat as this creates an unhealthy impression in front of the customer.
- Explain to the participants about the importance of following workplace etiquette. It is the accepted social behaviour while working along with others in a team.
- It includes the norms as shown in the following figure:

Arrive on time for work and show positive enthusiasm at work

Behave in a respectful manner with others

Maintain yourself and keep the tools in a clean and organized condition

Never indulge in negative or irrelevant talk

Always be eager to learn new things

Fig.8.2.1: Workplace etiquette norms

## Notes for Facilitation

- Exercise Handling Strategy
  - To facilitate the exercise, ask the participants to answer true or false for the following statements:
    1. Project management reduces the cost of project - True
    2. It is very important to create a strategy to start a project - True
    3. Project management is not beneficial for the employees – False

## UNIT 8.3: Decision making and Problem-solving Process

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain what is decision making
- Identify the steps involved in decision making
- Explain the techniques used in decision making
- List the advantages of decision making
- Identify the steps involved in a problem-solving process

### Say

- Introduce the unit to the participants by explaining the customer's problem to them.
- Tell the participants to discuss with the customer, all possible solutions to their problems.
- Tell them that it is the responsibility of a technician to inform the customers whether the module has to be replaced or repaired, with reasons.

### Notes for Facilitation

- Start the session by telling the participants that customer satisfaction is of prime importance to an IoT technician.
- Tell them how to deal with customer problems and how to find out solutions for them.
- Tell them the steps required to replace faulty modules.
- Tell the participants to enquire from the customer whether to replace the module or not, depending upon the situation.
- Tell them to ask the customer to maintain the copy of the invoice and the warranty for future purpose.
- Further, explain to the technician about the framework of decision making as per the following figure:

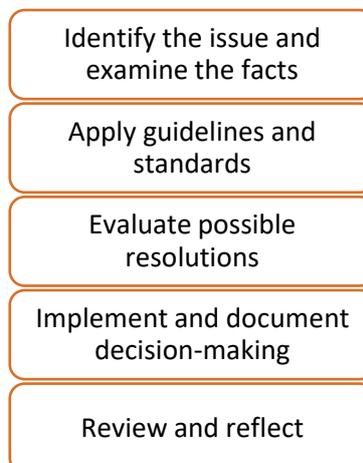


Fig 8.3.1 Frame work of decision making

- Exercise Handling Strategy:
  - To facilitate the exercise, ask the participants to form groups and give them exercise papers which contain the fill in the blanks statements and ask them to fill them. Statements that can be are:
    - Nominal and Delphi techniques are used in decision making.
    - Problem solving, and decision making are important in organizational process.
    - First step in decision making is Identifying the problem.
    - Advantages of decision making are:
      - It is an important and primary function of any business
      - It helps to organize the activities
      - It reduces the problems
      - It reduces the time taken for the process
      - It improves skill set
      - It provides experience
      - It increases work efficiency and productivity

## UNIT 8.4: Records Maintenance

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify business records
- Explain the methods of record maintenance
- Explain the importance of record maintenance

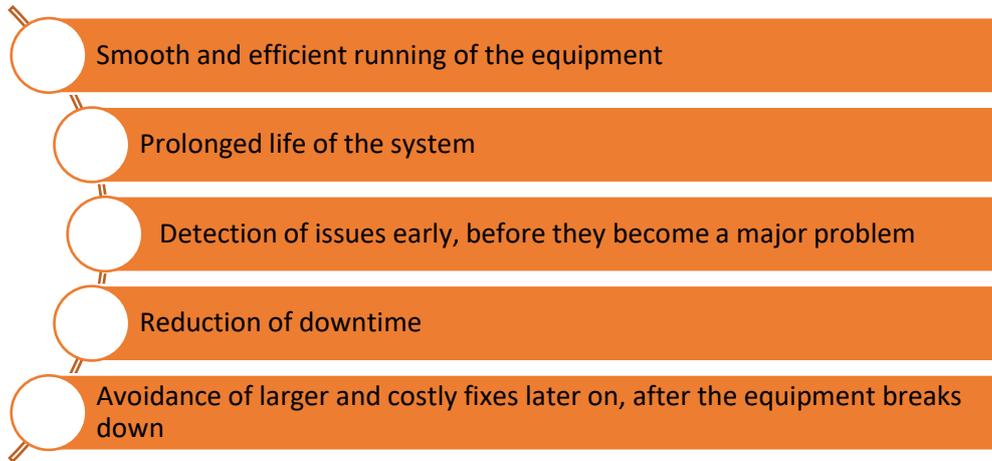
### Say

- Start the session by telling the participants that support services are services that address problems with a service or product sold to a customer.
- Tell them that a technician is responsible for attending to problems to resolve or perform maintenance functions by visiting the client or remote locations.
- Tell them that an invoice is a copy from a manufacturer given to the customer after purchase of goods and services.

### Notes for Facilitation

- Explain to the participants, the roles and responsibilities of a technician with the help of the following points:
  - Attends to problems to resolve them
  - Performs maintenance functions by visiting clients or remote locations
  - Assesses and installs or fixes the equipment or machinery.
  - Provides support and service in different fields such as IT.
- Tell them that a technician provides hardware and related software service and maintenance. The maintenance may include installation or repair of hardware equipment or associated software by monitoring, troubleshooting and replacing faulty modules.
- Explain to them the importance of doing regular preventive maintenance of the equipment.

- Explain that a regular maintenance plan ensures the benefits as shown in the following figure:



*Fig.8.4.1: Regular maintenance plan*

- Explain that the following steps should be followed to keep a computer system efficient:
  - Use Microsoft Fix It
  - Reduce items that run on start-up
  - Remove programs no longer in use
  - Clean the system drive
  - Clean the browser
  - Scan for and remove malware
  - Scan and remove viruses and spyware
  - Make adjustments for better performance
  - Defrag system drive
  - Add more ram memory
  - Upgrade to an SSD drive
- Explain the importance of performing software maintenance.
- Explain that software maintenance consists of the following four techniques:
  - Corrective maintenance
  - Adaptive maintenance
  - Perfective maintenance
  - Preventive maintenance
- Explain the importance of doing regular software updates.
- Explain that malware, short for malicious software, is especially designed to gain access or damage a computer without the knowledge of the owner.
- Explain the importance of performing Windows maintenance.
- Explain that Windows automatic maintenance schedules the maintenance, only when the system is on and idle.
- Explain that the first step of hardware maintenance is cleaning a computer and its components. Cleaning the physical components is essential as it:
  - Keeps everything in good working order

- Allows proper air flow
- Prevents spreading of germs
- Tell the participants about the importance of having a proper toolkit before starting cleaning and maintenance work.
- Explain to them that the hardware tools can be classified into four categories:
  - Electrostatic tools
  - Hand tools
  - Cleaning tools
  - Diagnostic tools
- Tell the participants about the importance of maintaining invoice and also tell the customer about the same.
- In addition, tell them it is necessary to maintain schedules and reports for future purpose and to keep track of all activities.
- Exercise Handling Strategy:
  - To facilitate the exercise, ask the participants to form groups and give them exercise papers which contain the fill in the blanks statements and ask them to fill them.  
Statements that can be used are:
    1. Common method to store the data are electronic and manual methods.
    2. IoT integrates hardware, software, infrastructure and network.

## UNIT 8.5: Record Performance/Test Results

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the significance of recording performance
- Analyse a technician's role in recording performance
- Identify methods used in recording performance

### Notes for Facilitation

- Explain to the participants about SLA by saying that it is a formal contract between the service provider and the customer, defining services, responsibilities, scope and duties of both the parties.
- Then, tell them about the importance of an SLA.
- Explain to the participants that there is a formal process of addressing IT related issues and problems when they appear. This process is called as escalation process.
- Explain to them about functional and hierarchical escalation with the help of the following points:
  - Functional and hierarchical type of escalations can regularly be found inside the IT service managed condition when incident and problem management orders are executed.
  - With functional escalations, the incident/problem is routed to a more experienced part that can deliver the next level of support.
  - With functional escalations, the occurrence/issue is directed to a more experienced part that can provide further level of support.
  - Hierarchical escalations act more as a correspondence and intend to caution both the care staff and the administration, in a proactive way, of potential SLA (Service Level Agreements) breaches.
- In addition, tell them the activities involved in the escalation management process such as initiating the escalation, logging the escalation and developing an escalation management action.
- Lastly, tell them about the importance of record keeping.
- Tell them that record keeping is very beneficial, especially in case of conflicts and contradictions in the work committed and the work done. Record keeping provides several benefits.
- Inform them that there is a written escalation process available at all IT departments and all the staff members are trained to its use. Under this process:
  - Priority levels are assigned to various issues
  - Delegated responsibilities are assigned to some particular personnel
  - A particular time is allocated to some personnel to resolve the issue before escalation

- Explain issue escalation using the following figure:

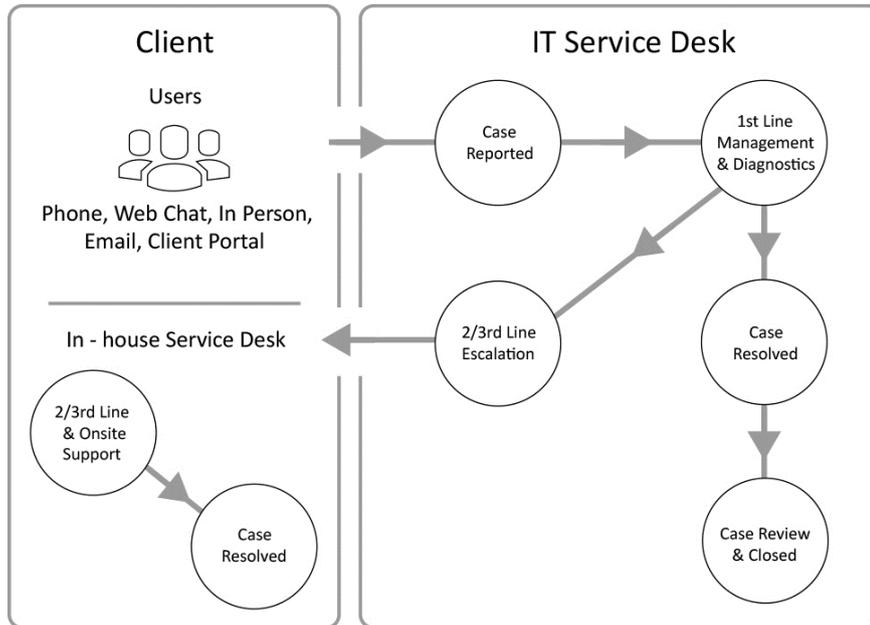


Fig.8.5.1: Issue escalation

- Exercise Handling Strategy
  - To facilitate the exercise, ask the participants to form groups and give them exercise papers which contain the fill in the blanks statements and ask them to fill them. The fill in the blank statements are as follows:
    1. Each organization needs to have proper \_\_\_\_\_ with client and technician to minimize error.
    2. After service, technician should \_\_\_\_\_ check at client's place.
    3. Give one example of things that every technician should have: \_\_\_\_\_
    4. \_\_\_\_\_ is one of the technician roles
    5. \_\_\_\_\_ tool is used for issue resolving by analysing previous history.
  - Answer for the above questions are:
    1. Each organization needs to have proper communication with client and technician to minimize error.
    2. After service, technician should schedule a maintenance and performance check at client's place.
    3. Give one example of things that every technician should have:
      - Install efficient and high-quality devices.
      - Schedule a visit to client site to check the performance of the device(s).
      - Make use of automation tools.
      - Place alarm system which can signal during error.
    4. Visiting customer's place for performance check is one of the technician's role.
    5. Real time data tool is used for issue resolving by analysing previous history.

## UNIT 8.6: Maintain Records and Process Documents

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the importance of documentation
- Explain global format system used for documentation
- List the steps of document processing
- List the qualities required to do documentation

### Notes for Facilitation

- Explain to the participants about the factors that they need to consider while doing documentation which are listed as follows:
  - What records need to be kept?
  - How are they to be stored – such as hard copy or electronic?
  - Where are the documents to be stored?
  - How long should the records to be retained? (what is an appropriate time; think about the shelf-life of the product and possibly how the product may be misused)
  - Who is responsible for the records?
  - Who needs frequent access to the records?
- Tell them that the documentation of critical incidents, whether positive or negative, is also recommended so that the managers have a record of employee performance spanning a period of time.
- Further, explain to them that documentation is used in other ways in organizations. These can include procedures, work instructions and computer software instructions, to name a few; but for purposes of the Human Resources function, these are the common uses of documentation. And, these are instructions about how to document appropriately.
- Explain to them about the list that needs to be documented when working in an organisation. The list is as follows:
  - Memos and letters sent to employees
  - A written summary of the date, time, place and people involved in an incident
  - Any work documents involved
  - Notes from meetings
  - Witness statements
  - Investigation interviews
  - Performance evaluations
  - Disciplinary actions of any kind, including termination

- Explain about the advantages of documentation which are listed in the following figure:

Easier to recall what happened if complaint is filed well after an incident occurred

Reduced amount of incorrect information discussed in a case

Possibility to save time and money on a lawsuit

Ability to protect employees and/or the company from invalid complaints

*Fig 8.6.1 Advantages of documentation*

- Exercise Handling Strategy:
  - To facilitate the exercise, ask the participants to group themselves for the discussion on the following topics:
    1. What are the tools used in document processing? The answer may be:
      - Laptop or desktop
      - Scanner
      - Software tools
    2. Give an example of things that a technician needs to document. The answer may be
      - The client's name
      - Project plan and strategy
      - Tools and product information
      - Duration of the project
      - Start date
      - Technician information
      - Work process information
      - Test and feedback information
      - Error report
      - Customer service and query information.
    3. Give 2 qualifications of a person who is involved in record maintenance. The answer may be:
      - Should be able to understand all the tools and sources related to maintenance
      - Should be in a position to take decisions appropriate for maintaining and processing records
      - Should be aware of legal and privacy statements
      - Should track all day-to-day activities
      - Should be able to protect them and be aware of the possible threats
      - Should be able to furnish required records
      - Should be able to classify important and unimportant information

## UNIT 8.7: Communication Skills

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the importance of communication skills
- Explain the methods to improve reading skills
- Explain the methods for improving writing skills
- Explain the methods to develop interpersonal skills

### Resources

- Available objects such as a duster, pen, notebook and soon.
- Papers and pens for the participants.

### Explain

- Explain to the participants that to be able to listen actively and to ensure that the customers can respond and understand efficiently, they need to:
  - Stop talking to listen to what the other person has to say.
  - Remove any external noise or distractions.
  - Deter from jumping to a conclusion or responding the moment the other person begins to speak.
  - Try not to be defensive in a conversation, especially when receiving a feedback.
  - Show interest in listening to a person, who is speaking, through non- verbal clues such as a nod or words such as hmm and yeah.
  - Ask for details to get the complete information.

### Say

- Tell the participants that communication is a two-way process.
  - The sender, who has a need to communicate with another person; the receiver, can send a message. This happens in a medium and reaches the receiver who then responds, based upon the understanding of the message.
  - Communication can be said to be complete only when the receiver understands the message in context in which it was meant to be understood.
- Give an example to the participants. In the morning when they join for work, their supervisor allocates the task for the day. Manual and diagram is the written medium of communication. What their supervisor tells them, becomes the spoken communication. In this case they are the receiver of the message. When they respond after having understood the message that becomes a feedback.

- Tell the participant that communication includes:
  - Verbal Communication – It mainly consists of the spoken words, such as, talking to team members and talking on phone with the customer.
  - Non-verbal communication – It consists mainly of gestures, facial expressions and movements. Showing thumbs up to say that the connection of a wire is done to an assistant, who is far away, or calling the assistant, by waving, to come closer with the cord are types of non-verbal communications.
  - Written communication – It is the written form of communication such as, reports, analysis and e-mails. A written document can be a report which has been submitted or an application.
- Tell the participants about the positive and negative gestures and the right body language to be followed at the workplace.
- Then, inform the participants about some basic dos and don'ts of communication using the points shown in the following table:

Dos	Don'ts
Communication should be very clear and precise. Mention all the details required to take action. Also, mention clearly the action intended	Communicating when not sure or giving incorrect details
Communication should be concise or short. It should not have irrelevant details which are of no concern to the recipient of the message	Giving incomplete message
Communication should be concrete. Mention the specific and actionable things	Communicating in an uncourteous way
The message in communication should be coherent or should be related. If something extra has to be mentioned, then mention clearly that it is an addition. Meaning is derived when the entire message is in context	Using jargons that the recipient may be unfamiliar with or using complex words or sentences

Fig 8.7.1 Dos and don'ts of communication

## Activity



- Divide the number of participants into pairs and make them sit back to back.
- Give one participant a pen and a paper and other a picture of a thing such as a car, a telephone and so on.
- Ask the participant holding the picture to describe it
- Ask the other participant to draw the picture based on the description.

## Time



- Set five minutes as the time limit of the activity.
- Ensure that the activity finishes within time.

## Do



- Draw the following diagram on the whiteboard to explain the steps of effective listening.

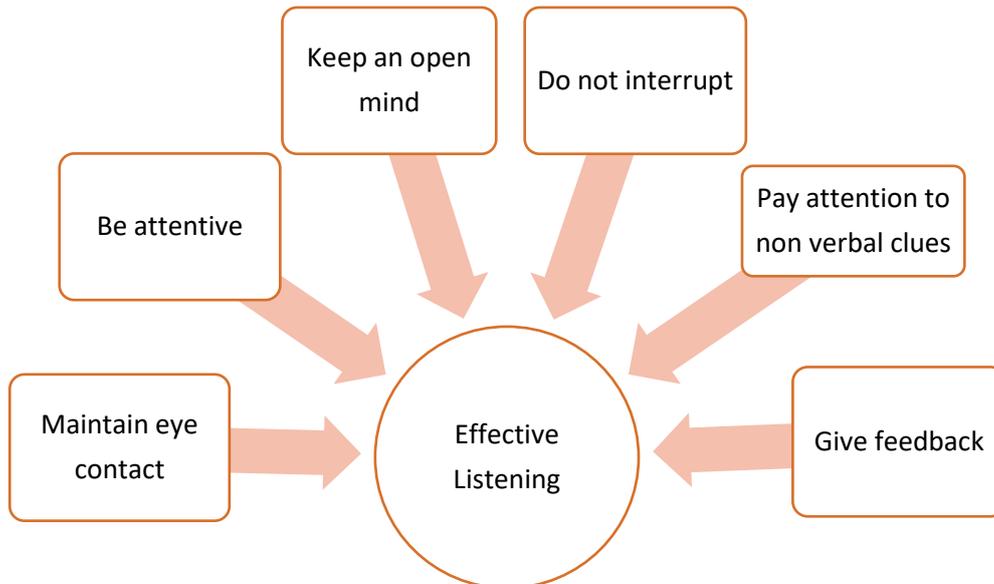


Fig. 8.7.2: Steps of effective listening

- Take the points one by one and explain the concept with the help of day to day examples.

## Explain



- Explain the importance of active listening and the steps of effective listening.
- Explain barriers to effective listening.
- Explain non-verbal communication.
- Explain the correct way of communicating long and emotional messages.
- Explain the importance of managing personal emotions during communication.
- Explain the steps required to manage a conflict.
- Explain interpersonal skills and personality development.

## Notes for Facilitation



- Give the participants a brief overview of what all will be covered in the program.
- Start the discussion by inviting the students to participate.
- At the end of the 'Draw as I say' activity, show how the drawing matches the picture in hand.
- Explain that to be effective, their communication should include:
  - What they saw

- What they heard
- What they felt
- What they want
- What will be the result?
- After explaining the steps of effective listening, explain the various barriers to active listening.
- After explaining the five components of communication, use examples from daily life to explain that emotional obstacles such as vulnerability, protecting, expectations and fear hinder effective communication.
- Explain that to be a good listener, they should:
  - Understand and use non-verbal communication
  - Listen and acknowledge
  - Reflect on what has been said
- Explain what interpersonal skills are.
- Elaborate on the importance of body language such as:
  - Gestures
  - Facial expressions
  - Eye contact
  - Posture
  - Tone of voice
- Demonstrate the correct and incorrect body language.
- Elaborate on the importance of using effective expressions while communicating.
- Introduce the topic of personality development.
- Exercise Handling Strategy:
  - To facilitate the exercise, ask the participants to form a team for group discussion and ask them to share their perceptions of the following topics:
    1. Give example of interpersonal skills. The answer may be:
      - Speaking and listening skills
      - Effective communication
      - Team work
      - Negotiation and influencing skills
      - Problem solving and decision making
    2. What are the required skills for technicians? The answer may be:
      - Writing skills
      - Reading skills
      - Interpersonal skills
    3. How can writing skills help technicians at work? The answer may be:
      - It helps to create and reply to client's emails and make invoices and proposals.

## UNIT 8.8: Special Policies for Women Working on Monitoring Consoles

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the special safety policies for women
- Explain methods to improve women safety
- Explain the need of relaxation policies for women

### Explain

- Explain that the suggested guidelines for the safety for women at workplace are broadly categorized under four heads:
  1. Physical
  2. Environmental
  3. Organizational
  4. Educational
- Each of the above heads has recommendations which are required and aspirational.
- Explain to them about the minimum requirements for women safety which are listed as follows:
  1. Identification documents (driving license, photo ID, address proof, finger prints) to be collected from drivers, security guards and all casual staff
  2. 24x7 operational Closed-Circuit Television (CCTV) cameras at vital locations or places, such as entry/ exit and common passages in the factories and industries. However, this should not impinge the modesty and privacy of the employees.
  3. Where CCTV is not possible, there should be manned entries/ gates and security deployment at the site/ office/ location 24x7 or depending upon the kind of working hours.
- Explain to them about some of the aspirational recommendations that is done in organisation for the women safety. Those are listed as follows:
  - Installation of electronic doors allowing access to the work area only to authorized employees / staff
  - High security fencing to discourage human trespassing in factory/office premises or campuses
  - Security guard or a colleague to accompany the driver in the cab, if a woman staff working in a night shift is either the first to be picked up or the last to be dropped.
  - GPS based monitoring of cabs/transport vehicles with panic buttons
  - SMS alerts / information systems to be designed/installed
  - A thorough risk assessment of the neighbouring area is recommended to ascertain that stringent measures are in place to mitigate any security risk

- Mobile Applications to be installed on employee phones for increased tracking and safety measures

## Notes for Facilitation

- Tell the participants about the laws which are made for women at an organisation as shown in the following figure:

### The Factories Act

- The Factories Act is a law that ensures the security, health, safety, welfare, working hours, leave and other benefits. It aims at protecting the workers employed in a company from any violence or unfair exploitation.

### The Maternity Benefit Act

- The Maternity Benefit Act was made to bring a uniform code for maternity benefit to women workers across industries.

### The Equal Remuneration Act

- The Equal Remuneration Act is made to ensure that there is no discrimination made in the payment of salaries to male and female employees.

*Fig 8.8.1 Women safety acts*

- Explain to them about why women safety is an issue at a workplace. Tell that there are certain circumstances when women face certain issues at work. Some of the issues related to women safety and the challenges they have to face are as follows:

#### **1. Cultural Pressures**

Cultural pressure has still remained an issue in a developing country like India. There are still some families who do not support women going to work alone away from family. Women at some places are forced to do household chores along with their work at the organization. This becomes a great challenge for working women.

#### **2. Male Dominating Professions**

There are still many professions that are male dominating which makes the survival of a woman to work in that field a difficult task. Some men still think that women are incapable to handle tasks that require an extra effort. They have to survive from office politics.

#### **3. Physically Lacking Strength**

Lack of physical strength is still considered a weakness in our society. Core engineering jobs are the areas in which women are considered less important. Due to such conception, women are facing difficulties in such fields.

**4. Men Versus Women Issues**

There are many people in the society who compare task of men with women at every stage. But it is a shame that irrespective of being equally talented, there is still discrimination in the eyes of the beholder.

**5. Gender Bias**

Gender bias is a challenge that many women are facing even in the modern era. Even though the corporate companies are sometimes focused on gender biased work where it includes traveling, field work, etc.

**6. Work-life imbalance**

Differentiating between personal life and professional career becomes a little hard for women. They tend to mix up work commitments with personal priorities and that is when all the issue starts.

**7. Maternity leaves**

Handling mood swings and morning sickness without showing a slightest discomfort, travelling to and fro after conceiving, avoiding office parties and late night meetings as her health may take a toll, listening to her boss's taunts as she constantly applies for check-up leaves, maternity leaves and so on are simply too hard for a pregnant woman. Most of the firms have policies where maternity leaves are granted for the first two babies, which is appreciable.

**8. Lack of role models**

The challenge that a woman faces are that there are very few role models for their encouragement. Women feel disconnected when they look up to men for guidance as there is a great difference in their objectivity and style of communication.

**9. Power play**

For generations, women have failed to resist the power play that men have played. Many women leaders have stated strongly that it took them a lot of time and plenty of courage to survive the power play politics and reach their current position in their workplace.

**10. Ego clashes**

Men always try to prove their superiority while at work. An alpha male will feel his ego is hurt when he has to report to a women manager.

**11. Security**

It is the most threatening issue for women of this era. As a result, women should learn the art of self-defence. Many organizations have implemented special security services for helping their women employees to get back home at late nights.

- Exercise Handling Strategy
  - To facilitate the exercise, ask the participants to form a team and give them topics as following for the group discussion:
    1. Why women need special policies at an organization? The answer may be:  
In the year 2016, 25% of employees in IoT companies were women. This number is likely to increase by 2020. In an organization, women can face problems like harassment and they are also physically weak. Hence, they need special policies at work.
    2. What are the special policy categories for women? The answer may be:
      - **Special leaves:** To encourage a supportive environment, considering women's biological factors, special leaves should be taken into account at work.
      - **Flexible timings:** In India, most working women manage home as well. Hence, it is important to allow them flexible work timings to reduce the pressure.
      - **Knowledge and smartness:** Every organization should nurture a work environment where female employees' knowledge and problem-solving ability can be put to best use.
    3. Explain some special policies for women. The answer may be:
      - Paid maternity leaves
      - Special policy against women harassment
      - Immediate termination of employee in case of attempting women abuse
      - Team should contain at least two female employees
      - Employee feedback system





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# 9. Maintaining Health and Safety

Unit 9.1 – Safety Hazards and their Types

Unit 9.2 – Dealing with Hazards

Unit 9.3 – Importance of Safe Work Area

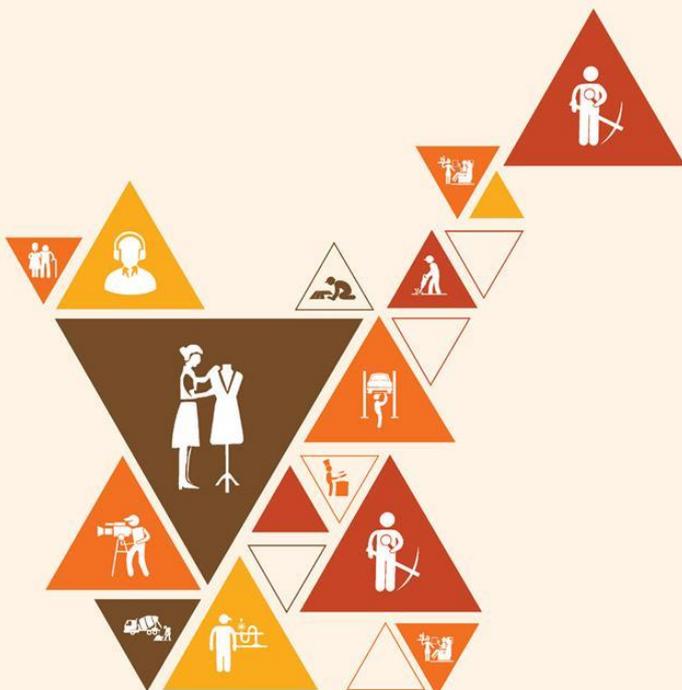
Unit 9.4 – Maintaining Safe Work Area

Unit 9.5 – Dealing with Emergencies

Unit 9.6 – Health and Safety and Security Standards

Unit 9.7 – Safety Breaches

Unit 9.8 – Evacuation Process and Safety Norms



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## Key Learning Outcomes

By the end of this module, the trainees will be able to:

- Define safety hazards
- List the possible hazards at work
- Explain the methods to identify hazards
- Explain role of organization in minimizing hazards
- Explain the different types of hazards
- List the steps to eliminate hazards
- Explain the possible ways to identify hazards
- Evaluate different types of risks
- Explain the ways to eliminate and control hazards
- List the organizational policies to control hazards
- Explain the need of safety at work place
- Identify the possible ways to eliminate hazards
- Explain the procedures to maintain safe work place
- List the facilities for safe work area
- Explain the requirements for safe work area
- List the possible emergencies at an office
- List the essentials to deal with an emergency
- Explain the emergency procedure
- List the goals of health, safety and security at work area
- Explain the need of health, safety and security at work
- List the advantages of maintaining good health and safety at work
- Describe safety breaches
- Identify safety breaches at work
- Explain the responsibilities of an organisation to deter safety breaches
- Explain assessment of safety breaches
- Identify the penalties for safety breaches
- Describe evacuation procedure
- Explain the government rules on safety
- List the benefits of government norms
- Describe evacuation procedure
- Explain the government rules on safety
- List the benefits of government norms

## UNIT 9.1: Safety Hazards and Their Types

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Define safety hazards
- List the possible hazards at work
- Explain the methods to identify hazards
- Explain role of organization in minimizing hazards
- Explain the different types of hazards

### Resources to be Used

- Available objects such as a duster, pen, notebook and so on.
- Various PPE such as gloves, goggles, helmet and jacket.

### Say

- Tell the participants that workplace safety is important to ensure reduction of accidents and improvement of work performance.
- Say that they should know about the work area, equipment involved, usage of tools, forms of personal protection and safety hazards information.

### Do

- Draw the following diagram on the whiteboard and explain the various types of hazards:

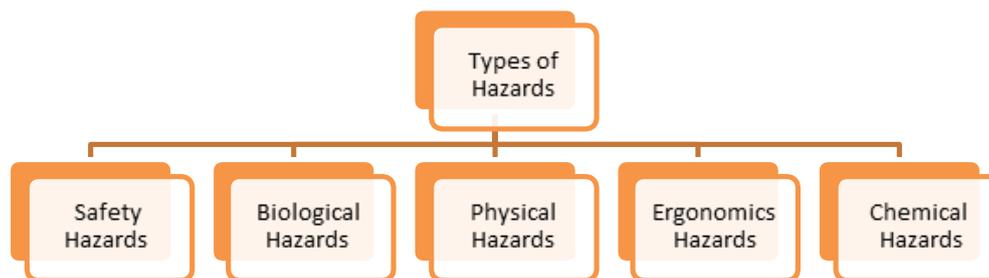


Fig. 9.1.1: Types of hazards

- Take the points one by one and explain the concept with the help of day to day examples.

### Explain

- Explain the sources of potential hazards and briefly explain each one of them.
- Explain the organizational safety policies.
- Explain the responsibilities of the safety committee.

- Explain the responsibilities of the managers with regard to employee health and safety.

## Notes for Facilitation

- Explain different types of hazards and their sources.
- Write on the white board and tell the participants that the policies followed in an organization are:
  - Environmental Management System (EMS)
  - Environment, Health and Safety (EHS)
  - Health and Safety (H & S)
- Briefly explain about the policies.
- Tell them that the safety committee, the employers and the employees have their own responsibilities towards organisational safety policies.
- Tell them that they should abide by the general safety guidelines to ensure workplace safety.

## Do

- Draw the following diagram on the whiteboard and explain the various safety precautions that should be taken while working:



Fig. 9.1.2: Safety precautions to be taken while working

- Take the points one by one and explain the concept in detail.

## Explain

- Explain electrical safety measures.
- Explain fire safety measures and mechanical safety.
- Explain to them some jobsite safety measures that should be followed.

## Elaborate

- Elaborate on the electrical safety measures that should be taken such as follows:
  - Handling electrical wires
  - Handling Internet cable and wires

- Maintaining safe distance from exposed electrical conductors
- Adopting proper work practice in wet or damp locations containing electricity
- Carrying out proper lockout/tag-out procedures for electrical equipment and systems
- Elaborate on the key points of a fire drill.

## Ask

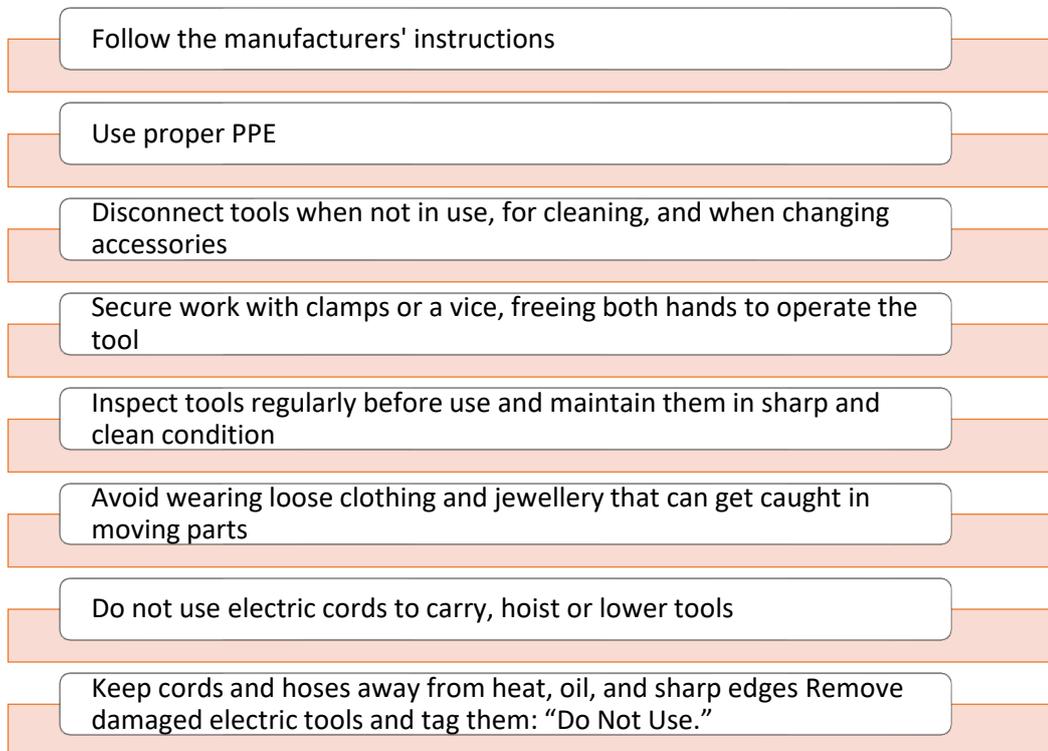
- Ask them if they can tell some safety precautions that should be taken while handling cables.
- Ask them if they can tell some protective gear that they should use while working.

## Notes for Facilitation

- Give the participants a brief overview of what all will be covered in the program.
- Start the discussion by inviting the participants to join in.
- Tell them that it is very important to follow safety guidelines and adhere to the protocol.
- Tell them that the employer also has certain responsibilities such as follows:
  - Assessing the workplace for hazards
  - Providing PPE
  - Determining when to use the PPE
  - Providing training to the concerned employees
- Tell that an employee's responsibilities include the following practices:
  - Using the PPE in accordance with the training received and other instructions
  - Inspecting the PPE daily and maintaining it in a clean and reliable condition
- Tell them that the on-site mechanical safety plan for an IoT technician includes the following measures:
  - Safe work area
  - Safe use of tools and equipment
  - Safe practices for personnel protection
  - Awareness of safety hazards and how to avoid them
- Tell them that misuse and improper maintenance of hand and power tools can cause potential hazards.
- Also, explain that power tools are extremely hazardous when used or maintained improperly. The workers using hand and power tools may be exposed to several hazards including the following:
  - Objects that are abrasive or can splash
  - Harmful dusts, fumes, mists, vapors and gases
  - Frayed or damaged electrical cords
  - Hazardous connections and improper grounding
- Also, tell them that eye protection is usually always required. All hand and power tools and similar equipment, whether furnished by the employer or the employee, should be maintained in a safe condition. All power tools must be fitted with factory guards and

safety switches, and hand-held power tools must be equipped with a constant pressure switch or on-off switch.

- Also, tell them some additional guidelines for using hand and power tools as shown in the following figure:



*Fig. 9.1.3: Guidelines for using hand and power tools*

- Tell them about various safety gears and the responsibilities of employees and employers towards it.

## Explain

- Explain that using PPE is important as it provides the following protection:
  - Skin protection
  - Eye Protection
  - Hearing Protection
  - Foot Protection
- Explain the meaning of the term 'incident reporting procedure'.
- Explain the types and the procedure of incident reporting.
- Further, explain that they must promptly inform their supervisor in case of any safety incident and follow the proper reporting procedure.
- Explain the importance of good housekeeping.

## Notes for Facilitation

- Show the participants various protective equipment and explain their use.
- Tell them to ensure that they have the PPE with them before starting.
- Tell that they must check that it is in a clean and reliable condition.
- Also, tell them that for hand they should use the following:
  - Durable gloves made of mesh, leather or high-performance materials to protect from cuts, burns and heat
  - Chemical-resistant rubber gloves to protect from burns and irritation
  - Electrical insulating gloves for exposure to live voltages
- Exercise Handling Strategy:
  - To initiate the exercise, ask the participants to separate in groups and ask them to have a discussion on the given topics.
  - Two steps taken for identifying hazards. The answers may be:
    - Standard procedures and protocols for hazard identification
    - Displaying symbols of hazard
    - Obvious indications like electric fuse, wet floor and sharp materials
    - Using senses, like some leakage smell, fuse sound
    - Climate and time; for example, moving to client's place, late night in winters
  - Two materials that are in-scope hazard at an organization. The answers may be:
    - Spill on the floor
    - Wet floor
    - Blockage at washrooms
    - Working at heights
    - Moving device
    - Electric device
    - Short circuit
    - High work load
    - High demands from client
    - Lack of respect
    - Physical abuse
    - Violence
    - Sexual harassment
    - Work pressure
    - Lack of social and colleague support
  - Explain the possible risks at an organization. The answer may be as follows:
    - Biological: This includes infection, injury or accidents
    - Chemical: This includes chemical spills or chemical accidents
    - Ergonomic: This includes office structure and work activity
    - Physical: This includes radiation, sound and other environmental conditions
    - Psychosocial: This includes mind hazards and factors affecting behavior; the examples are stress and work pressure

- For the second exercise, ask the participants to write the following on the board:
  1. Physical hazard – virus, bacterial infection
  2. Chemical hazard – stress and pressure
  3. Ergonomic hazard - pesticides
  4. Biological hazard – slips and falls
  5. Psychosocial hazard - noise and temperature
- Ask some of the participants to come and match the hazards with their examples. Ask the others to check whether they are correct or not. The answer is:
  1. Physical hazard – slips and falls
  2. Chemical hazard – pesticides
  3. Ergonomic hazard - noise and temperature
  4. Biological hazard – virus, bacterial infection
  5. Psychosocial hazard - stress and pressure

## UNIT 9.2: Dealing with Hazards

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the steps to eliminate hazards
- Explain the possible ways to identify hazards
- Evaluate different types of risks
- Explain the ways to eliminate and control hazards
- List the organizational policies to control hazards

### Ask

- Ask the participants if they can list the possible hazards at the work.
- Ask them to name the safety gears a technician should use.
- Ask the participants to tell why it is necessary to receive risk management training.
- Ask them about the common errors which may lead to a mishap.
- Ask the participants to list a few potential hazards.
- Ask them about the basic first aid steps by giving them the following situations:
  - A co-worker faints
  - A co-worker burns his/her finger
  - Someone suffers a bee sting
  - Someone chokes while eating

### Explain

- Explain to the participants about the importance of following the health and safety norms. Emphasize that they should follow the safety guidelines at all times.
- Explain to the participants how providing health and safety information helps to ensure that the employees work safely and without risks to their health. For example, it is essential for the workers to understand:
  - The need of wearing safety gears as soon as they commence their work.
  - The importance of maintaining a correct posture while working to avoid health hazards.
  - The basic first aid measures so that they may help a victim.
  - The importance of identifying, reporting and escalating any potential hazard.
  - The basic health guidelines drawn by the company.
  - The need to assess and control risks.
- Tell that effective health and safety training shall help them in being competent during an unforeseen mishap. For example:
  - Electric shocks
  - Falls
  - Burns

- Inhaling any foreign body
- Cuts
- Explain the proper handling of tools, equipment and hazardous materials.
- Explain the importance of using safety gears such as wrist strap, gloves and proper clothing.
- Tell them about the procedures which are required to be followed in case of emergencies.
- Explain to them in detail about providing first aid.
- Explain the importance of maintaining a proper posture while working.
- Explain to them that risk management refers to the practice of identifying potential risks in advance, analysing them and taking precautionary steps to reduce/curb the risk.
- Exercise Handling Strategy:
  - To facilitate the exercise, ask the participants to complete the sentences which are listed in the following:
    1. Low level risk causes \_\_\_\_\_.
    2. Give an example of visible hazards. \_\_\_\_\_
    3. Give an example of invisible hazards. \_\_\_\_\_
    4. Write a method that can be followed in organizational control operation \_\_\_\_\_.
    5. Write a method that can be followed in technician control operation \_\_\_\_\_.
  - The answers to the questions are:
    1. Infection or injury
    2. Physical and chemical hazards
    3. Biological and psychological hazards
    4. Work place modification and tools and device replacement
    5. Hearing protection, eye wear and breathing mask

## UNIT 9.3: Importance of Safe Work Area

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the need of safety at work place
- Identify the possible ways to eliminate hazards
- Explain the procedures to maintain safe work place

### Say

- Tell the participants that workplace safety is essential to reduce the risks and to stay protected from harm.
- Say that they should know about the safety procedures and the safety hazards information.

### Explain

- Explain employee rights and responsibilities.
- Explain common work place problems.
- Explain to them some of the employer's duties.

### Elaborate

- Elaborate on the employer' duty by saying that the employers have legal obligations to ensure a safe and healthy workplace for their employees in the first instance – and also for anyone else who may visit the workplace such as customers, contractors and members of the public.
- All employers, whatever the size of the business, must do the following:
  - Design, provide and maintain workplaces which are safe and without risk to health.
  - Identify any hazards (actual or potential) and take measures to control the risks, preferably by eliminating them – but if that is not possible, by reducing them as far as possible.
  - Ensure that safe working practices are developed and implemented.
  - Implement measures to reduce the risk of bullying and harassment.
  - Provide adequate first aid facilities.
  - Provide employees with information, instructions and training. They must set up contingency plans to deal with accidents and emergencies (including the evacuation of the workplace).
  - Ensure that ventilation, temperature, lighting, toilet, washing and rest facilities meet the standard of health, safety and welfare sought by the statutory bodies.
  - Ensure that appropriate work equipment is provided and is properly used and regularly maintained.
  - Take necessary precautions against the risks caused by flammable or explosive hazards, electrical equipment, noise, dust and radiation.

- Take reasonable steps to avoid potentially dangerous work involving manual handling and provide manual handling training where required.
- Provide health supervision, as needed.
- Provide protective clothing, where required, and appropriate warning signs.
- Report specific accidents, injuries, diseases and dangerous occurrences to the appropriate authorities and maintain records of accidents and injuries as appropriate.

## Ask

- Ask them if they can tell some employees' rights and responsibilities which helps to protect them from safety hazards.
- Ask them if they can tell some common work problems.

## Notes for Facilitation

- Explain to them that safety is one of those things that many of us take for granted until it is too late. After an injury or a mishap has happened, most of us wish we could have had more instruction on how to stay safe.
- Further, tell them that safety is the responsibility of every person who works for the company. The person must not only take reasonable care of himself/herself but also of other human beings and the surroundings which may be affected by unsafe acts or omissions. The important thing to remember is that any working environment is a potentially dangerous place. A safe attitude is essential because it will help to guard against complacency and create a productive working environment for all. So, it is crucial to be aware of the risks to health and safety before an accident happens, and to take steps to remove or control those risks.
- Write on the white board and tell the participants the obvious reasons why workplace safety should be the priority. Some of them are as follows:
  - Injury
  - Death
  - Corporate financial loss
  - Property damage
  - Worker productivity increases
  - The service or quality of the product improves
  - Corporate reputation / public relations improve
- Briefly, explain about the organisational safety policies.
- Exercise Handling Strategy:
  - To facilitate the exercise, ask the participants to answer true or false for the following sentences:
    1. Hazard management increases the cost of the business.
    2. Housekeeping is a process of keeping a house clean.
    3. A survey does not play a main role in assessing hazards.
    4. Regular inspection is important to maintain safe workplace.
    5. Eliminating hazards improves the quality of work.

- Answers are:
  1. False
  2. True
  3. False
  4. True
  5. True

## UNIT 9.4: Maintaining Safe Work Area

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the facilities for safe work area
- Explain the requirements for safe work area

### Ask

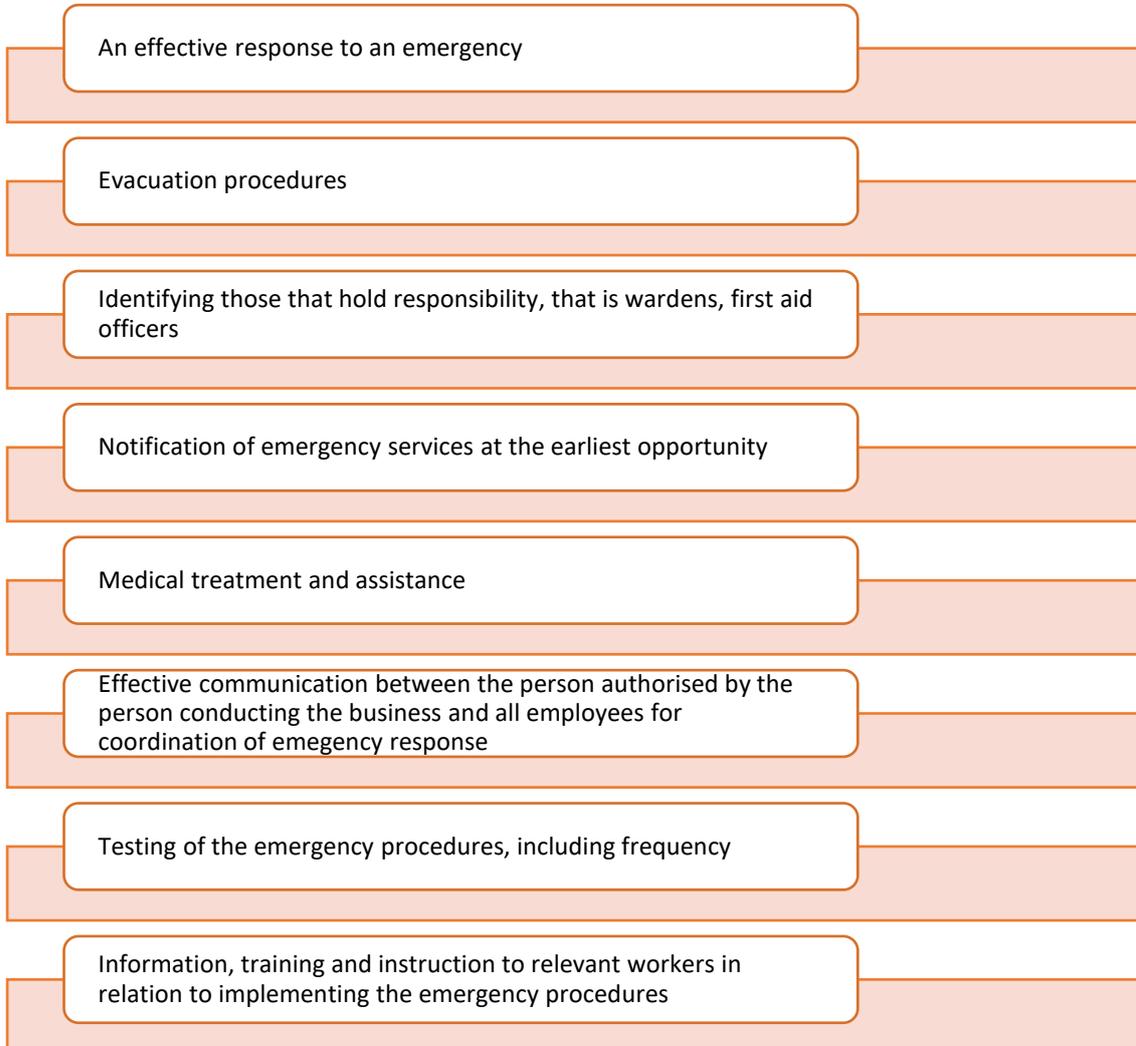
- Ask the participants if they can tell some of the requirements for safe work area.
- Ask them if they can tell some of the practices which can provide them safety at their work place.

### Elaborate

- Elaborate on the point that a successful system is a part of an overall business operation; as important as the other things to be done to succeed in business.
- Successful, safe and healthy systems have the following elements in place:
  - Managers committed to making the program work
  - Employees involved in the program
  - A system to identify and control hazards
  - Compliance with OSHA regulations
  - Training on safe work practices
  - Mutual respect, caring and open communication in a climate conducive to safety
  - Continuous improvement

## Notes for Facilitation

- Tell the participants that an emergency is an abnormal and dangerous situation needing prompt action to control, correct and return to a safe condition.
- Further, tell them about the emergency procedure which contains the features as shown in the following figure:



*Fig 9.4.1 Emergency procedure*

- Explain to them about the supervisor's role during an emergency situation as follows:
  - The supervisor should have knowledge of the emergency procedures for the site, and the application to his or her area of responsibility.
  - The person should ensure all workers under his/her supervision are aware of the procedures, including early warning and evacuation
  - The person should ensure all the workers are aware of who the wardens and first aid officers are.
  - He/she should ensure that all workers have been trained and have practiced emergency procedures.
  - The person should ensure maintenance of all equipment including fire extinguishers, warning systems, emergency lighting and exits.

- He should be trained in the use of emergency equipment such as a fire extinguisher.
- Exercise Handling Strategy:
  - To facilitate the exercise, write the following on the white board and ask the participants to come and match them to their correct answers:
    1. Infection control – Physical hazard reduction
    2. Arrangement – Psychological hazard reduction
    3. Light and ventilation - Sanitizer
    4. Friendly environment – Coffee and tea
    5. Refreshing activities – Quality work place
  - Ask the other participant to check if the answers are correct and make it an interactive session by asking the reason for their answer. The answers are:
    6. Infection control – Sanitizer
    7. Arrangement – Physical hazard reduction
    8. Light and ventilation - Quality work place
    9. Friendly environment – Psychological hazard reduction
    10. Refreshing activities – Coffee and tea

## UNIT 9.5: Dealing with Emergencies

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the possible emergencies at an office
- List the essentials to deal with an emergency
- Explain the emergency procedure

### Explain

- Explain to the participants that workplace emergency is an unforeseen situation that threatens the employees, customers or the public, disrupts or shuts down operations or causes physical or environmental damage. Emergencies may be natural or manmade and include the following:
  - Floods
  - Hurricanes
  - Tornadoes
  - Fires
  - Toxic gas releases
  - Chemical spills
  - Radiological accidents
  - Explosions
  - Civil disturbances
  - Workplace violence resulting in bodily harm and trauma
- Tell them that the best way of protection is to prepare to respond to an emergency before it happens. Few people can think clearly and logically in a crisis; so, it is important to do so in advance, when there is time to be thorough.

### Say

- Give them some worst-case scenarios as the following and ask them to brainstorm for the solutions:
  - What would they do if a fire accident happens while working?
  - What if a hurricane hit their building head-on?
- Once they have identified potential emergencies, ask them to consider how these would affect them and how they would respond.

## Notes for Facilitation

- Tell them that an emergency action plan covers designated actions that the employers and employees must take to ensure employee safety from fire and other emergencies. Not all employers are required to establish an emergency action plan. Also, putting together a comprehensive emergency action plan that deals with all types of issues specific to a worksite is not difficult.
- Explain to them that when developing an emergency action plan, it is a good idea to look at a wide variety of potential emergencies that could occur in a workplace. It should be tailored to the worksite and include information about all potential sources of emergencies. Developing an emergency action plan means one should do a hazard assessment to determine what, if any, physical or chemical hazards in the workplace could cause an emergency. If there is more than one worksite, each site should have an emergency action plan.
- Further, tell them that the emergency action plan must include the points as shown in the following figure:

A preferred method for reporting fires and other emergencies

An evacuation policy and procedure

Emergency escape procedures and route assignments, such as floor plans, workplace maps and safe or refuge areas

Names, titles, departments and telephone numbers of individuals, both within and outside the company, to contact for additional information or explanation of duties and responsibilities under the emergency plan

Procedures for employees who remain to perform or shut down critical plant operations, operate fire extinguishers, or perform other essential services that cannot be shut down for every emergency alarm before evacuating

Rescue and medical duties of workers designated to perform them

*Fig 9.5.2: Emergency action plan*

- Explain to them about the conditions in which they need to call out for emergency evacuation. Some of the conditions are as follows:
  - In the event of an emergency, local emergency officials may give the order to evacuate the premises.
  - In some cases, they may give the instruction to shut off the water, gas, and electricity.

- If there is access to radio or television, listen to newscasts to stay informed and follow whatever official orders are received.
- In other cases, a designated person within the business should be responsible for making the decision to evacuate or shut down operations.
- Protecting the health and safety of everyone in the facility should be the first priority. In the event of a fire, an immediate evacuation to a predetermined area away from the facility is the best way to protect the employees.
- On the other hand, evacuating the employees may not be the best response to an emergency such as a toxic gas release at a facility across the town from the location of the business.
- The type of building the business has may be a factor in the decision. Most buildings are vulnerable to the effects of disasters such as tornadoes, earthquakes, floods or explosions. The extent of the damage depends on the type of emergency and the building's construction. Modern factories and office buildings, for example, are framed in steel and may be structurally sounder than the neighbourhood business premises.
- In a disaster such as a major earthquake or explosion, however, nearly every type of structure will be affected. Some buildings will collapse, and others will be left with weakened floors and walls.
- Exercise Handling Strategy:
  - To facilitate the exercise, ask the participants to form a group and give them some of the following topics for group discussion.
    - Ask them to give an example for a possible emergency at an office. The answer may be:
      - Fire accidents
      - Medical emergencies including heart issues, respiration problems and allergic reactions
      - Falling incidents
      - Electric shock
      - Stress
    - Ask them to name any two essentials used at the time of an emergency. The answer may be:
      - Alarm system
      - Emergency symbols
      - Call and contact number
      - Safety officer
      - Emergency procedure
    - Ask them to write a step involved in dealing with an emergency. The answer may be:
      - Switch on the alarm and indicate to others regarding the emergency.
      - Call the safety officer or rescue operations and give details of the emergency.
      - Evacuate all the persons from the emergency situation using the safety exit.

- Help people who are physically challenged or others who are in the need of help.
- Switch off all the electric devices and power sources.
- Take charge and ensure every person is in the safe zone.
- Ask them to write three major requirements to overcome an emergency situation.  
The answer may be:
  - Well trained safety officer
  - Evacuation procedure
  - Safety procedure and hazard removal process

## UNIT 9.6: Health, Safety and Security Standards

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the goals of health, safety and security at work area
- Explain the need of health, safety and security at work
- List the advantages of maintaining good health and safety at work

### Do

- Welcome and greet the participants.

### Activity

- Group the participants into pairs and make them sit back to back.
- Give one participant a pen and paper and other a picture of a thing such as a chair, a sanitizer or an eye wear.
- Ask the participant holding the picture to describe it.
- Ask the other participant to draw the picture based on the description.

### Time

- Set five minutes as the time limit of the activity.
- Ensure that the activity finishes within time.

### Explain

- Introduce the topic of importance of health, safety and security.
- Explain the importance of all the three components.
- Explain the goals of health, safety and security.
- Tell the participants how these three factors have importance at work.

## Do

- List the following points on the whiteboard to explain strategic goals of health and safety.
  - Health: Increase the focus on work-related health risks.
  - Safety: Maintain and develop the advances achieved in the management of work-related safety risks.
  - Chemicals: Focus on the risks to human safety and health arising from chemicals used at work and by the general public.
  - Accreditation: Provide an impartial, internationally recognised accreditation service, responsive to market.
  - How to work: Continue to change and transform the way to work
- Take the points one by one and explain the concept with the help of day to day examples.

## Notes for Facilitation

- Start a discussion by asking how to ensure the health, safety and security of the people at a workplace through the following points:
  - Establishing management commitment
  - Consultation with external experts
  - Identifying rights, obligations and responsibilities
  - Implementing policies and procedures
  - Ensuring suitable safety and security resources
  - Training staff
  - Identifying all potential risks and hazards
  - Assessing risks and hazards
  - Controlling risk and hazards
- Exercise Handling Strategy:
  - Ask them to form groups for a discussion on the given questions.
  - Explain two goals of a healthy, safe and secure environment. The answer can be:
    - To reduce accidents
    - To improve satisfaction of employees
    - To improve law adherence and ethics at work
    - To increase dignity
    - To reduce the cost
    - To reduce the hazards
    - To improve work efficiency and productivity
    - To improve business
  - Explain any two advantages of a healthy, safe and secure environment. The answer may be:
    - Decreases accidents and misbehaviors at work
    - Reduces the cost of insurance and maintenance
    - Improves legal and safety policies

- Improves business operations
- Aids employee retention
- Why is health at work important? The answer may be:
  - In an organization, a technician should be healthy to give high productivity and efficiency rate. The organization should minimize the health hazards at work to ensure that the technicians do not get affected by any health issue because of some work activity.
  - It is also essential to provide leave for those who are infected, because they can spread the illness to other technicians at work.
  - Providing education and training on hygienic conditions and health procedures can help to maintain a healthy work environment.

## UNIT 9.7: Safety Breaches

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Describe safety breaches
- Identify safety breaches at work
- Explain the responsibilities of an organization to determine safety breaches
- Explain assessment of safety breaches
- Identify the penalties for safety breaches

### Explain

- Explain the breaches of work health and safety law as the following:
  - Exposing workers to the risk of excessive noise
  - Working at heights where the risk of falling is not controlled
  - Allowing unlicensed operators to use specified equipment (such as forklifts)
  - Not ensuring that the plant is appropriately guarded to eliminate or minimise exposure of workers to moving parts
  - Failing to have in place, safe work method statements for work to be carried out in or near a confined space
- Exercise Handling Strategy:
  - To facilitate the exercise, ask the participants to form groups and give the questions for discussion.
  - What is a safety breach? The answer may be:
    - Every organization has a standard policy and system to maintain safety. If there is any technician's act that happens against this policy and the system, then it is called a safety breach.
  - List any four penalties for safety breaches. The answer may be:
    - Warning
    - Notice from manager
    - Day – Suspension (For a day)
    - Fine
    - Suspension (For more than 3 days)
    - Permanent relieve from work
    - Police intervention if the breach is related to law and government rule

- Name mild and serious safety breaches, two each. The answer may be:

**Mild Safety Breaches**

- Making noise at work
- Working at the tool or device with no experience
- Working without manager approval
- Leave without notification
- Late entry into office
- Fail to deliver on time
- Negative attitude and behaviour
- Leave work without notification
- Failure to use PPE at work

**Serious Safety Breaches**

- Mistake which can cause death or serious injury to co-worker
- False electric connection and failure to check electric line
- Destruction of Internet or other operation system
- Sexual harassment
- Client abuse
- Fraudulence in making invoice
- Personal identity fraudulence

*Fig 9.7.1 Mild and serious safety breaches*

## UNIT 9.8: Evacuation Procedure and Safety Norms

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Describe evacuation procedure
- Explain government rules on safety
- List the benefits of government norms

### Explain

- Explain the health and safety acts which are present in India. For example, the Factories Act 1948 was enacted to ensure the employees' health and safety. It is explained in detail in the following image:

In accordance with the Factories Act 1948, an occupier of an establishment has to ensure the health, safety and welfare of all the workers while they are at work in the factory.

It is obligatory for an employer/occupier to ensure the provision and maintenance of plant and systems of work that are safe and without health risks.

Arrangements should be made to rectify risks involved in use, handling, storage and transport of articles and substances.

The establishment should be monitored to check the quality of the premises; cleanliness, disposal of wastes and effluents, ventilation and temperature, dust and fume, artificial humidification, overcrowding, lighting, clean drinking water, latrines and urinals and spittoons.

Safety of the worker must be ensured by installing and maintaining the machinery, mechanisms, transmission apparatus, tools, equipment and machines in best possible safety conditions.

The employer is obliged to take care to protect the worker's health and safety by providing the means of rescue, the first aid and the cleanup; and appropriate arrangements and organization of the workplace.

The Factories Act requires employers to provide protective equipment (means of protection) to workers involved in hazardous work.

The type of PPE needed varies depending on the nature of work being performed. It includes screens or suitable goggles for protection of eyes.

The right use of PPE reduces risk of accident and illness, minimizes future medical costs, and helps in creation of safer working environment.

In accordance with the Factories Act, it is the responsibility of an employer to provide instruction, training and supervision, as is necessary to ensure health and safety of the employees at work.

Fig 9.8.1 Factories Act

- Further, explain to them that the Labour Inspection System of the Factories Act provides for a vibrant labour inspection system. However, this system is state based.
- Tell them that the Ministry of Labour and Employment along with ministries specialized for certain industrial sectors (for example the Ministry of Power, Ministry of Mines) are responsible for formulating and administering laws and regulations relating to labour and employment.
- Also, explain that the national legislation provides inspectors with the power to enter in workplace premises; examine, inquire or interview anyone, ask for or take copy of any prescribed register, record or other document and take measures and photographs. The labour inspector is also authorized to dismantle any item or subject it to any process or test and take possession of any such article or substance that seems to cause danger to health and safety; it can be detained i for as long as it is necessary for such an examination.

## Notes for Facilitation

- Exercise Handling Strategy:
  - To facilitate the exercise, ask the participants to form groups and give the questions for discussion.
  - What is an evacuation procedure? The answer may be:
    - During any emergency it is mandatory for the technicians to leave the place of risk on an immediate basis. The procedure which is followed to send the people out of an emergency situation is called the evacuation procedure.
  - Write any four requirements of an evacuation procedure. The answer may be:
    - Technology to report the issue
    - Policy and standard procedure
    - Maps and routes of floor and infrastructure of building
    - Symbols indicating hazards
    - Boards containing contact information
    - Safety officer
    - Training materials to use during evacuation
    - Assembly area
    - Safe zone
  - List any two government norms that should be followed at work place. The answer may be:
    - In work place, every employee should be treated with basic human rights.
    - The workplace should get the authorization for safety and security measurements from the government.
    - There should be a defined pay for each employee at work.
    - The work timings should not be more than eight hours.
    - There should not be any child labour at work.
    - Women's rights and special women policy should be there at work.

- Write two benefits of following government norms at work place. The answer may be:
  - Increases the respect of each individual at work.
  - Ensures treatment of people in an appropriate manner.
  - Creates good culture at work.
  - Allows people to feel safe while working.
  - Improves the interest in work.
  - Develops the skill set of a technician.
  - Improves and gives chance to learn new things at work.
  - Improves active level.
  - Reduces the risks and accidents
  - Reduces the abuse and harassment at work.
  - Increases the female employment rate.
- What are the types of evacuation procedures? The answer may be:
  - Evacuation due to fire
  - Evacuation due to other causes excluding fire



## Introduction: Employability and Entrepreneurship Skills

This Facilitator's guide includes various activities which will help you as a facilitator to make the sessions participative and interactive.

### Ice breaker

- You can begin the module with the following ice breaker:

#### Five of Anything Ice Breaker Steps:

- Divide the participants into groups of four or five by having them number off. (You do this because people generally begin a meeting by sitting with the people they already know best.)
- Tell the newly formed groups that their assignment is to share their five favourite movies of all time, their five favorite novels or their five least liked films. The topic can be five of anything - most liked or disliked.
- This ice breaker helps the group explore shared interests more broadly and sparks lots of discussion about why each person likes or dislikes their selected five.
- Tell the groups that one person must take notes and be ready to share the highlights of their group discussion with the class upon completion of the assignment.

### Expectation Mapping

During the first session and after ice breaker session, ask the participants to answer the following question: "What do I expect to learn from this training?"

1. Have one of the participants write their contributions on a flip chart sheet.
2. Write down your own list of covered material in the training on another flip chart sheet.
3. Compare the two sheets, commenting on what will and what will not be covered during the training.
4. Set some ground rules for the training sessions. Ask the participants to put these rules on a flipchart and display it in the class.
5. You may get back to those sheets once again at the end of the last session of the training.
6. Benefits of doing this exercise:
  - Participants feel better as their opinions are heard.
  - Participants get to know what they should expect from the training.
  - The facilitator gets to know which points to emphasize, which to leave out, and which to add during the training.
7. Expectations from the participants:
  - Must sign the attendance sheet when they arrive for class.
  - Conduct themselves in a positive manner
  - Be punctual, attentive, and participative
8. Explain the contents that are going to get covered one by one and connect it with the expectation mapping done earlier.

9. By the end of this exercise, the participants should have a clear understanding of what to expect from the session and what are the areas that will not get covered.

### **Defining Objectives**

1. Defining the objectives in the beginning of the units sets the mood for the unit.
2. To begin with the end in mind sets the expectations of the participants as what could be the important takeaways from the session.
3. It is also a way of making participants take responsibility of their own learning process.
4. For the facilitator, the objectives decide a designed path to progress on so that the learning stays aligned and on track.
5. Read the objectives slowly, one by one, and ask the participants to explain what they think it means.
6. At the end of the session, you could again revisit the objectives to find out from the participants about how many objectives have been achieved.

### **In order to effectively facilitate this workshop:**

1. You must have thorough knowledge of the material in the Participant Handbook, and be prepared to answer questions about it.
2. You may also wish to read other material to enhance your knowledge of the subject.
3. There may be issues raised with which you are not able to deal, either because of lack of time or knowledge.  
You can either state that you will obtain answers and get back to the participants with the information. In case the query can be turned to an assignment to the class, do so. You can work with the participants on the assignment.
4. You must have a very clear understanding of what the participants want to accomplish by the end of the workshop and the means to guide the participants.
5. As the facilitator, it is your responsibility to make sure that all logistical arrangements are made for the workshop. This may involve doing it yourself or confirming that someone else has made all necessary arrangements associated with the workshop. Assume nothing and check everything before the workshop begins.
6. To break the monotony and boredom during sessions, introduce mini breaks in the form of stretching exercises, jokes, some group songs or games.
7. Invite discussion from the participants.
8. Probe the participants further and lead them to come to affirmative conclusions.
9. Let the participants answer. No answer is incorrect.
10. Ask one participant to write all the points on the whiteboard.
11. Build the sessions from the answers provided by the class.
12. Prepare for the sessions in advance so that the resources like flipcharts, handouts, blank sheets of paper, marker pens, etc. can be kept ready.
13. Ensure that resources like board, markers, duster etc. is available before your session starts.

**General instructions for role playing:**

1. You are not being asked to be an actor or to entertain. The purpose of the role play is to provide a situation in which you can practice certain skills.
2. When you read the brief, try to imagine yourself in the situation described and behave in a way you feel to be natural – but be conscious of the fact that your role may require a different approach from that which you might normally use.
3. You (and others) may benefit from the change in approach and behavior. Therefore, try to use the approach you feel to be most appropriate for the circumstances described in your brief.
4. The brief is just the starting point. It simply sets the scene and the tone of session or activity. Try not to keep referring to the brief as this will affect the spontaneity of the meeting. Allow the role play to develop as you think it might in real life and change your reactions in line with the behavior and responses of others involved.
5. If you find that you have too little information to answer questions or to describe what has happened in the situation, do feel free to add your own thoughts and ideas. Try to keep these within the framework of the role you are taking and try to make your improvisations as realistic as possible.

## UNIT 10.1: Personal Strengths & Value Systems

### Key Learning Outcomes

By the end of this module, the trainees will be able to:

1. Explain the meaning of health
2. List common health issues
3. Discuss tips to prevent common health issues
4. Explain the meaning of hygiene
5. Discuss the purpose of Swachh Bharat Abhiyan
6. Explain the meaning of habit
7. Discuss ways to set up a safe work environment
8. Discuss critical safety habits to be followed by employees
9. Explain the importance of self-analysis
10. Discuss motivation with the help of Maslow's Hierarchy of Needs
11. Discuss the meaning of achievement motivation
12. List the characteristics of entrepreneurs with achievement motivation
13. List the different factors that motivate you
14. Discuss the role of attitude in self-analysis
15. Discuss how to maintain a positive attitude
16. List your strengths and weaknesses
17. Discuss the qualities of honest people
18. Describe the importance of honesty in entrepreneurs
19. Discuss the elements of a strong work ethic
20. Discuss how to foster a good work ethic
21. List the characteristics of highly creative people
22. List the characteristics of highly innovative people
23. Discuss the benefits of time management
24. List the traits of effective time managers
25. Describe effective time management technique
26. Discuss the importance of anger management
27. Describe anger management strategies
28. Discuss tips for anger management
29. Discuss the causes of stress
30. Discuss the symptoms of stress
31. Discuss tips for stress management

## UNIT 10.1.1: Health, Habits, Hygiene: What is Health?

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the meaning of health
- List common health issues
- Discuss tips to prevent common health issues
- Explain the meaning of hygiene
- Discuss the purpose of Swachh Bharat Abhiyan
- Explain the meaning of habit

### Resources to be Used

- Participant Handbook

### Ask

- What do you understand by the term “Health?”
- According to you, who is a healthy person?

### Say

- Discuss the meaning of health and a healthy person as given in the Participant Handbook.

### Ask

- When did you visit the doctor last? Was it for you or for a family member?

### Say

- Discuss the common health issues like common cold, allergies etc. Refer to the Participant Handbook.
- Let us do a small activity. I will need some volunteers.

### Role Play

- Conduct a small skit with volunteers from the class. Consider one of the villagers has been appointed as a health representative of the village, what measures will you as a health representative suggest to the common villagers to prevent common health issues discussed.

- You will need at least 4 volunteers (Narrator, Health Representative, Head of the Village, Doctor).
- Explain the health concerns of the village to the Narrator. The Narrator will brief the class about the skit.
- Give the group of volunteers, 5 minutes to do discuss.
- At the end of 5 minutes, ask the group to present the skit to the class assuming them as the villagers.
- The class can ask questions to the group as a common villager.

## Summarize

- Through this activity we got some tips on how can we prevent these common health issues.

## Say

- Let us now see how many of these health standards we follow in our daily life.

## Activity

- Health Standard Checklist from the Participant Handbook.

## Ask

- How many of you think that you are healthy? How many of you follow healthy habits?

## Say

- Let's do an exercise to find out how healthy you are.
- Open your Participant Handbook section 'Health, Habits, Hygiene: What is Health?', and read through the health standards given.
- Tick the points which you think are true for you.
- Try to be as honest as possible as this test is for your own learning.

## Do

- Ensure that all the participants have opened the right page in the Participant Handbook.
- Read aloud the points for the participants and explain if required.
- Give them 5 minutes to do the exercise.
- At the end of 5 minutes, ask the participants to check how many ticks have they got.

## Summarize



- Tell them that they need to follow all the tips given in this checklist regularly in order to remain healthy and fit.

## Ask



### Discuss:

- Is it necessary to practice personal hygiene every day? Why?
- How does a person feel when they do not practice good personal hygiene? Why?
- Can good personal hygiene help a person feel good about his/her self? How?

## Say



- Discuss the meaning of hygiene as given in the Participant Handbook.

## Activity



- Health Standard Checklist: Hygiene

## Say



- Let's do an exercise to find out if we maintain good hygiene habits or not.
- Open the Participant Handbook and read through the Health Standard checklist given.
- Tick the points which you think are true for you.
- Try to be as honest as possible as this test is for your own learning.

## Do



- Ensure that all the participants have opened the right page in the Participant Handbook.
- Read aloud the points for the participants and explain if required.
- Give them 5 minutes to do the exercise.
- At the end of 5 minutes, ask the participants to check how many ticks have they got.
- Ask them to calculate their score.
- Tell them what each score indicates by reading aloud what has been mentioned in the Participant Handbook.

## Ask



- How many of you have heard about “Swachh Bharat Abhiyan”?
- Can you tell the class what it is about?

## Summarize

- Tell them about Swachh Bharat Abhiyan as given in the Participant Handbook and request them to take a pledge to keep our country clean.

## Ask

- What is a habit?

## Say

- Discuss some good habits which can become a way of life.

## Summarize

- Tell them about good and bad habits and the reasons to make good habits a way of life.

## UNIT 10.1.2: Safety

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss ways to set up a safe work environment
- Discuss critical safety habits to be followed by employees

### Resources to be Used

- Participant Handbook
- Safety signs and symbols
- Safety equipments
- Blank papers
- Pens

### Say

- There are many common safety hazards present in most workplaces at one time or another. They include unsafe conditions that can cause injury, illness and death.
- Safety Hazards include:
  - Spills on floors or tripping hazards, such as blocked aisles or cords running across the floor. Working from heights, including ladders, scaffolds, roofs, or any raised work area.
  - Unguarded machinery and moving machinery parts; guards removed or moving parts that a worker can accidentally touch.
  - Electrical hazards like cords, missing ground pins, improper wiring.
  - Machinery-related hazards (lockout/tag out, boiler safety, forklifts, etc.)

### Team Activity

#### Safety Hazards

- There are two parts to this activity.
- First part will cover the potential safety hazards at work place.
- Second part will cover a few safety signs, symbols and equipments at work place.
- Use this format for the first part of the activity.

PART 1		
Hazard	What could happen?	How could it be

## Ask



- How could you or your employees get hurt at work?

## Say



- Let's understand it better with the help of an activity. You will be given a handout within your groups. You have to think about the possible hazards of your workplace, what damage these hazards could cause and about the corrective action.

## Do



- Divide the class into five to six groups of four participants each.
- Put the format on the board for the activity.
- Give blank papers and pens to each group.
- The group is expected to think and discuss the potential safety hazards in the workplace.
- Ask the group to discuss and fill the format using the blank sheet.
- Give the groups 5 minutes for the activity.
- For the second part of the activity, show the class some pictures of safety signs, symbols and equipments.
- Now they will put down a few safety symbols, signs or equipment against the safety hazards identified.
- Give them 5 to 10 minutes to discuss and draw/note it.
- At the end of 10 minutes the groups will present their answers to the class.

## Say



- Now, let's discuss the answers with the class.
- All the groups will briefly present their answers.

## Do



- Ask the audience to applaud for the group presentation.
- Ask de-brief questions to cull out the information from each group.
- Keep a check on time.
- Tell the group to wind up the discussion quickly if they go beyond the given time limit.

## Ask

### De-briefing

- What did you learn from the exercise?
- As an entrepreneur, is it important to ensure the safety of your employees from possible hazards? Why?

## Summarize

- Ask the participants what they have learnt so far.
- Ask if they have any questions related to what they have talked about so far.
- Close the discussion by summarizing the tips to design a safe workplace and non-negotiable employee safety habits.

## UNIT 10.1.3: Self-Analysis- Attitude, Achievement Motivation: What is Self-Analysis?

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the importance of self- analysis
- Discuss motivation with the help of Maslow's Hierarchy of Needs
- Discuss the meaning of achievement motivation
- List the characteristics of entrepreneurs with achievement motivation
- List the different factors that motivate you
- Discuss the role of attitude in self- analysis
- Discuss how to maintain a positive attitude.
- List your strengths and weaknesses

### Resources to be Used

- Participant Handbook
- Old newspapers
- Blank papers
- Pencils/ pens

### Activity

This is a paper pencil activity.

What are the three sentences that describe you the best?
--

What do you need to live happily?
-----------------------------------

What are your strengths and weaknesses?
---

### Do

- Write the three questions on the board/ flipchart before the session begins.
- Give plain papers and pencils/ pens to each participant.
- Tell participants to write the answer for the three questions on the paper.
- Tell them the purpose of this activity is not to judge anyone but to understand more about self.

## Say

- Discuss the concept of Self-Analysis and motivation with reference to Maslow's Hierarchy of Needs as discussed in the Participant Handbook.

## Team Activity

### Tower building

- Each group which will create tower using the old newspapers.

## Do

- Divide the class into groups.
- Give them some old newspapers.
- The task is to create a tower out of the newspapers.
- The group which will create the highest tower standing on its own will be considered the winning group.
- Groups can use as many newspapers as they want to and, in any way, they want.

## Ask

- What did the winning group do differently?
- If you were given a chance, how would you have made the tower differently?
- How did you feel while making the tower?
- Did you feel motivated?

## Say

- Discuss the concept of achievement motivation and characteristics of entrepreneurs with achievement motivation as discussed in the Participant Handbook.

## Ask

- Is your attitude positive or negative?

## Say

- Let me tell you a story:

It's Little Things that Make a Big Difference.

There was a man taking a morning walk at the beach. He saw that along with the morning tide came hundreds of starfish and when the tide receded, they were left behind and with the morning sun rays, they would die. The tide was fresh and the starfish were alive. The

man took a few steps, picked one and threw it into the water. He did that repeatedly. Right behind him there was another person who couldn't understand what this man was doing. He caught up with him and asked, "What are you doing? There are hundreds of starfish. How many can you help? What difference does it make?" This man did not reply, took two more steps, picked up another one, threw it into the water, and said, "It makes a difference to this one." What difference are we making? Big or small, it does not matter. If everyone made a small difference, we'd end up with a big difference, wouldn't we?

## Ask

- What did you learn from this story?

## Activity

### What Motivates You?

- This is an individual activity.
- It is an exercise given in the Participant Handbook.

## Do

- Ask the class to open their Participant Handbook and complete the exercise given in the section What Motivates You?
- Ensure that the participants have opened the correct page for the activity.
- Give the class 5 minutes to complete the activity.

## Say

- Discuss the concept of attitude and how to cultivate a positive attitude as discussed in the Participant Handbook.

## Summarize

- Close the discussion by summarizing how self-analysis, knowledge about what motivates you and your positive attitude can help in your business as well in life.

## UNIT 10.1.4: Honesty & Work Ethics

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss the qualities of honest people
- Describe the importance of honesty in entrepreneurs
- Discuss the elements of a strong work ethic
- Discuss how to foster a good work ethic

### Resources to be Used

- Participant Handbook

### Ask

- What do you understand by honesty?
- Why is it important for entrepreneurs to be honest?
- Do you remember any incident where your honesty helped you in gaining confidence?
- Do you remember any incident where someone lost business due to dishonesty?

### Say

- Discussed in the Participant Handbook.
- “Let's understand it better with the help of some case scenarios. You will be given some cases within your groups. You have to analyse the case scenario that has been given to you and then find an appropriate solution to the problem.
- Keep your discussion focussed around the following:
  - What went wrong?
  - Who was at fault?
  - Whom did it impact- the customer or the businessman?
  - How would it impact the business immediately? What would be the long term impact?
  - What could be done?
  - What did you learn from the exercise?

### Do

- Divide the class into four groups of maximum six participants depending on the batch size.
- Give one case study to each group.
- Instruct them to read the case carefully.

- Put down the de-brief questions on the board and ask the groups to focus their discussion around these questions.
- The group is expected to analyse and discuss the case amongst them and find a solution to the given problem.
- Give the class 5-10 minutes to discuss the case and note down their solutions.
- At the end of 10 minutes the team should present their case solution to the class. The presentation can be a narration or a role play.
- Ask the group to select a group leader for their group. The group leader to discuss and assign roles to the group members for the presentation.

## Team Activity

### Case Study Analysis

#### Scenario 1

Aakash has a small mobile retail sales and repair shop in Allahabad. He has one of the most popular outlets and has great rapport with his customers. It's around 11 AM when a customer barges in to the shop and starts shouting at Aakash for giving her a faulty instrument. The screen of her mobile is cracked from one side. Aakash remembered thoroughly checking the handset before handing it over to the customer. The customer threatens to sue him and to go to Consumer Court for cheating her. Now, the problem occurred somewhere outside the shop but as other customers were listening to the conversation, it might impact his business. The situation needs to be managed very sensitively. What would you do if you were in Aakash's place?

#### Scenario 2

Rajni does beautiful Phulkari embroidery on suits and sarees. She has a small home-based business. She has a huge list of customers on Facebook and WhatsApp who give her orders regularly. Smita is one of her old and regular customers. As her sister-in-law's wedding was around the corner, Smita wanted to buy few handcrafted Phulkari duppatta. She placed an order for three duppattas via WhatsApp and requested Rajni to send them as soon as possible. When the parcel reached Smita through courier she found that out of the three duppattas, only one was hand embroidered and the other two had machine embroidery on them. Even the length and the quality of the material was not as desired. Smita was heartbroken. It was a complete waste of money and moreover she couldn't wear what she had planned to during the wedding functions. She sent a message to Rajni on WhatsApp, expressing her anger and disappointment.

Smita has also sent a feedback and expressed her disappointment on the social media... this will directly affect Rajni's business. What would you do if you were in Rajni's place?

**Scenario 3**

Shankar is a tattoo artist who has a small tattoo showroom in a big, reputed mall in New Delhi. Mr Saksham had an appointment for today, at 11:00 am but he reached at 11:50 am. Meanwhile, Shankar had to reschedule his next appointment. After availing Shankar's services, Mr Saksham started yelling in an abusive language, refusing to pay the requisite amount, and finding faults in the services provided by him. Who was at fault in this case? What should Shankar do? Should he confront Saksham or give in to the demands of the client?

**Scenario 4**

Shailender is an online cloth reseller who does business through social networking sites such as Facebook and WhatsApp. Priyanka made online payment for a dress to Shailender. But she did not receive the dress for a month. When she asked for a cancellation, Shailender started misleading her. For almost 45 days, he kept promising her that he will pay the amount today, tomorrow, day after etc. Even after repeated calls and messages when she did not receive the payment or the dress, she decided to write a post against him on a popular social media platform. As a result, Shailender lost lots of customers and his flourishing business faced a major crisis. How could this situation have been managed?

**Say** 

- Now, let's discuss the problem and solution with the larger group.
- The group will first briefly describe the case to the class.
- Then discuss the issue identified and the proposed solution.
- Once the presentation is over, the class can ask their questions.

**Do** 

- Congratulate each group for the group presentation.
- Ask the audience to applaud for them.
- Ask de-brief questions to cull out the information from each group.
- Keep a check on time. Tell the group to wind up the discussion quickly if they go beyond the given time limit.

**Summarize** 

- Ask the participants what they have learnt from the exercise/ activity.
- Ask if they have any questions related to what they have talked about so far.
- Close the discussion by summarizing the importance of honesty and work ethics for entrepreneurs.

## UNIT 10.1.5: Creativity and Innovation

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the characteristics of highly creative people
- List the characteristics of highly innovative people

### Resources to be Used

- Participant Handbook
- Chart papers
- Marker pens

### Ask

- You must be aware of the term 'Rags to riches' and heard stories related to the term.
- What do these stories tell us?
- What was so special about these people?

### Say

- Let's have a look at these stories.
- There are some inspiring stories about people which I would like to share with you.
- Narrate these stories to the class.

#### **A.P.J. Abdul Kalam**

Who has not heard of A.P.J. Abdul Kalam: Avul Pakir Jainulabdeen Abdul Kalam hailed from a very humble background. His father was a boat owner. To help his family, Kalam would work as a newspaper vendor. With limited resources, he graduated in Physics and studied aerospace engineering. He was instrumental in India's step towards nuclear energy. In 2002, he became the 11th President of India.

#### **Water filter/purifier at source**

Two young boys studying in classes 4 and 5, from Lingzya Junior High School, Sikkim designed a simple innovative low cost water purifier.

Inspiration behind the idea: Most people today prefer to use a water filter/purifier at their home. Both the children have given idea to have filter/purifier at the source of water so that everyone has access to clean water without having to make an investment in purchasing a filter/purifier. Soring's idea is to have a centralized purification system at the point of distribution like water tank while Subash's idea is to have such purifiers attached to public taps.

Source: <http://www.rediff.com/getahead/report/achievers-top-31-amazing-innovations-from-young-Indians/20151208.htm>

**Solar seeder**

This is a story of a innovative solar seeder and developed by Subash Chandra Bose, a class 8, student from St Sebastiyar Matriculation School, Pudukkottai, Tamil Nadu. Subash has developed a solar powered seed drill, which can undertake plantation for different size of seeds at variable depth and space between two seeds.

Source: <http://www.rediff.com/getahead/report/achievers-top-31-amazing-innovations-from-young-Indians/20151208.htm>

**Looms for physically challenged**

Now this is really inspiring of two sisters, Elakkiya a Class 6 student and Pavithra a Class 9 student of SRC Memorial Matriculation, Erode, Tamil Nadu.

The two sisters have come up with loom for lower limbed physically challenged. In their loom, they have replaced the pedal operated system with a motor and a gearbox attached to a pulley mechanism.

Source: <http://www.rediff.com/getahead/report/achievers-top-31-amazing-innovations-from-young-Indians/20151208.htm>

**Ask**

- If they can, why can't you?
- Discuss concepts related to 'Creativity and Innovation' with the participants as given in the Participant Handbook.

**Say**

- Recall the stories on motivation.
- What is the inner drive that motivates people to succeed?
- Let's learn more about such creative and innovative entrepreneurs with the help of an activity.

**Team Activity**

- This is a group activity.
- Think of any one famous entrepreneur and write a few lines about him or her.

**Activity De-brief**

- Why did you choose this particular entrepreneur?
- What is his/her brand name?
- What creativity does he/she possess?
- What was innovative about their ideas?

**Do**

- Instruct the participants that this is group work.
- Divide the class into small groups of 4 or 6 depending on the batch size.
- Give each group a chart paper.
- Tell the participants they have to write a few lines about any one famous entrepreneur.
- Give the participants 10 minutes to discuss and write.
- Keep a check on time. Tell the group to wind up quickly if they go beyond the given time limit.
- Ask each group to read out what they have written.
- Ask the de-brief questions.

**Summarize**

- Summarize the unit by asking participants if they know of some people who are highly creative and innovative in their approach.
- Ask them to share some experiences about these people with the class.

**Notes for Facilitation**

- Source for stories on innovations:  
<http://www.rediff.com/getahead/report/achievers-top-31-amazing-innovations-from-young-Indians/20151208.htm>

## UNIT 10.1.6: Time Management

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss the benefits of time management
- List the traits of effective time managers
- Describe effective time management techniques

### Resources to be Used

- Participant Handbook

### Ask

**Does this sound like you?**

- I can never get enough time to finish what I am doing in a day.
- I have so many things to do that I get confused.
- I want to go for a walk and exercise, but I just do not have the time.
- I had so much to do, so I could not deliver that order on time.
- I would love to start my dream business; but, I just do not have the time.

### Example

- Let's look at these two examples:

**Example 1:**

Ankita works from home as a freelance writer. She says she can easily put in 8 hours of dedicated work in a day. Because she works from home, she saves money on travel and has a comfortable work routine. But there is a challenge and it is distraction. As she works from home, she can easily just get up and sit down on the sofa to watch TV, wasting valuable time. She may have chores to do, errands to run and bills to pay. She ends up working only two to three hours a day and the result is, her work gets piled up. She is unable to take on more work due to this. Even though her quality of work is appreciated her clients are not very happy about the delay in submission.

**Example 2:**

Javed has started a successful online selling company from home and makes a good living from his sales. He has set up a small office space in his living room. As both his parents are working full-time, he also has the role of taking care of his two younger siblings. He almost spends half of his day with the younger kids. He does not mind it but it means taking time away from the work. He is still able to manage his online business with these commitments. He wants to spend some more dedicated hours so as to increase his profits. He also wants to look into new business avenues. What should he be doing.

## Ask



- Does this happen with you too?
- Do you find it difficult to prioritize your work?
- Are you able to manage your time effectively?

## Activity



- Conduct a group discussion based on the above examples.
- Direct the discussion on how to prioritize work and manage time effectively.

## Say



- Time management is not only about how hard you work but also about how smart you work.
- Discuss “What is Time Management” with the participants as given in the Participant Handbook.

## Ask



- Why is it important to manage time? How does it help?
- What happens when you don't manage your time effectively?
- Do you find it difficult to prioritize your work?

## Say



- Discuss the benefits of time management given in the Participant Handbook.
- Let's learn effective time management with the help of an activity.

## Activity

**Effective Time Management**

- This activity has two parts:

**Part 1 To Do List**

- You have to make a to-do list.
- List all of the activities/ tasks that you have to do.
- Try to include everything that takes up your time, however unimportant it may be.
- If they are large tasks, break them into action steps, and write this down with the larger task.
- You can make one list for all your tasks or have separate to-do lists for personal and professional tasks.

**PART 2**  
**URGENT-IMPORTANT GRID**

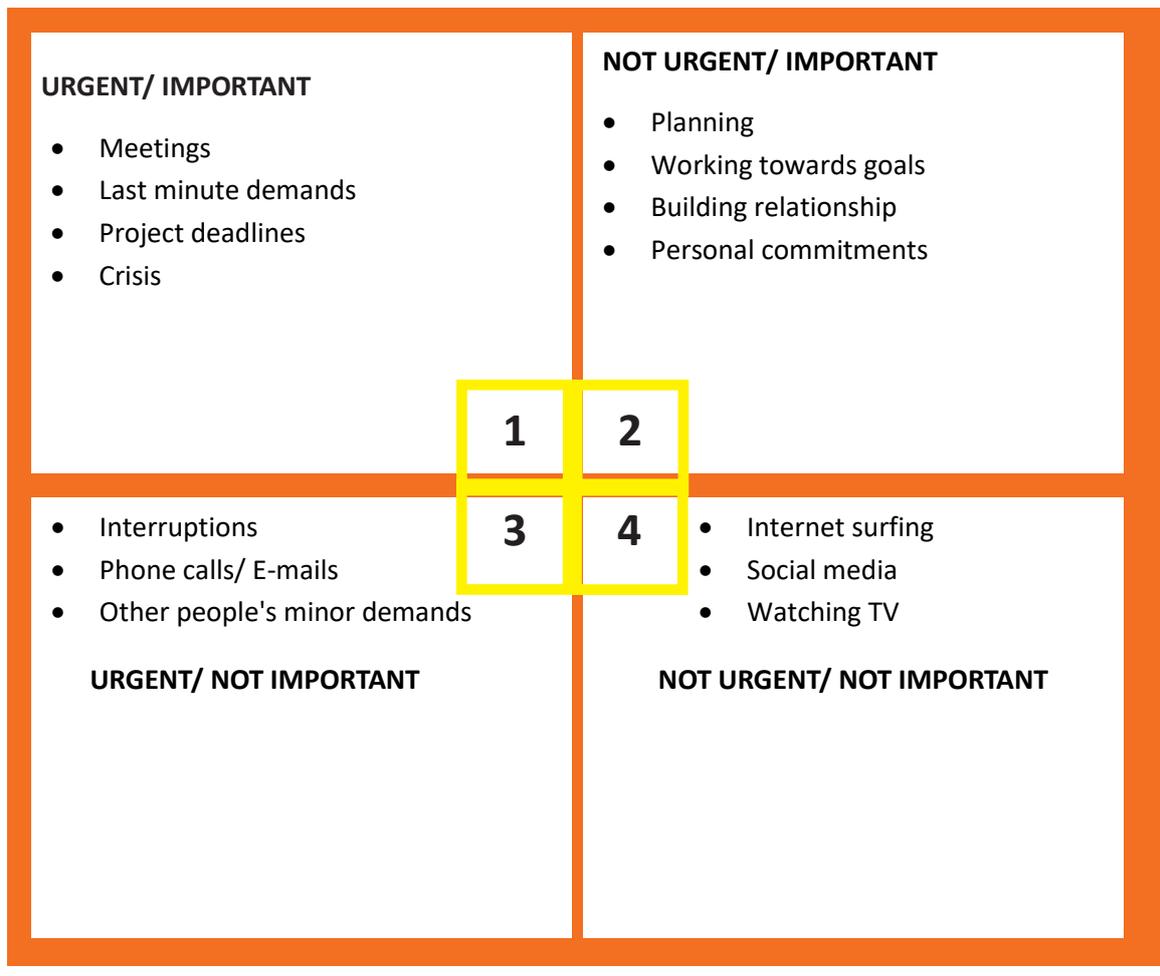
- You have to make a grid as shown on the board here.
- This grid has four boxes. As you can see, each box has a different heading.
- At the heart of the urgent-important grid, are these two questions:
  - Is this task important?
  - Is this task urgent?
- Now, you have to think about each activity that you have written in your to-do list and put it into one of the four categories.
- **What do these categories depict?**
- **Category 1: Urgent/Important**
  - This category is for the highest priority tasks. They need to get done now.
- **Category 2: Not Urgent/Important**
  - This is where you want to spend most of your time.
  - This category allows you to work on something important and have the time to do it properly.
  - This will help you produce high quality work in an efficient manner.
  - The tasks in this category are probably the most neglected ones, but also the most crucial ones for success.
  - The tasks in this category can include strategic thinking, deciding on goals or general direction and planning – all vital parts of running a successful business.
- **Category 3: Urgent/Not Important**
  - This is where you are busy but not productive. These tasks are often mistaken to be important, when they're most often busywork.
  - Urgent but not important tasks are things that prevent you from achieving your goals.
  - However, some may be activities that other people want you to do.
- **Category 4: Not Important and Not Urgent**
  - This category doesn't really include tasks, but rather habits that provide comfort, and a refuge from being disciplined and rigorous with your time management.
  - Some may be activities that other people want you to do.
  - These might include unplanned leisure activities as well.

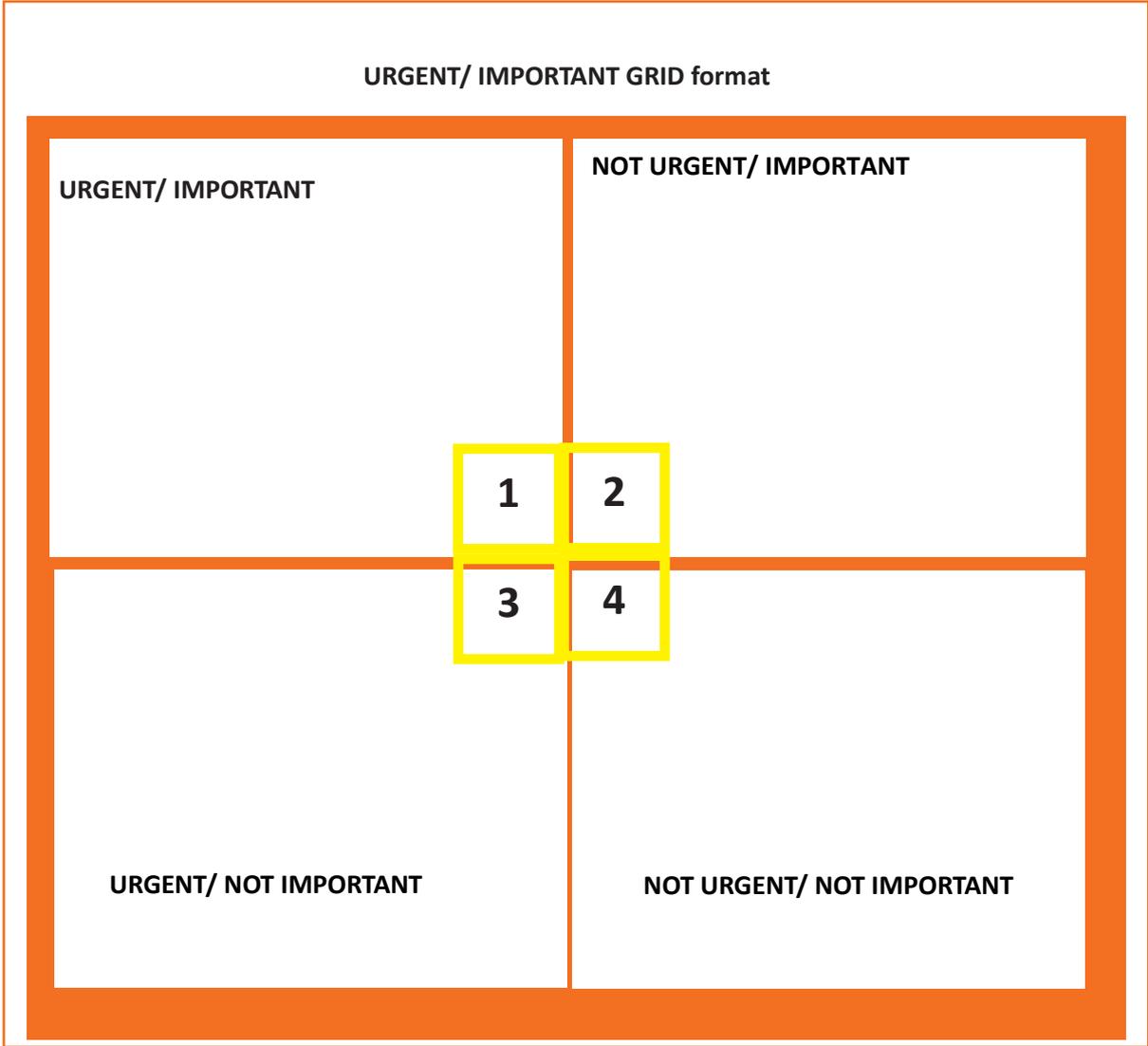
**To – Do List Format**

1	
2	
3	
4	
5	
6	

7	
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9	
10.	
11.	
12.	
13.	
14.	
15.	

**URGENT-IMPORTANT GRID**





## Do



- Put down the formats for the to-do list and the urgent/ important grid on the board.
- Instruct the participants to prepare their to-do list first.
- Give the participants 10 minutes to prepare the list.
- Once done, instruct them to divide the tasks in to-do list into the four categories.
- Explain the four categories to the participants giving examples specific to their context.
- As you explain the categories fill the grid with the type of tasks.
- Give the participants 40 minutes to fill the grid.
- Then explain how to balance the tasks between the four categories.
- Keep a check on time. Tell the group to wind up quickly if they go beyond the given time limit.

## Say

**Activity De-brief:**

**How can we balance tasks between the four categories? How to manage time through this grid?**

- **Category 1: Urgent/Important**
  - Try to keep as few tasks as possible here, with the aim to eliminate.
  - If you spend too much of your time in this category, you are working solely as a trouble shooter, and never finding time to work on longer-term plans.
- **Category 2: Not Urgent/Important**
  - Plan these tasks carefully and efficiently as they are most crucial ones for success.
  - If necessary, also plan where you will do these tasks, so that you're free from interruptions.
  - Include strategic thinking, deciding on goals or general direction and planning in your planning process.
- **Category 3: Urgent/Not Important**
  - Ask yourself whether you can reschedule or delegate them.
  - A common source of such activities is other people. Sometimes it's appropriate to say "no" to people politely, or to encourage them to solve the problem themselves.
- **Category 4: Not Important and Not Urgent**
  - You also want to minimize the tasks that you have in this category.
  - These activities are just a distraction – avoid them if possible.
  - You can simply ignore or cancel many of them.
  - Politely say "no" to work assigned by others, if you can, and explain why you cannot do it.
  - Schedule your leisure activities carefully so that they don't have an impact on other important tasks.
- Discuss the traits of effective time managers and effective time management techniques as given in the Participant Handbook.

## Summarize

- Discuss the traits of effective time managers and effective time management techniques as given in the Participant Handbook.

## Notes for Facilitation

- Here is a short story. You can conclude the session narrating the story. To make it more interesting you can perform the demonstration described and discuss the short story.
  - One day an expert in time management was speaking to a group of students. As he stood in front of the group, he pulled out a large wide-mouthed glass jar and set it on the table in front of him. Then he took out a bag of about a dozen rocks and placed them, one at a time, into the jar. When the jar was filled to the top and no more rocks would fit inside, he asked, "Is this jar full?" Everyone in the class said, "Yes." Then he said, "Really?"
  - He reached under the table and pulled out a bucket of gravel (small stones). He dumped some gravel in and shook the jar causing pieces of gravel to work themselves down into the space between the rocks. Then he asked the group once more, "Is the jar full?" By this time, the class began to understand. "Probably not," one of them answered. "Good!" he replied.
  - He reached under the table and brought out a bucket of sand. He started dumping the sand in the jar and it went into all of the spaces left between the rocks and the gravel. Once more he asked the question, "Is this jar full?" "No!" the class shouted. Once again he said, "Good." Then he grabbed a jug of water and began to pour it in until the jar was filled to the brim. Then he looked at the class and asked, "What is the point of this illustration?" "One student raised his hand and said, "No matter how full your schedule is, if you try really hard you can always fit some more things in it!" "No," the speaker replied, "that's not the point. The truth this illustration teaches us is: If you don't put the big rocks in first, you'll never get them in at all." What are the 'big rocks' in your life? Your children; your loved ones; your education; your dreams; a worthy cause; teaching or mentoring others; doing things that you love; time for yourself; your health; your mate (or significant other). Remember to put these BIG ROCKS in first or you'll never get them in at all. If you sweat about the little stuff (the gravel, sand, and water) then you'll fill your life with little things you worry about that don't really matter, and you'll never have the time you need to spend on the big, important stuff (the big rocks).
- End the story with these lines...  
So, tonight, or in the morning tomorrow, when you are reflecting on this short story, ask yourself this question: What are the 'big rocks' in my life? Then, put those in your jar first.

## UNIT 10.1.7: Anger Management

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss the importance of anger management
- Describe anger management strategies
- Discuss tips for anger management

### Resources to be Used

- Participant Handbook

### Ask

- What is anger? Is anger good or bad?
- Is anger normal or an abnormal behaviour? How can anger harm you?
- Why is it important for entrepreneurs to manage their anger?

### Say

- Talk about anger and the importance of anger management in entrepreneurs as discussed in the Participant Handbook.
- Let us do a small activity. This is an individual activity.
- Think of the incidents and situations that angered you and hurt you.

### Do

- Instruct them to note down these situations under different categories (as given in the Activity).
- Give the class 3-5 minutes to think and note down their answers.
- At the end of 5 minutes, ask some participants to volunteer and present their answers.
- They can also share these situations with their fellow participants if they do not wish to share it with the entire class.

### Activity

- Do you remember any incident which has hurt?
  - you physically
  - you mentally
  - your career
  - your relationships.

## Ask

- Do you ever get angry?
- What are the things that make you angry?
- Do you remember any incident where your anger management helped you in maintaining healthy relationship?
- Do you remember any incident where someone lost business/ friend/ relationship due to temper (anger)?

## Say

- There are a few strategies which can help in controlling your anger. Let's do an activity to understand the anger management process better.
- This is an individual activity.
- Think of the incidents/ situations which trigger your anger (the cause).
- Then think what happened as a result of your anger (the effect).
- You need to come up with some techniques to manage your anger.

## Do

- Give the class the anger triggers (the cause) as listed in the activity.
- Put down the activity format (Anger Triggers, Result of your Anger, Anger Management Techniques) on the board and instruct the class to write the answers under different categories.
- Give the class 3-5 minutes to think and note down their answers.
- At the end of 5 minutes, ask the participants who wish to volunteer and present their answers.

## Activity

### Trigger points and Anger Management Techniques Activity

#### Anger Triggers

List of triggers that make you angry:
Someone says you did something wrong.
You want something you can't have now.
You get caught doing something you shouldn't have been doing.
You are accused of doing something you didn't do.
You are told that you can't do something.

Someone doesn't agree with you.

Someone doesn't do what you tell him to do.

Someone unexpected happens that messes up your schedule.

Result of your anger:

Write the techniques that you use to manage your anger:

**Anger Management Techniques**

## Say

- Now, let's discuss the problems and solution with all.
- The individual will first briefly describe trigger points to the class.
- Then discuss the result of the anger. Other participants are requested to remain quiet while one is making the presentation.
- Post presentation, other participants may ask questions.

## Do

- Congratulate each individual for sharing their points.
- Ask the audience to applaud for them.
- Ask de-brief questions after the presentation to the class.
- Keep a check on the time. Ask the participants to wind up the activity quickly if they go beyond the given time limit.

## Ask

### De-brief questions:

- In the situation described by the presenter, who was at fault?
- How could you have handled this situation alternatively?

## Summarize

- Close the discussion by summarizing the strategies and tips of anger management for entrepreneurs.
- Ask the participants what have they learnt from this exercise/ activity.
- Ask if they have any questions related to what they have talked about so far.

## Notes for Facilitation

- Encourage the participants to share information about them while presenting the situations to the class.
- Keep the format of the Activity prepared in a chart paper so that it can be displayed during the session.

## UNIT 10.1.8: Stress Management: What is stress?

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss the causes of stress
- Discuss the symptoms of stress
- Discuss tips for stress management

### Resources to be Used

- Participant Handbook

### Ask

- You are waiting in the reception for an interview or a very important meeting, suddenly your legs are shaky, your hands are cold, you are feeling nervous. Have you ever been in this kind of situation?
- Have you had days when you had trouble sleeping?
- Have you ever been so worried about something that you ended up with a terrible headache?

### Say

- You've probably heard people say, "I'm really stressed out" or "This is making me totally stressed."

### Ask

- What do you understand by stress?
- What gives you stress?
- How do you feel when you are stressed or what are the symptoms of stress?
- How can stress harm you?
- Why is it important for entrepreneurs to manage stress?

### Say

- When we feel overloaded or unsure of our ability to deal with certain challenges, we feel stressed.
- Discuss about stress, causes of stress, and symptoms of stress as discussed in the Participant Handbook.
- Let's understand the causes of stress and how to deal with them with the help of some case scenarios.

- You will be given some cases.
- You have to analyse the case scenario and then find an appropriate solution to the problem.
- This will be a group activity.

## Do

- Divide the class into four groups of 5- 6 participants (depending on the batch size).
- Assign one case scenario to each group.
- Instruct them to read the case carefully.
- The group is expected to analyse and discuss the case amongst them and find a solution to the given problem.
- Explain their discussion should result in getting answers for the following questions:
  - What was/ were the cause(s) of stress?
  - Was the stress avoidable or manageable under the given circumstances?
  - If yes, how do you think that the stress could be avoided (managed)?
  - If no, then why not?
- Give the class 10-12 minutes to discuss the case and note down their solutions.
- At the end of 12 minutes, the team should present their case solution to the larger group.
- Ask the group to select a group leader for their group.
- The group leader to discuss and assign roles to the group members for the presentation.

## Team Activity

### Case Study Analysis

#### Scenario 1

Akash's alarm doesn't go off and he gets late getting out of the house. He hits traffic and ends up 15 minutes late to work, which his boss notices. He gets to his desk and finds he has to complete 2 reports in next one hour. Just when he is about to begin work, a message pops up "Telecon with the client begins in 10 minutes. Please be in the conference room in 5 minutes." He is not prepared for the call. He is stressed. He does not want to speak to his boss about this. He is stressed, feeling uncomfortable and sick. Not in a position to attend the call or finish the reports on time.

#### Scenario 2

While paying his overdue bills, Rahul realised that it's the middle of the month and he has only Rs 500 left in his account. He has already asked all of his friends, and family for loans, which he hasn't paid back yet. He is still contemplating over the issue when his phone rings. His sister's birthday is due next week and she has seen a beautiful dress which she wants to buy but cannot tell the parents as it is a bit expensive. She wishes if Rahul could buy the dress for her. Rahul has promised to buy her the dress for her birthday.

Rahul is stressed, does not understand what to do. He is unable to concentrate on his work and unable to complete the tasks assigned. His team leader has already warned him of the delay.

### Scenario 3

Sheela calls the cable company as she has unknown charges on her bill. She has to go through the automated voice mail menu three times and still can't get through to a customer care executive. After 15 minutes of repeated efforts, her call is answered. She explains the entire issue to the customer care executive but before the person could suggest a way out, the call drops.

Now Sheela has to call back and repeat the whole process all over again with a new customer care executive. She is very angry and calls again but cannot connect this time.

She has to leave to office so she decides to call from office and check. When she connects this time, she is angry and argues with the executive on the call. All her co-workers around are looking at her as her volume has suddenly increased. She bangs the phone and ends the call. Her co-worker Neelam enquires what has happened to her. She ignores her and just walks off. She has become irritable and her behaviour and tone with other co-workers is not acceptable.

### Scenario 4

Arpit is a young entrepreneur who started doing business through Facebook few weeks back. He had always been into a job. Although Arpit has very few financial liabilities, it wasn't an easy decision to leave a comfortable job at once and look for newer pastures. Arpit's boss warned him of the consequences and the challenges of starting a business when nobody ever in his family had been in business.

He has not been able to get a good deal till now. This is an important life shift for him which comes with unknown variables. Arpit is nervous and is wondering if he has what it takes to fulfill the requirement of his new role, or the new experiences he's likely to face.

## Ask

### De-brief questions:

- What was/ were the cause(s) of stress?
- Was the stress avoidable or manageable under the given circumstances?
- If yes, how do you think that the stress could be avoided (managed)?
- If no, then why not?

## Say

- Now, let's discuss the problem and solution with the larger group.
- The group will first briefly describe the case to the class.

- Then discuss the issue identified and the proposed solution.
- Post presentation, the other groups may ask questions to the group that has presented.

## Do

- Congratulate each group for sharing their points.
- Ask the audience to applaud for them.
- Ask de-brief questions to cull out the information from each group.
- Keep a check on time. Tell participants to wind up the discussion quickly if they go beyond the given time limit.

## Say

- While it is common and normal to feel some tension. This feeling nervous and tensed can interfere with your thinking process and can have a negative impact on your performance.
- Stress can deplete the most vibrant of souls. It can have a negative effect on every aspect of a person's life including their health, emotional well-being, relationships, and career. However, one needs to understand the causes and types of stress before looking for ways to manage it.

### De-brief:

#### Scenario 1

The cause of stress was lack of time management and the habit of procrastinating. If Akash would have managed his time well, planned alternate ways to get up on time, finished prior tasks on time and planned for client meetings in advance then he wouldn't have faced stress.

#### Scenario 2

The cause of stress was lack of financial planning. Rahul should have planned his financial resources well in advance and saved some money for the rainy day. Also, differentiating between needs and wants and keeping a check on non-essential expenditure would have saved Rahul from this situation.

#### Scenario 3

Sometimes, stress is caused due to external factors instead of internal ones. In this case, the stress was unavoidable because we have no control over this customer care system. Every time, you will get in touch with a new executive and will have to explain all over again. This might cause stress but despite being frustrated and angry there is little that we can do about it. All Sheila could do was to find ways to calm herself down through some breathing exercises and meditation, reading some good book or listening to music and then start afresh.

**Scenario 4**

A positive, major life change can be a source of good stress. Regardless of how good the change is, it can be stressful. Stress caused by a positive and major life change can be beneficial because it causes a person to step out of their comfort zone and learn new skills. Here, Arpit may become a successful entrepreneur or learn new ways to do things differently. Now let us see this scenario, can I have a volunteer to read out this case to the class

**Do**

- Ask one of the participant who can volunteer and read out this scenario to the class.

**Scenario 5**

Rakesh lives in Kathmandu with his wife and two beautiful daughters Sarah and Sanya. Nepal was hit by a massive earthquake and Rakesh's building collapsed during the earthquake. During evacuation, Rakesh realised that though his wife and Sarah were fine and suffered only minor bruises, Sanya was nowhere in the scene. Panic stricken, he started calling her name and searching her frantically. A little later, he heard a meek voice from beneath the debris. He quickly removed the rubble to find a huge bed. Rakesh was pretty sure that Sanya was trapped underneath. Though he was badly bruised, he gathered all his courage and with all his might, he lifted the several-ton bed to save Sanya's life. Everyone was relieved to see Sanya alive and also extremely surprised to see this father's ability to access superhuman strength.

- Ask the audience to applaud for the participant after the scenario is read completely.
- Discuss the scenario, ask de-brief questions:
  - What kind of stress was Rakesh undergoing in this case?
  - Was the stress avoidable or manageable under the given circumstances?
  - What was the result of the stress?

**Say****De-brief:**

- Not all stress is harmful; good stress is actually energizing. This was a case of lifesaving stress, or hero stress, which is an important example of good stress. You may have heard stories in which a person performs an impossible feat of physical strength in order to save their life or the life of someone they love. This type of stress causing a surge of adrenaline is good for us.

## Summarize

- Close the discussion by summarizing the tips to manage stress as given in the Participant Handbook.
- Ask the participants what they have learnt from this exercise/ activity.
- Ask if they have any questions related to what they have talked about so far.

## Notes for Facilitation

- Keep printed copies of the activities/ scenarios ready for the session.
- Put down the de-brief questions on a flip chart so that it can be displayed in the class during the activity.
- Encourage participation and make the discussions interactive.

## UNIT 10.2: Digital Literacy: A Recap

### Key Learning Outcomes



By the end of this module, the trainees will be able to:

1. Identify the basic parts of a computer
2. Identify the basic parts of a keyboard
3. Recall basic computer terminology
4. Recall the functions of basic computer keys
5. Discuss the main applications of MS Office
6. Discuss the benefits of Microsoft Outlook
7. Identify different types of e-commerce
8. List the benefits of e-commerce for retailers and customers
9. Discuss Digital India campaign will help boost e-commerce in India
10. Describe how you will sell a product or service on an e-commerce platform

## UNIT 10.2.1: Computer and Internet Basics: Basic Parts of a Computer

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Identify the basic parts of a computer
- Identify the basic parts of a keyboard
- Recall basic computer terminology
- Recall the functions of basic computer keys

### Resources to be Used

- Participant Handbook
- Computer Systems with the required applications

### Say

- Let's take a quick recap of the basic computer parts.
- Discuss 'Basic Parts of Computer' and 'Basic Parts of a Keyboard' with the class as given in the Participant Handbook.

### Explain

- Explain all the parts of the computer and the keyboard by demonstrating on the real system.

### Ask

- Do you know about internet?
- Have you ever used internet?
- Why do you think internet is useful?
- What was the last task you performed on internet?

### Say

- Let's look at some basic internet terms.
- Discuss 'Basic Internet Terms' with the participants as given in the Participant Handbook.

### Summarize

- Ask the participants what they have learnt from this exercise/ activity.
- Ask if they have any questions related to what they have talked about so far.

- Close the discussion by summarizing the importance of computer and internet for entrepreneurs.

## Practical

- Conduct a practical session.
- Ask the participants to assemble in the computer lab.
- Give some hands-on practice exercises.

## Do

- Group the participants for the activity depending on the batch size and the number of computer systems available in the lab.
- Explain the purpose and duration of the activity.
- Ensure the participants complete the practical exercises assigned.

## UNIT 10.2.2: MS Office and Email: About MS Office

### Unit Objective

By the end of this unit, the trainees will be able to:

- Discuss the main applications of MS Office
- Discuss the benefits of Microsoft Outlook

### Resources to be Used

- Participant Handbook
- Computer Systems with the required applications

### Ask

- What is the most frequent activity that you do on the computer?
- Do you know how to make presentations on the computer?

### Say

- Give a brief introduction of MS Office as given in the Participant Handbook.
- Discuss the most popular office products. Explain in brief their application, benefits and working.
- Microsoft Word is a word processing program that allows for the creation of documents. The program is equipped with templates for quick formatting. There are also features that allow you to add graphics, tables, etc.
- Microsoft Excel is a tool for accounting and managing large sets of data. It can also simplify analysing data. It is also used to create charts based from data, and perform complex calculations. A Cell is an individual data box which will have a corresponding Column and Row heading. This gives the cell a name, referred to as the Cell Reference. There can be multiple pages in each workbook. Each page, or sheet, is called a Worksheet. When you open a new Excel file, it automatically starts you with three worksheets, but you can add more.

### Explain

- Explain the working and frequently used features of Office on a real system.

### Ask

- What do you know about e-mails?
- Do you have an email id?
- How often do you check your e-mails?

## Say

- Communication is vital for every business. The fastest and the safest way to communicate these days are through emails. MS Outlook helps to manage your emails in a better way and also offers a host of other benefits.
- Discuss “Why Choose Microsoft Outlook?” with the participants as given in the Participant Handbook.

## Do

- Ask the participants to assemble in the computer lab.
- Explain the working of Outlook on a real system.

## Demonstrate

- Demonstrate how to create email id.
- Demonstrate how to write new mails, send mails.
- Demonstrate how to use MS Office application to create a letter and send it as attachment in an email.
- Demonstrate how to use other MS Office applications.

## Practical

- Give some hands-on practice exercises
- Group the participants for the activity depending on the batch size and the number of computer systems available in the lab.
- Explain the purpose and duration of the activity.

## Summarize

- Ask the participants what they have learnt from this exercise/ activity.
- Ask if they have

## UNIT 10.2.3: E-Commerce

### Unit Objective

By the end of this unit, the trainees will be able to:

- Identify different types of e-commerce
- List the benefits of e-commerce for retailers and customers
- Discuss Digital India campaign will help boost e-commerce in India
- Describe how you will sell a product or service on an e-commerce platform

### Resources to be Used

- Computer Systems with internet connection
- Participant Handbook

### Ask

- How many of you have done shopping online?
- Can you name at least five shopping websites?
- What is the product that you most frequently buy online?
- Why do you do shopping online instead of going to the market?

### Say

- Give a brief introduction of “What is E-commerce”. Refer to the Participant Handbook.
- E-commerce emerged in the early 1990s, and its use has increased at a rapid rate. Today, many companies sell their products online. Everything from food, clothes, entertainment, furniture and many other items can be purchased online.

### Ask

- What other types of transactions have you performed on the internet other than buying products?

### Say

- Give examples of e-commerce activities from Participant Handbook.

### Team Activity

#### E-commerce examples

- Instruct the participants to list some of the payment gateways that they have used for e-commerce activities.

- Give them 5 minutes to make this list.
- Discuss payment gateways and transaction through payment gateways.
- Conclude the discussion by mentioning how important e-commerce has become in our day to day transactions.

### Say

- E-commerce activities can be classified based on the types of participants in the transaction.
- Discuss “Types of E-commerce” from the Participant Handbook.

### Do

- Discuss all types of E-commerce by giving examples and names of some popular websites which use them.
- Make the discussion interactive by asking the class to share some popular e-commerce sites of each type.

### Say

- E-commerce activities bring a host of benefits for both, retailers and customers.
- Discuss benefits of E-commerce from the Participant Handbook.

### Explain

- The majority of the population that uses E-commerce activities lives in tier-1 and tier-2 cities. To encourage the use of digital money in tier-3 and 4 areas, PM Mr. Modi launched the “Digital India Campaign”.
- Discuss “Digital India Campaign” from the Participant Handbook.
- By Digital India project the government will deliver services via mobile connectivity and in doing so, is expected to bring the internet and broadband to remote corners of the country. This connectivity will in turn enhance e-commerce activities also. Furthermore, the Indian Government is also modernizing India Post and aims to develop it as a distribution channel for e-commerce related services.

### Say

- Now let us discuss how to sell a product using E-commerce.
- Every product has to be sold on a platform on the internet. Think of it as a shop that you have to sell your product. Now this shop can be your own or shared or rented. If the shop is your own or rented there will be only your products in that shop. If the shop is shared, there will be products of multiple sellers in that shop. A common example is a departmental store which has products from multiple brands in the shop.

- Similarly, in E-commerce the shop is the website where your products are displayed. If it is your own website it will exclusively showcase your products. In this case the cost that you will incur will be:
  - Developing the website
  - Hosting the website
  - Maintenance of the website
- If you rent a website it will also showcase your own products but the development, hosting and maintenance parts goes to the owner. This saves time and the cost to manage these activities.
- Smaller companies usually go for renting a website and the bigger ones develop their own website.
- The concept of shared platforms has become very popular in recent times. In this platform, the sellers have to register and then they can sell their goods on a common platform. Among the most popular of these are Amazon, Myntra, Flipkart, etc.

### Role Play



- Tell the participants to choose a product or service that they want to sell online.
- Tell them to write a brief note explaining how they will use existing e-commerce platforms or create a new e-commerce platform to sell their product or service.

### Ask



- How much money are you carrying in your wallet?
- Do you have a credit/debit card?
- How do you make payments while doing online shopping?

### Say



- Demonetization has made carrying cash in the wallet very difficult. People either shop through cards or some other form of digital money.
- So, what do you think is digital money?
- In this form, the money is both paid and received digitally. There is no hard cash involved. It is an instant and convenient way to make payments.
- There are various types of digital payments. Let us discuss some of them in brief here.
- The first one is the most commonly used system i.e. the cards. Debit card, credit card, prepaid card, all fall under this category.
- Then is the e-wallet or the mobile wallet. This has become the most used form of digital money after demonetization. Examples are Paytm, state bank buddy, Freecharge, etc.
- Many other forms of digital money are also coming up in market like mobile apps, Aadhar card based payment, etc.

**Do** 

- Demonstrate how to make and receive payments through digital models like Paytm and state bank buddy.

**Ask** 

- Why do you think people have started using digital money instead of hard cash? Is demonetization the only reason?

**Say** 

- Digital money gives a lot of advantages over the conventional hard cash. Some of them are:
  - Digital payments are easy and convenient. You do not need to take loads of cash with you, a mobile phone or a card will suffice.
  - With digital payment modes, you can pay from anywhere anytime.
  - Digital payments have less risk.

**Summarize** 

- Ask the participants what they have learnt from this exercise/ activity.
- Ask if they have any questions related to what they have talked about so far.
- Close the discussion by summarizing the importance of e-commerce and digital money.

## UNIT 10.3: Money Matters

### Key Learning Outcomes

By the end of this module, the trainees will be able to:

1. Discuss the importance of saving money
2. Discuss the benefits of saving money
3. Discuss the main types of bank accounts
4. Describe the process of opening a bank account
5. Differentiate between fixed and variable costs
6. Describe the main types of investment options
7. Describe the different types of insurance products
8. Describe the different types of taxes
9. Discuss the uses of online banking
10. Discuss the main types of electronic funds transfer

## UNIT 10.3.1: Personal Finance – Why to Save?

### Unit Objective

By the end of this unit, the trainees will be able to:

- Discuss the importance of saving money
- Discuss the benefits of saving money

### Resources to be Used

- Participant Handbook

### Ask

- How many of you save money?
- Why do you feel the need to save it?
- Do you plan your savings?
- Where do you keep the money you save?
- How do you use the money that you have saved?

### Example

- Let's look at these two examples:

Example 1:

Suhani works in a good company and earns Rs.30,000 month. She always saves 5000 per month and keeps it aside as a personal saving. She keeps the money at home and has saved quite a lot. One day her mother has a medical emergency and has to be taken to the hospital. Her family is worried about the amount they have to spend for the treatment. It will cost them atleast 40,000.

Suhani says tells her family not to worry and that she has about 50,000, which she has saved over the months.

Example 2:

Jasmeet works in the same company and earns the same as Suhani. She is very fond of shopping and spends most of her money on buying new clothes. At the end of the month, she is always asking her father for money as her pay is finished.

### Ask

- Who do you identify with –Suhani or Jasmeet?
- How do you think Suhani manages to save money which Jasmeet is unable to do?

### Say

- We should always set aside some and save some money from our monthly pay. The future is unpredictable. Saving money not only gives you a sense of financial security but it can be used in case of emergencies.
- Discuss “Importance of Saving” with the participants as given in the Participant Handbook.

### Ask

- What are the benefits of saving money?
- What does being financially independent mean to you?

### Say

- Discuss “Benefits of Saving” with the participants as given in the Participant Handbook.
- Now let us continue with Suhani's story. Suhani has told her family not to worry and that she has about 50,000, which she has saved over the months. The family is happy about Suhani's decision of saving money, which will be of great help for them now. Suhani is going to the hospital today to pay the first instalment for the treatment. Suddenly finds only 35,000 in her cash box when she counts and does not remember using it. She has not kept any record and now she is upset.

### Ask

- Was it a good decision by Suhani to save a part of her earnings every month?
- Was it a wise decision to keep all her savings as cash in a cash box?
- Could she have managed to save money in a better and more effective manner?
- Do you want to learn how to save money and use it effectively?

### Say

- Let's learn personal saving with the help of a group activity.

## Team Activity

### Personal Finance- Why to save

- This activity has two parts:

#### PART 1 WAYS TO SAVE MONEY

- You are earning 30,000/- per month. You have recently changed your job and have to move to a metropolitan city. You are now living as a paying guest paying 8,000/- per month. Your other estimated expenditures like travel, food, recreation would be around Rs. 17, 000 per month.
- Make a list of different ways to save money.

#### PART 2 HOW WILL YOU USE THE MONEY?

- After a year how much have you been able to save?
- How will you use the money that you have saved?

## Do

- Divide the class into groups of four.
- Instruct the participants to think and prepare a list of the various ways they can save money.
- Give the participants 10 minutes to prepare the list.
- Once done, instruct them to think of how they could use the money they have saved.
- Give the participants 10 minutes to prepare the list.
- Keep a check on time. Tell the group to wind up quickly if they go beyond the given time limit.

### Activity De-brief

- What were the different ways you could save money?
- How much money were you able to save?
- How will you use the money you have saved in one year?

## Say

- Discuss the importance of personal finance and why it is important to save money.

## Summarize

You can summarize the session by discussing:

- The importance of saving money.
- Ways to save money.
- How the money saved can be used for different purposes.

## UNIT 10.3.2: Types of Bank Accounts, Opening a Bank Account

### Unit Objective

By the end of this unit, the trainees will be able to:

- Discuss the main types of bank accounts
- Describe the process of opening a bank account

### Resources to be Used

- Account opening sample forms
- Participant Handbook

### Ask

- How many of you save money?
- Where do you keep the money you save?
- How many of you have a bank account?
- What type of account do you have?

### Example

- Let's look at the given example:

Reena is in the third year of college but in the evening, she gives tuitions for children living in her colony. She earns 15,000/- per month. As her students stay in different parts of the city, she has to walk a lot.

To save time, she decides to buy a second hand scooter for herself. But she has to save money for it. Her class mate advises her to open a recurring deposit account in the bank. She goes to the bank close to her home. The personal manager gives her some forms to fill. She is confused as she has never done this before. Her elder sister has an account in the same bank. She asks for help from her sister. She goes to the bank the next day with her sister. The personal banker gives her a list of documents that she will need to submit with the form for opening an account. The banker advises her to open a 6 months recurring deposit.

### Ask

- Do you try to save money monthly but have to spend it on unforeseen expenditure?
- Have you ever thought of depositing your savings in a bank?

## Say

- Before opening a bank account, you need to know the types of accounts we have in India.
- Discuss “Types of Bank Accounts” with the participants as given in the Participant Handbook.

## Ask

- Can someone say what are the different types of bank accounts?

## Say

- Let's learn about the different types of bank accounts through an activity.

## Team Activity

- Divide the class in four groups.
- Label the groups as savings account, current account, recurring account and fixed deposit.
- On a chart paper, ask them to write the key points of their account.

### Activity De-brief

- Ask each group to present the key points of their account.

## Say

- Now that you know about the four different types of accounts, let's learn how to open a bank account.
- Discuss “Opening a Bank Account” with the participants as given in the Participant Handbook.
- Discuss “Tips” that the participants should keep in mind while opening a bank account as given in the Participant Handbook.

## Ask

- What are the main documents required for opening a bank account?
- What are some important points to ask the bank personnel while opening an account?

## Say

- Mention officially valid KYC documents (refer to the Participant Handbook)
- Now, let's understand the procedure of opening a bank account through an activity.

## Team Activity

### Opening a Bank Account

- This activity is done in groups.
- Divide the class in groups of four or six

#### PART 1

#### FILLING A BANK ACCOUNT OPENING FORM

- You have to fill a bank opening form.
- You can refer to the section “Opening a Bank Account” of your Handbook for reference.
- List all the steps that you will be required to fill in the form.
- List the documents that you need for filling the form.
- Now fill in the form.

#### Activity De-brief

#### How did you design the form?

- What all details did you fill in the form?
- What were your KYC documents?
- How would this activity help you in future?

## Do

- Instruct the participants to read the section “Opening a Bank Account” of the Participant Handbook.
- Give each group one sample account opening form.
- Give the participants 5 minutes to read the form.
- Give them 15 minutes to fill it.
- Assist them by explaining each category and how to fill it.
- Keep a check on time.
- Tell the group to wind up quickly if they go beyond the given time limit

## Summarize



### Note:

- You can summarize the unit through a role play.
  - A person wanting to open an account in the bank.
  - What is the procedure that he will go through?
  - Discuss the key points of different types of bank accounts.
  - How to select the type of account
  - How to fill the account opening form.
- A sample account opening form is given in the following page for reference. Use it for the activity in the class.

### Sample Bank Account Opening form.

<div style="border: 1px solid black; width: 100%; height: 100%; display: flex; align-items: center; justify-content: center;"> <p>Photograph</p> </div>	<h1 style="color: blue; margin: 0;">XXX Bank</h1>			
<b>SAVING BANK ACCOUNT OPENING FORM</b>				
Account No.: _____	Date: _____			
Name of the Branch				
Village/Town				
Sub District / Block				
District				
State				
SSA Code / Ward No.				
Village Code / Town	Name of Village /			
<b>Applicant Details:</b>				
Full Name	Mr./Mrs./	First	Middle	Last Name
Marital Status				
Name of				
Name of Mother				
Address				
Pin Code				
Tel No. Mobile			Date of Birth	
Aadhaar No.			Pan No.	
MNREGA Job Card No.				
Occupation/Profession				
Annual Income				
No. of Dependents				

<b>Detail of Assets</b>	Owning House : Y/N	Owning Farm :		
	Y/N			
	No. of Animals :	Any other :		
<b>Existing Bank A/c. of family members / household</b>	Y / N	If yes, No. of A/cs. _____		
<b>Kisan Credit Card</b>	Whether Eligible Y / N			
I request you to issue me a <b>Rupay Card</b> .				
I also understand that I am eligible for an Overdraft after satisfactory operation of my account after 6 months of opening my account for meeting my emergency/ family needs subject to the condition that only one member from the household will be eligible for overdraft facility. I shall abide by the terms and conditions stipulated by the Bank in this regard.				
<b>Declaration:</b>				
I hereby apply for opening of a Bank Account. I declare that the information provided by me in this application form is true and correct. The terms and conditions applicable have been read over and explained to me and have understood the same. I shall abide by all the terms and conditions as may be in force from time to time. I declare that I have not availed any Overdraft or Credit facility from any other bank.				
<b>Place:</b>				
<b>Date:</b>		<b>Signature / LTI of Applicant</b>		
<b>Nomination:</b>				
<b>I want to nominate as under</b>				
Name of Nominee	Relationship	Age	Date of Birth in case of minor	Person authorised in case to receive the amount of deposit on behalf of the nominee in the event of my /minor(s) death.
<b>Place:</b>				
<b>Date:</b>				
<b>Signature / LTI of Applicant</b>				
<b>Witness(es)*</b>				
1. _____				
2. _____				
*Witness is requires only for thumb impression and not for signature				

## UNIT 10.3.3: Costs: Fixed vs. Variables: What are Fixed and Variable Costs?

### Unit Objective

By the end of this unit, the trainees will be able to:

- Differentiate between fixed and variable costs

### Resources to be Used

- Participant Handbook
- Blank sheets of paper
- Pens

### Ask

- What is cost?
- Will a telephone bill fall under the category of a fixed or variable cost?

### Say

- Discuss: Fixed and Variable cost with examples. Let us do a small activity.

### Team Activity

Identify the type of cost

1. Rent
2. Telephone bill
3. Electricity bill
4. Machinery
5. Insurance
6. Office supplies/ Raw materials
7. Employee salaries
8. Commission percentage given to sales person for every unit sold
9. Credit card fees
10. Vendor bills

Do

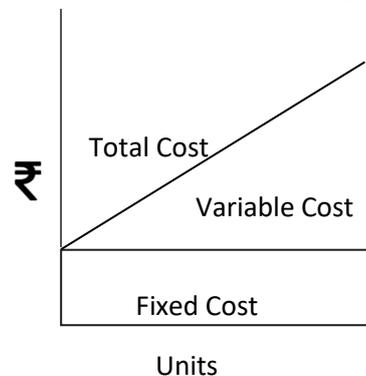


- Divide the class into two groups. Read out the list of costs given in the activity.
- Read out each item from the cost list and ask the groups in turns to identify whether it is a fixed or variable cost.

Say



- We saw that your utility bills like rent, electricity, telephone etc. are all fixed costs because you have to pay it every month.
- Variable costs is an expense which varies with production output or volume. For example, commission, raw material etc.
- Discuss “Cost: Fixed vs. variables” with the participants as given in the Participant Handbook.
- Illustrate the relation between the costs with a graph.



- Let's learn the difference between fixed and variable cost with the help of an activity.

Team Activity



### Fixed vs. Variable Costs

- This is a group activity.
- You want to start your own entrepreneur business.
- State the type of business you want to start.
- List down all the cost or requirements for your business.
- How will you differentiate between the fixed and variable cost.

### Activity De-brief

- What is the total cost of your business?
- What are the fixed costs?
- What are the variable costs?
- How did you differentiate between the fixed and variable costs?

## Do

- Instruct the participants that this is group work.
- Divide the class into small groups of 4 or 6.
- Give each group a sheet of paper.
- Tell the participants that they have to start their own entrepreneur business.
- Ask them the type of business they want to start.
- Instruct them to differentiate between the fixed and the variable costs of the business they want to start.
- Give the participants 15 minutes to discuss and write.
- Keep a check on time. Tell the group to wind up quickly if they go beyond the given time limit.

## Summarize

- Note: You can summarize the unit either by having a role play between a consultant and a budding entrepreneur explaining the differences between fixed and variable costs or by discussing the key points of the unit.

## Notes for Facilitation

- Answers for the activity - Identify the type of cost
- |  |            |
|--|------------|
| 1. Rent  | (Fixed)    |
| 2. Telephone bill  | (Fixed)    |
| 3. Electricity bill  | (Fixed)    |
| 4. Machinery   | (Fixed)    |
| 5. Insurance   | (Fixed)    |
| 6. Office supplies/ Raw materials                                  | (Variable) |
| 7. Employee salaries   | (Fixed)    |
| 8. Commission percentage given to sales person for every unit sold | (Variable) |
| 9. Credit card fees  | (Variable) |
| 10. Vendor bills   | (Variable) |

## UNIT 10.3.4: Investments, Insurance and Taxes

### Unit Objective

By the end of this unit, the trainees will be able to:

- Describe the main types of investment options
- Describe the different types of insurance products
- Describe the different types of taxes

### Resources to be Used

- Participant Handbook

### Ask

- Ask the participants- “What do you see first thing in when you get your mobile bill? Apart from the amount and due date do you have a look at the taxes you are being billed for?”
- Why do you think people get their cars insured or have a medical insurance?
- You have saved money and want to invest it; how would you decide what is the best investment for your money?

### Example

- Let's have a look at a few scenarios.

Ranbir has sold his house and deposited the money in his bank. His Chartered Accountant tells him that he will have to re-invest the money otherwise he will have to pay capital tax. What is capital tax and how is it different from income tax?

Jasmeet and Anup are blessed with a baby girl. They decide to have an insurance policy that will mature when their daughter is ready to higher education.

Shivani is working in a corporate office and getting good pay. She will have to pay income tax so she decides to invest her money in tax saving schemes. She goes to the bank manager to discuss the best products in which she can invest.

### Say

- Discuss the Investment, Insurance and Taxes as given in the Participant Handbook.

## Ask

- How do investments, insurances and taxes differ from each other?

## Say

- Let's learn the differences between the three by having an activity.

## Say

- We will have a quiz today.

## Team Activity

- The activity is a quiz.

## Do

- Divide the class into groups of three and give a name to each group
- Explain the rules of the quiz. For each correct answer, the group gets 1 mark. If the group is unable to answer the question is rolled over to the next group.
- Explain the purpose and duration of the activity.
- On the blackboard write the names of the groups.
- Ask the questions of the quiz.
- Keep a score for the groups.
- Set guidelines pertaining to discipline and expected tasks.

## Summarize

- Summarize the unit by discussing the key points and answering question

## Notes for Facilitation

### Questions for the quiz

1. Mr. Das gets monthly return on one of his insurance policies. Name the policy?  
*Money Back Life Insurance*
2. What are bonds?  
*Bonds are instruments used by public and private companies to raise large sums of money.*
3. Who issues the bonds?  
*Private and public companies issue the bonds.*

4. Why are bonds issued?

*To raise large amount of money as it cannot be borrowed from the bank.*

5. Who is the buyer of stocks and equities?

*The general public is the buyer.*

6. What types of scheme is the Sukanya Samriddhi Scheme?

*Small Saving Scheme*

7. What is the difference between mutual and hedge funds?

*Mutual funds are professionally managed financial instruments that invest the money in different securities on behalf of investors. Hedge funds invest in both financial derivatives and/or publicly traded securities.*

8. Why is a loan taken from the bank to purchase real estate?

*To lease or sell to make profit on appreciated property price.*

9. Name the two types of insurances?

*Life Insurance and Non-life or general insurance*

10. Which insurance product offers financial protection for 15-20 years?

*Term Insurance*

11. What is the benefit of taking an endowment policy?

*It offers the dual benefit of investment and insurance.*

12. What are the two benefits of a Whole Life Insurance?

*It offers the dual benefit of investment and insurance*

13. Which policy covers loss or damage of goods during transit?

*Marine Insurance*

14. After what duration is the income tax levied?

*One financial year*

15. What is long term capital gain tax?

*It is the tax payable for investments held for more than 36 months.*

16. Name the tax that is added while buying shares?

*Securities Transaction Tax*

17. What is the source of corporate tax?

*The revenue earned by a company.*

18. Name the tax whose amount is decided by the state?

*VAT or Value Added Tax*

19. You have bought a T.V. What tax will you pay?

*Sales Tax*

20. What is the difference between custom duty and OCTROI?

*Custom duty is the charges payable when importing or purchasing goods from another country. OCTROI is levied on goods that cross borders within India.*

## UNIT 10.3.5: Online Banking, NEFT, RTGS, etc.

### Unit Objective

By the end of this unit, the trainees will be able to:

- Discuss the uses of online banking
- Discuss the main types of electronic funds transfer

### Resources to be Used

- Participant Handbook
- Computer System with internet connection
- Debit card

### Ask

- When was the last time you visited a bank?
- How do you pay your bill for electricity and telephone?
- Have you ever tried to transfer money from one bank account to another bank account using the online banking facility?

### Say

- Most of us lead a busy life. Time has become more important than money. In this busy schedule, no one has time to stand in bank queues. That's where Online Banking comes in. Online banking or internet banking means accessing your bank account and carrying out financial transactions through the internet.
- Discuss “What is online banking?” from the Participant Handbook.
- There are various advantages of online banking:
  - It saves time, as you need to visit the branch.
  - You can conduct your banking transactions safely and securely without leaving the comfort of your home.
  - Online Banking also gives you round the clock access.
  - Online Banking makes it possible for you to pay your bills electronically.

### Do

- Show them how they can use the internet banking.
- Use the computer system and show the demo videos on how to use internet banking provided on most banking sites. the computer system.
- Tell the class the various features of online banking:
  - Through their website set-up your online account.

- Choose a secure username and password.
- Set-up your contact information.
- Once your information is verified, you are good to go.
- Once you enter the portal explore all the features and learn your way through the portal.

### Say

- One of the biggest advantage that online banking offers, as discussed earlier, is transferring money from one account to another. This transaction is called electronic funds transfer. Electronic transfers are processed immediately with the transferred amount being deducted from one account and credited to the other in real time, thus saving time and effort involved in physically transferring a sum of money.
- Discuss “Electronic Funds Transfer” from the Participant Handbook.

### Do

- Discuss how to transfer money from one account to another using online banking (NEFT/RTGS, etc.).
- Illustrate with an example.

### Summarize

- Close the discussion by summarizing the about online banking.
- Ask the participants if they have any questions related to what they have talked about so far.

## UNIT 10.4: Preparing for Employment & Self-Employment

### Key Learning Outcomes



By the end of this module, the trainees will be able to:

1. Discuss the steps to follow to prepare for an interview
2. Discuss the steps to create an effective Resume
3. Discuss the most frequently asked interview questions
4. Discuss how to answer the most frequently asked interview questions
5. Identify basic workplace terminology

## UNIT 10.4.1: Interview Preparation: How to Prepare for an Interview?

### Unit Objective

By the end of this unit, the trainees will be able to:

- Discuss the steps to follow to prepare for an interview

### Resources to be Used

- Participant Handbook

### Ask

- Have you ever attended an interview?
- How did you prepare before going for an interview?

### Say

- An interview is a conversation between two or more people (the interviewer(s) and interviewee) where questions are asked by the interviewer to obtain information from the interviewee.
- It provides the employer with an opportunity to gather sufficient information about a candidate and help them select the ideal candidate.
- It also provides the interviewee with an opportunity to present their true potential to the employer, build confidence and help make a decision about the job by asking questions regarding designation, salary, perks, benefits, promotions, transfers, etc.
- Let's do an activity to understand how to prepare for interviews better.

### Activity 1

- Introducing Yourself

### Do

- Select a participant and ask him/her to answer the following questions: “What can you tell me about yourself.”
- Give the participant at least one minute to speak.
- Once he/she is done, ask the rest of the participant what they gathered about the participant who was providing information.
- Now repeat the exercise with five other participants.

## Ask

- What information you should include when you are describing or introducing yourself in an interview?
- What information you should not include when you are describing or introducing yourself in an interview?

## Say

- Tell the participants that when an interviewer asks you to say something about yourself, he/she is not asking you to present your life history.
- Introduction should be short and crisp and should present you in a positive light. It should include the following points:
  - Any work experience that you might have
  - A brief summary of your educational qualifications
  - Your strengths and achievements
  - Any special projects that you might have been part of
- The following topics should be avoided during an introduction:
  - Detailed description of your family (unless you are specifically asked to do so)
  - Too much information about your weaknesses
  - Information that is not true

## Do

- Congratulate each participant for sharing their points.
- Ask the audience to applaud for them.
- Ask de-brief questions to cull out the information from each group.
- Keep a check on time.

## Activity 2

- Planning the right attire

## Do

- Describe 2 individuals to the participants. One is wearing a casual t-shirt, jeans, and slippers. He has not combed his hair and neither has he trimmed or shaved his beard. The other individual is dressed formally with a shirt and pant and is well-groomed. He has also worn formal shoes and a belt. Ask the participants which person would they prefer to hire in their organization and why?

## Summarize

- Close the discussion by discussing 'how to prepare for an interview' as discussed in the Participant Handbook.
- You can add the following points to it:
  - Tell the participants to create a positive and good impression in an interview. It is important for them to prepare for an interview beforehand.
  - The interviewer analyses not only your technical knowledge in relation to the job, but also whether or not you are a fit for the organization.
  - Every employer looks at the whole package and not just one or two things in isolation. Therefore, the way you dress and the way you present yourself is also important along with your skills and talents.
  - The participants will get only one chance to create a good first impression.

## UNIT 10.4.2: Preparing an Effective Resume: How to Create an Effective Resume?

### Unit Objective

By the end of this unit, the trainees will be able to:

- Discuss the steps to create an effective Resume

### Resources to be Used

- Participant Handbook
- Blank Papers
- Pens

### Ask

- When preparing for an interview, what are the most important things that you need to do?
- What documents do you carry with you, when you go for an interview?
- What is a resume?
- Why do you need a resume?

### Say

- Resume is not just a sheet of paper with your qualifications printed on it.
- It is a selling tool that will help the employer to see how and what you can contribute for company.
- Talk about the steps involved in creating an effective/attractive resume discussed in the Participant Handbook.
- Now let's prepare a resume to understand the process in a better way.

### Do

- This is an individual activity.
- Give the details of the activity.
- Instruct them to read the activity carefully.
- The participant is expected to make an attractive resume based on the information provided.
- Give the class 25-30 minutes to study the case and create a resume.
- At the end of 30 minutes, the participants should exchange the resume with the person sitting next to him or her.
- Every participant will evaluate the resume prepared with their fellow participants.

## Say

- Do you think the candidate should apply for the job posting described in the advertisement?
- We have already discussed the steps involved in creating an effective/attractive resume.
- Now let's prepare a resume for the candidate details given in the activity.

## Activity

### Case Study Analysis

- In the first section of the activity, you are being given the information about a candidate who is applying for a particular job.
- In the second section, you are being given the detailed description of the job posting. Create a resume for the candidate to apply for the job posting.
- Use the information that has been provided about the candidate to create this resume

### Candidate Details

Nipesh Singla was born on 20th April, 1988 in Chandigarh, India. He currently resides at 1XX7, Sector XX D, Chandigarh –160018. His mobile number is 988XXXXX01, and e-mail address is nxxxxxxxla@gmail.com. Nipesh attended middle and senior school at Government Boys Senior Secondary School, Sector 15, Chandigarh. He has been a very talented boy since school. He was fond of painting and watching old Hindi movies. As part of a school charity program, he volunteered at the children's hospital during his senior years. In July 2007, he joined Westwood School of Hotel Management, Zirakpur to pursue a diploma course in Hotel Management and Catering. After completing this course, he joined XYZ Group of Hotels as a Housekeeping intern in June 2010 for six months. In this role, he was responsible for cleanliness and maintenance of one floor in the hotel. Taking advantage of his strong interpersonal skills, he also got opportunities to make housekeeping arrangements for corporate meetings. While pursuing education, he gained working knowledge of Microsoft Word, Excel, Access and PowerPoint.

Nipesh is detail-oriented, flexible and adaptable. He has successfully worked with a diverse work force. He gelled well with his peers, both in college and during his internship. After completing the internship, his objective has been to find a job opportunity where he can use his skills and experience. Backed by experience, he is confident about his skills as housekeeping assistant.

**Job Posting**

\*Do you see yourself as a HOUSEKEEPING SUPERVISOR?

What's your passion? Whether you're into cricket, reading or hiking, at IHG we are interested in YOU. At IHG, we employ people who apply the same amount of care and passion to their jobs as they do in their hobbies people who put our guests at the heart of everything they do. And we're looking for more people like this to join our friendly and professional team.

THE LOCATION:

At the moment, we are looking for HOUSEKEEPING SUPERVISOR to join our youthful and dynamic team at Holiday Inn Amritsar, Ranjit Avenue in Amritsar, Punjab (India). Holiday Inn Amritsar is ideally located in Amritsar's commercial district on Ranjit Avenue with the world famous Golden Temple located only a short distance away. Sparkling chandeliers mark an incomparable arrival experience as you escape to the welcoming environment that is, Holiday Inn Amritsar. The fresh international brand to celebrate and explore Amritsar.

*Salary:* Negotiable

*Industry:* Travel / Hotels / Restaurants / Airlines / Railways

*Functional Area:* Hotels, Restaurants

*Role Category:* Housekeeping

*Role:* Housekeeping Executive/Assistant.

Desired Candidate Profile

Friendly, pleasant personality, Service - oriented.

You should ideally be Graduate/ Diploma holder in HM and at least 2 years of experience as a supervisor in good brand with good communication skills, English is a must.

In return we'll give you a competitive financial and benefits package. Hotel discounts worldwide are available as well as access to wide variety of discount schemes and the chance to work with a great team of people. Most importantly, we'll give you the room to be yourself.

\*Please get in touch and tell us how you could bring your individual skills to IHG. Education-

*UG:* Any Graduate/ Diploma holder

*PG:* Post Graduation Not Required

Say



- Now, let's share the resume with the fellow participant sitting next to you and evaluate each other's effort.

**Do**

- Congratulate each participant for making their first attempt towards creating an effective resume.
- As a follow up activity, you can suggest them to prepare their own resume and show it to you the next day.

**Summarize**

- Close the discussion by showing some effective resume samples to the candidates.
- Ask the participants what they have learnt from this activity.
- Ask if they have any questions related to what they have talked about so far.

**Notes for Facilitation**

- Keep printed copies of the activity ready for the session.
- Put down the suggested format of the resume on the board while explaining the steps in preparing a resume.
- Do check the participants' resume and suggest necessary changes.
- Suggested example for the case presented:

Nipesh Singla  
 #1XX7, Sector XX-D  
 Chandigarh-160018  
 Mobile No: 91-988XXXXX01  
 E-mail: nxxxxxxxxla@gmail.com

**Objective:** Seeking an opportunity to use my interpersonal skills and experience to contribute to your company's growth, profitability and objectives.

**Professional strengths:**

- Proficient in housekeeping
- Experienced in and capable of working with a diverse work force
- Team player and friendly in nature
- Successful working in a multi-cultural environment
- Detail oriented, flexible, and adaptable
- Knowledge of Microsoft Word, Excel, Access and PowerPoint

**Educational background**

- Diploma in Hotel Management and Catering, Westwood School of Hotel Management, Zirakpur
- High School, Government Boys Senior Secondary School, Sector 15, Chandigarh

**Professional internships:**

- Housekeeping Intern, XYZ Group of Hotels, New Delhi (June 2010 – August 2010)
  - Responsible for cleanliness and maintenance of one floor in the hotel.
  - Got opportunities to make housekeeping arrangements for corporate meetings.

**Volunteer Work:**

- Student volunteer at children's hospital in Chandigarh.

Nipesh Singla

## UNIT 10.4.3: Interview FAQs

### Unit Objective

By the end of this unit, the trainees will be able to:

- Discuss the most frequently asked interview questions
- Discuss how to answer the most frequently asked interview questions

### Resources to be Used

- Participant Handbook

### Say

- Tell the participants you will provide them with interview situation and questions and they have to try to answer them.
- Tell them you will also explain the different ways to approach these questions.

### Do

- Divide the class in pairs and ask the participants to perform a role play.
- One partner will play the role of the interviewer while the other will play the role of the interviewee.
- Tell them the interviewer can start the interview by asking the interviewee to introduce himself/herself.
- Call all the pairs one by one in front of the class to enact the role play.
- Follow the same pattern for all other situations.
- Time allotted for each situation is 8-10 minutes.
- Congratulate each participant for giving their input.
- Ask the class to applaud each time a team has completed their role play.
- Keep a check on time.

### Role Play

Conduct a role play for the situation given.

#### Situation 1

- The interviewer will start by asking the interviewee a few generic questions such as:
  - What is your name?
  - Tell me something about yourself?
  - Can you tell me something about your family?

- Then, the interviewer will bluntly ask the following questions:
  - How do you explain this huge time gap in your resume?
  - What is the reason for this?
  - Weren't you looking for a job or is it that no one selected you?

## Say

### De-brief:

- When you put information on your resume, you should be prepared to answer any questions about it.
- Be present and focused on the questions being asked to you.
- One way of tackling the blunt questions is to tell the interviewer you did not come across an opportunity where you were sufficiently satisfied with both the remuneration offered as well as the profile. Therefore, you waited for the right opportunity to come along while looking for an ideal job.

## Role Play

Conduct a role play for the situation given.

### Role Play – Situation 2

- The interviewer will start by asking the interviewee a few generic questions such as:
  - What is your name?
  - Tell me something about yourself?
  - Can you tell me something about your family?
- Then, at the end of the interview, ask the interviewee:
  - There are over 200 people who have applied for this job, some with excellent work experience. Why should I hire you?

## Say

### De-brief:

- There is nothing wrong with stating your strengths and achievements. However, do not come across as arrogant or too boastful.
- You need show the interviewee that you have unique skills or talents to contribute to the company. The interviewer needs to know how you stand apart from the rest of the crowd.
- Tell the interviewer you are looking forward to working with the company and that you are a hard-working individual.

## Role Play



Conduct a role play for the situation given.

### Role Play – Situation 3

- The interviewer will start by asking the interviewee a few generic questions such as:
  - What is your name?
  - Tell me something about yourself?
  - Can you tell me something about your family?
- Then, lean forward, clasp your hands on the table and in a soft voice ask the interviewee:
  - Did you ever experience any neglect or disregard from your previous office? In other words, did you ever suffer because your office or team displayed favouritism?

## Say



### De-brief:

- Keep this in mind: Do not criticize anyone during an interview.
- You are free to express your opinion, however, your language, answers, body language, and the tone of your voice should remain constructive and neutral.
- Since criticism will show you in negative light, you should keep your answers honest yet diplomatic.
- You can tackle such questions by saying, “I got along well with most of my faculty and peers.”

## Role Play



Conduct a role play for the situation given.

### Role Play – Situation 4

- The interviewer will start by asking the interviewee a few generic questions such as:
  - What is your name?
  - Tell me something about yourself?
  - Can you tell me something about your family?
- Then very bluntly ask the interviewee:
  - How long do you plan to stay with this company if you are selected?
- After the candidate responds, ask sarcastically:
  - Do you seriously mean that?

## Say



### De-brief:

- Don't provide unreal and idealistic answers.
- Your answers should be honest yet diplomatic. In a situation like this, the interviewer does not expect you to provide a specific timeline.

- You can say something like, “I would like to stay with the company as long as I can contribute constructively and develop as an employee, within the organization, professionally and financially.”

## Role Play



Conduct a role play for the situation given.

### Role Play – Situation 5

- The interviewer will start by asking the interviewee a few generic questions such as:
  - What is your name?
  - Tell me something about yourself?
  - Can you tell me something about your family?
- Ask him/her how important he/she thinks it is to be punctual in the corporate world.
- After he/she answers, look up sternly at the interviewee and in a crisp voice, say:
  - You were late for this interview by 10 minutes. That surely does not seem to be in line with what you just said?

## Say



### De-brief:

- Politely apologize for being late.
- You can add something such as, “I assure you this is not a habit”. All your future actions should be in line with this statement.
- Avoid giving any excuses.
- You might feel obligated to provide a justification for your tardiness, but the interviewer is not interested in that.
- Do not over apologize. Once this response is out of the way, turn your focus back to the interview.

## Role Play



Conduct a role play for the situation given.

### Role Play – Situation 6

- The interviewer will start by asking the interviewee a few generic questions such as:
  - What is your name?
  - Tell me something about yourself?
  - Can you tell me something about your family?
- After asking a few academic or job-related questions, ask the interviewee:
  - If you get this job, what salary package do you expect us to give you?

## Say

### De-brief:

- If there is no way for you to avoid this question, respond to the interviewer by providing a reasonable and well-thought out salary range.

## Role Play

Conduct a role play for the situation given.

### Role Play – Situation 7

- The interviewer will start by asking the interviewee a few generic questions such as:
  - What is your name?
  - Tell me something about yourself?
  - Can you tell me something about your family?
- Then, bringing the interview to a close, ask the interviewee:
  - Do you have any questions for me?

## Say

### De-brief:

- Ask relevant questions.
- Don't bombard the interviewer with questions.
- If you have questions about the result of the interview, you can limit your questions to 1 or 2. Keep them short and relevant like:
  - When will I be informed about the results of the interview?
  - What are the working hours?
  - Will the job require me to travel?

## Explain

- Tell the participants to be prepared for answering different types of questions in an interview.
- Stay calm and focused and take a moment to think about how you should respond. Always maintain a confident tone.
- Even if you don't intend to, your body language conveys your level of discomfort with a particular question.
- Try to keep your actions, tone, and gestures neutral.
- Maintain your composure while answering personal question.

## Do

- Tell all the participants to form pairs again.
- Tell them to use the following list of frequently asked interview questions to conduct mock interviews.

- They will use all or some of these questions to conduct mock interviews with their partners.
- One partner will play the role of the interviewer while the other will play the role of the interviewee.
- After they are through asking and answering the questions, the roles will be reversed.
- The same list of questions will be used again.
- After each mock interview ask the interviewer to provide feedback and clear any doubts that may arise.
- Time allotted for each situation is 30-35 minutes.

## Activity



### Mock Interview Questions

Mock Interview Questions
Tell me something about your family.
What qualities would you look for in a Manager or a Supervisor?
Why did you apply for this job?
What do you know about this company?
How do you deal with criticism?
How do you plan to strike a good work-life balance?
Where do you see yourself five years from now?
Have you applied for jobs in other companies?
What kind of salary do you expect from this job?
Do you have any questions for me?

## Summarize



- Close the discussion by discussing the questions in the both activities.
- Ask the participants what they have learned from this activity.
- Ask if they have any questions related to what they have talked about so far.

## UNIT 10.4.4: Work Readiness – Terms and Terminology

### Unit Objective

By the end of this unit, the trainees will be able to:

- Identify basic workplace terminology

### Resources to be Used

- Participant Handbook
- Chart papers
- Blank sheets of paper
- Pens

### Ask

- What do you understand by workplace terminology?
- Are offer letter and contract of employment the same?

### Say

- Let's start this unit with an activity.

### Team Activity

#### Workplace terminology

- This is a group activity conducted in three parts.

#### Part 1

Sheila received a call from the recruiter of MND Company. Before she is recruited by the company, think of the recruitment process she will have to go through. Start from the telephone call to signing her letter of acceptance. Write down all the words that come to your mind.

#### Activity De-brief

- Have the participants read out the words they have written
- Encourage all the participants to participate in the activity

## Do

- Divide the class into small groups of 4 or 6.
- Instruct the participants that they will be doing a brainstorming activity.
- Give them one chart paper each. Tell them to divide the chart in two parts.
- Instruct them that they have to use one half of the chart paper now. The other half will be used later.
- The participants have to write all the words that come to their mind related to the recruitment process.
- Give them 10 minutes to do the activity.
- Tell them that there are no right or wrong answers.
- Keep a track of the time.

## Say

- You all know quite a few words related to the terms used in the office.
- Let us talk about some new terms that have been missed out.
- Discuss “Work Readiness – Terms and Terminology” with the participants as given in the Participant Handbook.

## Ask

- Why is it important to know the workplace terms?
- How do they help?
- Can the words be categorised further?

## Say

- Let's now continue the activity.

## Team Activity

### Terms and Terminology

- This is again a group activity. The members of the group remain the same as in Activity 1.

#### Part 2

- With the help of the new terms you have learned, make a flow chart of the hiring process of MND Company.

### Activity De-brief

- Ask the groups to share the flow charts and the new terms they added while preparing the flow chart.

**Do** 

- Instruct the participants that they have to use the 2nd half of the same chart they had used before.
- Using the new terminology and the terms they had previously written on the chart, they have to make a flow chart of the hiring process of the MND Company.
- Give them 10 minutes for this activity.
- Keep a check on time. Tell the group to wind up quickly if they go beyond the given time limit.

**Say** 

- Let's go ahead with the activity.

**Team Activity** **Terms and Terminology**

- The activity continues with the same group members.

**Part 3**

Sheila now works for the MND Company. She is not aware of the company culture and policies. She goes to the HR Department to get her doubts clarified. Can you think of the terms for which she wants clarity? Make a list of those words.

**Activity De-brief**

- Ask the groups to share their list of words. Some of the words are benefits, comp. time, deduction, employee training, holidays, lay-off, leave, maternity leave, mentor, notice, paternity leave, and time sheet.

**Do** 

- Instruct the participants to identify the key terms an employee of a company should know. They can use the same chart paper for this activity.
- Give them 5 minutes for this activity.
- Keep a check on time. Tell the group to wind up quickly if they go beyond the given time limit.

**Summarize** 

- Note: You can either summarize the key points of the unit or have a role play where an employee has just joined a company and the HR Manager explains the terms of employment.

## UNIT 10.5: Understanding Entrepreneurship

### Key Learning Outcomes



By the end of this module, the trainees will be able to:

1. Discuss the concept of entrepreneurship
2. Discuss the importance of entrepreneurship
3. Describe the characteristics of an entrepreneur
4. Describe the different types of enterprises
5. List the qualities of an effective leader
6. Discuss the benefits of effective leadership
7. List the traits of an effective team
8. Discuss the importance of listening effectively
9. Discuss how to listen effectively
10. Discuss the importance of speaking effectively
11. Discuss how to speak effectively
12. Discuss how to solve problems
13. List important problem-solving traits
14. Discuss ways to assess problem solving skills
15. Discuss the importance of negotiation
16. Discuss how to negotiate
17. Discuss how to identify new business opportunities
18. Discuss how to identify business opportunities within your business
19. Explain the meaning of entrepreneur
20. Describe the different types of entrepreneurs
21. List the characteristics of entrepreneurs
22. Recall entrepreneur success stories
23. Discuss the entrepreneurial process
24. Describe the entrepreneurship ecosystem
25. Discuss the purpose of the Make in India campaign
26. Discuss key schemes to promote entrepreneurs
27. Discuss the relationship between entrepreneurship and risk appetite
28. Discuss the relationship between entrepreneurship and resilience
29. Describe the characteristics of a resilient entrepreneur
30. Discuss how to deal with failure

## UNIT 10.5.1: Concept Introduction (Characteristic of an Entrepreneur, types of firms/ types of enterprises)

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss the concept of entrepreneurship
- Discuss the importance of entrepreneurship
- Discuss the characteristics of an entrepreneur
- Describe the different types of enterprises

### Resources to be Used

- Participant Handbook

### Say

- Let's start this session with some interesting questions about Indian entrepreneurs.

### Team Activity

#### Quiz Questions

1. Who is the founder of Reliance Industries?  
Dhirubhai Ambani
2. Who is the Chairman of Wipro Limited?  
Azim Premji
3. Who launched e-commerce website Flipkart?  
Sachin Bansal and Binny Bansal
4. Who is the founder of Paytm?  
Vijay Shekhar Sharma
5. Who is CEO of OLA Cabs?  
Bhavish Aggarwal
6. Who is the founder of Jugnoo?  
Samar Singla (autorickshaw aggregator)
7. Who is the founder of OYO Rooms?  
Bhavish Aggarwal

### Do

- Tell them that you will ask them few questions about a few entrepreneurs.

- Divide the class in to two groups.
- In turns ask the quiz questions to the groups.
- If the answer is incorrect pass the question to the other group.
- Share the answer if the groups are not able to answer.
- Congratulate the participants who answered correctly.

### Ask

- What do you understand by entrepreneurs?
- What is the importance of entrepreneurship in today's scenario?
- What do you think are the characteristics of successful entrepreneurs?
- What are different types of enterprises that an entrepreneur in India can own and run?

### Say

- Talk about entrepreneurs, importance of entrepreneurship, characteristics of successful entrepreneurs, and different types of enterprises in India as discussed in the Participant Handbook.
- Tell the participants, stories of successful Indian entrepreneurs- their struggles, the moments of heartbreak, the perseverance and triumph.
- Ask them if they know of any such entrepreneur.

### Summarize

- Close the discussion by summarizing about the opportunities for entrepreneurs in India.

### Notes for Facilitation

- Check out different Government schemes for small entrepreneurs. Share the information with the participants.
- You can tell them about the government websites like Start Up India, [mudra.org.in](http://mudra.org.in) etc.
- Discuss about various schemes and policies by the Government of India for entrepreneurs.

## UNIT 10.5.2: Leadership and Teamwork

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the qualities of an effective leader
- Discuss the benefits of effective leadership
- List the traits of an effective team

### Resources to be Used

- Participant Handbook
- Blank sheets of paper
- Pens

### Do

- Show the picture given below to the class.
- Ask them to quickly write on a piece of paper what comes to their mind after seeing the picture.
- Now ask them, “What do you understand from this picture?”
- Encourage participants to share their thoughts.



### Say

- This picture depicts the qualities of a leader and the difference between a leader and a boss.
- A boss focuses on structure and inspires fear whereas a leader follows vision and generates enthusiasm.
- A boss blames employee for the breakdown whereas a leader fixes breakdowns.
- A boss depends on authority whereas a leader depends on goodwill.
- A boss says “I” and a leader says “We.”
- A boss drives employee whereas a leader coaches them.
- A boss takes credit whereas a leader gives credit.

**Say** 

- Talk about leadership and leadership qualities for an entrepreneur as discussed in the Participant Handbook.

**Ask** 

- Why is it important for a leader to be effective? How does it help the organization?

**Say** 

- Let us discuss benefits of effective leadership as discussed in the Participant Handbook.
- “Out-of-the-box thinking” is one of the new leadership styles. It means thinking differently and from a new perspective.

**Ask** 

- Do you consider yourself a team player?

**Team Activity** 

**Long Chain**

- This is a group activity.

**Do** 

- Divide the class into 2 teams.
- Ask each team to create a chain using materials they have in class such as shoe laces, belts, paper, handkerchief, ribbons, etc.
- The team that creates the longest chain wins the game.
- Observe if the participants are interacting with their team or working in isolation.
- Share your observations with the class.

**Say** 

**De-brief:**

- What did the winning team do differently?
- Who was responsible for the winning team's success?
- How does this activity explain the role of teamwork in entrepreneurial success?

**Say** 

- Tell the class that both the teams performed well.

- Discuss that the objective of this activity was to open communication channels and how this has been achieved.
- The participants should aim to keep the communication channels open when interacting with their peers and team members.
- It will set the pace and enthusiasm required for all the ensuing teamwork activities.
- Talk about teamwork and importance of teamwork in entrepreneurial success as discussed in the Participant Handbook.

## Summarize



- Close the discussion by summarizing about the importance of teamwork for employees.
  - Teamwork helps in reducing stress for the employees.
  - Teamwork helps employers in generating more number of solutions to a problem and developing improved communication amongst employees.
- Ask the participants what they have learned from these exercises.
- Ask if they have any questions related to what they have talked about so far.

## UNIT 10.5.3: Communication Skills: Listening & Speaking: The Importance of Listening Effectively

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss the importance of listening effectively
- Discuss how to listen effectively
- Discuss the importance of speaking effectively
- Discuss how to speak effectively

### Resources to be Used

- Participant Handbook

### Activity

#### Activity – Chinese Whisper

Step 1: Form a circle.

Step 2: Start a whisper chain. Any one participant will whisper a message into his/her neighbour's ear. No one else must hear the message. The message can be serious or downright funny.

Step 3: The next person who first heard the message should whisper the message very quickly to the person sitting next to them.

Step 4: The game goes on until the last person says whatever they heard out loud and the first person reveals the real message.

Compare them and have a great laugh!

### Ask

#### De-brief questions:

- Was the original message the same as the message that is communicated at the end of the game?
- Why do you think there was a difference in the messages?

### Say

- No, the original message was not same at the end of game.
- The barriers to communication like language, disturbance and noise, poor listening skills, boredom, poor speaking skills, etc. are the potential reasons this happens.

- There are various aspects to communication. Speaking skills and listening skills are two major components to any communication. There is always some room for improvement in the way we communicate.
- It is important to accept the reality of miscommunication and work to minimise its negative impacts.

### Say

- Communication is a two-way process where people exchange information or express their thoughts and feelings
- It involves effective speaking and effective listening.
- If I go to the store to get bread, I exchange money for the bread. I give something and get something in return.
- Communication takes place in the same manner. You have to provide and receive information for communication to take place.

### Ask

- How often do you hear these statements?
  - “You’re not listening to me!”
  - “Why don’t you let me finish what I’m saying?”
  - “You just don’t understand!”
- What do you think the other person is trying to convey to you through these sentences?
- We will not talk about the importance of listening effectively as discussed in the Participant Handbook.

### Say

- Let’s play a game to understand effective listening process better.

### Do

- This is a class activity.
- The participants need to answer the questions they hear.
- Instruct them to listen carefully.
- You will read it at a stretch and if need be repeat it once more.
- Tell the participants to raise their hand if they know the answer to the question asked.
- Keep a check on time.

## Activity



### Riddles:

Is there any law against a man marrying his widow's sister?

If you went to bed at eight o'clock at night and set the clock's alarm to ring at nine o'clock, how many hours of sleep would you get?

Do they have a 26th of January in England?

If you had only one match and entered a dark room that had a kerosene lamp, oil heater, and a wood stove, what would you light first?

The Delhi Daredevils and the Chennai Super Kings play five IPL matches. Each wins three matches. No match was a tie or dispute. How is this possible?

There was an airplane crash. Every single person died, but two people survived. How is this possible?

If an airplane crashes on the border of two countries, would unidentified survivors be buried in the country they were travelling to or the country they were travelling from?

A man builds an ordinary house with four sides except that each side has a southern exposure. A bear comes to the door and rings the doorbell. What is the colour of the bear?

### Answers:

There's no law against a man marrying his widow's sister, but it would be the neatest trick in the book since to have a widow, the man would have to be dead.

You'd get one hour's sleep since alarm clocks do not know the difference between morning and night.

Oh, yes. They have a 26th of January in England. They also have a 27th, a 28th, and so on.

First of all, you would light the match.

Who said the Delhi Daredevils and the Chennai Super Kings were playing against each other in those games?

Every SINGLE person died, but those two were married.

You can't bury survivors under any law especially if they still have enough strength to object.

The bear that rang the doorbell would have to be a white bear. The only place you could build a house with four southern exposures is at the North Pole where every direction is in South.

## Ask



### De-brief question:

- What were the barriers that came into your way of listening?
- How can you overcome barriers to listening?

## Say

- There is a difference between hearing and listening.
- If you don't listen properly, the message may be misunderstood.
- Be open-minded while listening to someone.
- It is important to listen effectively and carefully without making assumptions.

## Activity

### Elevator Pitch:

You are in the lift of a hotel and you bumped into your former client who is a famous businessman. He has financed a lot of small business ventures and can finance your new start-up too. After exchanging pleasantries, he asks you what your new company does. You open your mouth, and then pause. Where do you even begin?

Then, as you try to organize your thoughts, his meeting is called, and he is on his way. If you would have been better prepared, you're sure that he would have stayed long enough to schedule a meeting with you too.

If you were given another chance, what would you have said to this person?

## Do

- Start off the task by providing a beginning sentence to get the story started, and then go around the classroom getting each one to add a new sentence to keep the story going.
- This task should be done spontaneously allowing only a little time to think (30 seconds).
- For example: **There was once a student who was looking for a job after graduation.**

## Notes for Facilitation

- Tell the participants to follow these steps to create a great pitch, but bear in mind that you'll need to vary your approach depending on what your pitch is about.
  1. **Identify Your Goal:** Start by thinking about the objective of your pitch. For instance, do you want to tell the potential clients about your organization? Do you have a great new product idea that you want to pitch to an executive or do you want a simple and engaging speech to explain what you do for a living?
  2. **Explain What You Do:** Start your pitch by describing what your organization does. Focus on the problems that you solve and how you help people. Ask yourself this question as you start writing: what do you want your audience to remember most about you? Keep in mind that your pitch should excite you first. After all, if you don't get excited about what you're saying neither will your audience. People may not remember everything that you say, but they will likely remember your enthusiasm.
  3. **Communicate Your USP:** Your elevator pitch also needs to communicate your unique selling proposition or USP. Identify what makes you, your organization or

your idea unique. You'll want to communicate your USP after you've talked about what you do.

4. **Engage with a Question:** After you communicate your USP, you need to engage your audience. To do this, prepare open-ended questions (questions that can't be answered with a "yes" or "no" answer) to involve them in the conversation. Make sure that you're able to answer any questions that he or she may have.
5. **Put it all Together:** When you've completed each section of your pitch, put it all together. Then, read it aloud and use a stopwatch to time how long it takes. It should be no longer than 20-30 seconds. Remember, the shorter it is, the better!

**Example:**

Here's how your pitch could come together:

"My company deals with cloth retail online business and we use various e-commerce platforms to sell our products. This means that you can do shopping with ease and spend time on other important tasks. Unlike other similar companies, we have a strong feedback mechanism to find out exactly what people need. This means that, on average, 95 percent of our clients are happy with our products. So, how can you help us in creating our own web portal?"

6. **Practice:** Like anything else, practice makes perfect. Remember, how you say it is just as important as what you say. If you don't practice, it's likely that you'll talk too fast, sound unnatural or forget important elements of your pitch. Set a goal to practice your pitch regularly. The more you practice, the more natural your pitch will become. Practice in front of a mirror or in front of colleagues until the pitch feels natural.

## Summarize

- Close the discussion by summarizing how to speak effectively as discussed in the Participant Handbook.

## UNIT 10.5.4: Problem Solving & Negotiation Skills

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss how to solve problems
- List the important problem-solving traits
- Discuss ways to assess problem solving skills
- Discuss the importance of negotiation
- Discuss how to negotiate

### Resources to be Used

- Participant Handbook

### Ask

- What is a 'problem'?
- What do you think are the problems you may face in the process of becoming a successful entrepreneur?

### Say

- Discuss the definition of problem as given in the Participant Handbook.
- In a hurdle race the hurdles are the obstacles on the way to reach your goal.
- Similarly, obstacles are the hurdles you may face while reaching your goal i.e. to set-up your own business.
- Your goal will be to reach the finishing line after crossing these hurdles.

### Ask

- What do you do when you face a problem?
- How do you resolve it? You can pick examples from the question asked previously 'the problems they are likely to face in the process of becoming a successful entrepreneur'.

### Say

- Discuss how to solve problems as given in the Participant Handbook.

### Team Activity

- This is a group activity.
- The groups will solve the problem and come up with the best solution in each case.

1. Unable to arrange for some extra finance for setting up a beauty parlour. The loan sanctioned and disbursed is not enough. You have tried all your contacts, friends and relatives. But unable to manage the extra amount. Bank will not sanction more amount as you have used up the complete sanction limit.
2. You have rented a space for your business and all arrangements are done. You will be operating from the office space rented in two days. Now the owner comes up to you and says he wants to sell the place and wants you to vacate in 15 days.
3. You have just set up your business and need extra human resource. You have tried inviting a few also tied up with an agency for getting the right candidate. But you are unable to get the right candidate. If the candidate is good, you cannot offer the salary demanded. If the candidate agrees to the salary, he/she has other demands like working hours to be reduced, leaves etc. which may not work for your set up.

### Do

- Divide the class into three groups. Give one scenario to each group.
- Explain the purpose and duration of the activity.
- Ask the groups to build on the scenario and present their solution as a role play.

### Say

#### De-brief questions:

1. What was the problem?
2. Is there any other alternative solution?
3. Is this the best solution presented?

### Ask

- Try to think of some people around you who are able to solve problems very easily. Even you or your friends might be approaching them when there is a problem. What qualities do they have? What personality traits do such people possess?

### Say

- Discuss the important traits for problem-solving as given in the Participant Handbook.

### Ask

- In order to build a successful organization, you need to hire people who possess good problem-solving skills.
- How would you assess the level of problem solving skills of potential candidates before hiring them?

## Say

- Discuss how to assess for problem- solving skills as given in the Participant Handbook.

## Summarize

- Ask the participants the things that they have learnt so far.
- Ask if they have any questions related to what they have talked about so far.
- Summarize the discussion on problem solving.

## Activity

- The activity is to organise an election event. Select three volunteers from the group. They have to give a speech on their election manifesto to the class. They have to negotiate with the fellow participants and convince them to vote for them. The best negotiator will win the election.

## Do

- Ask three participants to volunteer for the activity.
- Explain the purpose and duration of the activity.
- Set guidelines pertaining to discipline and expected tasks.

## Ask

- Out of the three contestants, whom would you support? Why? What did they say or do which convinced you to make your decision?
- Have you ever tried to negotiate in your personal or professional life?
- Ask the class to share some of their experiences where they have been able to strike a deal by negotiating.

## Say

- Discuss “What is Negotiation?” as given in the Participant Handbook.

## Ask

- Why is it important to negotiate? As an entrepreneur, where do you think that negotiation skills will be needed?

## Say

- Discuss the importance of negotiation while starting a business as given in the Participant Handbook.

## Say

- Discuss the important steps to negotiate as given in the Participant Handbook.

## Role Play

- Conduct a role play activity.
- Ask the participants to assemble together.
- Explain the purpose and duration of the activity.
- Set guidelines pertaining to discipline and expected tasks.

## Do

- Divide them into groups of four (4) (depending on the batch size).
- Give them the hand-outs for role play scenarios.
- Two groups to be given scenarios on problem solving.
- Other two groups to be given scenarios on negotiation.
- The groups will build on the scenarios and prepare for the role play.
- Give the groups atleast 5 mins to discuss and be ready with the role play.
- Invite each group one by one to come and present their role play.

### **Problem solving Scenario 1**

Avinash has a Mobile Repair Store in Allahabad. His outlet is one of the most popular one in the vicinity and he has great rapport with his customers. He is always well-dressed, jovial and full of energy.

It's around 11 AM, when a customer barges in to the shop and starts shouting at Avinash for giving her back the instrument which is still not working. The screen of her mobile is also cracked from one side. Avinash remembered thoroughly checking the handset before handing it over to the customer. The customer threatens to sue the company and to go to Consumer Court for cheating her.

### **Problem solving Scenario 2**

You are running a successful small scale business, Shreeji Aggarbattis,. Your staff members do door to door selling and organise marketing campaigns in local markets. Your brand has established it's name in last few years.

Recently, lot of customers have been coming to you and lodging complaints that your staff members indulge in malpractices. Few of them informed you that a staff member engaged them in a friendly conversation. In the meanwhile, the other gave them lesser packets of aggarbattis than they paid for.

Another set of customers lodged complaint about the misconduct and rude behaviour of a particular staff member. You often hear from your customers that the orders don't get delivered on time or wrong products get delivered. You have already been struggling with shortage of staff and such complaints are a serious concern as it is hampering your brand image. What strategies will you adopt to solve this problem?

**Negotiation Scenario 1**

You have interviewed a prospective new employee who could be a key member of your new entrepreneurial venture. The new person is demanding a salary that is 20% higher than you thought based on your business plan. Finances are tight, yet you believe this person could make a significant impact on future profits. If you paid the required salary for the new person, then you would have to restructure your entire business plan. You've been searching for an individual with this skill level for three months. The candidate is waiting for your response. Now you have to call him in to make the final negotiations.

**Negotiation Scenario 2**

You are a young entrepreneur who has just registered his start up project and applied for a bank loan accordingly. You receive a letter saying that your loan application has been rejected as your start up idea did not appeal to the bank and they think that it is not a revenue generating model. You have taken an appointment to meet the manager and show your negotiation skills to get your loan approved.

## Notes for Facilitation

**Facilitating Role Plays****Preparing for the activity**

1. Carefully review the details of the scenario and the character descriptions.
2. Become familiar with the key issues being addressed in the scenario.
3. Study the provided material so that you are ready to address issues related to the situations depicted in the role-plays.
4. Anticipate and know how to address issues participants might raise during the activity.

**Conducting the activity**

1. Introduce the activity. Emphasize that role-playing provides participants with an opportunity to apply their new knowledge, skills, and tools in situations that simulate actual interactions with customers.
2. Ask participants to form pairs. Direct the members of each group to choose who will play the roles. Remind the groups that each participant should be given the opportunity to play/practice the different roles.
3. Conduct a demonstration so that participants become familiar with the expectations related to the roles and support materials.
4. Give the pairs/ groups 10 to 15 minutes to conduct the role-play (depending on the duration of the session).
5. After all the groups have finished with the role-play, conduct a debriefing session on each role-play.
6. Ask the groups to take five minutes to talk about what happened during the role-play. The groups should discuss the questions given in the debriefing for each role-play.

Encourage participants to provide constructive criticism during their discussions.

## Summarize



- Wrap the unit up after summarizing the key points and answering questions.

## UNIT 10.5.5: Business Opportunity Identification: Entrepreneurs and Opportunities

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss how to identify new business opportunities
- Discuss how to identify business opportunities within their business

### Resources to be Used

- Participant Handbook
- Blank sheets of paper
- Pens

### Ask

- How does an entrepreneur identify an opportunity?
- What do you think are the common queries or concerns faced by entrepreneurs?
- How can you identify new business opportunity?

### Say

- Let's talk about opportunity, common queries or concerns faced by entrepreneurs, idea as an opportunity, factors to consider when looking for opportunities, ways to identify new business, and opportunity analysis as discussed in Participant Handbook.
- Let's do an activity to understand ways to identify business opportunities within your business.

### Do

- Tell the class that this is an individual activity.
- Tell the participants to create a matrix on their notebooks.
- There will be four boxes in your matrix.
- Strength, Weakness, Opportunity and Threats will be the four headings of the matrix. This is called the SWOT matrix.
- Read out the questions to them and tell the participants they need to answer the questions asked in each matrix.
- Tell them they can also use their own understanding of themselves to fill the SWOT matrix.

## Activity



### Do your SWOT analysis

#### Strength

What are your strengths?  
 What unique capabilities do you possess?  
 What do you do better than others?  
 What do others perceive as your strengths?

#### Weakness

What are your weaknesses?  
 What do your competitors do better than you?

#### Opportunity

What trends may positively impact you?  
 What opportunities are available to you?

#### Threat

Do you have solid financial support?  
 What trends may negatively impact you?

## Do



- Congratulate everyone for the class activity.
- Ask the audience to applaud for themselves.
- Allot the participants sufficient time to complete this activity, but do keep a check on time.
- Ask de-brief questions to cull out information from the participants.

## Ask



### De-brief questions:

- What are your weaknesses according to your SWOT analysis?
- Do you think you can change your weakness into strength? How?
- Do you think you can work on your threats? How?

## Summarize



- Close the discussion by summarizing ways to identify business opportunities within your business.
- Ask the participants what they have learned from this exercise.
- Ask if they have any questions related to what they have talked about so far.

## UNIT 10.5.6: Entrepreneurship Support Eco-System

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Explain the meaning of entrepreneur
- Describe the different types of entrepreneurs
- List the characteristics of entrepreneurs
- Recall entrepreneur success stories
- Discuss the entrepreneurial process
- Describe the entrepreneurship ecosystem
- Discuss the purpose of the 'Make in India' campaign
- Discuss the key schemes to promote entrepreneurs

### Resources to be Used

- Participant Handbook
- Chart papers
- Marker pens
- Pencils
- Colour pencils
- Scale
- Eraser
- Other requisite stationery material

### Ask

- Do you think that entrepreneurs need support?
- What do you think is an eco-system?
- What do you think 'entrepreneurship support eco-system' means?

### Say

- Let's learn what entrepreneurship support eco-system means.
- Discuss 'Entrepreneurship Support Eco-System' as given in the Participant Handbook

### Ask

- Can you define entrepreneurship support eco-system?
- What are the key domains of the support eco-system?

## Say

- Let's learn more about these domains by conducting an activity.
- You have to make a poster showing the components of the six main domains of entrepreneurship support eco-system.

## Team Activity

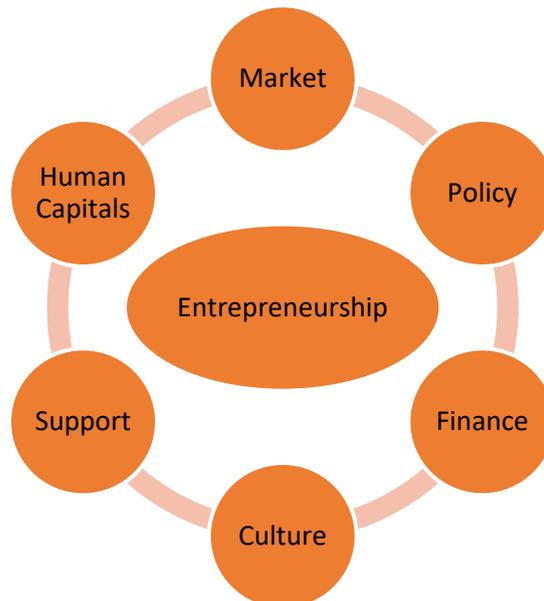
- Making a poster showing the entrepreneurship support eco-system.

## Do

- Divide the class into groups of four or six.
- Hand out chart paper and coloured pens.
- Explain the purpose and duration of the activity.
- Go around checking the progress of each group.
- Set guidelines pertaining to discipline and expected tasks.

### Activity De-brief

Ask each group to display their poster and explain the key domains of entrepreneurship support eco-system.



## Ask

- What kind of government support eco-system is available for entrepreneurs in India?

## Say

- Discuss 'Make in India' campaign as given in the Participant Handbook.

## Team Activity



- Presentation on key schemes to promote entrepreneurs

## Do



- Divide the class into pairs.
- Number each pair from 1-15.
- Assign a scheme, same as their group number, to each group.
- Ask them to read the scheme carefully and present it to the class.
- Explain the purpose and duration of the activity.
- Go around checking the progress of each group.
- Set guidelines pertaining to discipline and expected tasks.

### Activity De-brief

- Ask each group to explain the scheme offered by government to promote entrepreneurs.

## Summarize



- Summarize the unit by discussing the key points and answering questions the participants may have.

## UNIT 10.5.7: Risk Appetite & Resilience

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss the relationship between entrepreneurship and risk appetite
- Discuss the relationship between entrepreneurship and resilience
- Describe the characteristics of a resilient entrepreneur

### Resources to be Used

- Participant Handbook
- Chart papers
- Blank sheets of paper
- Pens
- Marker pens

### Ask

- Can you define risk or explain what constitutes a risk?
- What do you people mean when they say, “This may be a risky proposition”?
- What risks are they talking about?

### Example

- Let's have a look at these two examples:

Rohit and his family were travelling by car from Delhi to Nainital. It was their second trip there. Rohit was familiar with the road. His friends told him that the highway after Rampur was in a bad condition. They advised him to take a shortcut and turn left from Moradabad and take the Kaladhungi road. This road is in a better condition. Since he was going with his family, and did want to take the risk of getting lost, he left early. He took the Kaladhungi road and reached Nainital well in time.

Suresh and his family too were travelling by car from Delhi to Nainital. It was their second trip there. His friends too advised him to take a shortcut and turn left from Moradabad and take the Kaladhungi road as this road was in a better condition. Suresh too decided to take the Kaladhungi road but he left Delhi in the afternoon. It was dark by the time he reached Kaladhungi, and he was sure that he was taking the correct turn. As it was late, he could not find anyone to give him directions. He ended up being in an unknown place that was scarcely inhabited.

## Say

- Let's see what type of risks Rohit and Suresh took.
- Discuss 'Risk Appetite and Resilience' with the participants as given in the Participant Handbook.

## Say

- Let's learn more about risk appetite and resilience with the help of an activity.

## Team Activity

### Risk Appetite

- This is a group activity.
- In the previous unit, you read success stories of Mr Dhirubhai Ambani and Dr Karsanbhai Patel.
- Mr Ambani left his job and started his company Reliance with just Rs. 50,000/-.
- Dr Patel kept his job, went door-to-door to sell Nirma, and only when the brand started gaining popularity did he start his own company.
- What types of risk did both of them take?
- What risk factors, do you think, did they keep in mind before launching their company?
- Write the Risk Appetite Statement of both the companies.

### Activity De-brief

- Who took a greater risk?
- What are the differences between the Risk Appetite Statement of both the companies?

## Do

- Instruct the participants that this is group work.
- Divide the class into small groups of 4.
- Give each group a chart paper.
- Tell the participants that they have to evaluate the risks taken by Mr Dhirubhai Ambani and Dr Karsanbhai Patel.
- Give the participants 15 minutes to discuss and write.
- Keep a check on time. Tell the group to wind up quickly if they go beyond the given time limit.

## Ask

- Do you think all entrepreneurial ventures are successful?
- What happens if the first venture is not successful?

- Should the entrepreneur stop when faced with challenges or face them?

## Example



- Let's have a look at the following example:

Vijay Shekhar Sharma is the founder of Paytm, which is a giant Indian e-commerce. He was born in a middle-class family in Uttar Pradesh. He started his first job at an MNC. He quit after six months and built a company One97 with his friends. As One97 grew bigger, it needed more money because it was running more servers, bigger teams, and had to pay royalty. At that time, the tech bubble popped and technology companies were running in losses. Finally, money ran out. So One97 took loans and then more loans at higher rates of interest, as high as 24 per cent, and became caught in a vicious cycle.

In 2014, Paytm was launched with online wallet services after which, the company enabled online payment transactions. The company got licenses from RBI in 2016 to launch India's first ever payment bank. Moreover, the main motive of Paytm was to transform India into a cashless economy.

After demonetization came into effect, Vijay Shekhar Sharma started promoting online and digital transactions to deal with the cash crunch. In fact, the service of the company's mobile wallet is accepted across India. The logo of Paytm is now popular almost everywhere from tea stalls to major companies.

## Say



- Let's see what qualities made Vijay Shekhar Sharma a resilient entrepreneur.
- Discuss Entrepreneurship and Resilience with the participants as given in the Participant Handbook.

## Say



- Let's learn more about entrepreneurship and resilience with the help of an activity.

## Team Activity



### Entrepreneurship and Resilience

- This is a group activity.
- Think of some entrepreneurship ventures that faced challenging times, but later resulted in success stories.
- Who is the founder of that company?
- What challenging times did it face?
- How did it overcome those challenges?
- List the resilient characteristics of the entrepreneur.

**Activity De-brief**

- Each group to give their presentation.
- Why did you choose this company?
- What is the success story of the company?

**Do** 

- Instruct the participants that this is group work.
- Divide the class into small groups of 4.
- Give each group a chart paper.
- Tell the participants that they have to think of an entrepreneur who faced challenging times, but eventually succeeded.
- Give the participants 15 minutes to discuss and write.
- Keep a check on time. Tell the group to wind up quickly if they go beyond the given time limit.

**Summarize** 

- You can summarize the key points of the unit.
- Ask the participants what they learned from the activities.
- Clarify any questions or doubts they might have.

## UNIT 10.5.8: Success and Failures

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss how to deal with failure

### Resources to be Used

- Participant Handbook

### Ask

- Have you heard the quote 'nothing is impossible'?
- What do you think it means?
- Do you think that all successful entrepreneurs became famous overnight or did they have to struggle or face failure before succeeding?

### Example

- Let's have a look at this example.

Shah Rukh Khan, also known as, SRK or King Khan is a force to reckon with. Did he achieve stardom overnight?

Shah Rukh Khan, who has seen many struggles in his life – he has slept on streets, struggled to support himself and his sister at a very young age, and lost his parents very early in life, which led to his sister seeking mental health support. Amidst all the chaos and challenges, he kept pushing himself, and today he stands tall as the 'Badshah of Bollywood'. Certainly, those years were not easy for him.

When he was young, he stood at Marine Drive and said, “I will rule this city one day”. Failure was not just his companion during or before his stardom, it is still a substantial part of his life. Success does not come easy. What made him a star was his acceptance of failure and the urge to improve.

### Say

- How do you define success and failure?
- What is fear?
- Discuss “success and failure” with the participants as given in the Participant Handbook.

## Ask

- Have you felt or experienced fear?
- What led you to feel that emotion?
- How did you handle it?

## Say

- Let's learn the about success and failure with the help of an activity.

## Team Activity

- Divide the class into groups of four.
- Instruct them to think of one scenario where they have to interview a successful entrepreneur.
- Explain the purpose and duration of the activity.
- Set guidelines pertaining to discipline and expected tasks.
- They have to choose one person from the group as the interviewee and one as the interviewer.
- Go around and make sure they have understood what is to be done and are discussing the roles properly.
- Check that everyone understands their role. Give clarifications if needed. Give the participants about 5 minutes to discuss and decide their roles.
- Ask the groups to stop the discussion as soon as the time is over.
- Invite each group one by one to come and present their interview as a role play.

## Notes for Facilitation

### Facilitating Role Plays

#### Preparing for the activity

1. Carefully review the details of the scenario and the character descriptions.
2. Become familiar with the key issues being addressed in the scenario.
3. Study the provided material so that you are ready to address issues related to the situations depicted in the role plays.
4. Anticipate potential questions that might be raised by the participants and be ready to address them.

#### Conducting the activity

1. Introduce the activity. Emphasize that role playing provides participants with an opportunity to apply their new knowledge, skills, and tools in situations that simulate actual interactions with customers.
2. Ask participants to form pairs. Direct the members of each group to choose who will play the roles. Remind the groups that each participant should be given the opportunity to play/practice the different roles.

3. Conduct a demonstration so that participants become familiar with the expectations related to the roles and support materials.
4. To maintain spontaneity of the interactions during the role play, ask the participants not to discuss the details of their roles prior to the role play.
5. Give the pairs 15-20 minutes to conduct the role play.
6. Circulate among the groups to answer any questions that may arise and provide guidance as needed.
7. After all the pairs have finished with the role play, conduct a de-briefing session on each role play.
8. Ask the groups to take five minutes to talk about what happened during the role play. The groups should discuss the questions given in the de-briefing for each role play. Encourage participants to provide constructive criticism during their discussions.
9. Conclude the activity by asking participants to think about whether and how they might use scripted role plays in their real life.

## Summarize



- Wrap the unit up after summarizing the key points and answering questions.

## UNIT 10.6: Preparing to be an Entrepreneur

### Key Learning Outcomes



By the end of this module, the trainees will be able to:

1. Discuss how market research is carried out
2. Describe the 4 Ps of marketing
3. Discuss the importance of idea generation
4. Recall basic business terminology
5. Discuss the need for CRM
6. Discuss the benefits of CRM
7. Discuss the need for networking
8. Discuss the benefits of networking
9. Discuss the importance of setting goals
10. Differentiate between short-term, medium-term and long-term goals
11. Discuss how to write a business plan
12. Explain the financial planning process
13. Discuss ways to manage your risk
14. Describe the procedure and formalities for applying for bank finance
15. Discuss how to manage their own enterprise
16. List the important questions that every entrepreneur should ask before starting an enterprise

## UNIT 10.6.1: Market Study/ The 4Ps of Marketing/ Importance of an IDEA: Understanding Market Research

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss how market research is carried out
- Describe the 4 Ps of marketing
- Discuss the importance of idea generation

### Resources to be Used

- Participant Handbook
- Chart papers
- Markers pens
- Blank sheets of paper

### Ask

- Suppose, you want to open a restaurant, what are the factors you will consider?
- How will you promote your restaurant?

### Example

- Let's have a look at this example.  
Arjun was an MBA working in a company. But he wanted to start a low cost budget hostel for foreign tourists coming to India. He did a lot of market research before starting the project. Based on the information he gathered, he made his business plan. His hostel is now flourishing and he is thinking of expanding to other tourist destinations.

### Say

- Discuss "Market Study" with the participants. Refer to the Participant Handbook.
- Let's learn about market study and research with the help of an activity.

### Team Activity

#### Market Study

- This is a group activity.
- You want to start your own tuition centre.
- What type of research will you do?

**Activity De-brief**

- Ask each group to come forward and give a brief presentation.
- Encourage other groups to be interactive and ask questions.
- What factors did you keep in mind while doing your research?
- Based on our research would you go ahead and open a tuition centre?

**Do** 

- Instruct the participants that this is group work.
- Divide the class into small groups of 4 or 6.
- Give each group a chart paper.
- Tell the participants that they have to start their own tuition centre.
- Give the participants 10 minutes to discuss and write the research work they need to do.
- Keep a check on time. Tell the group to wind up quickly if they go beyond the given time limit.

**Say** 

- By opening a tuition centre you are offering a service.

**Ask** 

- What factors will you keep in mind before opening it?

**Say** 

- Discuss “The 4Ps of Marketing” with the participants as given in the Participant Handbook.

**Say** 

- Let's learn about the 4Ps of Marketing with the help of an activity.

**Team Activity** **4 Ps of Marketing**

- This is a group activity.
- You have to sell a pen to four different segments:
  1. Rural villagers
  2. Rural middle class
  3. Urban middle class
  4. Upper end rich people (Niche market)

Keeping the 4Ps of Marketing in mind, what marketing strategy will you design to sell the pen?

#### Activity De-brief

- Ask each group to present their strategy.
- Encourage other groups to be interactive and ask questions.

### Do



- Instruct the participants that this is group work.
- Divide the class into four groups.
- Give each group a chart paper.
- Assign each group a target audience for selling the pens:
  1. Rural villagers
  2. Rural middle class
  3. Urban middle class
  4. Upper end rich people
- Tell the participants that they have to design a marketing strategy keeping the 4Ps of Marketing in mind.
- Give the participants 20 minutes to discuss and come up with their strategy.
- Keep a check on time. Tell the group to wind up quickly if they go beyond the given time limit

#### Activity De-brief

- Ask each group to come forward and give a brief presentation.
- Ask each group what they kept in mind while designing their marketing strategy.
- Encourage other groups to be interactive and ask questions.

### Say



- Each entrepreneur has an idea of wants he wants to sell. It may be a service or a product.
- Discuss “Importance of an IDEA” as given in the Participant Handbook.

### Summarize



- Summarize the key points of the unit.
- Ask the participants what they learnt from the activities.
- Encourage them to ask if they have any doubts.

## UNIT 10.6.2: Business Entity Concepts

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Recall basic business terminology

### Resources to be Used

- Participant Handbook

### Say

- Let's recall some basic business terminology.
- Discuss the Business Entity Concepts as given in the Participant Handbook.
- Let's learn some basic business terminology by having an activity.
- We will have a quiz today.

### Activity

- The activity is a quiz.

### Do

- Divide the class in two groups and give a name to each group.
- Explain the rules of the quiz. For each correct answer the group gets 1 mark.
- If the group is unable to answer the question is passed to the next group.
- Explain the purpose and duration of the activity.
- Ask the questions of the quiz.
- Keep a score of the groups.
- Set guidelines pertaining to discipline and expected tasks.

### Summarize

- Summarize the unit by discussing the key points.

### Notes for Facilitation

#### QUESTIONS FOR THE QUIZ

1. What does B2B mean?

*Business to business*

2. What is a financial report?

*A comprehensive account of a business' transactions and expenses*

3. Who is a sales prospect?

*A potential customer*

4. How is working capital calculated?

*Current assets minus current liabilities*

5. What is an estimation of the overall worth of a business called?

*Valuation*

6. You are buying a house. What type of transaction is it?

*Complex transaction*

7. How will you calculate the net income?

*Revenue minus expenses*

8. How is Return on Investment expressed?

*As percentage*

9. How will you calculate the cost of goods sold?

*Cost of materials minus cost of outputs*

10. 10. What is revenue?

*Total amount of income before expenses are subtracted.*

11. What is a Break-Even Point?

*This is the point at which the company will not make a profit or a loss. The total cost and total revenues are equal.*

12. What is the formula used to calculate simple interest?

*$A = P(1 + rt)$ ;  $R = r * 100$*

13. What are the three types of business transactions?

*Simple, Complex and Ongoing Transactions*

14. The degrading value of an asset over time is known as

*Depreciation*

15. What are the two main types of capital?

*Debt and Equity*

## UNIT 10.6.3: CRM & Networking

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss the need for CRM
- Discuss the benefits of CRM
- Discuss the need for networking
- Discuss the benefits of networking

### Resources to be Used

- Participant Handbook

### Ask

- Can your business run without customers/buyers?
- Who is the most important entity in any business?

### Say

- The key to every success business lies on understanding the customer's expectations and providing excellent customer service.
- Discuss about CRM and its benefits. Refer to the Participant Handbook.
- Providing excellent customer service entails:
  - Treating your customers with respect.
  - Be available as per their need/ schedule.
  - Handling complaints effectively.
  - Building long lasting relationships.
  - Collecting regular feedback.
- Handle customer complaints proactively. Ask “what happened”, “why it happened”, “how can it be avoided next time”, etc.
- Collecting feedback from the customers regularly will enable you to improve your good/service.
- “Let's understand it better with the help of some case scenarios. You will be given some cases within your groups. You have to analyse the case scenario that has been given to you and then find an appropriate solution to the problem.”

### Do

- Divide the class into four groups of maximum six participants depending on the batch size.
- Give one case study to each group.

- Instruct them to read the case carefully.
- The group is expected to analyse and discuss the case amongst them and find a solution to the given problem.
- Put down the discussion points (de-brief questions) on the board. Give the class 5-10 minutes to discuss the case and note down their solutions.
- At the end of 10 minutes, the team should present their case solution to the class.

## Team Activity

### Case Study Analysis

Raju runs a business of wooden furniture. He has a huge list of customers on Facebook and WhatsApp who give him orders regularly. Ankita is one of his old and regular customers. She placed an order for a new chester and TV cabinet via WhatsApp and requested Raju to send them as soon as possible. When the parcel reached Ankita through courier she found that chester was broken and the TV unit was chipped from the bottom. Ankita was heartbroken. It was a complete waste of money. She sent a message to Raju on WhatsApp, expressing her anger and disappointment. Raju might lose an old customer forever if he doesn't satisfy the customer. What should Raju do to retain his customer?

### Scenario 2

Rajni runs a boutique shop. She sells suits and sarees. She is one of the most successful designer in her city. Rajni swears that all the clothes in her boutique have unique designs. Smita has to attend her cousin's wedding; she goes to Rajni's boutique to buy a saree. Smita wanted a unique designer saree. Rajni customized a saree for her and sent it over the courier. When Smita had a look at the saree she realised her two friends had the same design sarees. She sent a message to Rajni on WhatsApp, expressing her anger and disappointment. Did Rajni make a false promise? Were her designs copied? What could happen to Rajni's image after this incident? What would you do if you were in Rajni's place?

### Scenario 3

Shama is a beautician who offers parlour services to ladies by making home visits. Recently, Shama got her name registered on an e-commerce website. Two days earlier, she got a message from Mrs Sushma. The appointment was fixed for next day, 11:00 am and the remuneration for the services was decided beforehand. When Shama reached there at 10:50 am, Mrs Sushma was not at home. When Shama called her, she asked her to wait for a while. Mrs Sushma reached home at 11:45 am. Meanwhile, Shama had to reschedule her next appointment. After availing Shama's services, Mrs Sushma refused to pay the requisite amount and started finding faults in the services provided by her. Who was at fault in this scenario? What should you do in case the customer behaves unreasonably? What would you do if you were in Shama's place?

**Scenario 4**

Shailender is the manager of a car showroom. He proactively takes part in all the transactions that happen in his showroom. Vinita wants to buy a new car. She has chosen a car from Shailender's showroom. The salesperson has given her a very good discount and has also promised free service for one year. Vinita goes to the showroom and asks to complete all the formalities to purchase the car. When she sees the final bill she realize that she has not received the promised discount neither was there any mention of the free services. She immediately demands to see the Shailender. When Shailender's head asks how much discount Vinita was promised, he realised the discount will make the sale in loss. The car showroom owner might lose a customer and deal due to false commitments made by his manager. Besides, the customer might tell this to other people, creating a bad name and image for the showroom. If you owned that showroom, how would you have convinced your customer?

**Say** 

- Now, let's discuss the problem and solution with the class.
- The group will first briefly describe the case to the class.
- Then discuss the issue identified and the proposed solution.
- Present the solution as a role play.
- Post presentation, the other groups may ask questions from the group that has presented.

**Do** 

- Congratulate each group for the presentation/ role play.
- Ask the audience to applaud for them.
- Keep a check on time. Tell the group to wind up the discussion quickly if they go beyond the given time limit.

**Say** 

- If your customers are happy with you they will give referrals which will help to grow your business.
- One more way of growing business is 'Networking'.
- Discuss Networking and its benefits. Refer to the Participant Handbook.

**Activity** **Group Discussion**

- Conduct a group discussion in the class on how they can do networking for their business.

## Summarize



- Ask the participants what they have learnt from this exercise/ activity.
- Ask if they have any questions related to what they have talked about so far.
- Close the discussion by summarizing the importance of CRM and Networking for entrepreneurs.
- Close the discussion by summarizing the importance of CRM and Networking for entrepreneurs.

## UNIT 10.6.4: Business Plan: Why Set Goals?

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss the importance of setting goals
- Differentiate between short-term, medium-term and long-term goals
- Discuss how to write a business plan
- Explain the financial planning process
- Discuss ways to manage your risk

### Resources to be Used

- Participant Handbook
- Chart papers
- Blank papers
- Marker pens
- Ruler

### Ask

- Remember we had written SMART Goals in a previous session? Let's try and recall why it is important to set goals?
- While framing SMART goals, we talked about 'T' in SMART, which was 'Time Bound'? What do we mean by time bound goals?
- What time limit did you set for your goal- 3 weeks, 3 years, 10 years?

### Say

- Talk about short term, long term and medium-term goals, as discussed in the Participant Handbook.

### Ask

- As you are planning to become an entrepreneur, you must have thought of an idea for a start-up. What is your business idea?

### Do

- Ask few participants to share their business ideas.

## Ask



- Have you created a business plan for your business idea?
- Do you think it is important to have a business plan in place? Why/ why not?

## Say



- Talk about 'Why Create a Business Plan' as discussed in the Participant Handbook.
- Let's understand it better with the help of an activity.

## Team Activity

**Writing a business Plan**

- This is a group activity.
- Give the groups the required resources such as chart paper and markers.
- This activity is divided into two parts:
  1. Create a business idea
  2. Develop a business plan
- The group will discuss and come up with a new business idea and present their idea to the class.
- In the second part of the activity the group will develop a business plan for the business idea.
- The business plan prepared will be presented by the groups to the class.

<b>MY BUSINESS PLAN</b>
Executive Summary: What is your Mission Statement?
Business Description: What is the nature of your business?
Market Analysis: What is your target market?
Organization and Management: What is your company's organizational structure?
Service or Product Line: What is the lifecycle of your product/ service?
Marketing and Sales: How will you advertise and sell your products?
Funding Request: How much fund is required and from where?

## Say

- Teams will need to brainstorm for this part of the activity.
- Use the blank papers for the second part of this activity
- Make your business plan on a chart paper based on the following parameters:
  1. Executive Summary
  2. Business Description
  3. Market Analysis
  4. Organization and Management
  5. Service or Product Line
  6. Marketing and Sales
- Explain each parameter in detail as done in the Participant Handbook.
- Discuss each parameter with the business idea examples of the groups.
- Groups will discuss and develop the business plan for their business idea.

## Say

- Now, let's share our plan with the class.
- Each group will briefly describe the plan to the class.
- Post presentation, the other groups may ask questions to the group who have presented their plan.

## Do

- Congratulate each group for sharing their points.
- Ask the audience to applaud for them.
- Keep a check on time. Tell group to wind up the discussion quickly if they go beyond the given time limit.

## Say

- Along with a business plan, you need to create a financial plan and evaluate the risk involved with your start up.
- Discuss 'Financial Planning' and 'Risk Management' in detail as given in the Participant Handbook.

## Summarize

- Ask the participants what they have learnt from this exercise/ activity.
- Ask if they have any questions related to what they have talked about so far.

## Notes for Facilitation



- Keep the business plan format ready in a flipchart to display it during the activity.

## UNIT 10.6.5: Procedures and Formalities for Bank Finance

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss the importance of setting goals
- Differentiate between short-term, medium-term and long-term goals
- Discuss how to write a business plan
- Explain the financial planning process
- Discuss ways to manage your risk

### Resources to be Used

- Participant Handbook
- Bank loan/finance form sample

### Ask

- While preparing a business plan in the last session, we discussed financial planning to arrange financial resources for your start-up. Therefore, how will you collect funds to start your business?

### Say

- While most entrepreneurs think 'product' is the most difficult thing to decide for a business, start-up capital poses an even a bigger obstacle. Though there are various ways of funding the business, to convince investors to invest money is the most challenging.
- Some of the funding options available in India are:
  - **Bootstrapping:** Also called self-financing is the easiest way of financing
  - **Crowd funding:** Funds are collected by consumers pre-ordering or donating for starting the business.
  - **Angel investors:** Individual or group of investors investing in the company
  - **Venture capitalists:** Venture capitals are professionally managed funds who invest in companies that have huge potential. They usually invest in a business against equity.
  - **Bank loans:** The most popular method in India.
  - Microfinance Providers or NBFCs
  - **Government programmes**
- Let us know discuss the most popular method i.e. bank finance in detail here.

## Do

- Discuss the list of documents that are required to apply for a loan like letter of introduction, business brochure, references of other banks, and financial statements.
- Explain the details to be filled in a loan application form.
- Divide the class into groups. Give each group a loan application form.
- Ask the groups to discuss and fill the form.

## Summarize

- Close the discussion by summarizing the important documents needed for bank loan.
- Ask the participants if they have any questions related to what they have talked about so far.

## Notes for Facilitation

- Checklist of documents is provided as resources for the session.
- You can make some copies and distribute it during the group activity.
- Download sample loan application forms from any nationalised bank's website. Print sufficient copies to circulate it amongst the groups.

### **CHECKLIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH LOAN APPLICATION (Common for all banks)**

- |   |
|---|
| 1. Audited financial statements of the business concern for the last three years  |
| 2. Provisional financial statements for the half – year ended on _____  |
| 3. Audited financial statements of associate concern/s for the last three years   |
| 4. Copy of QIS II for the previous quarter ended on _____   |
| 5. Operational details in Annexure I  |
| 6. CMA data for the last three years, estimates for current year and projection for the next                                  |
| 7. Term loan/DPG requirements in Annexure II  |
| 8. List of machinery in respect of machinery offered as security in Annexure III  |
| 9. Additional details for export advances furnished in Annexure IV  |
| 10. Property statements of all directors/partners/proprietor/guarantors   |
| 11. Copies of ITAO of the company for the last three years  |
| 12. Copies of ITAOs/WTAOs of the directors/partners/proprietor and guarantors   |
| 13. Copies of certificate from banks and financial institutions certifying the latest liability with                          |
| 14. Copy of board resolution authorizing the company to apply to your bank for the credit facilities mentioned in application |

15. Copy of memorandum and article of association (in case of limited company)/partnership deed (in case of partnership firm)

16. Cash budget for the current year and next year in case of contractors and seasonal industries.

## UNIT 10.6.6: Enterprise Management – An Overview: How to Manage Your Enterprise?

### Unit Objectives

By the end of this unit, the trainees will be able to:

- Discuss how to manage their own enterprise

### Resources to be Used

- Participant Handbook

### Ask

- Having set up a business, do you think it is possible to do everything on your own?
- Does one require trained persons for help?
- What does management mean?

### Say

- Let's have a look at this example:  
Kapil had a small business that was beginning to pick up pace. He wanted to expand his business, and therefore employed few more people. One day, as he was walking past Ramesh, one of his new employees, he overheard Ramesh talking rudely to a customer on the phone. This set him thinking. Kapil realised that he should have regular team meetings to motivate his employees and speak with them about any problems they might be facing during work. He should also conduct training sessions on new practices, soft skills, and technology, and develop work ethics manual for managing his enterprise.

### Say

- Was Kapil correct in his approach or he should have scolded Ramesh instantly in front of his other employees?
- Discuss “Enterprise Management – An Overview” with the participants as given in the Participant Handbook.

### Say

- Let's learn how to effectively manage an enterprise or business through an activity.

## Team Activity

### Enterprise Management

- This is a group activity.
- Design a matrix listing the topics and key words that are needed to run an enterprise effectively and smoothly.

### Activity De-brief

- Have each group present their matrix.
- Encourage participants of the other groups to ask question about each other's presentation.

## Do

- Instruct the participants that this is group work.
- Divide the class into small groups of 4.
- Give each group a chart paper and coloured pen.
- Tell the participants that they have make a matrix they need to fill.
- They have to write the main topics and key words that will them effectively manage their enterprise.
- Give the participants 15 minutes to discuss and write.
- Keep a check on time. Tell the group to wind up quickly if they go beyond the given time limit.

## Summarize

- Ask the participants what they have learned from this exercise/activity.
- Ask if they have any questions related to what they have talked about so far.
- Close the discussion by summarizing the importance of effective management to run an enterprise as given in the Participant Handbook.

## UNIT 10.6.7: 20 Questions to Ask Yourself before Considering Entrepreneurship

### Unit Objectives

By the end of this unit, the trainees will be able to:

- List the important questions that every entrepreneur should ask before starting an enterprise

### Resources to be Used

- Participant Handbook
- Blank sheets of paper
- Pens

### Ask

- Why do you want to become an entrepreneur?

### Say

- It is very important to know why you want to become an entrepreneur. Your personal goals for becoming an entrepreneur play a key role in the success of your business. Your goals should be clear well before you start your business.
- Apart from the goals, the other aspects of business that you need to bear in mind are the potential problems that you may face to set-up, your areas of interest, and all the other dimensions of the business.
- Let's understand it better with the help of some questions that every entrepreneur should ask before starting their own business.
- Open the Participant Handbook section named '20 Questions to Ask Yourself Before Considering Entrepreneurship'. You have to answer the questions individually.
- Then, we will have a class discussion on all the questions.

### Do

- Read out the questions one by one in front of all the participants.
- Participants have to answer all the one by one questions.
- Give the class 10-15 minutes to note down their answers.
- At the end of 15 minutes, open the discussion for all the questions.
- Moderate the discussion by focusing on the relevant points.

- Keep a check on time and don't let the discussion get sabotaged or lose track of time. Ensure all the questions are covered and discussed.
- Give the participants 15 minutes to discuss and write.
- Keep a check on time. Tell the group to wind up quickly if they go beyond the given time limit.

## Summarize

- Ask the participants what they have learned from this exercise/activity.
- Ask if they have any questions related to what they have talked about so far.



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MINISTRY OF SKILL DEVELOPMENT  
& ENTREPRENEURSHIP



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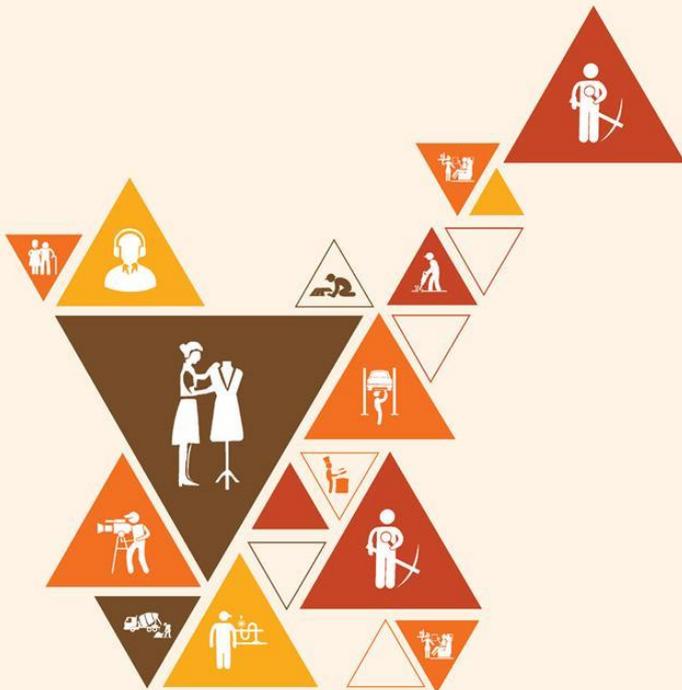
Transforming the skill landscape



# 11. Annexures

Annexure 1 – Training Delivery Plan

Annexure 2 – Assessment Criteria



## Annexure 1

### Training Delivery Plan

Training Delivery Plan			
<b>Program Name:</b>	Certificate Course in Telecom Technician – IoT Devices/Systems		
<b>Qualification Pack Name &amp; Ref. ID</b>	Telecom Technician – IoT Devices/Systems (TEL/Q6210)		
<b>Version No.</b>	1.0	<b>Version Update Date</b>	26-06-2018
<b>Pre-requisites to Training</b>	10 + 2 preferably		
<b>Training Outcomes</b>	<p>After completing this programme, participants will be able to:</p> <ol style="list-style-type: none"> <li>1. Install IoT Devices at Customer Premises/equipment: List IoT devices (nodes and gateways) and identify suitable points/locations for installing them.</li> <li>2. Configure IoT devices and establish communication: Connect nodes and gateways (hardware pre-configured) to data transfer devices (PC/Laptop) for software upload to micro-controllers, on-board compilation and debugging of software.</li> <li>3. Troubleshoot the IoT devices: Troubleshoot IoT nodes and gateways over different modes of communication (Bluetooth, Zigbee, Wi-Fi etc.)</li> <li>4. Demonstrate health and safety measures: Work in accordance with emergency procedures, standards and guidelines for health and safety in the organization</li> </ol>		

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
1.	Introduction to Internet of Things (IoT) and Telecom	Basics of Micro-processor Boards and Microcontroller Units	<ul style="list-style-type: none"> <li>Explain the basics of IoT</li> <li>Identify the applications of IoT in current world</li> <li>Explain the basics of microprocessors and microcontrollers</li> <li>Describe different processor boards and their applications</li> <li>Explain how IoT works for roadside assistance and smart cities</li> </ul>	TEL/N6234	Theoretical session on Telecom and its background, IoT and its uses. Activity on identifying the types of sensor devices and their work	Microprocessor Boards Arduino-BCMI/ Uno Nano 32- ESP 32 Raspberry-pi	T: 3 hours P: 0 hours
		Functioning of Sensors and Actuators	<ul style="list-style-type: none"> <li>List various types of sensors</li> <li>Identify the importance of actuators</li> <li>Explain the basic programming of a microcontroller board</li> </ul>			Associated Technical Documentation & accessories (power, connectivity cables, programing framework)	T: 2 hours P: 4 hours
		Application of Communication Protocol in Internet of Things	<ul style="list-style-type: none"> <li>List various short-range wireless communications systems</li> <li>Identify the protocols used for communication in IoT</li> <li>Compare different communication technologies</li> </ul>			Desktop PCs (for supporting framework, connectivity of boards and programing) Pressure sensor, Accelerometer and Gyroscope, Temperature sensor, Humidity sensor, Proximity sensor, Touch sensor, Analog and Digital sensor, reed sensor, and Video surveillance cameras.	T: 2 hours P: 4 hours
		Micro-controller Boards, PIN Configurations and Their Interconnectivity	<ul style="list-style-type: none"> <li>Identify the components of a microcontroller board</li> <li>Describe the layout of various development board</li> </ul>				T: 2 hours P: 6 hours

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
		Understanding Edge Devices	<ul style="list-style-type: none"> <li>Explain the functions of edge devices</li> <li>Identify the different types of edge devices</li> </ul>				T: 2 hours P: 6 hours
		Nodes and Gateways	<ul style="list-style-type: none"> <li>Explain nodes</li> <li>Describe gateway architecture</li> <li>List the steps in setting up an IoT framework</li> </ul>				T: 2 hours P: 4 hours
		Cloud Computing	<ul style="list-style-type: none"> <li>Explain the concept of cloud computing</li> <li>List the characteristics of cloud computing</li> <li>Explain how cloud computing is related to business analytics</li> <li>Explain the advantages of cloud utilization</li> </ul>				T: 2 hours P: 4 hours
<b>NOS Total: T= 15 hours; P= 22 hours</b>							
2.	Hardware and Protocol Requirements	Establishing Framework for Internet of Things	<ul style="list-style-type: none"> <li>List the steps of installation of IoT framework</li> <li>Explain how to collect data</li> <li>List the input parameters for a sensor</li> </ul>	TEL/N6234	Theoretical methods of establishing an IoT set up at a site, installing router, nodes, sensor etc. Practical on establishing IoT set up at a site with all the necessary connections	Gateway and nodes for installation. Router set up with cables. Ethernet cable, power cables and power supply.	T: 2 hours P: 4 hours
		Installing Gateway as per the Power Supply Requirements	<ul style="list-style-type: none"> <li>List the characteristics of power sources available for the nodes and gateways</li> <li>Identify the characteristics of battery used for IoT framework</li> <li>Execute connection establishment between the</li> </ul>				T: 2 hours P: 6 hours

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
			nodes and gateways				
		Establishing Communication between Nodes, Gateway and Servers	<ul style="list-style-type: none"> <li>• Explain the communication channels</li> <li>• Describe wireless sensor network</li> <li>• Explain sensor connectivity</li> </ul>				T: 2 hours P: 4 hours
		Establishing Ethernet Connectivity	<ul style="list-style-type: none"> <li>• Identify the connectivity options</li> <li>• Describe how to configure network setting</li> <li>• List the steps of crimping</li> <li>• Execute the establishment of Ethernet connection</li> </ul>				T: 2 hours P: 6 hours
		Authentication and Access Control Mechanism	<ul style="list-style-type: none"> <li>• Identify the importance of authentication and authorization in IoT</li> <li>• Explain access control system.</li> <li>• Identify the software interface characteristics.</li> <li>• List different software available for access control management.</li> <li>• Describe how to secure wireless connection</li> <li>• Describe malware and distributed denial of service (DDoS) attacks</li> </ul>				T: 2 hours P: 4 hours
<b>NOS Total: T= 10 hours; P= 22 hours</b>							
3.	Establishing the IoT Framework	Preparing for Installation of IoT	<ul style="list-style-type: none"> <li>• List the pre-installation requirements for</li> </ul>	TEL/N6234	Practical on preparing site for installation	Sensors (Wired and Wireless) mounting kit.	T: 6 hours P: 7 hours

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
		Edge Devices	<p>the software and tools</p> <ul style="list-style-type: none"> <li>Identify the tools and equipment</li> <li>Explain how to choose the correct location for mounting</li> <li>Explain how to select resources such as power supply</li> </ul>		of IoT devices and checking the connections Theoretical sessions on the procedure for establishing IoT framework at a site	Connecting cables to processor board {directly/through bread-boards) Power supply Tool kit	
		Mounting the Devices at Desired Locations	<ul style="list-style-type: none"> <li>Explain the steps for surface preparation while mounting devices</li> <li>Identify the correct distance between the devices</li> <li>Describe signal and power loss during inter-device communication</li> <li>Evaluate the resource consumption of the set-up</li> <li>Identify the correct set of source for power and other utilities</li> </ul>				T: 7 hours P: 8 hours
		Performing Checks and Connections	<ul style="list-style-type: none"> <li>Explain the connectivity between the devices</li> <li>Describe preparation of devices for transmission of data</li> <li>Explain power supply selection and grounding</li> <li>Identify post commissioning checks</li> </ul>				T: 7 hours P: 7 hours
<b>NOS Total: T= 20 hours; P= 22 hours</b>							

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
4.	Communication and Microprocessors	Connecting Microcontroller Boards for Data Transfer	<ul style="list-style-type: none"> <li>Identify the connectivity points in Arduino and Raspberry pi</li> <li>List the connectivity options available for microcontroller</li> </ul>	TEL/N6235	Theoretical session on connecting microprocessor boards such as Raspberry Pi, Arduino uno Practical on connecting boards and loading codes	IoT devices such as: <ul style="list-style-type: none"> <li>Sensors</li> <li>Controllers</li> <li>Recorders</li> <li>Power meters</li> <li>Security cameras</li> </ul> Apps and software/tools enabling monitoring of IoT devices through consoles LoRa WAN, gateway nodes, IoT devices, MCU boards, breadboard, LED lights PIC compiler, In-Circuit Debugger, microcontroller	T: 2 hours P: 6 hours
		Connecting the Boards	<ul style="list-style-type: none"> <li>List the types of cables and connectors</li> <li>Explain how to connect a device to the microcontroller board</li> </ul>				T: 3 hours P: 7 hours
		Installing Suitable Framework	<ul style="list-style-type: none"> <li>Execute the steps of connecting Arduino board to the PC</li> </ul>				T: 3 hours P: 5 hours
		Transferring Software Code to On-board Microprocessor	<ul style="list-style-type: none"> <li>Identify the nodes and gateways</li> <li>Explain the basic coding structure of microcontroller</li> <li>Identify the options to transfer codes</li> <li>Explain the challenges in transferring codes</li> </ul>				T: 3 hours P: 7 hours
		Compiling Code to On-board Microprocessor	<ul style="list-style-type: none"> <li>Explain how to compile a code</li> <li>List the types of compilers available</li> </ul>				T: 3 hours P: 7 hours
		Understanding Error Codes and Debug Software	<ul style="list-style-type: none"> <li>Identify the ways of debugging a microcontroller code</li> <li>Explain the steps of setting the software in debug mode</li> <li>Interpret the error codes</li> </ul>				T: 3 hours P: 7 hours

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
		Functioning of Micro-controller and Attached Devices	<ul style="list-style-type: none"> <li>Explain the steps to check the microcontroller functions</li> <li>Describe how to use the Emulator to check the proper functioning of the devices</li> <li>Manage the communication hurdles</li> </ul>				T: 3 hours P: 7 hours
<b>NOS Total: T= 20 hours; P= 32 hours</b>							
5.	Interconnecting the Hubs and Edge Appliances	Initializing Nodes and Gateways	<ul style="list-style-type: none"> <li>Identify the prerequisites for initialization of nodes and gateways</li> <li>Explain the configuration of edge appliances</li> <li>Identify the steps of node and gateway initialization</li> <li>Describe how to check connectivity</li> <li>Explain the execution scenarios of software</li> </ul>	TEL/N6235	Theoretical session on nodes and gateway connection and initialisation Practical session on connecting nodes and initialising to enable service	Apps and software/tools enabling monitoring of IoT devices through consoles DSL Modem, Router Cables, tool kit. Testing tool, network set up, PC Wi fir network set up.	T: 3 hours P: 7 hours
		Launching the Software on Nodes and Gateways	<ul style="list-style-type: none"> <li>Identify the prerequisites for software installation</li> <li>Explain the challenges with launching software</li> </ul>				T: 3 hours P: 7 hours
		Confirming Communication	<ul style="list-style-type: none"> <li>Explain the data transfer indicators</li> <li>Compare data transfer on various networks</li> <li>Explain different data transfer failure scenarios</li> </ul>				T: 3 hours P: 7 hours

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
		Establishing Connectivity	<ul style="list-style-type: none"> <li>List the steps to connect to a network remotely</li> <li>Identify the steps to connect to short range networks</li> </ul>				T: 3 hours P: 7 hours
		Controlling Edge Appliances and Hubs	<ul style="list-style-type: none"> <li>Explain the configuration of a router</li> <li>Describe controlling of devices by connecting hub</li> <li>Explain the bypassing of a hub</li> </ul>				T: 3 hours P: 7 hours
		Checking for Data Transfer and Confirming from the Server End	<ul style="list-style-type: none"> <li>Explain the types of data transfer</li> <li>Identify various data transfer modes</li> <li>Explain how to control the data transfer</li> </ul>				T: 3 hours P: 7 hours
<b>NOS Total: T= 20 hours; P= 24 hours</b>							
6.	Configuring Devices	Testing Connectivity between Devices	<ul style="list-style-type: none"> <li>Identify the types of IOT testing</li> <li>Explain connectivity of IoT devices</li> <li>Explain the IoT test approaches</li> <li>List the IoT test challenges and IoT testing tools</li> <li>Describe testing pin configuration</li> </ul>	TEL/N6236	Practical session on configuring IoT devices and sensor at a location Practical session on testing connectivity, power supply and memory status on devices	Microprocessor Boards Arduino-BCMI/ Uno Nano 32- ESP 32 Raspberry-pi  Associated Technical Documentation & accessories (power, connectivity cables, programing framework)  Desktop PCs (for supporting framework, connectivity of	T: 2 hours P: 7 hours
		Checking Connectivity between Devices	<ul style="list-style-type: none"> <li>Explain the different ways of connecting the IoT gateway to the nodes</li> <li>List the tools to verify networking connectivity</li> <li>Explain the role of event viewer and hardware in</li> </ul>				T: 2 hours P: 7 hours

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
			verifying network connectivity <ul style="list-style-type: none"> <li>• Explain the role of local connectivity</li> </ul>			boards and programing)	
		Checking On-board Memory Storage Card	<ul style="list-style-type: none"> <li>• List the steps to check on-board memory storage card for storing node data in Raspberry Pi</li> <li>• Explain the two ways to store data locally for the Arduino boards</li> </ul>				T: 1 hours P: 7 hours
		Testing Working of Connectivity Modules	<ul style="list-style-type: none"> <li>• List the parameters to check working of on-board Wi-Fi or a 3G, 4G connectivity module</li> <li>• Explain the role of range, bandwidth, Intermittent connectivity and security</li> <li>• List the steps to run Wireshark</li> </ul>				T: 2 hours P: 7 hours
		Checking the On-board Power Supply	<ul style="list-style-type: none"> <li>• Explain the checking of on-board power supply</li> <li>• Demonstrate checking of power supply at different hardware configurations</li> </ul>				T: 1 hours P: 7 hours
		Checking Communication Link Performance Matrix	<ul style="list-style-type: none"> <li>• List the parameters affecting the performance matrix of node and gateway connections</li> <li>• Explain the role of Maximum transmission unit (MTU), data loss,</li> </ul>				T: 2 hours P: 7 hours

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
			delay and reliability				
		Checking Data Transfer from Gateway to Server	<ul style="list-style-type: none"> <li>Identify the basic troubleshooting steps to check the data transfer between the gateway and the server</li> <li>Identify the Secure Internal Communication (SIC) ports</li> <li>Explain the checking of SIC and gateway connectivity</li> </ul>				T: 2 hours P: 7 hours
		Checking Communication between Devices	<ul style="list-style-type: none"> <li>Identify the steps for loading software and testing the communication between devices</li> <li>Explain starting a node, checking active links and establishing a session</li> </ul>				T: 2 hours P: 7 hours
		Setting Connectivity Credentials	<ul style="list-style-type: none"> <li>Describe securing of devices using the MQTT protocol</li> <li>Explain device authentication based on user id/password</li> <li>Explain device authentication based on one time password (OTP)</li> </ul>				T: 1 hours P: 7 hours
<b>NOS Total: T= 15 hours; P= 15 hours</b>							
7.	Major Project Implementation	Project on Humidity and Temperature Sensing Device	<ul style="list-style-type: none"> <li>Prepare an IoT project for humidity and temperature device which obtains information of the</li> </ul>	TEL/N623 4, TEL/N623 5, TEL/N623 6	Project based program for candidates to make project based on IoT	Temperature, humidity sensor, android phone, internet connection, pollution check sensor	T: 0 hours P: 15 hours

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
			surrounding environment and uploads the data in cloud network.				
		Project on Air Pollution Sensing Device	<ul style="list-style-type: none"> <li>Prepare an IoT project for air pollution measuring device which obtains information of the about air pollution through any smart phone.</li> </ul>				T: 0 hours P: 15 hours
<b>NOS Total: T= 00 hours; P= 30 hours</b>							
8.	Understanding Organizational Policies	Organizational Processes and Standards	<ul style="list-style-type: none"> <li>Define organizational processes</li> <li>Identify the elements and steps of an organizational process</li> <li>Explain the importance of organizational processes</li> <li>Identify the hierarchy in an organization</li> </ul>	TEL/N623 4, TEL/N623 5, TEL/N623 6, TEL/N250 9	Theoretical session on organisation culture, reporting and communication methods at workplace Practical session on communication and reporting methods	PPT, computer, Participants handbook	T: 1.5 hours P: 1.5 hours
		Project Handling Concepts and Applications	<ul style="list-style-type: none"> <li>Explain different project handling concepts</li> <li>List the steps of an IoT project implementation process</li> </ul>				T: 1.5 hours P: 1.5 hours
		Decision Making and Problem Solving Process	<ul style="list-style-type: none"> <li>Explain what is decision making</li> <li>Identify the steps involved in decision making</li> <li>Explain the techniques used in decision making</li> <li>List the advantages of decision making</li> <li>Identify the steps involved in a</li> </ul>				T: 1.5 hours P: 1.5 hours

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
			problem solving process				
		Record Maintenance	<ul style="list-style-type: none"> <li>Identify business records</li> <li>Explain the methods of record maintenance</li> <li>Explain the importance of record maintenance</li> </ul>				T: 1 hours P: 1 hours
		Record Performance/Test Results	<ul style="list-style-type: none"> <li>Explain the significance of recording performance</li> <li>Analyse a technician's role in recording performance</li> <li>Identify methods used in recording performance</li> </ul>				T: 1 hours P: 1 hours
		Maintain Records and Process Documents	<ul style="list-style-type: none"> <li>Explain the importance of documentation</li> <li>Explain global format systems used for documentation</li> <li>List the steps of document processing</li> <li>List the qualities required to do documentation</li> </ul>				T: 1.5 hours P: 1.5 hours
		Communication Skills	<ul style="list-style-type: none"> <li>Explain the importance of communication skills</li> <li>Explain the methods to improve reading skills</li> <li>Explain the methods for improving writing skills</li> </ul>				T: 1 hours P: 1 hours

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
			<ul style="list-style-type: none"> <li>Explain the methods to develop interpersonal skills</li> </ul>				
		Special Policies for Women Working on Monitoring Consoles	<ul style="list-style-type: none"> <li>List the special safety policies for women</li> <li>Explain methods to improve women safety</li> <li>Explain the need of relaxation policies for women</li> </ul>				T: 1 hours P: 1 hours
<b>NOS Total: T= 10 hours; P= 10 hours</b>							
9.	Maintaining Health and Safety	Safety Hazards and their Types	<ul style="list-style-type: none"> <li>Define safety hazards</li> <li>List the possible hazards at work</li> <li>Explain the methods to identify hazards</li> <li>Explain role of organization in minimizing hazards</li> <li>Explain the different types of hazards</li> </ul>	TEL/N2509	Theoretical session on maintaining safety and health at work place Practical session on handling emergency situation and hazards at workplace	PPEs safety gloves, shoes, mask, ESD band First aid kit Fire extinguisher types	T: 1.5 hours P: 1.5 hours
	Dealing with Hazards	<ul style="list-style-type: none"> <li>List the steps to eliminate hazards</li> <li>Explain the possible ways to identify hazards</li> <li>Evaluate different types of risks</li> <li>Explain the ways to eliminate and control hazards</li> <li>List the organizational policies to control hazards</li> </ul>	T: 1.5 hours P: 1.5 hours				
	Importance of Safe Work Area	<ul style="list-style-type: none"> <li>Explain the need of safety at work place</li> </ul>	T: 1.5 hours P: 1.5 hours				

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
			<ul style="list-style-type: none"> <li>Identify the possible ways to eliminate hazards</li> <li>Explain the procedures to maintain safe work place</li> </ul>				
		Maintaining Safe Work Area	<ul style="list-style-type: none"> <li>List the facilities for safe work area</li> <li>Explain the requirements for safe work area</li> </ul>				T: 1 hours P: 1 hours
		Dealing with Emergencies	<ul style="list-style-type: none"> <li>List the possible emergencies at an office</li> <li>List the essentials to deal with an emergency</li> <li>Explain the emergency procedure</li> </ul>				T: 1 hours P: 1 hours
		Health, Safety and Security Standards	<ul style="list-style-type: none"> <li>List the goals of health, safety and security at work area</li> <li>Explain the need of health, safety and security at work</li> <li>List the advantages of maintaining good health and safety at work</li> </ul>				T: 1 hours P: 1 hours
		Safety Breaches	<ul style="list-style-type: none"> <li>Describe safety breaches</li> <li>Identify safety breaches at work</li> <li>Explain the responsibilities of an organisation to deter safety breaches</li> <li>Explain assessment of safety breaches</li> <li>Identify the penalties for safety breaches</li> </ul>				T: 1.5 hours P: 1.5 hours

Sr. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools/Aids	Duration
		Evacuation Procedure and Safety Norms	<ul style="list-style-type: none"> <li>Describe evacuation procedure</li> <li>Explain the government rules on safety</li> <li>List the benefits of government norms</li> </ul>				T: 1 hours P: 1 hours
<b>NOS Total: T= 10 hours; P= 30 hours</b>							

## Annexure II

### Assessment Criteria

#### CRITERIA FOR ASSESSMENT OF TRAINEES

Assessment Criteria for “Telecom Technician - IoT Devices/Systems (Installation & M2M Communication Setup)”	
Job Role	Telecom Technician - IoT Devices/Systems (Installation & M2M Communication Setup)
Qualification Pack	TEL/Q6210, V. 1.0
Sector Skill Council	Telecom Sector Skill Council
<b>Sr. No.</b>	<b>Guidelines for Assessment</b>
1.	Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2.	The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3.	Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.
4a.	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below).
4b.	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criterion.
5.	To pass the Qualification Pack, every trainee should score a minimum of 70% of aggregate marks to successfully clear the assessment.
6.	In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

Assessable Outcome	Assessment Criteria	Total Mark (400)	Out Of	Marks Allocation	
				Theory	Skills Practical
TEL/N6234 Installation of	PC1. understand basics of various type of micro-processor boards (Arduino, raspberry-Pi etc.)		10	10	0
	PC2. understanding functioning of various type of sensors (humidity, temperature, reed, pressure etc)		10	5	5

<b>IoT devices at customer premise/equipment</b>	PC3. understand basics of short range communication protocols (blue tooth, Zigbee etc) and 3G/4G protocols and their applicability in IoT	100	10	6	4
	PC4. identify various components and PIN configurations on the micro-controller boards and interconnectivity provisions for input/output/power supply etc.		10	0	10
	PC5. differentiate between node and a gateway		10	5	5
	PC6. establish installation points to capture desired input parameters by the nodes/sensors		10	4	6
	PC7. establish installation point for gateway accounting for power supply requirements		10	4	6
	PC8. establish clear line of communication between nodes and gateway and between gateway and servers via 3G/4G or Wi-Fi networks		10	0	10
	PC9. Establish Ethernet connectivity, as required.		2	2	0
	PC10. prepare surface at location/point for mounting the device		6	0	6
	PC11. mounting of IoT devices at identified locations/points		8	2	6
	PC12. provide necessary connections to power supply, earthing, ensure proper grounding, no-floating earth situation.		4	4	0
<b>Total</b>			<b>100</b>	<b>42</b>	<b>58</b>
<b>TEL/N6235</b> <b>Configuration of IOT devices and establishing communication links</b>	PC1. understand connectivity options available on micro controller boards for data transfer		10	4	6
	PC2. connect, using appropriate cable and connectors, micro controller to data transfer device (PC/Laptop)		8	0	8
	PC3. install suitable framework (on PC/Laptop), compatible with the micro-controller board		6	0	6
	PC4. transfer software code to on-board micro-processor on nodes and gateways		6	0	6
	PC5. compile code on-board microprocessor using PC/laptop based framework		6	0	6

	PC6. understand error codes and debug software	100	8	4	4
	PC7. confirm proper functioning of micro-controller and attached devices using emulators/framework features		8	0	8
	PC8. initialize the nodes and gateways for execution of the uploaded software		8	0	8
	PC9. launch the software on nodes and gateways		10	4	6
	PC 10.confirm communication /data transfer using on-screen I/O streams or appropriate LED indications {as per the system test manual}		10	4	6
	PC11. Establish connectivity between gateway and local Wi-Fi router or 3G/4G connectivity options (pre-configured in the uploaded software on gateway micro-controller)		10	4	6
	PC12. Check for data transfer and confirm from the server end	10	0	10	
<b>Total</b>			<b>100</b>	<b>20</b>	<b>80</b>
<b>TEL/N6236</b>  <b>Undertake Level 1 Troubleshooting of IoT devices</b>	PC1. test connectivity (PIN configurations) between sensors and micro-controller device using appropriate software tools/framework	100	8	2	6
	PC2. check on-board power supply		6	3	3
	PC3. re-load node software		6	0	6
	PC4. test connectivity between nodes and gateway using appropriate software tools/framework		8	4	4
	PC5. check on-board power supply		6	0	6
	PC6. check all connectivity and PIN/jumper settings		10	4	6
	PC7. check on-board memory storage card for storing node data (using appropriate micro-controller board software/framework)		8	4	4
	PC8. check working of on-board Wi-Fi module, 3G, 4G connectivity module, as applicable, at the nodes		10	4	6
	PC9. check working of on-board Wi-Fi, 3G, 4G connectivity module, as applicable		10	4	6
	PC10. Set appropriate connectivity ID's/password in the software code		8	3	5

	PC11. check communication link performance matrix between node and gateway using appropriate software tools/framework		8	2	6
	PC12. re-load node & gateway software, if required, and check communication again		6	0	6
	PC13. check data transfer from gateway to server		6	0	6
<b>Total</b>			<b>100</b>	<b>30</b>	<b>70</b>
<b>TEL/N2509</b> <b>Health &amp; Safety</b>	PC1. ensure that work is carried out in accordance with the laid down safety, security policies and procedures of the organization	100	10	6	4
	PC2. ensure that site is assessed for safety and emergency readiness compliance as per company's guidelines		12	6	6
	PC3. ensure electrical safety compliances and EMI/EMC hygiene requirements are met as per the guidelines		15	9	6
	PC4. identify and correct any hazards that you can deal with safely, competently and within the limits of your authority		15	10	5
	PC5. report any hazards that you are not competent to deal with to the relevant person in line with organizational procedures and warn other people who may be affected		12	7	5
	PC6. follow your organization's emergency procedures promptly, calmly and efficiently		12	6	6
	PC7. identify and recommend opportunities for improving health, safety, security to the designated person		14	8	6
	PC8. complete any health and safety records legibly and accurately		10	5	5
<b>Grand Total</b>		<b>400</b>	<b>100</b>	<b>57</b>	<b>43</b>

### Do

- Explain each Guideline for Assessment in detail
- Explain the score that each trainee needs to obtain
- Recapitulate each NOS one-by-one and take participants through the allocation of marks for Theory and Skills Practical.
- Explain the Allocation of Marks. Explain that they will be assessed on Theory and Skills Practical.







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Address : 2nd Floor, Plot No 105, Sector 44, Gurgaon 122003

Email : [tssc@tsscindia.com](mailto:tssc@tsscindia.com)

Website : [www.tsscindia.com](http://www.tsscindia.com)

Phone : +91-124-4148029, 4375891

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