

LAB PRACTICALS

Practical 1

 **AIM : Raspberry Pi Hardware Preparation and Installation**

Apparatus

1. Raspberry Pi (latest Model)
2. Monitor or TV
3. HDMI cable
4. Ethernet cable
5. USB keyboard
6. USB mouse
7. Micro USB power supply
8. 8GB or larger microSD card
9. SD Card Reader

Theory

Raspberry Pi 3 Model B:

The Raspberry Pi 3 is the third generation Raspberry Pi. It replaced the Raspberry Pi 2 Model B in February 2016. Compared to the Raspberry Pi 2 it has :

- A 1.2GHz 64-bit quad-core ARMv8 CPU
- 802.11n Wireless LAN
- Bluetooth 4.1
- Bluetooth Low Energy (BLE)

Like the Pi 2, it also has :

- 4 USB ports
- 40 GPIO pins
- Full HDMI port
- Ethernet port
- Combined 3.5mm audio jack and composite video
- Camera interface (CSI)

- Display interface (DSI)
- Micro SD card slot (now push-pull rather than push-push)
- Video Core IV 3D graphics core
- The Raspberry Pi 3 has an identical form factor to the previous Pi 2 (and Pi 1 Model B+) and has complete compatibility with Raspberry Pi 1 and 2.

► **Monitor or TV**

- A monitor or TV with HDMI in can be used as a display with a Raspberry Pi. Most modern television sets and monitors have an HDMI port, and are the easiest to get working with the Raspberry Pi. You can use an HDMI cable to connect the Raspberry Pi directly to the television or monitor.
- Some older monitors have a DVI port. These work well with the Raspberry Pi, although you'll need an HDMI-to-DVI adapter to attach to an HDMI cable, or a one-piece HDMI-to-DVI cable. Some old monitors have a VGA port. These can be trickier to use as you'll need an HDMI-to-VGA converter, which can change digital video to analogue video. A simple port adapter won't work.

► **HDMI to HDMI Cable**

Connect Raspberry Pi to a Monitor or TV with a HDMI to HDMI cable.

► **Ethernet cable**

Ethernet cable will allow your Pi to connect with the internet. It is also useful for headless setup of Raspberry Pi

► **USB Keyboard and Mouse**

- Any standard USB keyboard and mouse can be used with the Raspberry Pi. This plug and play devices will work without any additional driver.
- Simply plug them into the Raspberry Pi and they should be recognized when it starts up.

► **Power Supply**

It is recommended that you use a 5V, 2A USB power supply for all models of Raspberry Pi.

► **SD Card**

The latest version of Raspbian, the default operating system recommended for the Raspberry Pi, requires an 8GB (or larger) micro

SD card. SD card will store the operating systems as well as all the file and applications created by you.

Procedure

► Get Raspbian OS on your microSD card

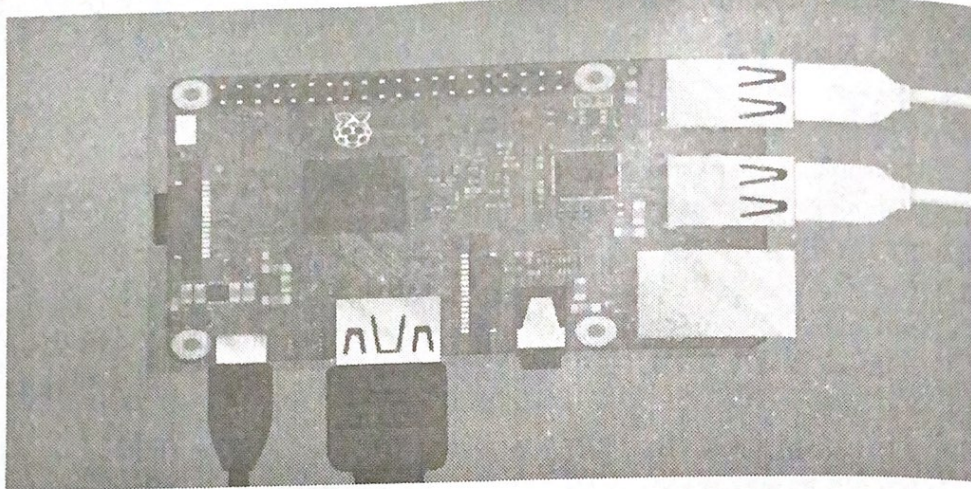
Raspbian comes pre-installed with plenty of software for education, programming and general use. It has Python, Scratch, Sonic Pi, Java, Mathematica and more.

1. To download Raspbian log on to raspberrypi.org and click on the download, then click on Raspbian and lastly download the RASPBIAN JESSIE WITH DESKTOP file. You can choose either the Torrent file or ZIP file.
2. The downloaded file will be in zip format. To unzip the file, you will require an unzip tool. You can use any unzipping tool viz. WINRAR, 7ZIP etc. After unzipping the file, you will find a disc image file in the unzipped folder.
3. Now format the SD Card before writing the disc image file on the SD card. You can use SD Formatter tool or any other tool of your wish.
4. To write the image file of the operating system on the SD card you will require a Disk Imager tool. For this you can use Win32 Disk Imager tool.
5. Once the image is written on the SD Card, your untitled SD card will now have the name boot. Your SD Card will now hold the Raspbian Operating system required for the first-time setup.


► Plugging in your Raspberry Pi

1. Begin by placing your SD card into the SD card slot on the Raspberry Pi. It will only fit one way.
2. Next, plug your keyboard and mouse into the USB ports on the Raspberry Pi.
3. Make sure that your monitor or TV is turned on, and that you have selected the right input (e.g. HDMI 1, DVI, etc).
4. Connect your HDMI cable from your Raspberry Pi to your monitor or TV.
5. If you intend to connect your Raspberry Pi to the internet, plug an Ethernet cable into the Ethernet port, or connect a WiFi dongle to one of the USB ports (unless you have a Raspberry Pi 3).
6. When you're happy that you have plugged all the cables and SD card in correctly, connect the micro USB power supply. This action will turn on and boot your Raspberry Pi.

Output

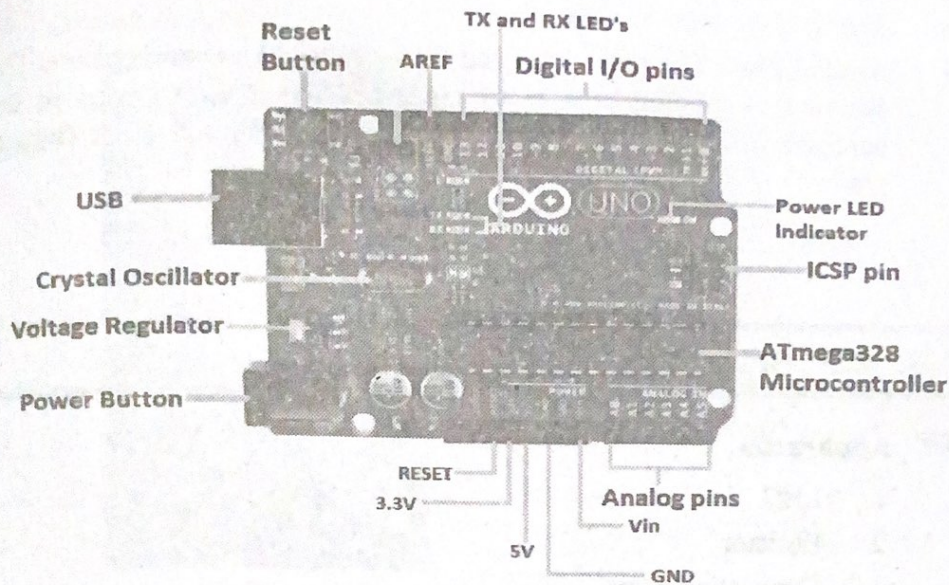


Practical 2

 **AIM : Demonstrate Arduino Uno and its pins interfacing with IDE.**

Theory

- The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board.
- Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits.
- The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.
- The IDE is common to all available boards of Arduino.
- The Arduino board is shown below:



► The list of components in detail

- **ATmega328 Microcontroller**- It is a single chip Microcontroller of the ATmel family. The processor code inside it is of 8-bit. It combines Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.
- **ICSP pin** - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.
- **Power LED Indicator**- The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.
- **Digital I/O pins**- The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.
- **TX and RX LED's**- The successful flow of data is represented by the lighting of these LED's.
- **AREF**- The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.
- **Reset button**- It is used to add a Reset button to the connection.
- **USB**- It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.
- **Crystal Oscillator**- The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.
- **Voltage Regulator**- The voltage regulator converts the input voltage to 5V.
- **GND**- Ground pins. The ground pin acts as a pin with zero voltage.

- **Vin-** It is the input voltage.
- **Analog Pins-** The pins numbered from A0 to A5 are analog pins. The function of Analog pins is to read the analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.

Practical 3

AIM : GPIO: Light the LED with Python

Apparatus

1. LED
2. Resistor
3. Connecting wires
4. Breadboard

Theory

Gpio

- One powerful feature of the Raspberry Pi is the row of GPIO (general purpose input/output) pins along the top edge of the board.
- These pins are a physical interface between the Pi and the outside world. At the simplest level, you can think of them as switches that you can turn on or off (input) or that the Pi can turn on or off (output). Of the 40 pins, 26 are GPIO pins and the others are power or ground pins.

Procedure

1. Connect the GPIO22 (i.e. Physical Pin 15) Pin of raspberry pi to one end of the resistor.
2. Connect another end of resistor to the positive end (anode) of LED
3. Connect the negative end (cathode) of LED to Ground of raspberry pi.
4. Then Power on your raspberry pi

File Edit Format Run Options Window Help

```
import RPi.GPIO as GPIO
import time
```

```
x=1
numTimes=int(input("enter the total number of times of times to blick:"))
speed=float(input("enter length of each blaink (sencond):"))
```

```
GPIO.setwarnings(False)
GPIO.setmode(GPIO.BOARD)
GPIO.setup(40,GPIO.OUT)
GPIO.setup(3,GPIO.OUT)
```

```
def Blink(numTimes,speed):
    for i in range(0,numTimes):
        GPIO.output(40,True)
        GPIO.output(3,True)
        print("Iteration",(i+1))
        time.sleep(speed)
        GPIO.output(40,False)
        GPIO.output(3,False)
        time.sleep(speed)
```

```
Blink(numTimes,speed)
print('Done')
```