

UNIT I – Introduction to Embedded System

Part – A

MCQ

1. An embedded system is

- A) A general-purpose computer
- B) A dedicated computer designed for a specific application
- C) A supercomputer
- D) A network server

Answer: B

2. Which of the following is an example of an embedded system?

- A) Laptop
- B) Desktop PC
- C) Washing Machine
- D) Workstation

Answer: C

3. Which feature best describes an embedded system?

- A) Multipurpose
- B) Dedicated function
- C) Large memory
- D) High storage capacity

Answer: B

4. Embedded systems are mainly designed to perform

- A) Multiple unrelated tasks
- B) General computing
- C) A specific task
- D) Internet browsing

Answer: C

5. Which of the following is NOT a characteristic of an embedded system?

- A) Real-time operation
- B) Reliability

- C) Dedicated function
- D) Unlimited memory

Answer: D

6. Small-scale embedded systems generally use

- A) Supercomputers
- B) Microcontrollers
- C) Mainframes
- D) Servers

Answer: B

7. Which is an example of a medium-scale embedded system?

- A) Digital Camera
- B) Calculator
- C) Traffic Light Controller
- D) Wrist Watch

Answer: A

8. Embedded systems are widely used in

- A) Consumer electronics
- B) Automotive systems
- C) Industrial automation
- D) All of the above

Answer: D

9. The primary purpose of an embedded system is

- A) Entertainment
- B) Performing a dedicated function efficiently
- C) General programming
- D) Data entry

Answer: B

10. Which quality attribute ensures correct operation without failure?

- A) Reliability
- B) Portability

- C) Scalability
- D) Compatibility

Answer: A

11. Which quality attribute refers to low power consumption?

- A) Efficiency
- B) Reliability
- C) Performance
- D) Availability

Answer: A

12. The brain of an embedded system is the

- A) Monitor
- B) Processor
- C) Printer
- D) Scanner

Answer: B

13. A microcontroller contains

- A) CPU only
- B) CPU and external memory
- C) CPU, RAM, ROM and I/O ports on a single chip
- D) Hard disk only

Answer: C

14. Which device is mainly used in embedded systems?

- A) Microcontroller
- B) Mainframe
- C) Supercomputer
- D) Laptop

Answer: A

15. A microprocessor differs from a microcontroller because a microprocessor

- A) Has built-in RAM and ROM
- B) Requires external memory and peripherals

- C) Has no CPU
- D) Is slower than a microcontroller

Answer: B

16. A compiler converts

- A) Machine code into Assembly code
- B) High-level language into machine code
- C) Binary into Decimal
- D) Hexadecimal into Octal

Answer: B

17. A cross compiler is used to

- A) Compile programs for another target processor
- B) Increase execution speed
- C) Debug hardware
- D) Design PCBs

Answer: A

18. An assembler converts

- A) C language into Java
- B) Assembly language into machine code
- C) Machine code into C language
- D) Binary into Decimal

Answer: B

19. A simulator is used to

- A) Manufacture processors
- B) Test and verify embedded programs without actual hardware
- C) Increase memory
- D) Connect to the Internet

Answer: B

20. Which of the following is NOT an application area of embedded systems?

- A) Medical equipment
- B) Automotive electronics

- C) Home appliances
- D) Word processing on desktop computers

Answer: D

21. The main difference between a general-purpose computer and an embedded system is

- A) Embedded systems perform dedicated tasks
- B) Embedded systems have larger storage
- C) Embedded systems always use Windows
- D) Embedded systems cannot execute programs

Answer: A

Analytical MCQs

1. Assertion–Reason

Assertion (A): Embedded systems are designed for dedicated applications.

Reason (R): They perform one or a limited number of predefined tasks efficiently.

- A) Both A and R are true, and R is the correct explanation of A.
- B) Both A and R are true, but R is not the correct explanation of A.
- C) A is true, but R is false.
- D) A is false, but R is true.

Answer: A

2. Case-Based

A microwave oven contains a microcontroller that controls cooking time, temperature, keypad input, and display.

Which characteristic of an embedded system is best illustrated?

- A) General-purpose computing
- B) Dedicated application control
- C) Multi-user processing
- D) Cloud computing

Answer: B

3. Flowchart-Based

An embedded controller follows this sequence:

Start → Read Sensor → Is Value > Threshold? → Yes: Turn ON Alarm → No: Keep Alarm OFF

Which statement is correct?

- A) The alarm is activated only when the sensor value exceeds the threshold.
- B) The alarm is always ON.
- C) The alarm never turns ON.
- D) The sensor is ignored.

Answer: A

4. Table-Based

Device	CPU	Memory	I/O
X	External	External	External
Y	Integrated	Integrated	Integrated

Which statement is correct?

- A) X represents a microcontroller.
- B) Y represents a microcontroller.
- C) Both X and Y are microprocessors.
- D) Both are general-purpose computers.

Answer: B

5. Inference-Based

A factory uses:

- Robot controller
- PLC
- CNC machine controller
- Smart energy meter

These devices are examples of

- A) Embedded systems in industrial automation
- B) Desktop computers
- C) Network servers
- D) Office applications

Answer: A

6. Scenario-Based

A traffic light controller works continuously for years with minimal failure.

Which quality attribute is most important?

- A) Portability
- B) Reliability
- C) Graphics capability
- D) High storage

Answer: B

7. Analytical Comparison

A student develops software on a PC and generates executable code for an ARM-based embedded board.

Which software tool is essential?

- A) Text editor
- B) Cross compiler
- C) Spreadsheet
- D) Browser

Answer: B

8. Application-Based

A washing machine automatically controls water level, washing time, and spin speed using sensors.

This is an example of

- A) General-purpose computer
- B) Embedded system
- C) Workstation
- D) Mainframe

Answer: B

9. Analytical Reasoning

A developer wants to test an embedded program before the hardware is available.

Which tool should be used?

- A) Compiler only
- B) Assembler only
- C) Simulator
- D) Spreadsheet

Answer: C

Part – B

1. Explain the **concept of an embedded system**. Discuss its **characteristics, classification, and applications** with suitable examples.
2. Describe the **structure of an embedded system** with a neat block diagram. Explain the function of each block.
3. Compare a **Microprocessor** and a **Microcontroller** with respect to architecture, memory, peripherals, applications, cost, and power consumption.

4. Explain the role of **Compiler, Cross Compiler, Assembler, and Simulator** in embedded system development. Illustrate the embedded software development process.

Analytical Question

5. A smart washing machine automatically senses the load, controls the water level, adjusts the washing time, and displays the remaining time to the user.

Based on the above scenario:

1. Explain why the washing machine is an **embedded system**.
2. Draw the **block diagram** of the embedded system used in the washing machine.
3. Identify the **processor, input devices, output devices, memory, and software** used.
4. Compare this embedded system with a **general-purpose computer**.

UNIT II – Arduino Hardware

Part – A

MCQs

1. Arduino is primarily a _____ platform.

- A) Database
- B) Microcontroller-based prototyping
- C) Operating System
- D) Compiler

Answer: B

2. Which microcontroller is used in the Arduino Uno?

- A) ATmega328P
- B) ATmega16
- C) PIC16F877A
- D) ESP8266

Answer: A

3. Arduino was originally developed in

- A) Germany
- B) India
- C) Italy
- D) Japan

Answer: C

4. Which of the following is an important feature of Arduino?

- A) Open-source hardware and software
- B) Requires expensive software
- C) Supports only Assembly language
- D) Cannot interface with sensors

Answer: A

5. Which Arduino board is most commonly used by beginners?

- A) Arduino Mega
- B) Arduino Uno
- C) Arduino Due
- D) Arduino Nano Every

Answer: B

6. Which Arduino board provides the maximum number of digital I/O pins?

- A) Arduino Uno
- B) Arduino Nano
- C) Arduino Mega 2560
- D) Arduino Mini

Answer: C

7. The Arduino Nano is mainly preferred because it is

- A) Large in size
- B) Compact and breadboard-friendly
- C) Expensive
- D) Used only for industrial systems

Answer: B

8. The Arduino Uno contains _____ digital I/O pins.

- A) 8
- B) 12
- C) 14
- D) 20

Answer: C

9. The Arduino Uno contains _____ analog input pins.

- A) 2
- B) 4
- C) 6
- D) 8

Answer: C

10. The operating voltage of the Arduino Uno is

- A) 3.3 V
- B) 5 V
- C) 9 V
- D) 12 V

Answer: B

11. Which software is used to program Arduino boards?

- A) MPLAB IDE
- B) Arduino IDE
- C) Keil μ Vision
- D) Code Composer Studio

Answer: B

12. Before uploading a sketch, the correct board should be selected from the

- A) Edit Menu
- B) Sketch Menu
- C) Tools Menu
- D) File Menu

Answer: C

13. Which peripheral is used to read analog signals?

- A) ADC (Analog-to-Digital Converter)
- B) DAC
- C) Timer
- D) UART

Answer: A

14. Which of the following is a digital peripheral?

- A) Push button
- B) LDR
- C) LM35
- D) Potentiometer

Answer: A

15. Which communication interface is commonly used to connect Arduino with a computer?

- A) USB
- B) HDMI
- C) VGA
- D) Ethernet

Answer: A

16. UART stands for

- A) Universal Asynchronous Receiver Transmitter
- B) Universal Analog Receiver Terminal
- C) Unified Automatic Receiver Transfer
- D) Universal Advanced Relay Technology

Answer: A

17. Which communication protocol uses only two wires (SDA and SCL)?

- A) SPI
- B) UART
- C) I²C
- D) CAN

Answer: C

18. Which communication interface generally uses four signal lines (MOSI, MISO, SCK, SS)?

- A) UART
- B) SPI
- C) I²C
- D) USB

Answer: B

19. Which Arduino board is suitable for projects requiring many input/output pins?

- A) Arduino Nano
- B) Arduino Uno
- C) Arduino Mega 2560
- D) Arduino Pro Mini

Answer: C

20. Digital pins of the Arduino Uno are mainly used for

- A) Reading and writing digital signals
- B) Measuring analog voltage only
- C) Video processing
- D) Audio recording

Answer: A

21. Which of the following communication interfaces is covered in the Arduino Hardware unit?

- A) UART, SPI and I²C
- B) HTTP only
- C) FTP only
- D) SMTP only

Answer: A

Analytical MCQs

1. Assertion–Reason Type

Assertion (A): Arduino Uno is widely used for beginners in embedded system development.

Reason (R): It is inexpensive, easy to program, and has sufficient I/O pins for most learning projects.

- A) Both A and R are true, and R is the correct explanation of A.
- B) Both A and R are true, but R is not the correct explanation of A.
- C) A is true, but R is false.
- D) A is false, but R is true.

Answer: A

2. Case Study Type

A student wants to build a smart irrigation system using **4 sensors, 2 relays, an LCD display, and a Wi-Fi module**. The project requires many I/O pins for expansion.

Which Arduino board is the most suitable?

- A) Arduino Nano
- B) Arduino Uno
- C) Arduino Mega 2560
- D) Arduino Mini

Answer: C

3. Table-Based Inference

Board **Digital** **I/O** **Analog** **Inputs** **Application**

X	14	6			Basic Projects
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Y	54	16			Large Projects
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Which option correctly identifies Boards X and Y?

- A) X–Nano, Y–Uno
- B) X–Uno, Y–Mega 2560
- C) X–Mega, Y–Nano
- D) X–Due, Y–Uno

Answer: B

4. Flowchart-Based Question

A user follows these steps:

Connect Arduino → Open IDE → Select Board → Select COM Port → Upload Sketch

If the **COM port is not selected**, what is the most likely outcome?

- A) Program uploads successfully.
- B) Upload fails because the IDE cannot communicate with the board.
- C) Arduino is permanently damaged.
- D) The LED blinks automatically.

Answer: B

5. Application-Based Question

A robot uses:

- 2 Push Buttons
- 1 Temperature Sensor
- 1 Servo Motor

Which statement is correct?

- A) Push buttons are digital inputs, and the temperature sensor provides an analog input.
- B) All devices provide analog inputs.
- C) Servo motor is an input device.
- D) Push buttons are analog outputs.

Answer: A

6. Communication Inference

An Arduino is connected to an RTC (Real-Time Clock) module using only **two signal wires (SDA and SCL)**.

Which communication protocol is being used?

- A) UART
- B) SPI
- C) I²C
- D) USB

Answer: C

7. Comparative Analysis

Three communication methods are available:

Interface Wires Required

- | | |
|---|---|
| X | 2 |
| Y | 4 |

Interface Wires Required

Z 2 (TX, RX)

Which option correctly identifies X, Y, and Z?

- A) X–SPI, Y–UART, Z–I²C
- B) X–I²C, Y–SPI, Z–UART
- C) X–UART, Y–I²C, Z–SPI
- D) X–USB, Y–UART, Z–SPI

Answer: B

8. Problem-Solving Question

A student uploads an Arduino sketch, but the IDE displays "**Board not found.**"

Which action should be performed first?

- A) Replace the microcontroller.
- B) Select the correct Board and COM Port in the IDE.
- C) Change the Arduino programming language.
- D) Increase the RAM.

Answer: B

9. Design-Based Question

A weather monitoring system uses **multiple analog sensors, several digital devices**, and **future expansion** is expected.

Which board provides the best flexibility?

- A) Arduino Nano
- B) Arduino Uno
- C) Arduino Mega 2560
- D) Arduino Pro Mini

Answer: C

Part – B

1. Explain the **features and architecture of the Arduino Uno** with a neat diagram. Describe the functions of its major components.
2. Compare the **Arduino Uno, Arduino Nano, and Arduino Mega** with respect to processor, memory, I/O pins, communication interfaces, and applications.
3. Explain the **procedure for installing the Arduino IDE** and describe the steps involved in uploading a program to an Arduino board.
4. Explain the **communication interfaces of Arduino (UART, SPI, and I²C)**. Compare them based on the number of wires, speed, applications, and advantages.

Analytical Question

5. A college plans to develop a Smart Classroom Monitoring System using Arduino. The system should measure temperature and light intensity, display the readings on an LCD, and send the data to a computer through serial communication. Future expansion with Wi-Fi is also required.

Based on the above requirements:

1. Select the most suitable **Arduino board** and justify your choice.
2. Draw the hardware block diagram.
3. Explain the purpose of the digital pins, analog pins, and communication interface used.
4. Describe how the Arduino IDE is used to upload the program.

UNIT III – Arduino Programming & Library Functions

Part – A

MCQs

1. Which software is used to write and upload Arduino programs?

- A) MPLAB IDE
- B) Arduino IDE
- C) Keil μ Vision
- D) Code Composer Studio

Answer: B

2. An Arduino program is called a

- A) Script
- B) Sketch
- C) Project
- D) Module

Answer: B

3. Which function is executed only once after the Arduino is powered on or reset?

- A) loop()
- B) main()
- C) setup()
- D) begin()

Answer: C

4. Which function executes continuously after setup()?

- A) loop()
- B) while()

- C) run()
- D) execute()

Answer: A

5. Which data type stores only TRUE or FALSE values?

- A) int
- B) float
- C) boolean
- D) char

Answer: C

6. Which data type is used to store a single character?

- A) int
- B) char
- C) float
- D) long

Answer: B

7. Which data type is suitable for storing decimal numbers?

- A) boolean
- B) int
- C) float
- D) char

Answer: C

8. Which keyword is used to declare a constant value in Arduino?

- A) define
- B) constant
- C) const
- D) fixed

Answer: C

9. A variable declared inside a function is called a

- A) Global variable
- B) Local variable
- C) Static variable
- D) External variable

Answer: B

10. A variable declared outside all functions is called a

- A) Local variable
- B) Temporary variable

- C) Global variable
- D) Dynamic variable

Answer: C

11. Which operator is used for addition?

- A) *
- B) /
- C) +
- D) %

Answer: C

12. Which operator is used to compare two values for equality?

- A) =
- B) ==
- C) !=
- D) <=

Answer: B

13. Which control statement is used to execute one of several alternatives?

- A) while
- B) for
- C) switch-case
- D) do-while

Answer: C

14. Which loop is guaranteed to execute at least once?

- A) for
- B) while
- C) do...while
- D) infinite loop

Answer: C

15. Which loop is commonly used when the number of iterations is known?

- A) do...while
- B) while
- C) for
- D) switch

Answer: C

16. Which function is used to configure a pin as INPUT or OUTPUT?

- A) digitalWrite()
- B) digitalRead()

- C) pinMode()
- D) analogRead()

Answer: C

17. Which function reads the logic level of a digital input pin?

- A) analogRead()
- B) digitalRead()
- C) digitalWrite()
- D) pinMode()

Answer: B

18. Which function is used to set a digital output pin HIGH or LOW?

- A) digitalWrite()
- B) digitalRead()
- C) analogRead()
- D) analogReference()

Answer: A

19. Which function reads the value from an analog input pin?

- A) digitalRead()
- B) analogRead()
- C) digitalWrite()
- D) analogWrite()

Answer: B

20. Which function is used to select the reference voltage for analog input conversion?

- A) analogRead()
- B) analogReference()
- C) digitalRead()
- D) pinMode()

Answer: B

21. Which of the following is NOT an Arduino library function listed in the syllabus?

- A) pinMode()
- B) digitalRead()
- C) analogReference()
- D) printf()

Answer: D

Analytical MCQs

1. Assertion–Reason Type

Assertion (A): Every Arduino sketch must contain setup() and loop() functions.

Reason (R): setup() executes once after reset, while loop() executes repeatedly during program execution.

- A) Both A and R are true, and R is the correct explanation of A.
- B) Both A and R are true, but R is not the correct explanation of A.
- C) A is true, but R is false.
- D) A is false, but R is true.

Answer: A

2. Flowchart-Based Question

A program follows the sequence:

Start → setup() → loop() → Read Push Button → LED ON/OFF → Repeat

Which statement is correct?

- A) setup() executes continuously.
- B) loop() executes repeatedly until power is removed.
- C) loop() executes only once.
- D) setup() is optional.

Answer: B

3. Code Analysis

```
void setup() {  
    pinMode(13, OUTPUT);  
}  
  
void loop() {  
    digitalWrite(13, HIGH);  
}
```

What will happen after the program is uploaded?

- A) Pin 13 continuously remains HIGH.
- B) Pin 13 continuously remains LOW.
- C) Pin 13 acts as an input.
- D) The program produces a compilation error.

Answer: A

4. Table-Based Inference

Pin Mode Function

INPUT Read external signals

OUTPUT Drive external devices

To connect an LED to Arduino, the pin should be configured as

- A) INPUT
- B) OUTPUT
- C) ANALOG
- D) SERIAL

Answer: B

5. Application-Based Question

A temperature sensor is connected to analog pin **A0**.

Which Arduino function should be used to read the sensor value?

- A) digitalWrite()
- B) analogRead()
- C) digitalWrite()
- D) pinMode()

Answer: B

6. Comparative Analysis

A programmer needs to:

- Read a push button.
- Turn ON an LED when the button is pressed.

Which combination of Arduino functions is most appropriate?

- A) analogRead() and analogReference()
- B) digitalWrite() and digitalWrite()
- C) pinMode() and analogRead()
- D) delay() and analogWrite()

Answer: B

7. Problem-Solving Question

A student writes the following statement:

```
digitalWrite(8, HIGH);
```

However, pin 8 was **not configured using pinMode()**.

Which statement is most appropriate?

- A) The program will always work correctly.
- B) The pin should first be configured as OUTPUT using pinMode().
- C) digitalWrite() automatically configures the pin.
- D) analogRead() should be used instead.

Answer: B

8. Case Study

A program stores the marks of **10 students** in a single variable.

Which programming concept would make the program more efficient?

- A) Constant
- B) Array
- C) Loop only
- D) Operator

Answer: B

9. Inference-Based Question

A student wants to measure the voltage from a potentiometer accurately by changing the analog reference voltage before using analogRead().

Which Arduino function should be used?

- A) digitalWrite()
- B) pinMode()
- C) analogReference()
- D) digitalWrite()

Answer: C

Part – B

1. Explain the **structure of an Arduino program** with the help of a sample sketch. Describe the purpose of setup() and loop() functions.

2. Discuss the **data types, variables, constants, and operators** used in Arduino programming with suitable examples.

3. Explain the various **control statements** (if, if-else, switch, for, while, do-while) used in Arduino programming with examples.

4. Explain the Arduino library functions **pinMode(), digitalWrite(), digitalRead(), analogRead(), and analogReference()** with suitable programming examples.

Analytical Question

5. A greenhouse automation system should continuously monitor temperature. If the temperature exceeds 35°C, a cooling fan must turn ON automatically; otherwise, it should remain OFF.

Based on this application:

1. Draw the program flowchart.
2. Write the Arduino algorithm.
3. Explain the use of setup(), loop(), pinMode(), analogRead(), and digitalWrite().
4. Explain the control statements used in the program.

UNIT IV – Arduino Interface with Devices, Sensors and Actuators

Part – A

MCQs

1. Which Arduino program is commonly used to verify that an Arduino board is working?

- A) Servo Test
- B) Blink LED
- C) LCD Display
- D) Motor Control

Answer: B

2. Which component emits light when current flows through it?

- A) Relay
- B) LED
- C) Buzzer
- D) Switch

Answer: B

3. Which Arduino function is used to read an analog voltage?

- A) digitalWrite()
- B) analogRead()
- C) digitalWrite()
- D) analogWrite()

Answer: B

4. Which function is used to read the state of a digital input pin?

- A) analogRead()
- B) digitalWrite()
- C) digitalWrite()
- D) pinMode()

Answer: B

5. A seven-segment display is mainly used to display

- A) Images
- B) Alphabetic characters only
- C) Numerical digits
- D) Audio signals

Answer: C

6. The standard LCD module commonly interfaced with Arduino is

- A) 8×8 LCD
- B) 16×2 LCD
- C) 20×20 LCD
- D) 32×2 LCD

Answer: B

7. A relay is mainly used to

- A) Measure temperature
- B) Switch high-power electrical loads
- C) Detect motion
- D) Measure humidity

Answer: B

8. Which output device produces sound?

- A) LED
- B) LCD
- C) Buzzer
- D) LDR

Answer: C

9. A switch connected to Arduino is generally used as

- A) An output device
- B) An input device
- C) A sensor
- D) An actuator

Answer: B

10. Which sensor is used to measure temperature?

- A) DHT22
- B) LM35
- C) LDR
- D) PIR

Answer: B

11. The DHT22 sensor measures

- A) Distance only
- B) Temperature and humidity
- C) Light intensity
- D) Motion

Answer: B

12. PIR stands for

- A) Passive Infrared Sensor
- B) Pulse Infrared Receiver
- C) Programmable Input Relay
- D) Passive Input Register

Answer: A

13. Which sensor is used to detect human motion?

- A) LM35
- B) LDR
- C) PIR
- D) HC-SR04

Answer: C

14. The HC-SR04 module is used to measure

- A) Humidity
- B) Distance
- C) Light intensity
- D) Temperature

Answer: B

15. The HC-SR04 sensor works using

- A) Infrared rays
- B) Ultrasonic waves
- C) Laser light
- D) Magnetic field

Answer: B

16. LDR stands for

- A) Light Dependent Resistor
- B) Low Digital Register
- C) Linear Detection Relay
- D) Light Display Receiver

Answer: A

17. An LDR is used to measure

- A) Temperature
- B) Pressure
- C) Light intensity
- D) Humidity

Answer: C

18. Which actuator converts electrical energy into rotational motion?

- A) LED
- B) Relay
- C) DC Motor
- D) LDR

Answer: C

19. Which motor provides precise angular position control?

- A) DC Motor
- B) Induction Motor
- C) Servo Motor
- D) Universal Motor

Answer: C

20. A stepper motor rotates

- A) Continuously without control
- B) In fixed angular steps
- C) Only in the clockwise direction
- D) At constant speed only

Answer: B

21. Which of the following devices is classified as an actuator?

- A) LM35
- B) DHT22
- C) Servo Motor
- D) HC-SR04

Answer: C

Analytical MCQs

1. Assertion–Reason Type

Assertion (A): A relay is used when an Arduino needs to control high-voltage or high-current loads.

Reason (R): Arduino digital output pins cannot directly drive high-power electrical appliances.

- A) Both A and R are true, and R is the correct explanation of A.
- B) Both A and R are true, but R is not the correct explanation of A.
- C) A is true, but R is false.
- D) A is false, but R is true.

Answer: A

2. Case Study

A smart street light system turns ON the street lights automatically when it becomes dark.

Which sensor is most appropriate for this application?

- A) PIR Sensor
- B) LM35 Sensor
- C) LDR Sensor
- D) HC-SR04 Sensor

Answer: C

3. Table-Based Inference

Sensor Measured Quantity

- X Temperature
- Y Distance
- Z Motion

Which option correctly identifies X, Y, and Z?

- A) X–LM35, Y–HC-SR04, Z–PIR
- B) X–PIR, Y–LM35, Z–LDR
- C) X–DHT22, Y–PIR, Z–LM35
- D) X–LDR, Y–HC-SR04, Z–LM35

Answer: A

4. Flowchart-Based Question

A home security system follows the sequence:

Start → Read PIR Sensor → Motion Detected? → Yes: Turn ON Buzzer → No: Continue Monitoring

When does the buzzer sound?

- A) Continuously after power ON.
- B) Only when motion is detected.
- C) Only when temperature increases.
- D) Only when the light intensity decreases.

Answer: B

5. Application-Based Question

A water tank monitoring system uses an ultrasonic sensor to measure the water level.

Which sensor should be selected?

- A) LM35
- B) HC-SR04
- C) DHT22
- D) LDR

Answer: B

6. Comparative Analysis

A project requires **precise angular positioning** of a robotic arm.

Which actuator is the best choice?

- A) DC Motor
- B) Servo Motor
- C) Relay
- D) Buzzer

Answer: B

7. Problem-Solving Question

A student interfaces a **16×2 LCD** with Arduino, but no characters appear on the display.

Which should be checked first?

- A) Proper LCD power supply and wiring connections.
- B) Replace the Arduino board immediately.
- C) Increase the clock frequency of the Arduino.
- D) Remove the LCD and use an LED instead.

Answer: A

8. Device Selection

A smart room automation system must perform the following:

- Detect human presence.
- Switch ON a fan.
- Display room temperature.

Which combination of devices is most suitable?

- A) PIR Sensor, Relay, LM35 Sensor, 16×2 LCD
- B) LDR, Servo Motor, Buzzer, LED

- C) HC-SR04, Stepper Motor, Seven-Segment Display
D) Potentiometer, Relay, LED, Switch

Answer: A

9. Inference-Based Question

A greenhouse monitoring system records the **temperature** and **humidity** simultaneously using a single sensor.

Which sensor should be used?

- A) LM35
B) HC-SR04
C) DHT22
D) PIR

Answer: C

Part – B

1. Explain the interfacing of **LED, Push Button Switch, and 16×2 LCD** with Arduino. Draw the circuit diagrams and explain their operation.

2. Describe the working principle and Arduino interfacing of the following sensors:

- LM35 Temperature Sensor
- DHT22 Temperature and Humidity Sensor
- PIR Motion Sensor
- HC-SR04 Ultrasonic Sensor

3. Explain the interfacing and applications of **LDR, Relay, and Buzzer** using Arduino with neat circuit diagrams.

4. Explain the interfacing and working of **DC Motor, Servo Motor, and Stepper Motor** with Arduino. Compare their characteristics and applications.

Analytical Question

5. Design a Smart Home Security System using Arduino that detects human movement using a PIR sensor. When motion is detected, a buzzer should sound, an LED should glow, and a message should be displayed on a 16×2 LCD.

Based on this application:

1. Draw the interfacing circuit/block diagram.
2. Explain the working principle of each component.
3. Describe the sequence of operation.

4. Suggest two improvements to make the system more reliable.

UNIT V – Embedded Application Development with Arduino

Part – A

MCQs

1. Arduino can be used to measure an unknown resistance using a

- A) Voltage divider circuit
- B) Transformer
- C) Oscillator
- D) Relay

Answer: A

2. Which sensor is commonly used with Arduino to measure temperature?

- A) HC-SR04
- B) LM35
- C) PIR
- D) LDR

Answer: B

3. Light intensity can be measured using

- A) DHT22
- B) LM35
- C) LDR
- D) Relay

Answer: C

4. Which sensor is used to measure distance in centimeters?

- A) PIR
- B) HC-SR04
- C) LDR
- D) DHT22

Answer: B

5. The HC-SR04 sensor measures

- A) Pressure
- B) Humidity
- C) Distance
- D) Voltage

Answer: C

6. Angle of rotation can be measured using a

- A) Relay
- B) Potentiometer
- C) LED
- D) Buzzer

Answer: B

7. A potentiometer is primarily used as a

- A) Variable resistor
- B) Temperature sensor
- C) Motion sensor
- D) Motor

Answer: A

8. Which sensor is used to measure humidity?

- A) LM35
- B) DHT22
- C) HC-SR04
- D) LDR

Answer: B

9. Bluetooth communication enables Arduino to communicate with

- A) Printer only
- B) Android phone
- C) Television only
- D) Monitor

Answer: B

10. Which module is commonly used for Bluetooth communication with Arduino?

- A) ESP8266
- B) HC-05
- C) GSM Module
- D) RFID Reader

Answer: B

11. Wi-Fi communication allows Arduino to connect to

- A) Local Area Network
- B) Relay
- C) Seven-segment display
- D) Buzzer

Answer: A

12. Which module is commonly used to add Wi-Fi capability to Arduino?

- A) HC-SR04
- B) ESP8266
- C) LM35
- D) DHT22

Answer: B

13. LAN stands for

- A) Local Area Network
- B) Logical Analog Network
- C) Long Access Network
- D) Linear Area Node

Answer: A

14. Sending sensor data to the Internet is an example of

- A) Embedded networking
- B) Analog interfacing
- C) Display control
- D) Power management

Answer: A

15. Which of the following is an Internet-based application of Arduino?

- A) Uploading sensor data to a cloud server
- B) Driving a DC motor only
- C) Blinking an LED
- D) Reading a push button

Answer: A

16. Which communication technology is most suitable for short-range wireless communication with a mobile phone?

- A) Bluetooth
- B) Ethernet
- C) HDMI
- D) VGA

Answer: A

17. Which communication technology provides Internet connectivity to Arduino?

- A) Wi-Fi
- B) Relay
- C) LCD
- D) Potentiometer

Answer: A

18. The main purpose of embedded application development is to

- A) Create real-world hardware applications
- B) Increase RAM size
- C) Design operating systems
- D) Replace the microcontroller

Answer: A

19. Arduino-based IoT applications mainly involve

- A) Sensor data collection and Internet communication
- B) Only text editing
- C) Only video playback
- D) Only gaming

Answer: A

20. Which of the following is NOT included in Unit V?

- A) Measurement of humidity
- B) Bluetooth communication
- C) Wi-Fi and LAN applications
- D) PCB fabrication

Answer: D

21. Which of the following is an application mentioned in the syllabus?

- A) Measurement of light intensity
- B) Measurement of humidity
- C) Sending data through the Internet
- D) All of the above

Answer: D

Analytical MCQs

1. Assertion–Reason Type

Assertion (A): Arduino can be used for Internet of Things (IoT) applications.

Reason (R): Arduino can acquire sensor data and transmit it to the Internet using communication modules such as Wi-Fi.

- A) Both A and R are true, and R is the correct explanation of A.
- B) Both A and R are true, but R is not the correct explanation of A.
- C) A is true, but R is false.
- D) A is false, but R is true.

Answer: A

2. Case Study

A farmer wants to monitor the **temperature** and **humidity** of a greenhouse and send the readings to a mobile application through Wi-Fi.

Which combination is most suitable?

- A) DHT22 + Wi-Fi Module
- B) LM35 + Relay
- C) HC-SR04 + Servo Motor
- D) LDR + Seven-Segment Display

Answer: A

3. Table-Based Inference

Application Sensor/Device

X	LDR
Y	HC-SR04
Z	Potentiometer

Which option correctly matches the application?

- A) X–Light Intensity, Y–Distance, Z–Angle of Rotation
- B) X–Temperature, Y–Humidity, Z–Voltage
- C) X–Distance, Y–Motion, Z–Current
- D) X–Humidity, Y–Light, Z–Resistance

Answer: A

4. Flowchart-Based Question

A smart water tank controller follows the sequence:

Start → Read HC-SR04 Sensor → Water Level Low? → Yes: Turn ON Pump → No: Pump OFF → Repeat

When will the water pump operate?

- A) Only when the water level is below the preset limit.
- B) Continuously after power ON.
- C) Only when the temperature increases.
- D) Only when the humidity decreases.

Answer: A

5. Problem-Solving Question

An Arduino project sends sensor data to an Android phone using an **HC-05 Bluetooth module**, but no data is received.

Which should be verified first?

- A) Bluetooth pairing and serial communication settings.
- B) Replace the Arduino board.
- C) Increase the supply voltage to 12 V.
- D) Remove the Bluetooth module.

Answer: A

6. Application-Based Question

A project measures the **rotation angle of a control knob** connected to Arduino.

Which component is most suitable?

- A) PIR Sensor
- B) Potentiometer
- C) Relay
- D) Buzzer

Answer: B

7. Comparative Analysis

A weather monitoring system must **upload sensor readings to a cloud server**.

Which communication method is the most appropriate?

- A) Wi-Fi
- B) Seven-Segment Display
- C) Buzzer
- D) Relay

Answer: A

8. Design-Based Question

A smart home system must perform the following:

- Measure room temperature.
- Measure light intensity.
- Send the readings to the Internet.

Which combination of components is most appropriate?

- A) LM35 + LDR + Wi-Fi Module
- B) PIR + Relay + Servo Motor
- C) HC-SR04 + Stepper Motor + LCD
- D) Seven-Segment Display + Buzzer + Switch

Answer: A

9. Inference-Based Question

A student develops an Arduino application that measures **temperature, humidity, and light intensity**, then displays the values on a mobile phone using wireless communication.

Which statement best describes this application?

- A) It is an embedded IoT application combining sensing and wireless communication.
- B) It is only a display application.
- C) It is only a motor-control application.
- D) It is only an analog measurement circuit.

Answer: A

Part – B

1. Explain how Arduino can be used to measure the following:

- Unknown Resistance
- Temperature
- Light Intensity
- Distance

Draw suitable block diagrams wherever necessary.

2. Explain the measurement of **angle of rotation using a potentiometer** and **humidity using a DHT22 sensor** with Arduino. Write the algorithm for both applications.

3. Explain the **Bluetooth communication between Arduino and an Android mobile phone**. Draw the block diagram and describe the communication process.

4. Explain the development of an **IoT-based Arduino application using Wi-Fi/LAN** for transmitting sensor data to the Internet. Draw the block diagram and explain the working principle.

Analytical Question

5. A farmer wants to monitor the temperature, humidity, and light intensity in a greenhouse using Arduino. The measured data should be displayed on a mobile phone and uploaded to the Internet for remote monitoring.

Based on the above application:

1. Draw the complete system block diagram.
2. Select suitable sensors and communication modules with justification.
3. Explain the complete working of the system.
4. Discuss the advantages of this IoT-based monitoring system over manual monitoring.