

GE-161L

Introduction to Information and Communication Technologies

Laboratory 01

Hardware and Operating Systems – I

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Learning Objectives:

- Familiarity with Hardware Devices
- Formation of Bootable Universal Serial Bus (USB)
- Installation Microsoft ® Windows
- Creation of Directories and Files Editing
- Use of Snipping Tool
- Use of Email

Required Resources:

- USB
- Open Desktop or Laptop PC
- Hard Disk
- Floppy Disk
- Webcam
- Graphic Tablet

General Instructions:

- In this Lab, you are **NOT** allowed to discuss your solution with your colleagues, even not allowed to ask how is s/he doing, this may result in negative marking. You can **ONLY** discuss with your Teaching Assistants (TAs) or Lab Instructor.
- Your TAs will be available in the Lab for your help. Alternatively, you can send your queries via email to one of the followings.

Lab Instructors:		
Course Instructor	Prof. Dr. Syed Waqar ul Qounain	swjaffry@pucit.edu.pk
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Background and Overview:

Hardware:

The hardware components of a computer system are the electronic and mechanical parts. The hardware is the parts of the computer itself including the Central Processing Unit (CPU) and related microchips and micro-circuitry, keyboards, monitors, case and drives (hard disk, CD, DVD, floppy disk, optical, tape drives, etc.). Other extra parts called peripheral components or devices include the mouse, printers, modems, scanners, digital cameras, and cards, etc.

Built-in Computer Components:

There are several hardware devices which are integrated inside a computer. Some of these are listed as follows.

1. **Motherboard:** A motherboard is the backbone that ties the computer's components together at one spot and allows them to talk to each other.
2. **Central Processing Unit (CPU):** A CPU is the electronic circuitry that executes instructions comprising a computer program.
3. **Basic Input Output System (BIOS):** BIOS is the program a computer's microprocessor uses to start the computer system after it is powered on.
4. **Complementary Metal Oxide Semiconductor (CMOS):** CMOS is a small amount of memory in the motherboard of your computer and is used to store BIOS settings.
5. **CMOS Battery:** A battery that maintains the time, date, hard disk and other configuration settings in the CMOS memory.
6. **Random Access Memory (RAM):** A RAM is a computer's short-term memory, which it uses to handle all active tasks and apps.
7. **Power Supply:** A power supply is an electrical device that supplies electric power to a computer.
8. **Fan (CPU, GPU, Case, etc.):** A computer fan is any fan inside, or attached to, a computer case used for active cooling.
9. **Video Card:** A video card is a built-in hardware component which generates a feed of output images for a display at display device.
10. **Sound Card:** A sound card is a built-in hardware component for producing sound on a computer that can be heard through speakers or headphones.
11. **Computer Bus:** A computer bus is a subsystem (comprised of wires) that is used to connect computer components and transfer data between them.
12. **Data Bus:** A data bus is a system within a computer or device, consisting of a connector or set of wires, that provides transportation for data.
13. **Control Bus:** A control bus is a computer bus that is used by the CPU to communicate with devices that are contained within the computer.
14. **Network Interface Card (NIC):** A NIC is a hardware component, which connect a computer over a network.
15. **Hard Drive (HDD):** A HDD is a computer's long-term memory (permanent storage), which it uses to store all type of data. HDD is electro-mechanical data storage device which retains data even computer is turned off.
16. **Solid-State Drive (SSD):** A SSD is electronic data storage device which retains data even computer is turned off.
17. **Optical Drive (e.g., BD/DVD/CD drive):** An optical drive is an internal or external computer disk drive that uses laser beam technology to read and write data.
18. **Card Reader (SD/SDHC, CF, etc.):** A card reader is a data input device that reads data from a card-shaped storage medium.

Computer Connected Devices:

Here are some of hardware devices which are usually connected with a computer, although laptops and notebooks have these as built-in components.

1. **Monitor:** A computer monitor is an output device that displays information in pictorial or text form.
2. **Keyboard:** A keyboard is a peripheral device that enables a user to input text into a computer.
3. **Mouse:** A mouse is a small handheld input device that controls a computer screen's cursor or pointer in conjunction with the way it is moved on a flat surface.
4. **Battery Backup (UPS):** An uninterruptible power supply (UPS) is a device that allows a computer to keep running for at least a short time when the primary power source is lost.
5. **Flash Drive:** A flash drive is a small electronic device containing flash memory that is used for storing data or transferring it to or from a computer, digital camera etc.
6. **Printer:** A printer is a device that accepts text and graphic output from a computer and transfers the information to paper.
7. **Speaker:** A Speaker is a transducer that convert electromagnetic waves into sound waves.
8. **External Hard Drive:** An external hard drive is a portable hard disk that connects to your computer with a USB cable.
9. **Pen Tablet:** A pen tablet is an input device consisting of a flat, pressure-sensitive pad which the user draws on or points at with a special stylus, to guide a pointer displayed on the screen.
10. **Joystick:** A joystick is an input device that can be used for controlling the movement of the cursor or a pointer in a computer device using a lever.
11. **Webcam:** A webcam is a small digital video camera that connects to a computer.
12. **Microphone:** A microphone is a device that translates sound vibrations in the air into electronic signals or scribes them to a recording medium.
13. **Scanner:** a scanner is a device that optically scans images, printed text, handwriting or an object and converts it to a digital image.
14. **Projector:** A projector is an optical device that projects an image on computer screen onto a surface, commonly a projection screen for a larger audience.
15. **Plotter:** A plotter is a graphics printer that draws images with ink pens on larger sheets.
16. **Floppy Disk Drive:** The floppy disk drive is a piece of computer hardware that reads data from and writes data to, a small disk called floppy disk.
17. **Heat Sink:** A heat sink is a passive heat exchanger that transfers the heat generated by an electronic or a mechanical device to a fluid medium, often air or a liquid coolant,
18. **Data Cable:** A data cable is, essentially, any type of media capable of carrying a binary electrical communication signal.
19. **Power Cable:** A power cable, also called a power cord is the primary cable that provides power to the computer's internal and external components.
20. **Daughterboard:** A daughterboard or daughter-card is a circuit board that plugs into and extends the circuitry of motherboard.

Computer Network Devices:

Here are some of hardware devices which are required for communication between computers, usually called as network devices.

1. **Repeater:** A repeater is an electronic device in a communication channel that increases the power of a signal and retransmits it, allowing it to travel further.
2. **Hub:** A network hub is a node that broadcasts data to every computer connected to it. A hub is less sophisticated than a switch, the latter of which can isolate data transmissions to specific devices.

3. **Bridge:** A bridge is a network device that connects multiple networks (local area networks) together to form a larger network.
4. **Switch:** A network switch connects devices within a network (often a local area network) and forwards data packets to and from those devices.
5. **Router:** A router is a networking device that forwards data packets between computer networks.
6. **Gateway:** A gateway is a hardware device that acts as a "gate" between two possibly different networks. It may be a router, firewall, server, or another device that enables traffic to flow in and out of the network.
7. **Brouter:** A brouter also known as the bridging router is a device that combines features of both bridge and router.
8. **Access Point:** A wireless access point, or more generally just access point, is a networking hardware device that allows other Wi-Fi devices to connect to a wired network.
9. **Print Server:** A print server is a device or program that connect printer to computers over a network.
10. **Firewall:** A firewall is a network security device that monitors incoming and outgoing network traffic and decides whether to allow or block specific traffic based on a defined set of security rules.

Operating System:

An operating system (OS) is system software that manages computer hardware, software resources, and provides common services for computer programs. The OS communicates user's requests to the computer in its language and gives the user the results. In other words, it acts as an interface between the user and the computer hardware. OS is system software that manages both, hardware and software of a computer. An OS usually provides basic functionalities that are common to most applications such as file management, device management, disk management, memory management, input/output management, network communication, graphical user interface etc.

There are different types of OSs available for various purposes. Following is a list of most commonly used OSs.

Microsoft ® Disk Operating System:

Microsoft ® Disk Operating System (MS DOS) is a command line based operating system. In this operating system user types various commands in text format to perform different task. It is a single-user, single-tasking operating system. MS DOS itself has no functionality to allow more than one program to execute at a time. Various commands of MS DOS could be used in the Command Line Interface (CLI) of the Microsoft ® Windows operating system.

Microsoft ® Windows:

Microsoft ® Windows (also referred to as Windows or Win) is a family of proprietary operating systems which provides Graphical User Interface (GUI) to interact with the computer. It is developed, published and owned by Microsoft. It is a multi-user, multi-tasking operating system. It provides a way to store files, run software, play games, watch videos, and connect to the Internet using standard Mouse and Keyboard.

Linux:

Linux is a family of free, open source operating systems which provide both Graphical User Interface (GUI) as well as a very powerful Command Line Interface (CLI) to interact with the computer. It is a multi-user, multi-tasking operating system. It provides a way to store files, run software, play games, watch videos, and connect to the Internet using standard Mouse and Keyboard.

Apple ® macOS:

Apple ® macOS (also referred to as MAC) is a family of proprietary operating systems which provides Graphical User Interface (GUI) to interact with the computer. It is developed, published and owned by Apple. It is a multi-user, multi-tasking operating system. It provides a way to store files, run software, play games, watch videos, and connect to the Internet using standard Mouse and Keyboard.

Android:

Android is a mobile operating system based on a modified version of the Linux and other open source software, designed primarily for touchscreen mobile devices such as smartphones and tablets. It is a multi-user, multi-tasking operating system. Android is developed by a consortium of developers known as the Open Handset Alliance and commercially sponsored by Google. Many, to almost all, Android devices come with preinstalled Google apps including Gmail, Google Maps, Google Chrome, YouTube, Google Play Music, Google Play Movies & TV, and many more.

Apple ® iOS:

iOS (formerly iPhone OS) is a mobile operating system created, developed and owned by Apple Inc. exclusively for its hardware. It is a multi-user, multi-tasking operating system. It is the operating system that powers many of the company's mobile devices, including the iPhone and iPod Touch. iOS is the second most popular mobile operating system in the world, after Android.

Activities:

Pre-Lab Activities:

Task 01: Hardware Devices

[5 Marks]

Make a list of hardware devices. Write the roles and detailed functionalities of the basic hardware devices like Keyboard, Mouse, and Monitor?

Task 02: Operating Systems

[5 Marks]

Make a list of operating systems. Write a comparison of the Microsoft ® Windows and Linux, and Android and Apple ® iOS?

In-Lab Activities:

Introduction to Computer Hardware Devices:

Computer hardware refers to the physical components that make up of a Computer. There are various hardware devices which are built-in a computer or could be connected.

Monitor:

A Monitor is a display device. It is technically a **matrix** (kind of a table) of tiny squares that can be one of three colors (Red, Green, or Blue). Squares will light up in particular colors and when you look at the image as a whole, it will appear as though the colors blend into another. So, a yellow screen can be made by alternating blue and green pixels. Each pixel has sub-pixels and a lot of other complexities.



Fig. 1(Monitor)

Keyboard:

A Keyboard is a device that enables a user to input text into a computer. A keyboard is the most basic way for the user to communicate with a computer. The keys include punctuation, alphabets, digits, and special keys like the Windows key and various Multimedia keys, which have specific functions assigned to them. Most keyboards have a similar layout. The layout of these keys is derived from the original layout of keys on a Typewriter. The most widely used layout in the English language is called **QWERTY**, named after the sequence of the first six letters from the top left.



Fig. 2(Keyboard)

Mouse:

A Mouse is a hand-controlled input device for interacting with a computer that has a **graphical user interface** (GUI). The mouse can be moved around on a flat surface to control the movement of a cursor on the computer display screen. Equipped with one or more buttons. It can be used to select the text, activate programs, or move items around the screen by quickly pressing and releasing one of the buttons (“clicking”) or by keeping a button pressed while moving the device (“clicking and dragging”).

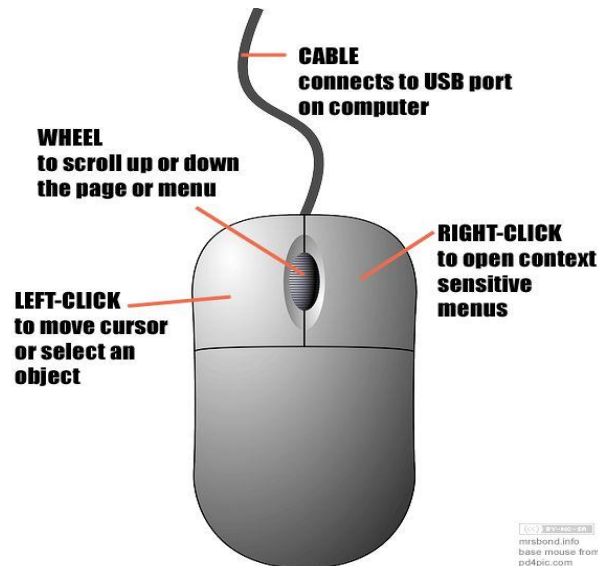


Fig. 3(Mouse)

Motherboard:

A motherboard is the main printed circuit board in a computer. The motherboard is a computer’s central communications backbone connectivity point, through which all components and external peripherals connect.

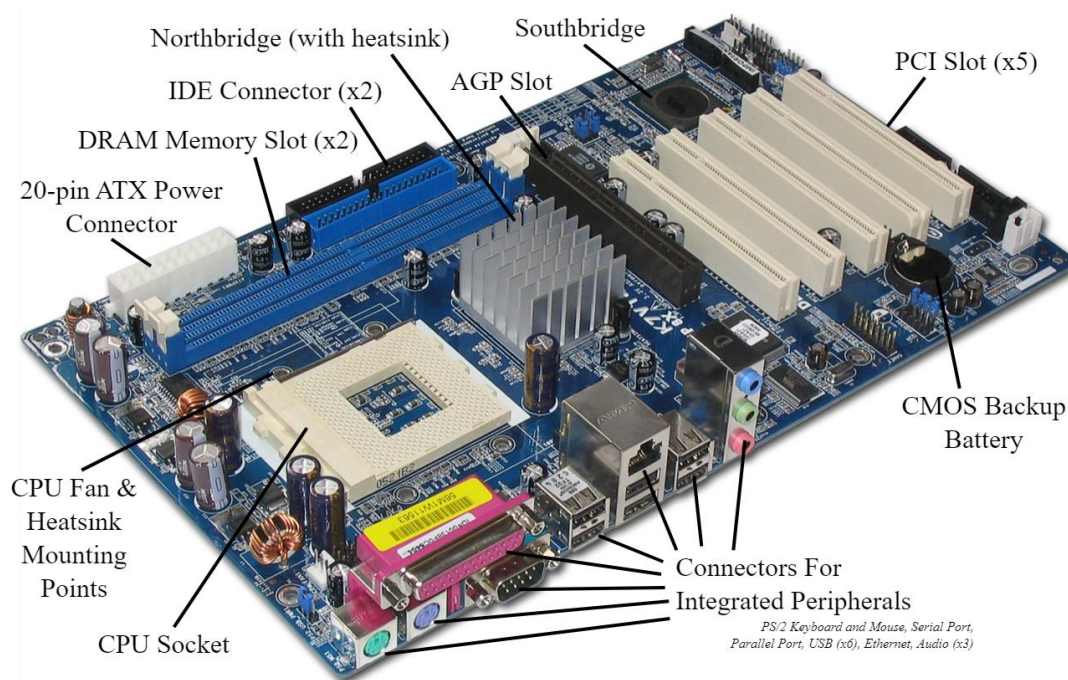


Fig. 4(Motherboard)

Processor:

A Processor is an integrated electronic circuit that performs the calculations that run a computer. A processor performs arithmetical, logical, input/output (I/O), and other basic instructions that are passed from an Operating System (OS).

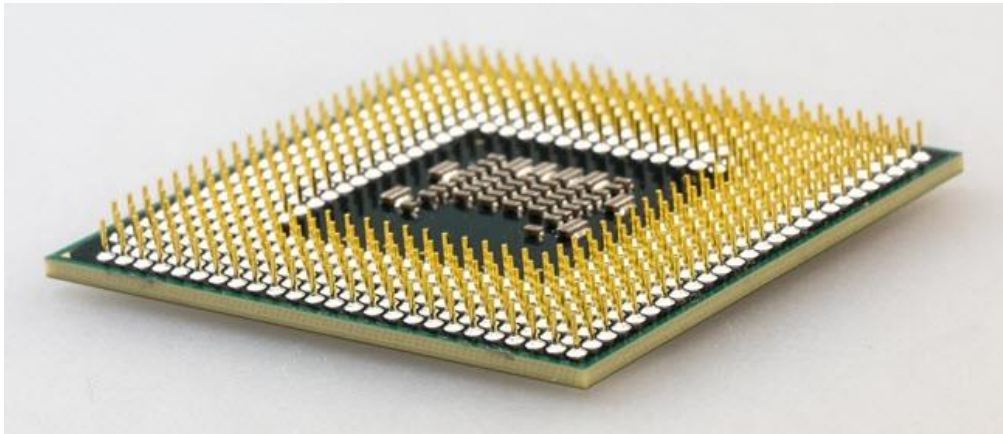


Fig. 5(Processor)

RAM:

Random Access Memory (RAM) is a high-speed component in devices that temporarily stores all information a device needs for the present and future. It's a type of computer memory that can be randomly accessed.



Fig. 6(RAM)

USB:

USB is the most common type of port found on modern computers. It is used to connect various peripherals, such as keyboards, mice, game controllers, printers, scanners, and external storage devices. USB provides both data transmission and low voltage (5V) power over a single cable. Devices that require five volts or less can operate over USB without an external power source.

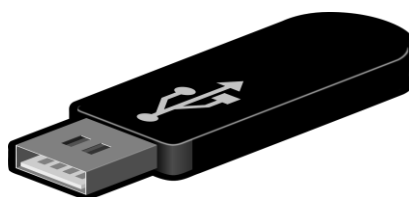


Fig. 10(USB)

Hard Disk:

When you save data or install programs on your computer, the information is typically written to your hard disk. A **hard disk drive (HDD)** is a data storage device. It is usually installed internally in a computer, attached directly to the disk controller of the computer's motherboard. It contains one or more platters, housed inside of an air-sealed casing. Data is written to the platters using a magnetic head, which moves rapidly over them as they spin. Because the data is stored magnetically, information recorded on the hard disk remains intact after you turn your computer off.

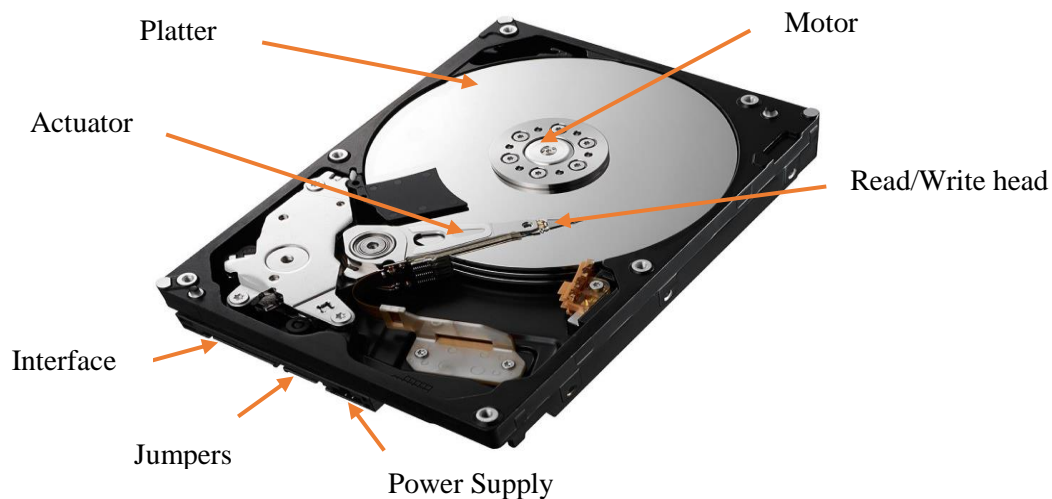


Fig. 7(Hard Disk)

Floppy Disk:

A floppy disk is a magnetic storage medium for computer systems. The floppy disk is composed of a thin, flexible magnetic disk sealed in a square plastic carrier. To read and write data from a floppy disk, a computer system must have a floppy disk drive (FDD). A floppy disk is also referred to simply as a floppy. Since the early days of personal computing, floppy disks were widely used to distribute software, transfer files, and create backup copies of data. When hard drives were still very expensive, floppy disks were also used to store the operating system of a computer.



Fig. 8(Floppy Disk)

Webcam:

A webcam is a small digital video camera connected to a computer. Webcams come with software that needs to be installed on the computer to help users to record video. Webcams are capable of taking pictures as well as high-definition videos, although the video quality can be lower compared to other camera models.



Fig. 9(Webcam)

Graphic Tablet:

A graphics tablet is a device that replaces your mouse with a stylus and digitized drawing pad. This gains creators the ability to make very specific brush strokes and pen paths that feel similar to drawing on paper. Since a graphics tablet feels more natural and precise than a mouse, they're a common tool used by many artists to improve their digital artwork.



Fig. 11(Graphic Tablet)

Microsoft ® Windows Installation

Creating Bootable USB:

- Attach USB to your PC
- On the Google search bar type “**download Windows 10**”
- Open the first site

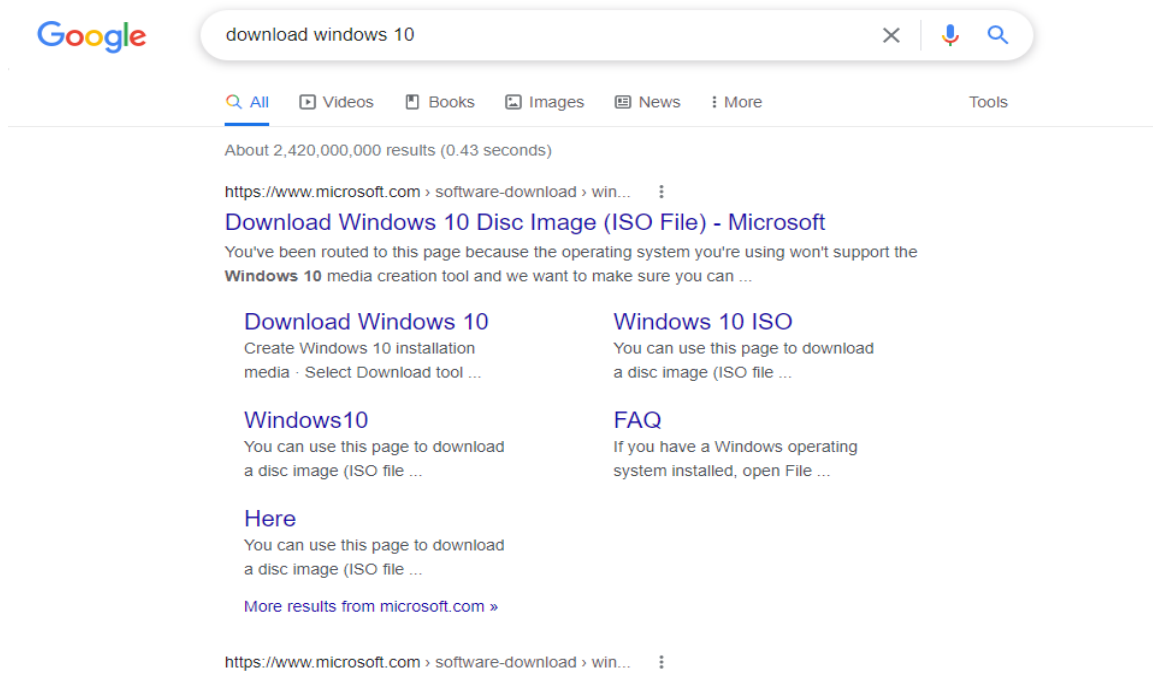


Fig. 12

After opening the site select the “**download tool now**” option under “**Create Windows 10 installation media.**”

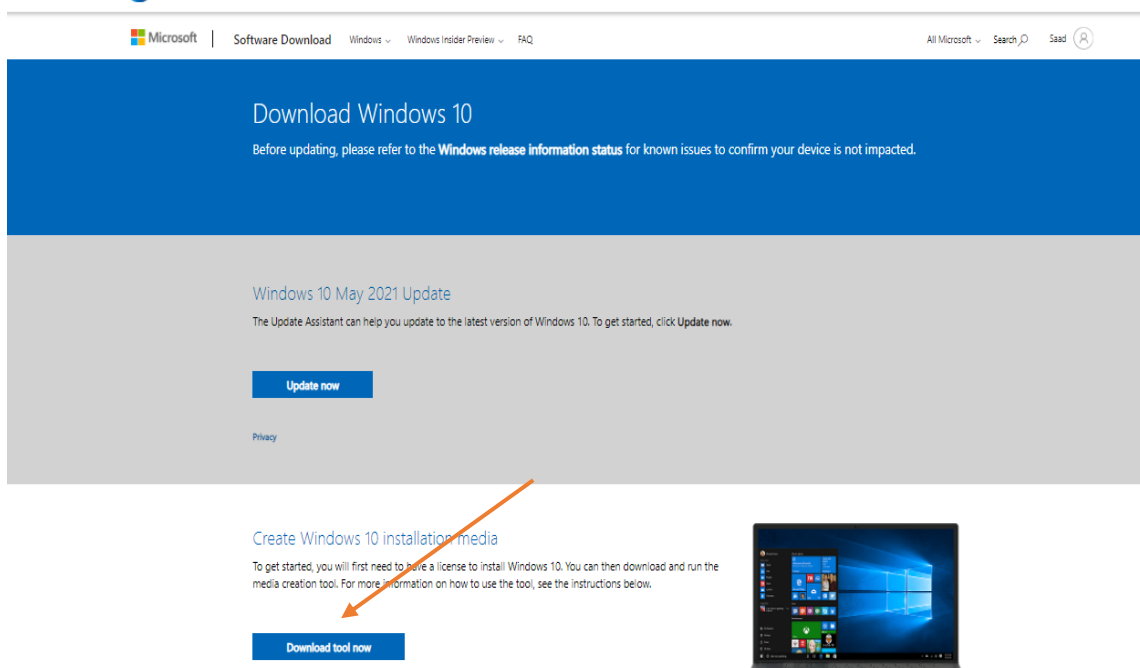


Fig. 13(Download Windows 10)

- After downloading open the “**Media Creation Tool**” following screen will appear
- Read the license terms
- Accept the license terms by clicking “**Accept**”



Fig. 14(Windows Setup)

- Select “**Create installation media for another PC**”
- Click “**Next**”

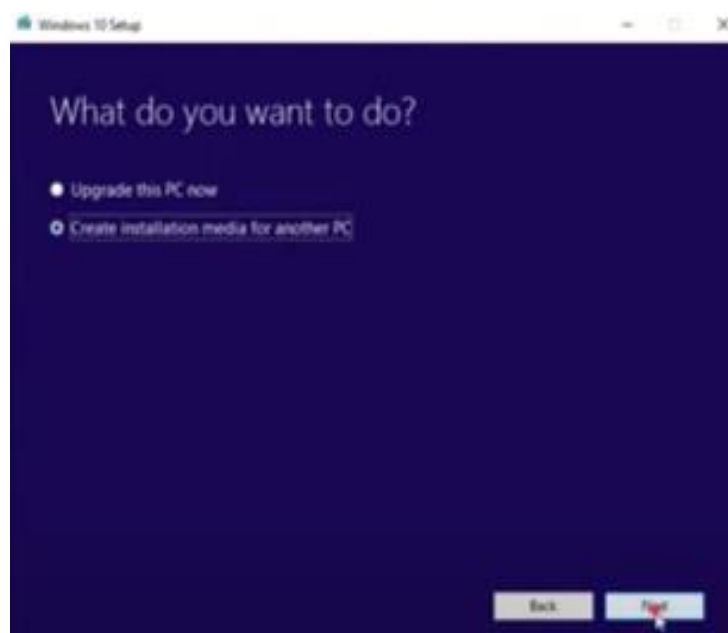


Fig. 25(Windows Setup)

- Select “**Language**”
- Select “**Edition**” of Microsoft ® Windows
- Select “**Architecture**”
- Click “**Next**”

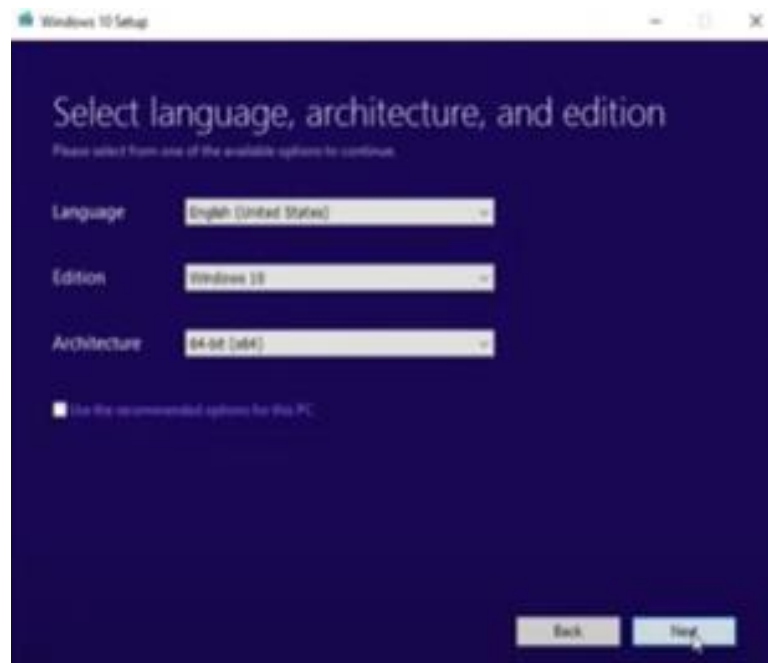


Fig. 36(Windows Setup)

- Select the “**USB Flash drive**” option
- Click “**Next**”

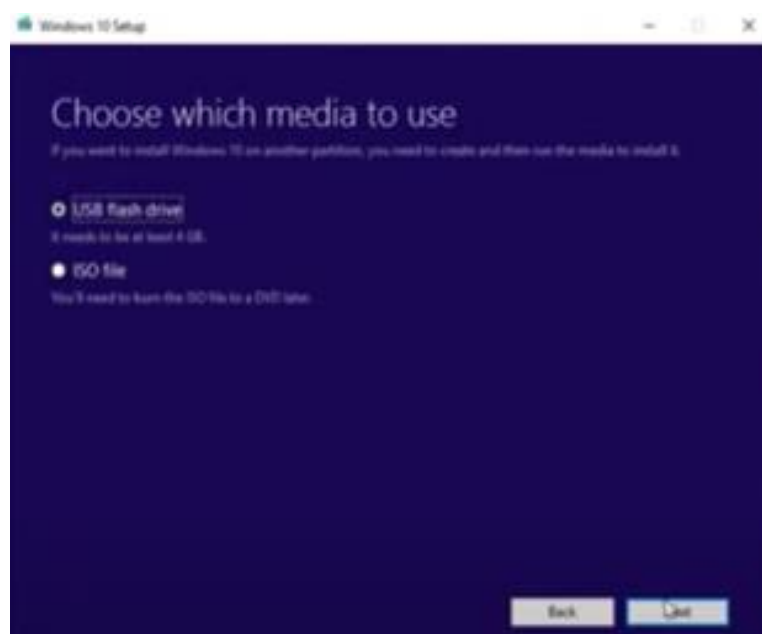


Fig. 47(Windows Setup)

When your USB drive is ready Click **“Finish”**.

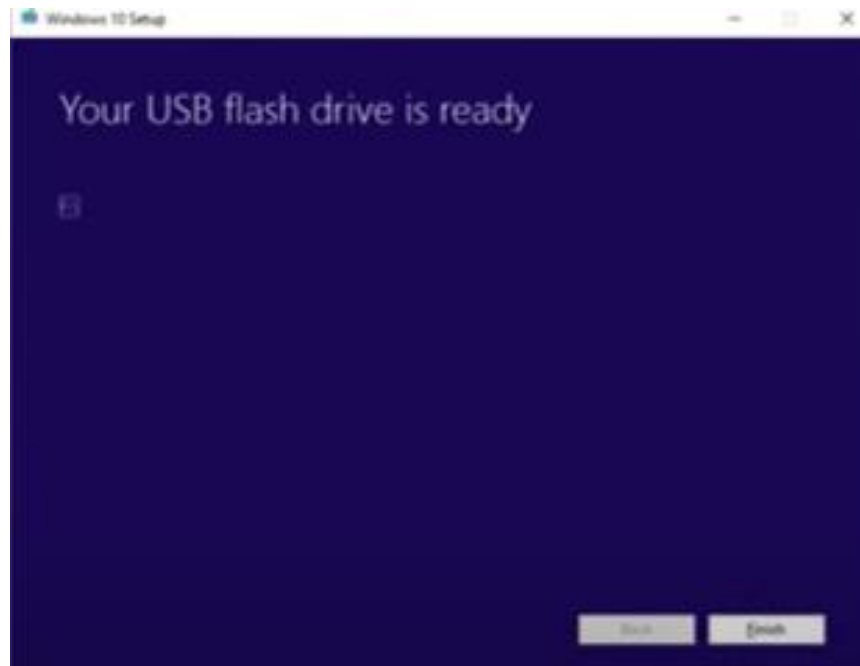


Fig. 58(Windows Setup)

Installing Windows via Bootable USB:

- Attach booted USB to PC for installing Microsoft ® Windows
- Start the PC
- Press the **boot key** of your PC

Common boot keys are Esc, F2, F10, or F12.

- **Boot Menu** will appear after following the above steps
- From Boot Menu choose your USB device

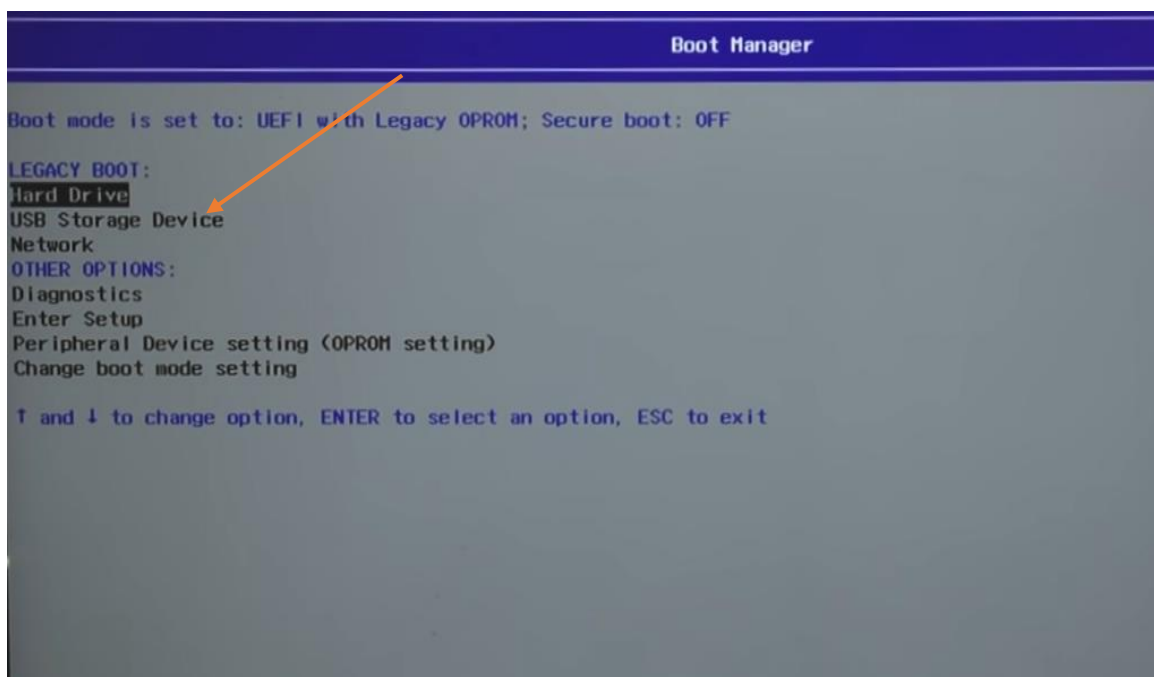


Fig. 69(Boot menu)

- Choose **“Language to install”**
- Choose **“Time and currency format”**
- Choose **“Keyboard or input method”**
- Click **“Next”**



Fig. 20(Windows Setup)

- Select the Microsoft ® Windows you want to install
- Click **“Next”**

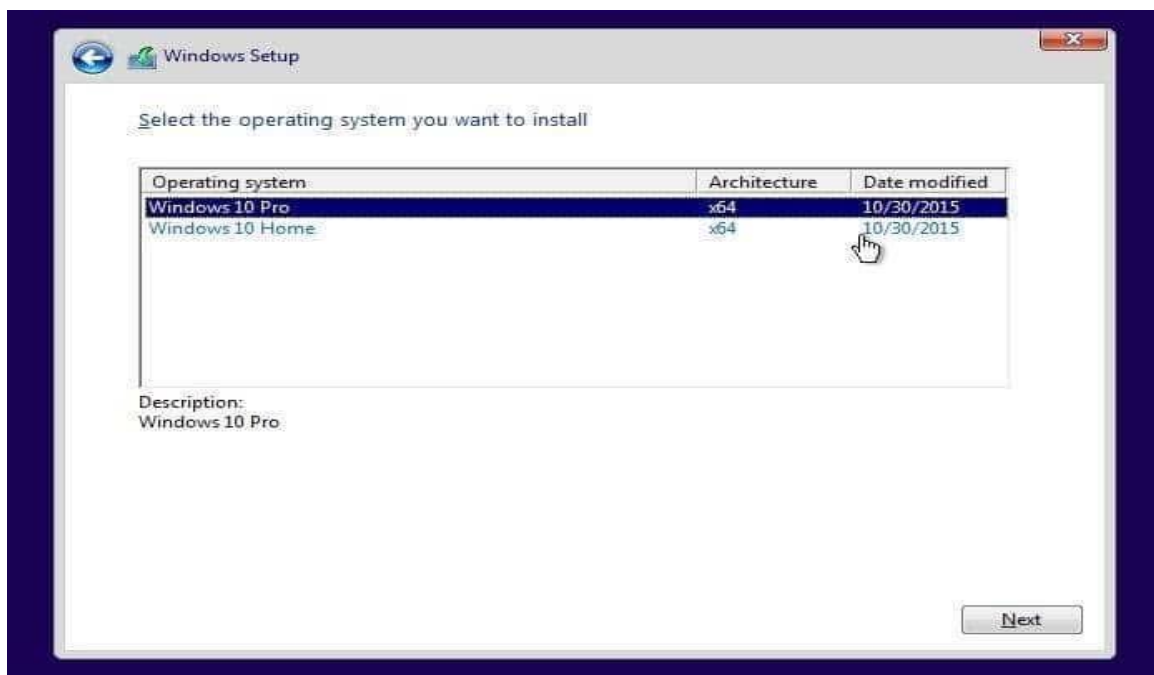


Fig. 21(Windows Setup)

- Read the license terms
- Accept the license terms
- Click “Next”

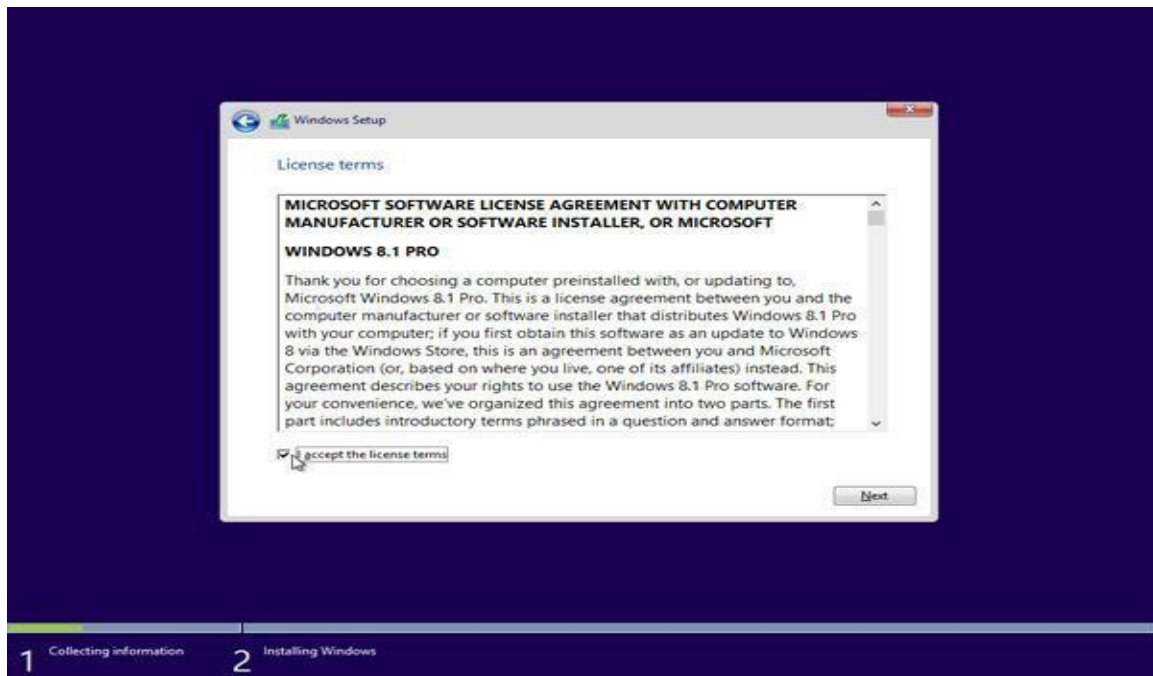


Fig. 22(Windows Setup)

Select the **partition** in which you want to install windows.

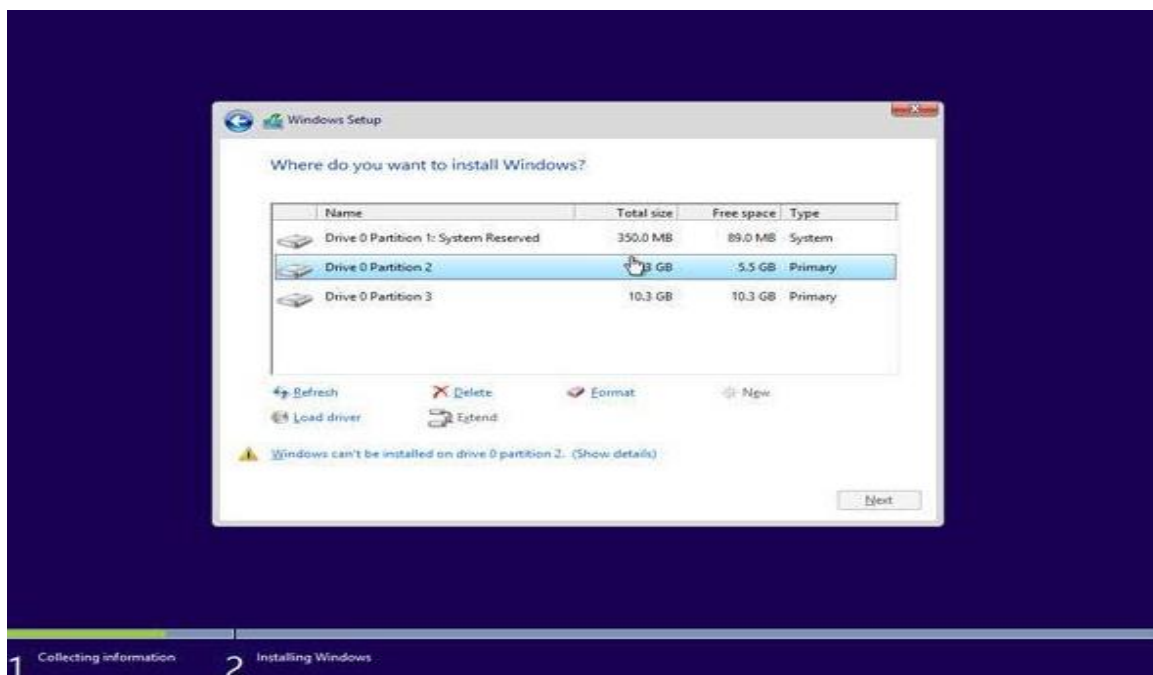


Fig. 23(Windows Setup)

You can also create a new partition by clicking the “New” option and mentioning the size of the new partition in **megabytes (MB)**.

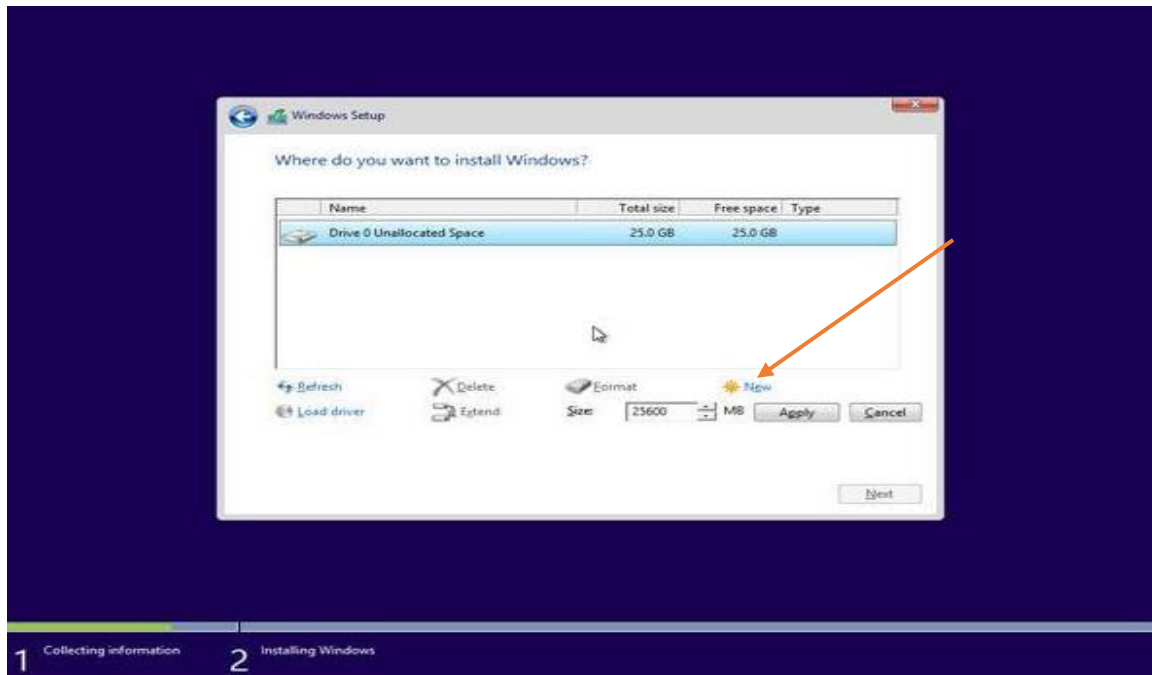


Fig. 24(Windows Setup)

- Enter “Username”
- Enter “Password”
- Enter “Password hint”
- Click “Next”

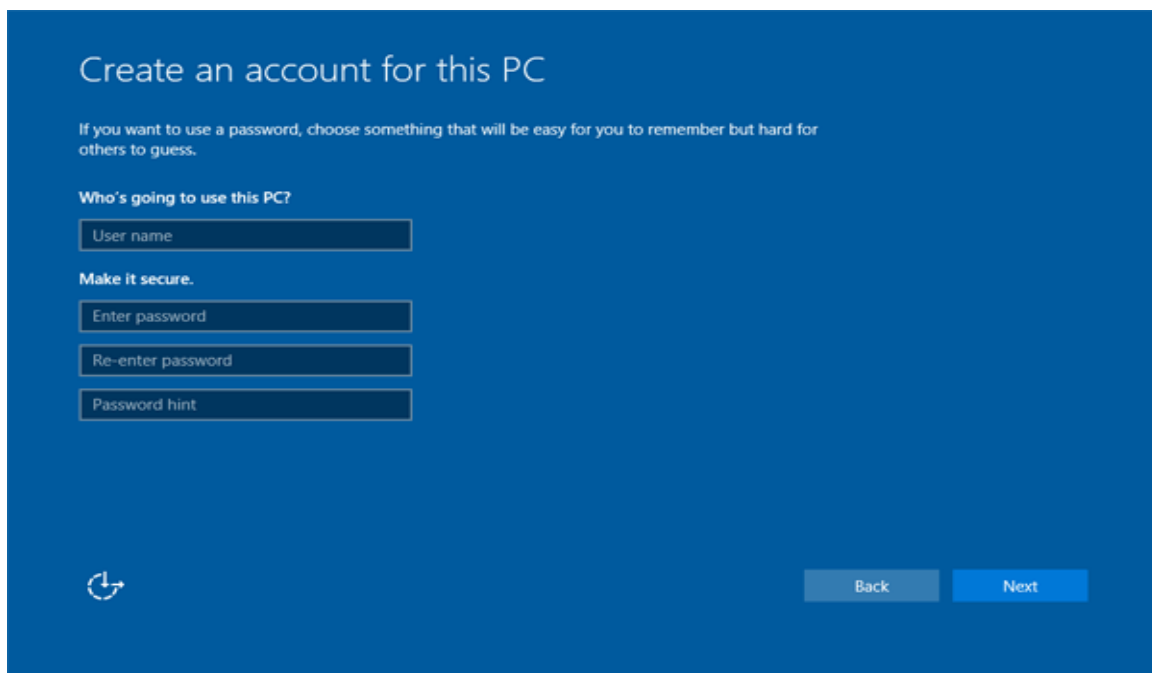


Fig. 25(Account Creation)

Creating Folder:

- Open **“File Explorer”**
 - Turn on your PC
 - Enter **“Username”**
 - Enter **“Password”**

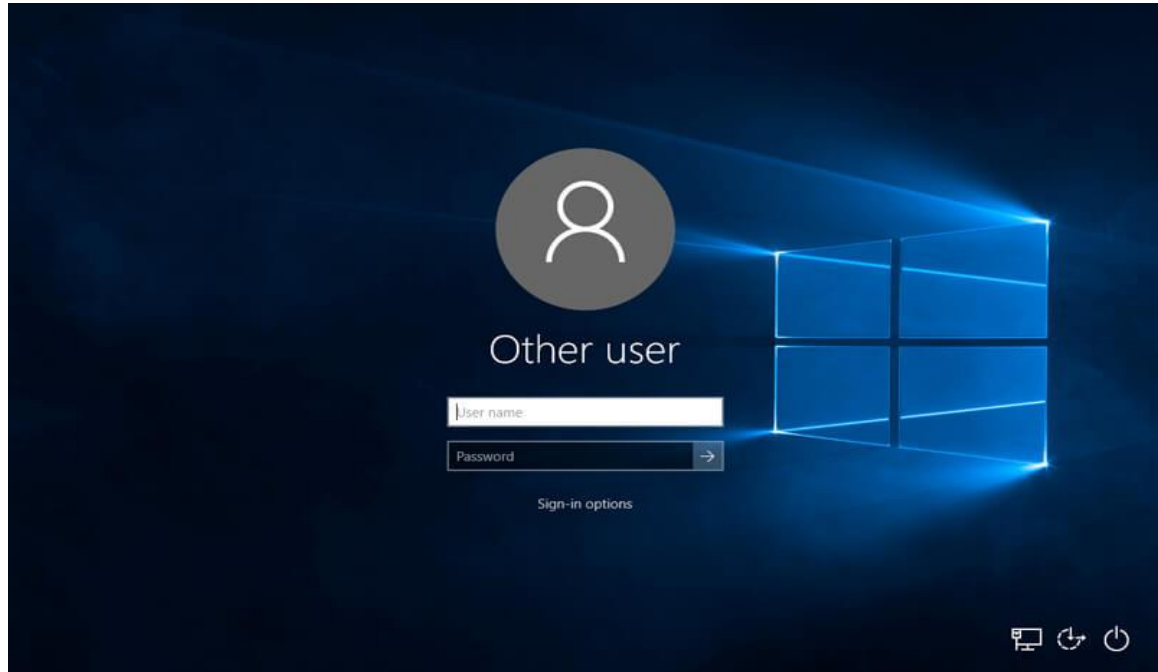


Fig. 26(Login Screen)

- Click on the **“File Explorer”** icon on the **taskbar**

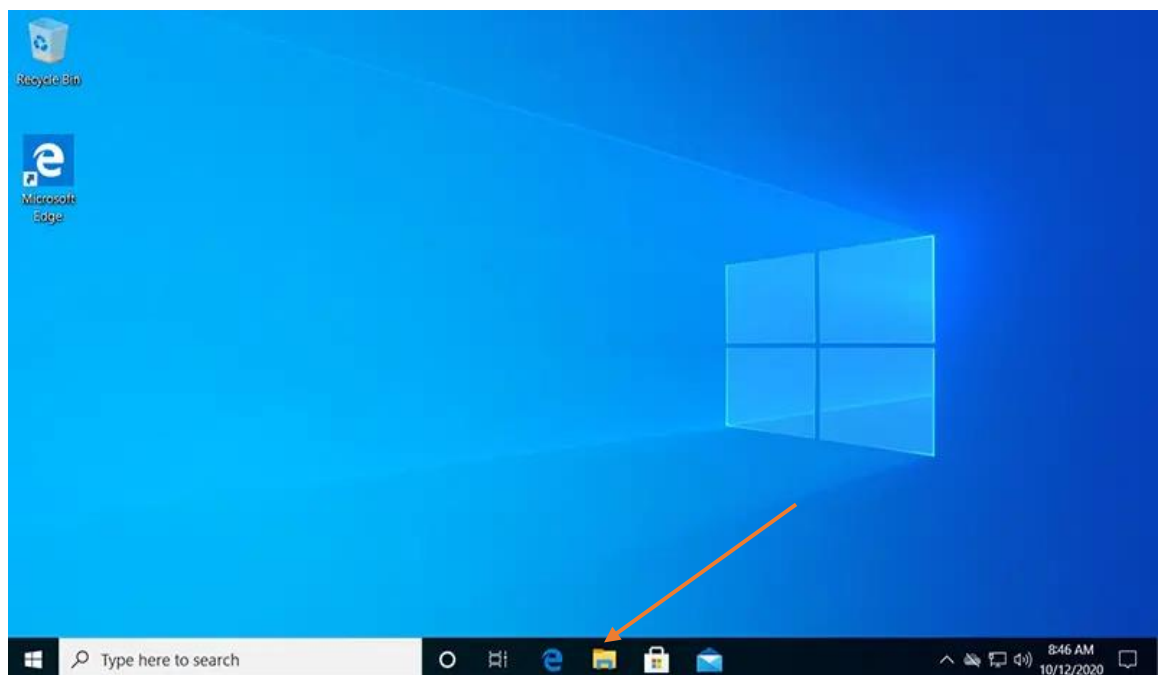


Fig. 27(File Explorer)

- **Right-click** and select “New” from the context menu

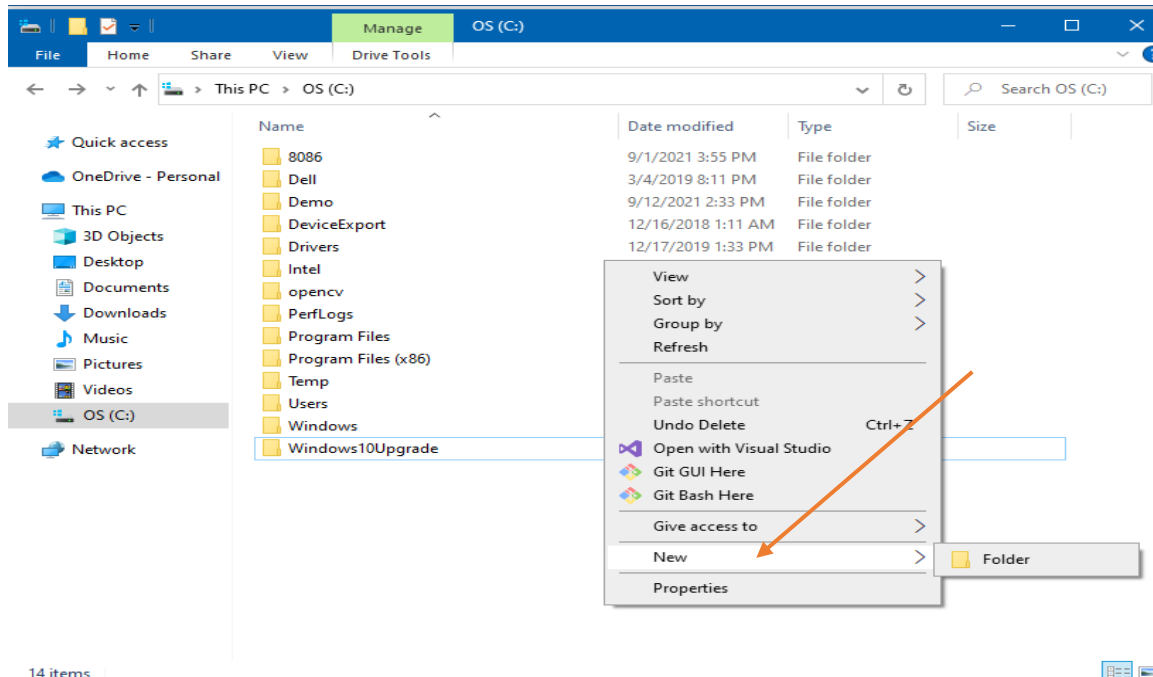


Fig. 28(Create Folder)

Click “Folder” from the extended context menu.

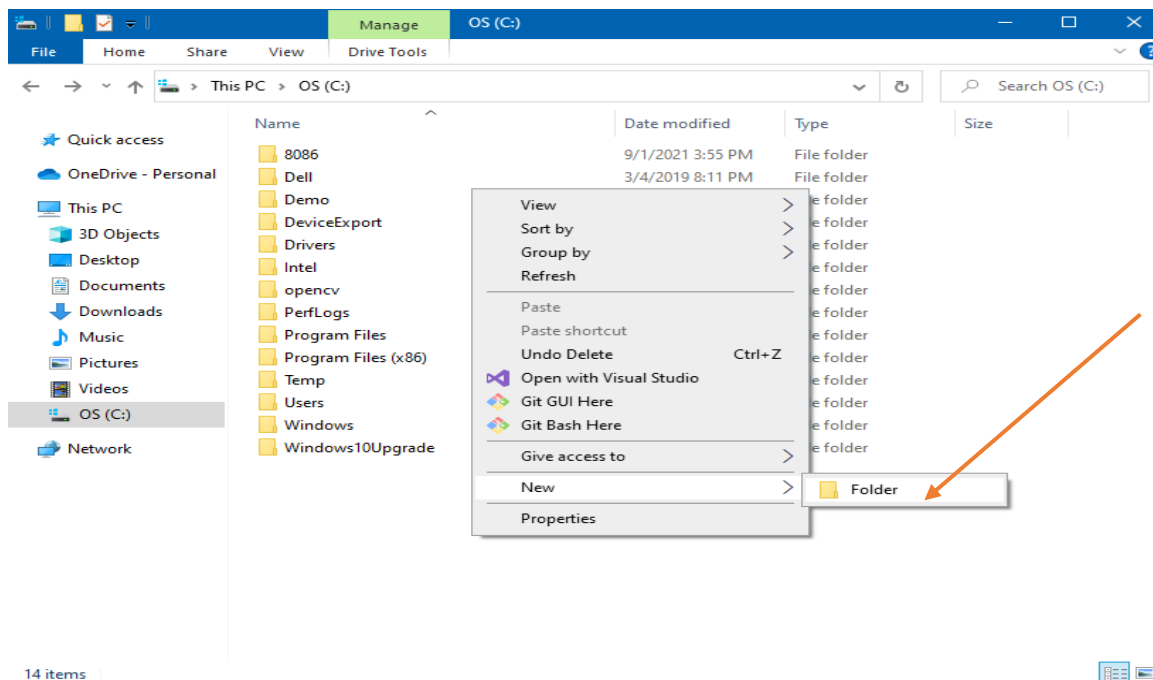


Fig. 29(Create Folder)

A new folder will be created.

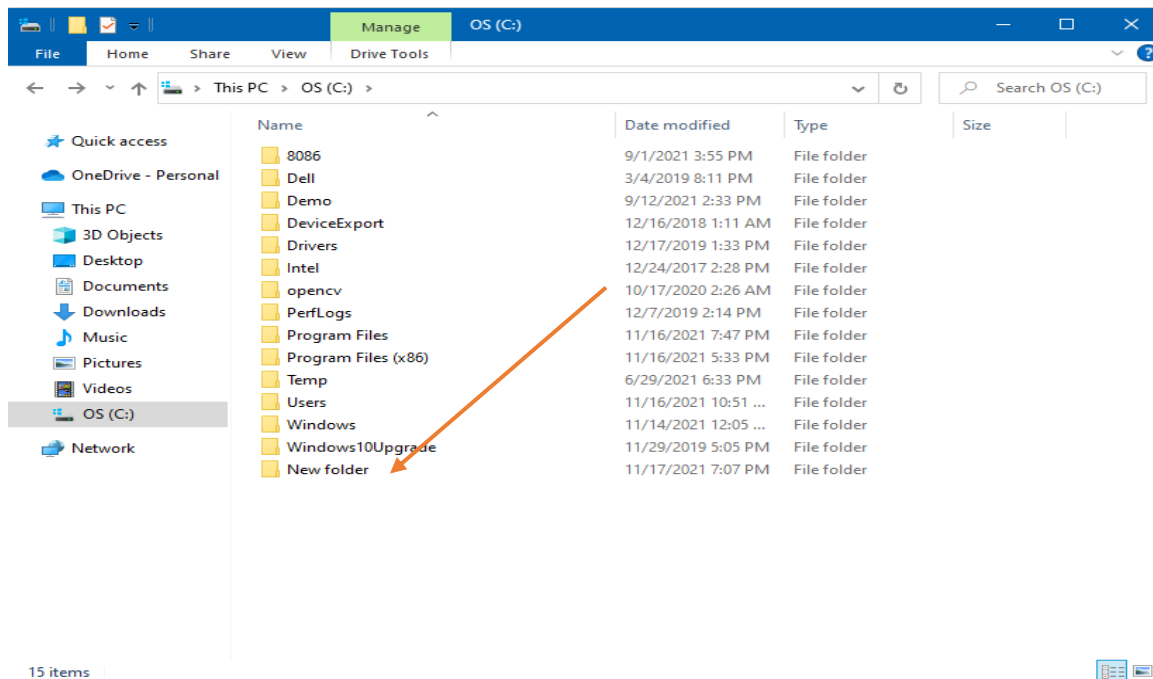


Fig. 30(Created Folder)

Creating File:

- Open a folder
- **Right-click** in it
- Select “New” from the context menu

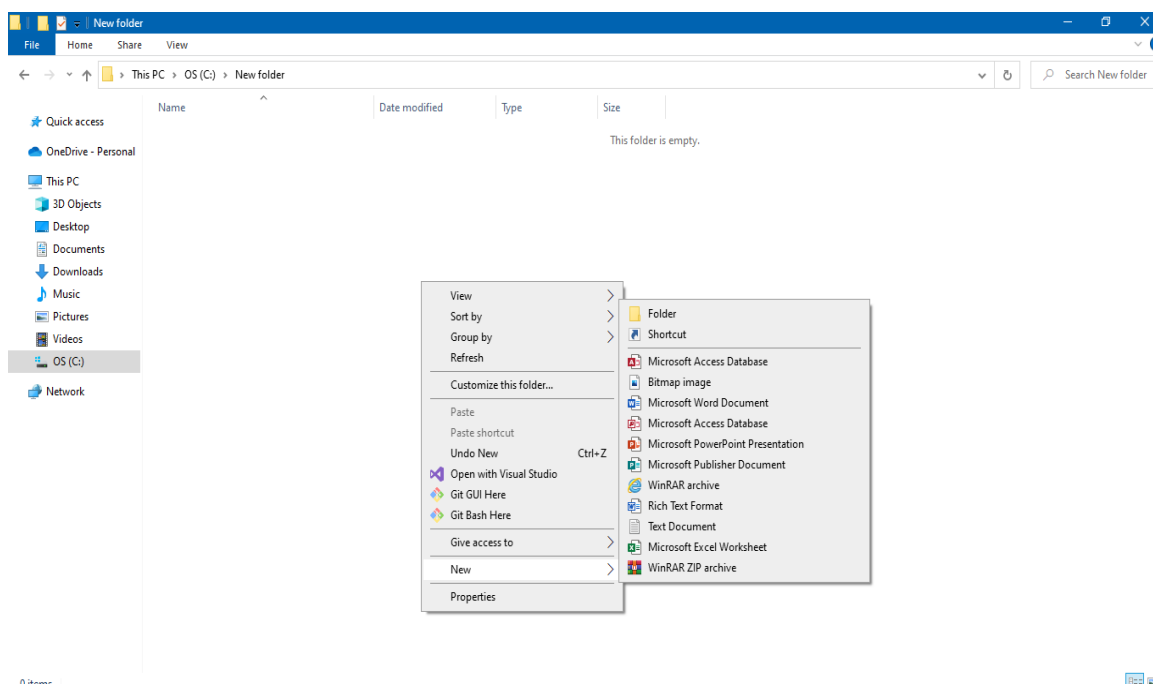


Fig. 31(Create File)

Select any file you want to create. Here we will be making a text document. So, click on **“Text Document”**.

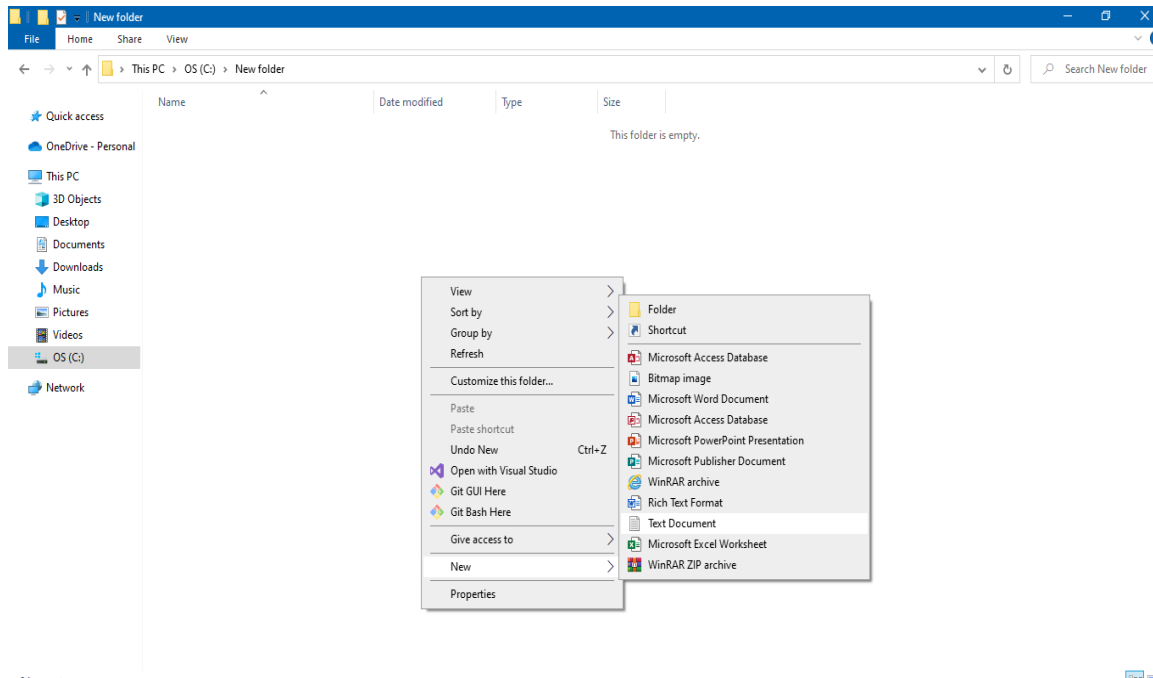


Fig. 32(Create Text File)

A new file will be created.

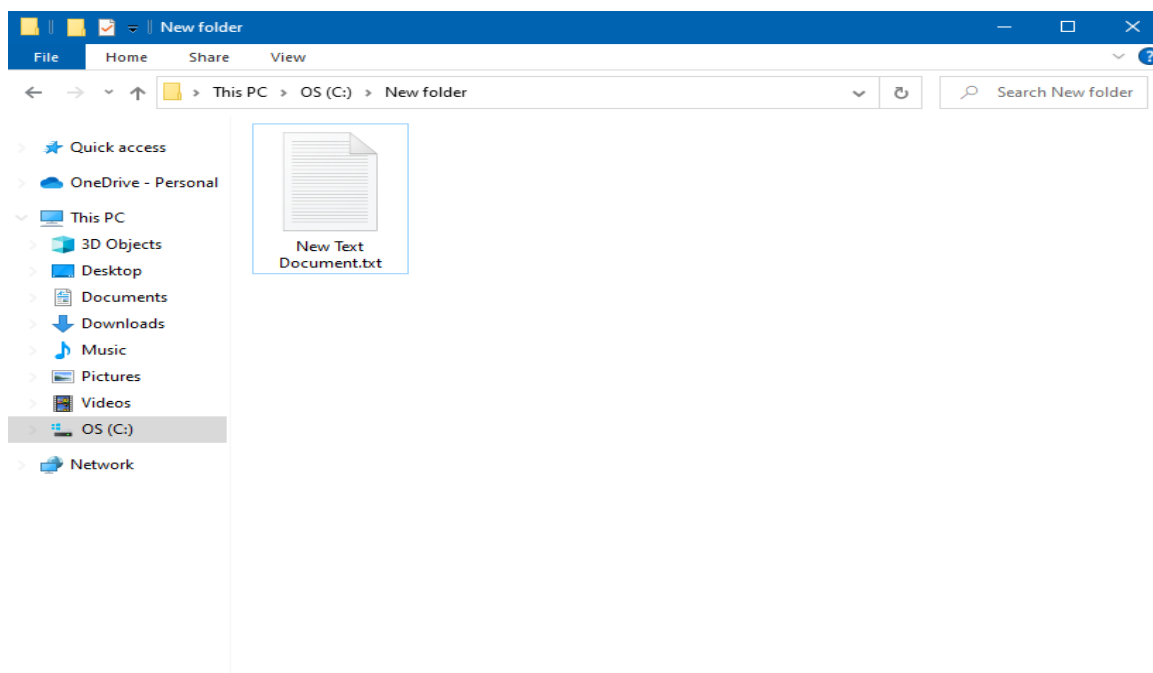


Fig. 33(Created Text File)

Renaming a File or Folder:

- **Right-click** the file or folder you want to rename
- Select **“Rename”** from the context menu

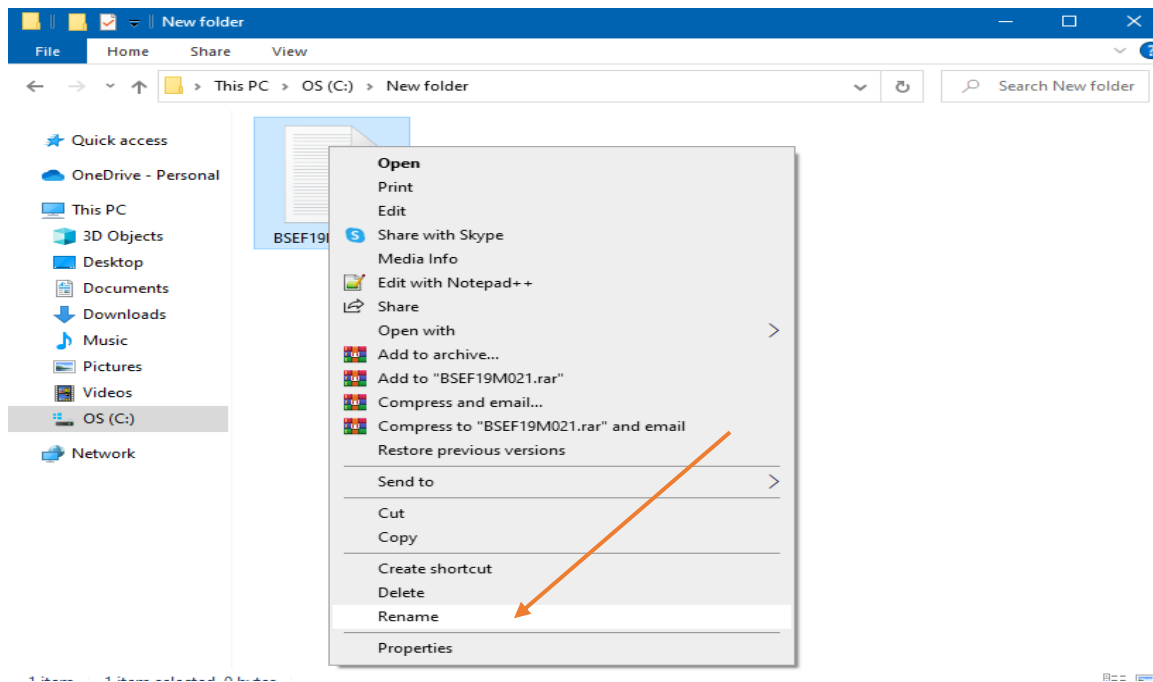


Fig. 34(Renaming File)

- Type **“BSEF19M021”** as a filename
- Press **“Enter”**

The file will be renamed.

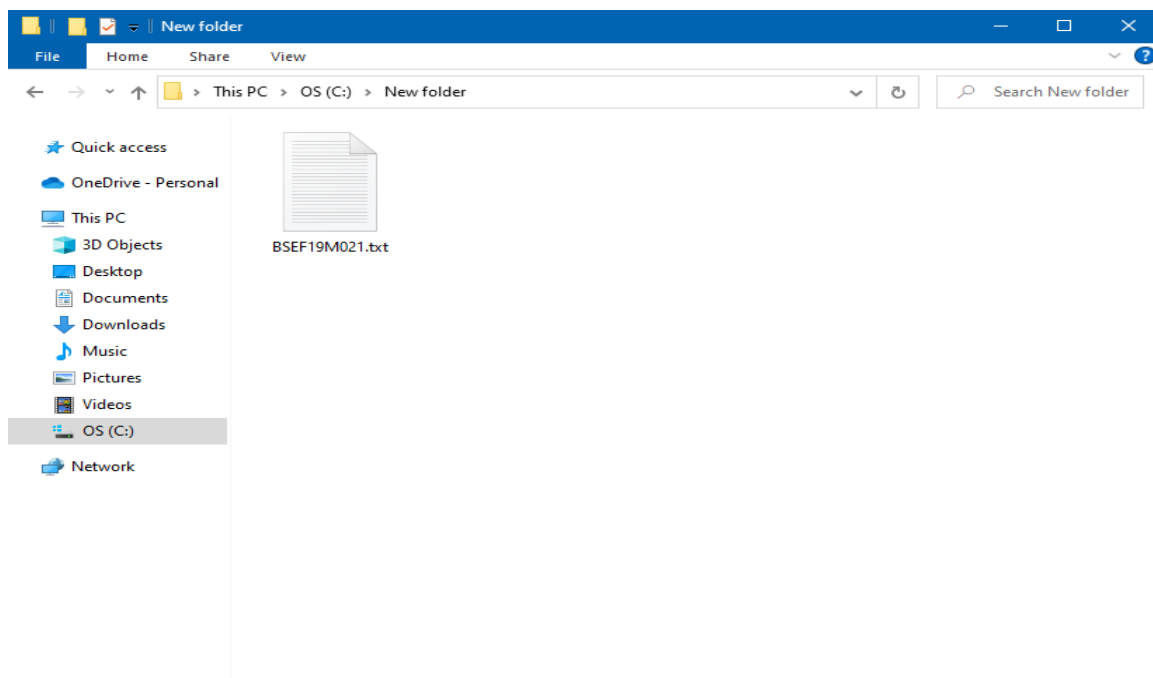


Fig. 35(Renaming File)

Creating Zipped folder:

- Select the file or folder you want to zip
- **Right-click** it
- From the Context menu, select “**Send to**”

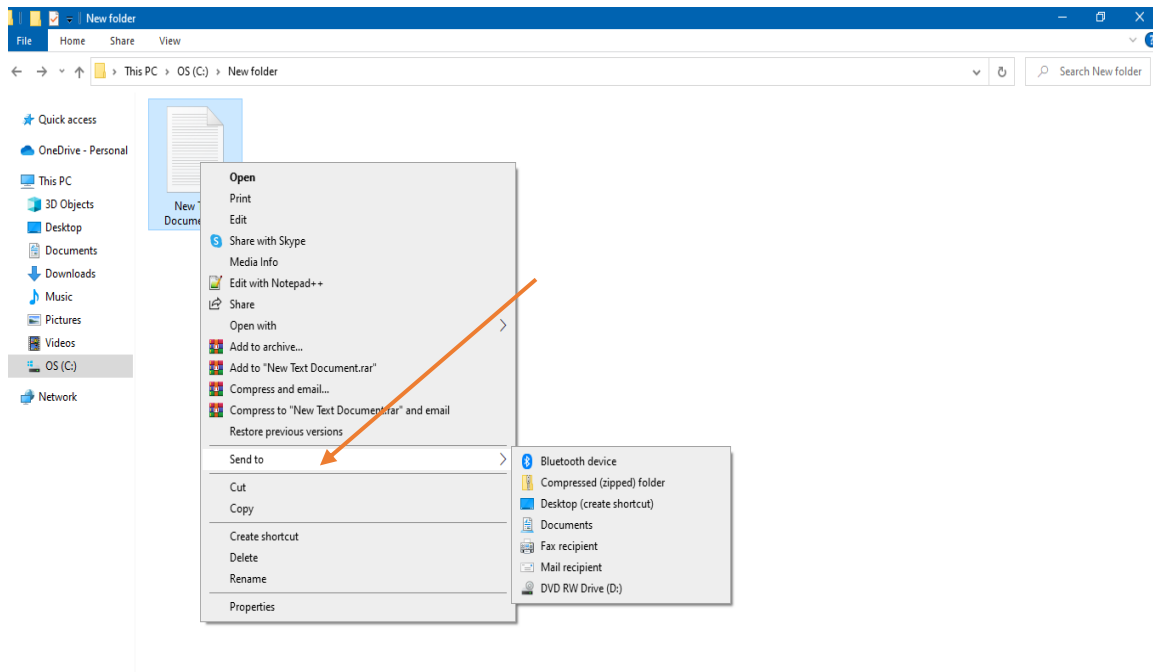


Fig. 36(Create Zipped Folder)

Select “**Compressed (zipped) folder**” from the extended Context menu.

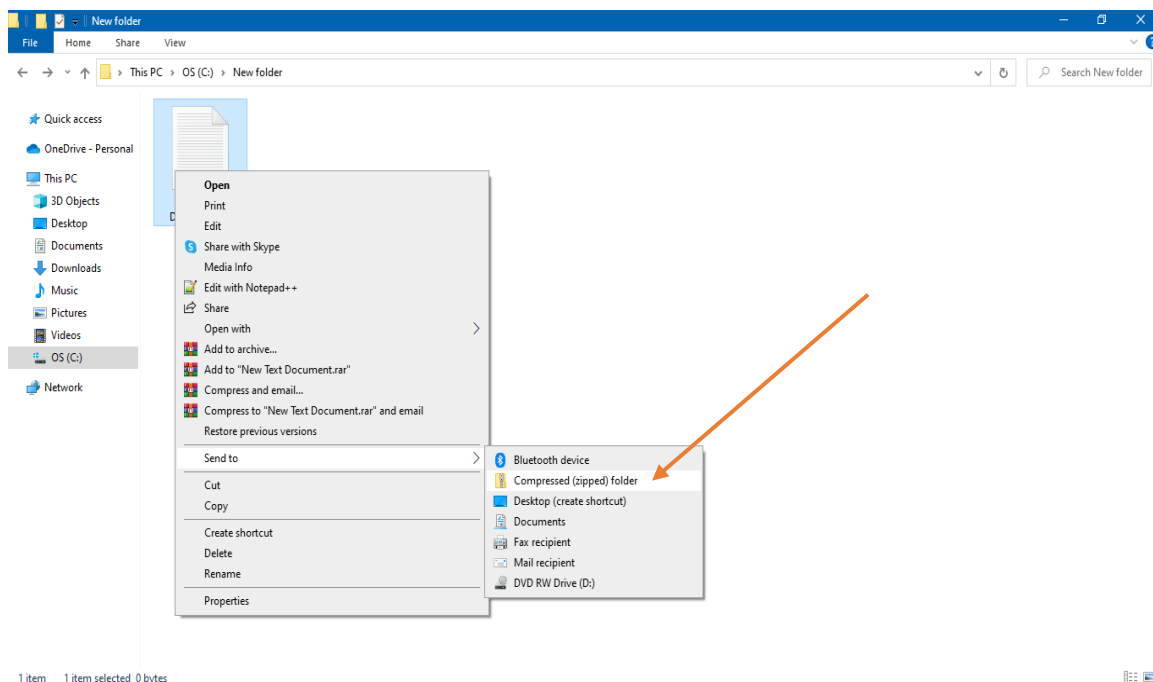


Fig. 37(Create Zipped Folder)

New **Zipped Folder** will be created.

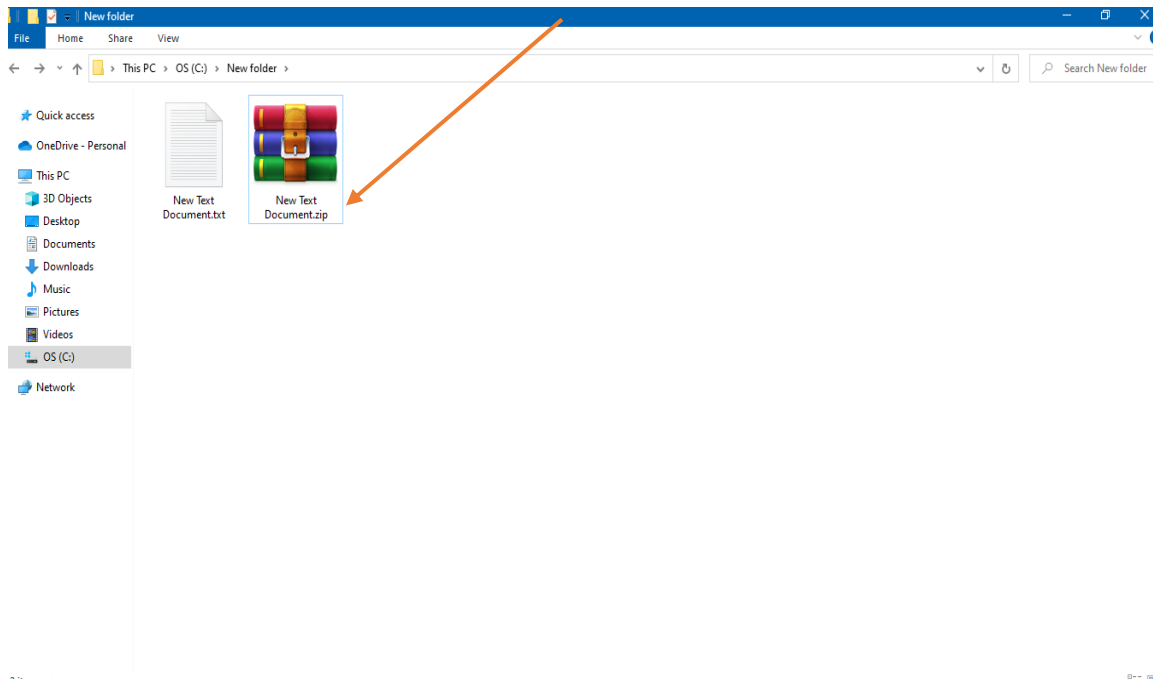


Fig. 38(Zipped Folder)

Task 01: Quiz

[15 minutes / 10 marks]

A short MCQ's type quiz on hardware devices and their roles.

Task 02: Creation and renaming of files, folders.

[25 minutes / 20 marks]

- Create a folder named **“BSEF19M021”**
- Create a subfolder within the **“BSEF19M021”** folder named **“Lab-01”**
- Lastly, create a Microsoft Word and Microsoft Excel file within the **“Lab-01”** folder named **“Your Roll No”**
- Use Snipping Tool to capture each step
- Zip the images
- Send the images to the Email address of the respective TA
- The subject of your email should be **“Your RollNo_Lab01”**.

Post-Lab Activities:**Task 01: Creating bootable USB**

[Estimated 30 minutes / 20 marks]

- By following the steps explained in Lab create a bootable USB (USB size must be 8GB or larger)
- Take snips of each step using the Snipping Tool (with the background of your PC visible)
- Zip the images
- Send the zipped folder to the Email address of the respective TA

Submissions:

- For Pre-Lab Activity: Perform Pre-Lab activity on a paper. Submit the paper by hand to the TA on the day of Lab.
- For In-Lab & Post-Lab Activity: Put all images captured by the Snipping Tool in a zipped folder and name it to your roll number. Email the zipped folder to TA. The email subject should be "Your RollNo_Lab-01".

Evaluations Metric:

- All the lab tasks will be evaluated offline by TA's
- Division of Pre-Lab marks:
 - Functionality of Hardware Devices [05 marks]
 - Comparison of Operating Systems [05 marks]
- Division of In-Lab marks:
 - Folder's creation [05 marks]
 - Files creation [05 marks]
 - Renaming folders and files [05 marks]
 - Creating Zipped folder and Use of Snipping Tools [05 marks]
 - Quiz [10 marks]
- Division of Post-Lab marks:
 - Bootable USB [15 marks]
 - Creating Zipped folder and Use of Snipping Tools [05 marks]

References and Additional Material:

- For Microsoft ® Windows installation
<https://www.microsoft.com/en-us/software-download/windows10>
- Microsoft ® Windows
<https://www.britannica.com/technology/Windows-OS>
- Computer Hardware
<https://computer.howstuffworks.com/what-is-computer-hardware.htm>
- Operating Systems
<https://computer.howstuffworks.com/operating-system.htm>

Lab Time and Activity Simulation Log:

- Slot – 01 – 00:00 – 00:15: Class Settlement, Attendance, Introduction
- Slot – 02 – 00:15 – 00:30: Introduction to Hardware Devices, Exposure of CPU
- Slot – 03 – 00:30 – 00:45: Exposure of CPU
- Slot – 04 – 00:45 – 01:00: Interaction with Hardware Devices
- Slot – 05 – 01:00 – 01:15: Interaction with Hardware Devices
- Slot – 06 – 01:15 – 01:30: Microsoft ® Windows Installation
- Slot – 07 – 01:30 – 01:45: Microsoft ® Windows Installation
- Slot – 08 – 01:45 – 02:00: Creation and Renaming of Files and Folders
- Slot – 09 – 02:00 – 02:15: Use of Snipping Tool and Composing Email
- Slot – 10 – 02:15 – 02:30: Quiz
- Slot – 11 – 02:30 – 02:45: In-Lab Task
- Slot – 12 – 02:45 – 03:00: In-Lab Task