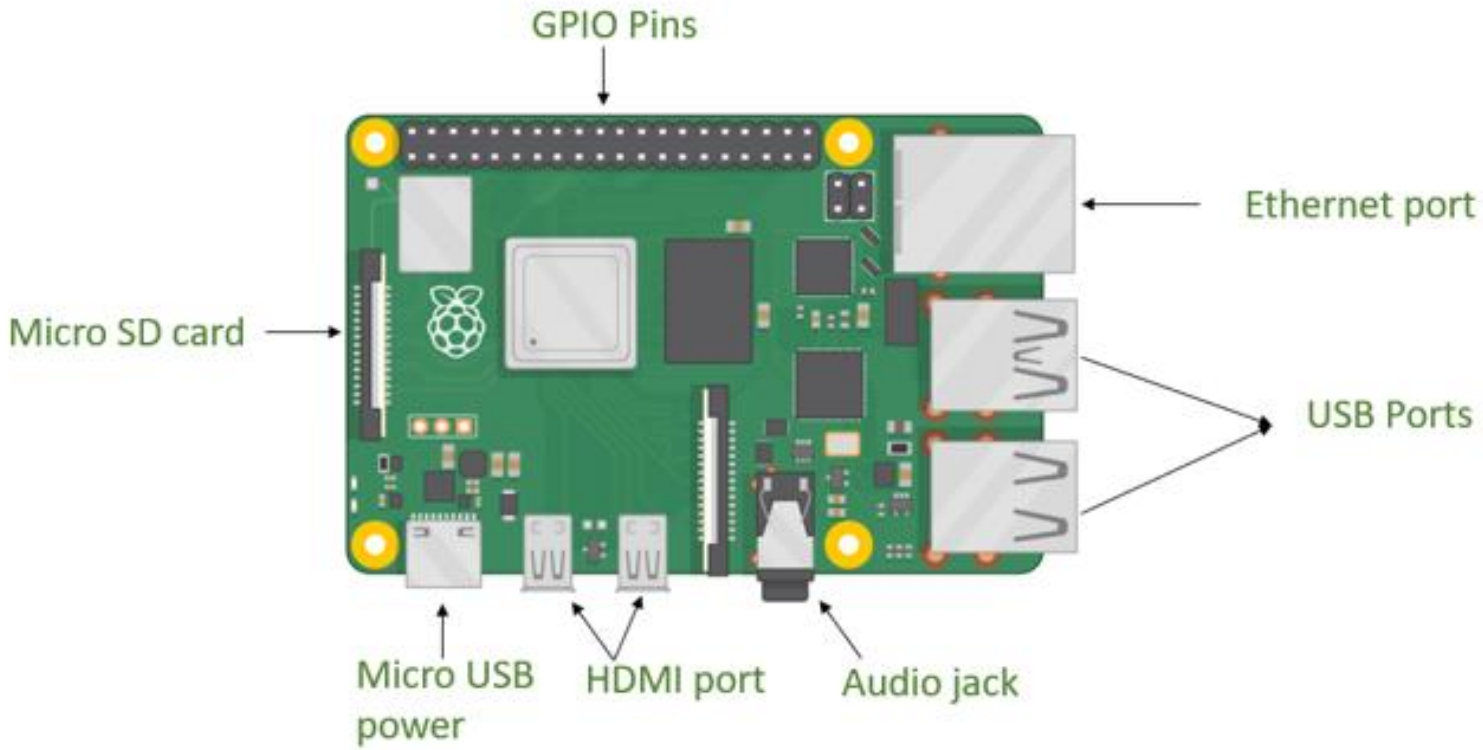
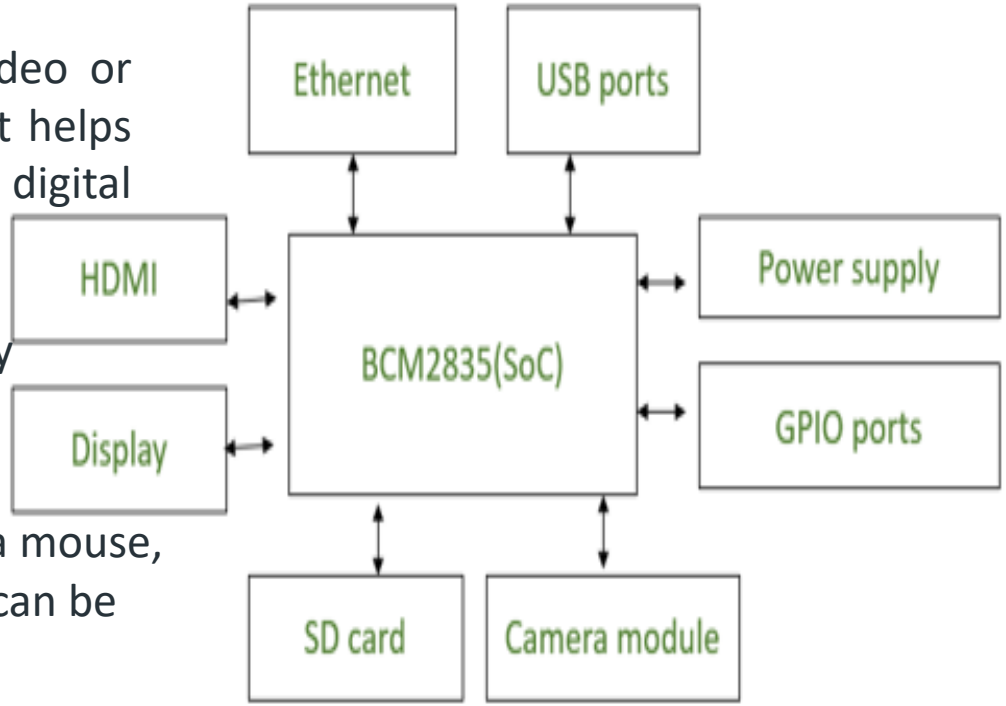
Raspberry Pi and its interfacing



Architecture of Raspberry Pi :

Draw and explain architecture of raspberry Pi (**06 marks**)

Processor: Raspberry Pi uses Broadcom BCM2835 system on chip which is an ARM processor and Video core Graphics Processing Unit (GPU). It is the heart of the Raspberry Pi which controls the operations of all the connected devices and handles all the required computations.



HDMI: High Definition Multimedia Interface is used for transmitting video or digital audio data to a computer monitor or to digital TV. This HDMI port helps Raspberry Pi to connect its signals to any digital device such as a monitor digital TV or display through an HDMI cable.

GPIO ports: General Purpose Input Output ports are available on Raspberry Pi which allows the user to interface various I/P devices.

USB ports: This is a common port available for various peripherals such as a mouse, keyboard, or any other I/P device. With the help of a USB port, the system can be expanded by connecting more peripherals.

SD card: The SD card slot is available on Raspberry Pi. An SD card with an operating system installed is required for booting the device.

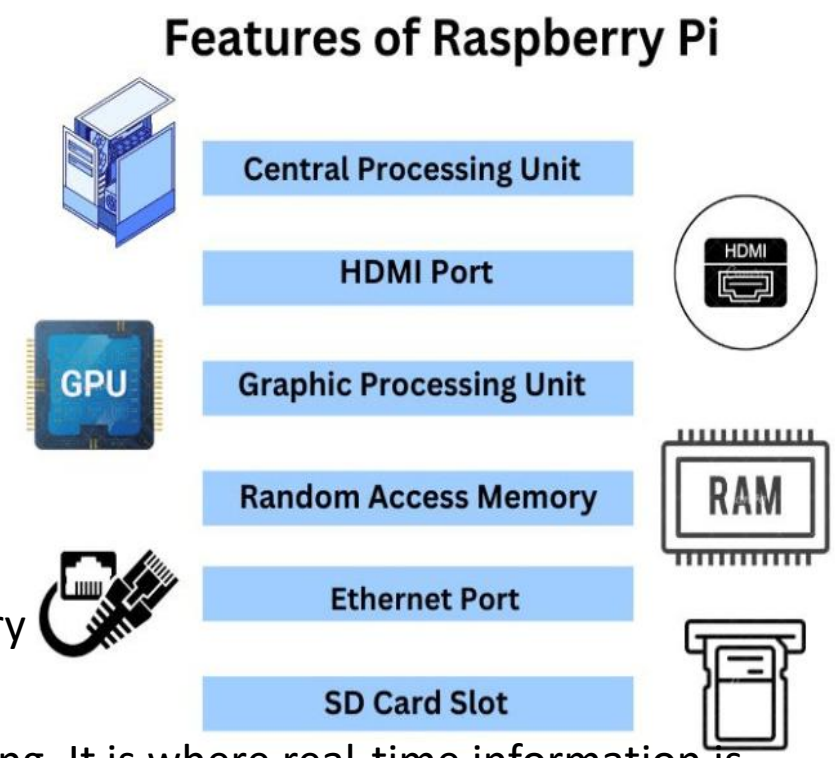
Ethernet: The ethernet connector allows access to the wired network, it is available only on the model B of Raspberry Pi.

Power supply: A micro USB power connector is available onto which a 5V power supply can be connected.

Display: Display Serial Interface (DSI) is used for connecting LCD to Raspberry Pi using 15 15-pin ribbon cables. DSI provides a high-resolution display interface that is specifically used for sending video data.

Features of Raspberry Pi :

Write features of Raspberry Pi (**04 marks**)



CPU: As we know, the central Processing Unit acts as the brain of a computer. In the raspberry pi, too, the CPU carries out instructions using logical and mathematical operations. In raspberry pi, the ARM11 series processor is used on its boards.

HDMI Port: When talking about Raspberry Pi, we know that it has video output options which are then displayed on the computer. For this, we use High Definition Multimedia Interface (HDMI). With an HDMI cable, we can connect a raspberry pi to a display device such as a TV. Apart from it, it also has an RCA port for other display options.

Graphic Processing Unit: GPU(Graphic Processing Unit) is another part of the Raspberry Pi board. Its primary purpose is to fasten the speed of image calculations.

Memory (RAM): Random Access Memory(RAM) is a core part of a computer's processing. It is where real-time information is stored for easy access. The Raspberry Pi had an initial 256MB RAM size. Over the years, developers gradually and significantly improved their size. Various Raspberry Pi models come with varying capacities. The latest model with the maximum capacity is the Raspberry Pi 4 model with 8GB RAM space.

Ethernet Port:A computer has many features, but with connectivity to the internet, we can explore additional features afterward. We can use the Ethernet Port to establish an internet connection for the Raspberry Pi. With the help of Ethernet ports, we can establish a wired internet connection to the Raspberry Pi.

SD Card Slot: Unlike our traditional PCs, our minicomputers don't have any hard drive or memory card. User can insert their SD cards into the SD card slot on the Raspberry Pi board.

Applications of Raspberry Pi

List features of Rpi (**03 marks**)

- Raspberry PI is used for **Game plays** in **Media streamers**.
- Raspberry Pi is used in **arcade machines cabinet** for Game plays.
- It is also used in **home automation systems** for general-purpose uses.
- Raspberry Pi is installed in **cars** and **internet radios** for **entertainment** purposes.
- In modern technologies like **controlling robots**, **cosmic computers**, looking for meteorites, etc.
- Raspberry Pi is used widely in **making Bots**.

Models of Raspberry Pi :

Write features of Raspberry Pi models (**04 marks**)

Raspberry Pi 0

- The Raspberry Pi 0(Zero) was released in **2015**.
- The size of this model was smaller compared to other models in the lineup.
- This model comes with a **1GHz single-core CPU**.
- The **RAM** size is **512MB**, and a single-core **ARM processor** is used in model zero.
- It has interfaces, including a **mini HDMI port** and **micro USB port** also supports **USB OTG connection** through its port.
- The Raspberry Pi Zero is **HAT-compatible** and has a **40-pin header**.

Raspberry Pi 1

In this series of model 1, there are a total of four versions released namely:

- Raspberry Pi 1 Model B was released in the year **2012**.
- Raspberry Pi 1 Model A was released in the year **2013**.
- Raspberry Pi 1 Model B+ was released in the year **2014**.
- Raspberry Pi 1 Model A+ was released in the year **2014**.

- The Raspberry Pi 1 model comes with a **700 MHz ARM11** processor.
- The size of the **RAM** is **512MB**.
- It has one **USB port** and also supports **full-size HDMI output** and has a **Four-pole 3.5 mm jack** with **audio output** and **composite video output**.
- It has a **40-pin GPIO** header with **0.1”-spaced male pins**.

Models of Raspberry Pi :

Raspberry Pi 2

- The Raspberry Pi 2 was released in the year **2015**.
- The **clock speed** of the **CPU** is **higher** than **previous models**, with the **speed of 900 MHz quad-core ARM Cortex-A7 CPU**.
- It has a total of **1GB RAM**.
- The Raspberry Model 2 has a **dedicated VideoCore IV 3D graphics core**.
- It also provides support to **Ethernet ports** and has a total of **four USB ports**.
- The model supports **full-size HDMI output**.

Raspberry Pi 3

- The Raspberry Pi 3 was released in the year **2016**.
- As compared to its previous model, the Raspberry Pi 3 has an **increased clock frequency of 1.2 GHz**.
- The **chipset(SoC)** used is **Broadcom BCM2837**.
- The processor used in this model is a **64-bit quad-core ARM Cortex-A53**, and the graphic processor used is Broadcom Dual Core VideoCore IV (OpenGL ES 2.0, H.264 Full HD @ 30 fps).
- The RAM used is **SDRAM of size 1 GB LPDDR2**.
- The port is also upgraded and comes with **USB 2.0 ports**.

Models of Raspberry Pi :

Raspberry Pi 4

- The Raspberry Pi 4 was released in the year **2019**.
- It is the latest model of Raspberry Pi and has many extra features compared to its previous model.
- Raspberry Pi 4 has a **quad-core 64-bit processor**.
- The **clock frequency** is also increased to **1.8 GHz**.
- Apart from it, **SDRAM** support is also available in various sizes (**1GB, 2GB, 4GB, or 8GB**).
- In Raspberry Pi 4, there is a **gigabit ethernet** access along with **Bluetooth 5.0 and BLE**.
- It has 2 USB **3.0** and **2.0** ports each for various connection purposes.

Raspberry Pi 4 Model B

- It is the latest product in the popular Raspberry Pi range of computers.
- It offers ground-breaking increases in processor speed, multimedia performance, memory, and connectivity compared to the prior-generation Raspberry Pi 3 Model B+, while retaining backwards compatibility and similar power consumption.
- For the end user, Raspberry Pi 4 Model B provides desktop performance comparable to entry-level x86 PC systems.

Raspberry Pi 4 Model B specifications : List any six features of Rpi 4 model - B (**03 marks**)

- **Processor**: Broadcom BCM2711, quad-core Cortex-A72 (ARM v8)
64-bit SoC @ 1.5GHz
- **Memory**: 1GB, 2GB or 4GB LPDDR4
(depending on model)
- **Connectivity**: 2.4 GHz and 5.0 GHz IEEE 802.11b/g/n/ac wireless
LAN, Bluetooth 5.0, BLE
Gigabit Ethernet
2 × USB 3.0 ports
2 × USB 2.0 ports.
- **GPIO**: Standard 40-pin GPIO header
(fully backwards-compatible with previous boards)
- **Video & sound**: 2 × micro HDMI ports (up to 4Kp60 supported)
2-lane MIPI DSI display port
2-lane MIPI CSI camera port
4-pole stereo audio and composite video port
- **Multimedia**: H.265 (4Kp60 decode);
H.264 (1080p60 decode, 1080p30 encode);
OpenGL ES, 3.0 graphics

Differentiate between Arduino and Raspberry Pi(**04 marks**)

S No.	Arduino	Raspberry Pi
1.	In the year 2005, the classrooms of the Interactive Design Institute in Ivrea, Italy, first introduced the Arduino board.	In the year 2012, Eben Upton first introduced the Raspberry Pi device in February.
2.	**Control unit of the Arduino is from the Atmega family.**	**The control unit of Raspberry Pi is from the ARM family.**
3.	**Arduino is based on a microcontroller.**	**Raspberry Pi is based on a microprocessor.**
4.	It is designed to control the electrical components connected to the circuit board in a system.	While Raspberry Pi computes data and produces valuable outputs, and controls components in a system based on the outcome of its computation.
5.	Arduino boards have a simple hardware and software structure.	While Raspberry Pi boards have a complex architecture of hardware and software.
6.	**CPU architecture: 8 bit.**	**CPU architecture: 64 bit.**
7.	**It uses very little RAM, 2 kB.**	**Raspberry Pi requires more RAM, 1 GB.**
8.	It **clocks** a processing speed of **16 MHz**.	Raspberry Pi **clocks** a processing speed of **1.4 GHz**.
9.	It is **cheaper** in **cost**.	Raspberry Pi is **expensive**.
10.	It has a higher I/O current drive strength.	While Raspberry Pi has a lower I/O current drive strength.
11.	**It consumes about 200 MW of power.**	**it consumes about 700 MW of power.**
12.	**Its logic level is 5V.**	**Its logic level is 3V.**
13.	**It does not have internet support.**	**It has inbuilt Ethernet port and WiFi support.**
14.	It has higher current drive strength.	It has lower current drive strength.
15.	Some of the applications of Arduino are traffic light countdown timer , Weighing machines , etc.	Some of the applications of Raspberry Pi are Stop motion cameras , Robot Controllers , Game Servers.
16.	Operating systems are required in Arduino.	Operating System is required in Raspberry Pi.
17.	Two tiny cores Arduino with 32 Mhz	Single core and 700 MHz