

ICH582 - EMBEDDED SYSTEM DESIGN WITH ARDUINO

MCQ

Unit I

1. What is an embedded system?
 - A) A general-purpose computer
 - B) A computer system designed for a specific function
 - C) A supercomputer
 - D) A mainframe computer

Answer: B) A computer system designed for a specific function

2. Which is a major characteristic of an embedded system?
 - A) Performs unlimited tasks
 - B) Designed for a specific application
 - C) Requires a large operating system always
 - D) Used only for gaming

Answer: B) Designed for a specific application

3. Embedded systems are mainly designed to perform:
 - A) General-purpose computing
 - B) Specific functions
 - C) Internet browsing only
 - D) Word processing only

Answer: B) Specific functions

4. Which of the following is NOT an embedded system application?
 - A) Washing machine
 - B) Automobile control system
 - C) Microwave oven
 - D) Desktop word processor

Answer: D) Desktop word processor

5. Small-scale embedded systems generally use:
 - A) Single 8-bit or 16-bit microcontroller
 - B) Supercomputer
 - C) Mainframe processor
 - D) Multiple servers

Answer: A) Single 8-bit or 16-bit microcontroller

6. Medium-scale embedded systems are generally:
- A) Simpler than small-scale systems
 - B) More complex and may use operating systems
 - C) Used only for calculators
 - D) Without processors

Answer: B) More complex and may use operating systems

7. Sophisticated embedded systems are characterized by:
- A) Very low complexity
 - B) High computational complexity
 - C) No software
 - D) No memory

Answer: B) High computational complexity

8. Which of the following is an important quality attribute of an embedded system?
- A) Reliability
 - B) Entertainment
 - C) Large physical size
 - D) High power consumption

Answer: A) Reliability

9. The main purpose of an embedded system is to:
- A) Perform a dedicated task
 - B) Replace all computers
 - C) Store movies
 - D) Browse websites

Answer: A) Perform a dedicated task

10. Which component executes instructions in an embedded system?
- A) Processor
 - B) Keyboard
 - C) Monitor
 - D) Printer

Answer: A) Processor

11. A microcontroller generally contains:
- A) CPU only
 - B) CPU, memory and peripherals on a single chip
 - C) Monitor and keyboard
 - D) Hard disk only

Answer: B) CPU, memory and peripherals on a single chip

12. A microprocessor mainly contains:
- A) CPU on a chip
 - B) CPU, RAM and I/O peripherals on one chip
 - C) Sensors only
 - D) Memory only

Answer: A) CPU on a chip

13. Which is generally preferred for dedicated embedded applications?
- A) Microcontroller
 - B) Mainframe
 - C) Desktop computer
 - D) Supercomputer

Answer: A) Microcontroller

14. A compiler converts:
- A) Machine code into source code
 - B) High-level language into machine/object code
 - C) Hardware into software
 - D) Binary into decimal only

Answer: B) High-level language into machine/object code

15. A cross compiler is used to:
- A) Compile programs for a different target processor/system
 - B) Convert analog signals to digital signals
 - C) Simulate hardware only
 - D) Design circuits

Answer: A) Compile programs for a different target processor/system

16. An assembler converts:
- A) Assembly language into machine code
 - B) Machine code into English
 - C) C language into assembly only
 - D) Analog signals into digital signals

Answer: A) Assembly language into machine code

17. A simulator is used to:
- A) Physically manufacture a processor
 - B) Model and test system operation without the actual hardware
 - C) Increase memory size
 - D) Replace the power supply

Answer: B) Model and test system operation without the actual hardware

18. Which of the following is an application area of embedded systems?

- A) Consumer electronics
- B) Automobile systems
- C) Medical equipment
- D) All of the above

Answer: D) All of the above

19. Real-time response is important in:

- A) Many embedded systems
- B) Only word processors
- C) Only printers
- D) Only calculators

Answer: A) Many embedded systems

20. Which factor is particularly important in portable embedded systems?

- A) Power consumption
- B) Keyboard size
- C) Monitor resolution
- D) Printer speed

Answer: A) Power consumption

21. The structure of an embedded system generally includes:

- A) Hardware and software
- B) Printer and scanner only
- C) Keyboard only
- D) Monitor only

Answer: A) Hardware and software

Analytical Reasoning

22. A washing machine has a microcontroller that continuously monitors water level, temperature, and motor speed. Which feature best explains why it is considered an embedded system?

- A) It can run multiple general-purpose applications
- B) It is designed for a specific control function
- C) It requires a keyboard and monitor
- D) It is mainly used for internet browsing

Answer: B) It is designed for a specific control function

23. A system must perform one dedicated task with limited memory, low power consumption, and fast response. Which type of computing system is most appropriate?

- A) General-purpose computer

- B) Embedded system
- C) Supercomputer
- D) Mainframe computer

Answer: B) Embedded system

24. An embedded system needs to respond to a sensor signal within a fixed time limit. Which characteristic is most important?
- A) Large storage capacity
 - B) High graphical performance
 - C) Real-time operation
 - D) Ability to install many applications

Answer: C) Real-time operation

25. Consider the following systems: Digital camera, Desktop computer, Microwave oven, Automatic washing machine. Which group mainly represents embedded systems?
- A) 1, 3 and 4
 - B) 1 and 2 only
 - C) 2 and 4 only
 - D) 2, 3 and 4

Answer: A) 1, 3 and 4

26. A system contains a processor, memory, input/output interfaces, and software designed to perform a dedicated function inside a larger product. Which block mainly determines the sequence of operations?
- A) Power supply
 - B) Processor
 - C) Sensor
 - D) Display unit

Answer: B) Processor

27. A designer chooses a microcontroller instead of a microprocessor for a temperature-control application. What is the most reasonable justification?
- A) A microcontroller generally integrates CPU, memory and peripherals on a single chip
 - B) A microcontroller always has higher processing speed
 - C) A microcontroller requires more external components
 - D) A microcontroller is intended only for desktop computers

Answer: A) A microcontroller generally integrates CPU, memory and peripherals on a single chip

28. A program is written on a computer using a development environment but must ultimately execute on an ARM-based embedded controller. Which tool is specifically required to generate code for the target processor?

- A) Simulator
- B) Cross compiler
- C) Text editor
- D) Debugger only

Answer: B) Cross compiler

29. A programmer wants to test an embedded program before downloading it into the actual hardware. Which tool can imitate the behavior of the target system?

- A) Assembler
- B) Simulator
- C) Compiler
- D) Linker

Answer: B) Simulator

30. An assembly-language program contains instructions such as MOV, ADD, and JMP. Which software converts these mnemonic instructions into machine code?

- A) Compiler
- B) Cross compiler
- C) Assembler
- D) Simulator

Answer: C) Assembler

Unit II

1. Arduino is primarily an:
 - A) Open-source electronics platform
 - B) Operating system
 - C) Database
 - D) Web browser

Answer: A) Open-source electronics platform

2. Arduino boards are mainly based on:
 - A) Microcontrollers
 - B) Hard disks
 - C) Graphics cards
 - D) Printers

Answer: A) Microcontrollers

3. Which Arduino board is commonly used for beginner-level projects?
 - A) Arduino Uno
 - B) Arduino Mega only

- C) Arduino Server
- D) Arduino Mainframe

Answer: A) Arduino Uno

4. Arduino Uno commonly uses which microcontroller?
- A) ATmega328P
 - B) ATmega2560
 - C) AT89C51
 - D) PIC16F84

Answer: A) ATmega328P

5. Arduino Mega 2560 uses:
- A) ATmega328P
 - B) ATmega2560
 - C) AT89S52
 - D) ESP8266

Answer: B) ATmega2560

6. Which Arduino board is suitable when a large number of I/O pins are required?
- A) Arduino Mega
 - B) Arduino Uno
 - C) Arduino Nano only
 - D) None

Answer: A) Arduino Mega

7. Arduino Nano is known for its:
- A) Compact size
 - B) Large display
 - C) Built-in hard disk
 - D) Large power supply

Answer: A) Compact size

8. Arduino Uno has how many digital I/O pins?
- A) 8
 - B) 14
 - C) 20
 - D) 54

Answer: B) 14

9. How many analog input pins are available on the Arduino Uno R3?
- A) 4
 - B) 6

- C) 8
- D) 16

Answer: B) 6

10. Which type of peripheral reads continuous voltage levels?
- A) Analog input
 - B) Digital output only
 - C) UART only
 - D) LED only

Answer: A) Analog input

11. Digital signals generally have:
- A) Two logic states
 - B) Infinite logic states
 - C) No logic states
 - D) Only analog values

Answer: A) Two logic states

12. Which interface is commonly used for serial communication in Arduino Uno?
- A) UART/Serial
 - B) VGA
 - C) HDMI
 - D) PS/2

Answer: A) UART/Serial

13. Which communication interface uses two wires called SDA and SCL?
- A) I²C
 - B) UART
 - C) SPI
 - D) USB

Answer: A) I²C

14. Which communication interface commonly uses MOSI, MISO, SCK and SS/CS?
- A) SPI
 - B) I²C
 - C) UART
 - D) USB

Answer: A) SPI

15. USB connection on an Arduino board can be used for:
- A) Programming and serial communication
 - B) Only powering external motors

- C) Measuring temperature
- D) Increasing RAM

Answer: A) Programming and serial communication

16. Which pin is commonly used to provide 5 V on an Arduino Uno?
- A) 5V pin
 - B) A0 pin
 - C) TX pin
 - D) RESET only

Answer: A) 5V pin

17. The Arduino IDE is used primarily to:
- A) Write, compile and upload Arduino programs
 - B) Manufacture Arduino boards
 - C) Design mechanical parts
 - D) Measure resistance directly

Answer: A) Write, compile and upload Arduino programs

18. Which of the following is a communication model used in Arduino systems?
- A) Serial communication
 - B) Parallel printer only
 - C) Mechanical communication
 - D) Hydraulic communication

Answer: A) Serial communication

19. Which Arduino board generally has the largest number of digital I/O pins among Uno, Nano and Mega?
- A) Nano
 - B) Uno
 - C) Mega
 - D) All have the same number

Answer: C) Mega

20. Arduino peripherals can include:
- A) Sensors and actuators
 - B) Only keyboards
 - C) Only monitors
 - D) Only hard disks

Answer: A) Sensors and actuators

21. Which of the following is NOT an Arduino board?
- A) Arduino Uno

- B) Arduino Nano
- C) Arduino Mega
- D) Arduino Pentium

Answer: D) Arduino Pentium

Analytical Reasoning

22. A student needs to build a compact sensor-based project where space on the breadboard is limited. Which Arduino board would be the most suitable choice?

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

Answer: B) Arduino Nano

23. A project requires a large number of digital I/O pins because it must control several motors, LEDs, and displays simultaneously. Which Arduino board would be the better choice?

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

Answer: C) Arduino Mega

24. A beginner wants to develop a simple temperature-monitoring system using a few sensors and LEDs. Why is Arduino Uno generally a suitable choice?

- A) It provides a reasonable number of I/O pins and is easy to program
- B) It has the largest number of I/O pins in the Arduino family
- C) It does not require a microcontroller
- D) It is designed only for industrial automation

Answer: A) It provides a reasonable number of I/O pins and is easy to program

25. An LDR is connected to an Arduino to measure changes in light intensity. Which type of Arduino peripheral should normally be used to obtain varying voltage values from the LDR?

- A) Digital input
- B) Analog input
- C) Digital output
- D) PWM output only

Answer: B) Analog input

26. A push button is connected to an Arduino. The program only needs to determine whether the button is pressed or released. Which type of pin is most appropriate?
- A) Analog input
 - B) Digital input
 - C) Analog output
 - D) Serial transmit pin only

Answer: B) Digital input

27. An Arduino needs to communicate with a computer to send sensor readings continuously. Which communication interface is commonly used for this purpose?
- A) UART/Serial communication
 - B) SPI only
 - C) I²C only
 - D) Analog input

Answer: A) UART/Serial communication

28. Suppose an Arduino must communicate with several sensors using only two signal lines. Which communication interface is particularly suitable when multiple devices share the same bus?
- A) I²C
 - B) UART
 - C) PWM
 - D) Analog input

Answer: A) I²C

29. A designer wants very fast communication between an Arduino and a display module using separate data lines for sending and receiving data. Which interface would be a suitable choice?
- A) SPI
 - B) ADC
 - C) PWM
 - D) Digital input

Answer: A) SPI

30. During Arduino board installation, the computer does not recognize the connected board correctly. Which step should be checked first?
- A) Increase the sensor supply voltage
 - B) Select the correct board and communication port in the Arduino IDE
 - C) Change all digital pins to analog pins
 - D) Rewrite the complete Arduino program

Answer: B) Select the correct board and communication port in the Arduino IDE

Unit III

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

- A) Arduino IDE
- B) Photoshop
- C) AutoCAD
- D) MATLAB only

Answer: A) Arduino IDE

2. An Arduino sketch normally contains which two main functions?

- A) start() and stop()
- B) setup() and loop()
- C) main() and exit()
- D) begin() and end()

Answer: B) setup() and loop()

3. The setup() function is executed:

- A) Repeatedly
- B) Once when the program starts
- C) Only after loop()
- D) Never

Answer: B) Once when the program starts

4. The loop() function is executed:

- A) Only once
- B) Repeatedly
- C) Before setup()
- D) Only during compilation

Answer: B) Repeatedly

5. Which data type is used to store true or false values?

- A) Boolean
- B) Float
- C) Char
- D) Long

Answer: A) Boolean

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

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

Answer: A) char

7. Which data type is used to store numbers with decimal values?

- A) float
- B) char
- C) Boolean
- D) unsigned char

Answer: A) float

8. A variable declared inside a function is called a:

- A) Global variable
- B) Local variable
- C) Constant
- D) Register

Answer: B) Local variable

9. A variable declared outside all functions is generally called a:

- A) Local variable
- B) Global variable
- C) Temporary variable
- D) Loop variable only

Answer: B) Global variable

10. Which operator is used for addition?

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

Answer: A) +

11. Which operator is used to test equality?

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

Answer: B) ==

12. Which operator represents logical AND?

- A) ||
- B) &&
- C) !
- D) &

Answer: B) &&

13. Which statement is used to make a decision based on a condition?

- A) if
- B) for
- C) array
- D) function

Answer: A) if

14. Which statement is suitable for selecting one option from several fixed choices?

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

Answer: A) switch-case

15. Which loop executes while its condition is true?

- A) while loop
- B) switch
- C) if
- D) break

Answer: A) while loop

16. Which loop executes its body at least once?

- A) while
- B) for
- C) do-while
- D) if

Answer: C) do-while

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

- A) for loop
- B) switch
- C) if
- D) do-while only

Answer: A) for loop

18. Which function is used to configure an Arduino pin as INPUT or OUTPUT?

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

Answer: A) pinMode()

19. Which function reads the logic state of a digital pin?

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

Answer: B) digitalRead()

20. Which function reads an analog input value?

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

Answer: A) analogRead()

21. Which function is used to introduce a time delay in milliseconds?

- A) delay()
- B) wait()
- C) stop()
- D) timeDelay()

Answer: A) delay()

Analytical Reasoning

22. A student has installed the Arduino IDE and connected an Arduino Uno, but the program cannot be uploaded. Which combination should be checked first?

- A) Sketch structure and variable scope
- B) Board type and communication port
- C) Data type and arithmetic operators
- D) if and while statements

Answer: B) Board type and communication port

23. Consider the following Arduino sketch:

```
int x = 10;

void setup() {
  int y = 20;
}

void loop() {
  x = x + 5;
}
```

Which statement is correct?

- A) Both x and y can be accessed inside loop()
- B) Only y can be accessed inside loop()
- C) x is a global variable, while y is a local variable
- D) Both x and y are global variables

Answer: C) x is a global variable, while y is a local variable

24. An Arduino sensor produces values ranging from 0 to 1023. A student wants to store these readings as whole numbers without negative values. Which data type is the most appropriate?

- A) float
- B) char
- C) unsigned int
- D) Boolean

Answer: C) unsigned int

25. Consider:

```
int a = 7;  
int b = 3;  
int result = a / b;
```

What will be stored in result?

- A) 2
- B) 2.33
- C) 3
- D) 21

Answer: A) 2

26. An LED should turn ON only when a temperature is greater than 30°C and a switch is pressed. Which logical expression best represents this condition?

- A) temperature > 30 || switchState == HIGH
- B) temperature > 30 && switchState == HIGH
- C) temperature < 30 && switchState == LOW
- D) temperature == 30 || switchState == LOW

Answer: B) temperature > 30 && switchState == HIGH

27. A program must select one of several actions depending on the value of mode, where mode can be 1, 2, 3 or 4. Which control statement is most suitable?

- A) while
- B) do...while
- C) switch...case
- D) Infinite for loop

Answer: C) switch...case

28. Consider the following code:

```
int i = 0;

while (i < 5) {
  digitalWrite(13, HIGH);
}
```

What is the most likely problem?

- A) The loop executes exactly five times
- B) The loop never executes
- C) The value of i never changes, so the loop becomes infinite
- D) digitalWrite() automatically increments i

Answer: C) The value of i never changes, so the loop becomes infinite

29. A student wants a block of code to execute at least once, even when the initial condition is false. Which control structure should be selected?

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

Answer: D) do...while

30. An Arduino program repeatedly needs to calculate the average of sensor readings. Instead of writing the same statements several times, the student creates a separate block that can be called whenever required. What programming concept is being used?

- A) Variable scope
- B) Function
- C) Constant
- D) Bitwise operator

Answer: B) Function

Unit IV

1. In an Arduino LED blinking program, which function is normally used to configure the LED pin as an output?

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

Answer: C) pinMode()

2. If an LED is connected to an Arduino digital pin and `digitalWrite(pin, HIGH)` is executed, the pin produces approximately:
- A) 0 V
 - B) 1 V
 - C) 5 V
 - D) -5 V

Answer: C) 5 V

3. An Arduino Uno reads an analog voltage using `analogRead()`. What is the typical ADC range?
- A) 0–255
 - B) 0–512
 - C) 0–1023
 - D) 0–4095

Answer: C) 0–1023

4. A digital switch connected to an Arduino gives only HIGH or LOW states. Which function is appropriate for reading it?
- A) `analogRead()`
 - B) `digitalRead()`
 - C) `analogWrite()`
 - D) `digitalWrite()`

Answer: B) `digitalRead()`

5. A seven-segment display is used with Arduino mainly to display:
- A) Analog waveforms
 - B) Numerical or selected alphanumeric characters
 - C) Temperature directly
 - D) Sound signals

Answer: B) Numerical or selected alphanumeric characters

6. Why are current-limiting resistors generally connected with the segments of a seven-segment display?
- A) To increase the supply voltage
 - B) To limit LED segment current
 - C) To convert analog signals
 - D) To store display data

Answer: B) To limit LED segment current

7. A 16×2 LCD can display:
- A) 16 rows and 2 columns
 - B) 16 characters and 2 rows

- C) 16 pixels and 2 rows
- D) 32 rows and 16 characters

Answer: B) 16 characters and 2 rows

8. If an Arduino program must switch a high-power load using a relay, the relay is useful because it:
- A) Converts analog signals into digital signals
 - B) Provides electrical isolation and allows switching of higher-power loads
 - C) Measures resistance
 - D) Increases Arduino memory

Answer: B) Provides electrical isolation and allows switching of higher-power loads

9. A buzzer connected to a digital output can be activated by making the output:
- A) HIGH
 - B) LOW only
 - C) Floating only
 - D) Analog input

Answer: A) HIGH

10. The LM35 temperature sensor has an output voltage that varies approximately:
- A) 10 mV per °C
 - B) 100 mV per °C
 - C) 1 V per °C
 - D) 5 V per °C

Answer: A) 10 mV per °C

11. If the LM35 output is approximately 250 mV, the measured temperature is approximately:
- A) 2.5°C
 - B) 25°C
 - C) 250°C
 - D) 0.25°C

Answer: B) 25°C

12. Which Arduino library is commonly used to interface a DHT22 humidity and temperature sensor?
- A) Servo.h
 - B) LiquidCrystal.h
 - C) DHT.h
 - D) Stepper.h

Answer: C) DHT.h

13. The DHT22 sensor can provide measurements of:

- A) Temperature and humidity
- B) Pressure and flow
- C) Light and distance
- D) Speed and acceleration

Answer: A) Temperature and humidity

14. The output of a PIR sensor is generally used to detect:

- A) Temperature change
- B) Human/animal motion
- C) Liquid level
- D) Light intensity

Answer: B) Human/animal motion

15. In an HC-SR04 ultrasonic sensor, the distance is determined mainly by measuring the:

- A) Resistance of the object
- B) Echo return time of the ultrasonic pulse
- C) Light intensity reflected from the object
- D) Temperature of the object

Answer: B) Echo return time of the ultrasonic pulse

16. If the echo time from an HC-SR04 increases, the detected object is generally:

- A) Closer
- B) Farther away
- C) Moving into the sensor
- D) Producing more light

Answer: B) Farther away

17. An LDR is particularly suitable for measuring:

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

Answer: C) Light intensity

18. The resistance of a typical LDR generally ____ when the incident light intensity increases.

- A) Increases
- B) Decreases
- C) Remains exactly constant
- D) Becomes infinite

Answer: B) Decreases

19. Which Arduino device is most suitable when precise angular positioning is required, such as moving to 90°?
- A) DC motor
 - B) Servo motor
 - C) Buzzer
 - D) Relay

Answer: B) Servo motor

20. Unlike a DC motor, a stepper motor is particularly useful when the application requires:
- A) Only continuous uncontrolled rotation
 - B) Controlled movement in discrete steps
 - C) Temperature measurement
 - D) Light detection

Answer: B) Controlled movement in discrete steps

21. A DC motor requires an external driver circuit when controlled by an Arduino mainly because:
- A) Arduino cannot generate any digital signals
 - B) The motor may require more current than an Arduino pin can safely provide
 - C) Arduino cannot execute motor programs
 - D) DC motors work only with analog inputs

Answer: B) The motor may require more current than an Arduino pin can safely provide

Analytical Reasoning

22. An LED connected to an Arduino pin should blink every 1 second. Which approach is most appropriate?
- A) Use `analogRead()` continuously
 - B) Set the LED pin as OUTPUT, change its state, and introduce a time delay
 - C) Set the LED pin as INPUT and use `digitalRead()`
 - D) Connect the LED directly between two input pins

Answer: B) Set the LED pin as OUTPUT, change its state, and introduce a time delay

23. An Arduino is required to read a potentiometer whose output varies continuously between 0 V and 5 V. Which method is most suitable?
- A) `digitalRead()` on a digital pin
 - B) `analogRead()` on an analog input pin
 - C) `digitalWrite()` on an analog pin
 - D) `digitalWrite()` on a digital pin

Answer: B) `analogRead()` on an analog input pin

24. A seven-segment display is used to show the digit 5. The Arduino must selectively turn ON particular LED segments. Which statement best explains the required operation?
- A) All segments must always be turned ON
 - B) Appropriate segment pins must be driven HIGH or LOW according to the display type
 - C) Only one Arduino pin is sufficient for a normal seven-segment display
 - D) The display can only be controlled using `analogRead()`

Answer: B) Appropriate segment pins must be driven HIGH or LOW according to the display type

25. A 16×2 LCD is connected to Arduino to display the temperature measured by an LM35. Why is an LCD initialization step required before displaying characters?
- A) To convert analog voltage into temperature
 - B) To configure the LCD for communication and display operation
 - C) To increase the Arduino clock frequency
 - D) To convert digital signals into analog signals

Answer: B) To configure the LCD for communication and display operation

26. An Arduino controls a relay connected to a digital output. The relay is used to switch a high-power load. Why is a relay useful in this application?
- A) It directly increases the Arduino's ADC resolution
 - B) It provides electrical isolation and allows a low-power control signal to switch a separate load
 - C) It converts temperature into voltage
 - D) It stores sensor readings permanently

Answer: B) It provides electrical isolation and allows a low-power control signal to switch a separate load

27. An LM35 is connected to an Arduino. If the sensor output increases as the temperature increases, which operation is required before displaying temperature in $^{\circ}\text{C}$?
- A) Convert the sensor's analog voltage into a temperature value using its sensitivity
 - B) Use `digitalRead()` and treat the result as temperature
 - C) Use `digitalWrite()` to calculate temperature
 - D) Apply a PWM signal to the sensor

Answer: A) Convert the sensor's analog voltage into a temperature value using its sensitivity

28. A PIR sensor is connected to an Arduino and its output changes when a person moves in front of it. Which type of input is normally appropriate for detecting this change?
- A) Analog input only

- B) Digital input
- C) PWM output
- D) Analog output

Answer: B) Digital input

29. An HC-SR04 ultrasonic sensor is used to measure the distance of an object. The Arduino sends a trigger pulse and then measures the duration of the returning signal. What quantity is primarily used to calculate distance?
- A) Echo pulse time
 - B) LED brightness
 - C) LCD contrast voltage
 - D) Motor speed

Answer: A) Echo pulse time

30. An LDR is used in an automatic street-light project. During daytime, its resistance changes due to increased light. Which Arduino approach is most appropriate for determining when to switch the street light?
- A) Read the LDR through an analog input and compare the measured value with a threshold
 - B) Connect the LDR only to a PWM output
 - C) Use `digitalWrite()` to measure LDR resistance directly
 - D) Use the LCD as the sensor

Answer: A) Read the LDR through an analog input and compare the measured value with a threshold

Unit V

1. In the voltage divider method, an unknown resistance can be determined by measuring the:
- A) Frequency across the resistor
 - B) Voltage across a known resistor
 - C) Power factor of the circuit
 - D) Temperature of the resistor

Answer: B) Voltage across a known resistor

2. An Arduino is used to measure an unknown resistance using a known resistor. If the measured voltage changes, the unknown resistance can be calculated using:
- A) Ohm's law and voltage divider principle
 - B) Faraday's law only
 - C) Kirchhoff's frequency law
 - D) Coulomb's law

Answer: A) Ohm's law and voltage divider principle

3. Which sensor is commonly used with Arduino for measuring temperature?
- A) LDR
 - B) LM35
 - C) HC-SR04
 - D) PIR

Answer: B) LM35

4. If an LM35 produces approximately 0.30 V, what temperature does it represent approximately?
- A) 3°C
 - B) 30°C
 - C) 300°C
 - D) 0.3°C

Answer: B) 30°C

5. Which component is most suitable for measuring light intensity using an Arduino analog input?
- A) LDR
 - B) Servo motor
 - C) HC-SR04
 - D) Relay

Answer: A) LDR

6. When the intensity of light falling on a typical LDR increases, its resistance generally:
- A) Increases
 - B) Decreases
 - C) Remains constant
 - D) Becomes zero immediately

Answer: B) Decreases

7. Which sensor is commonly used to measure distance in centimetres with Arduino?
- A) LM35
 - B) DHT22
 - C) HC-SR04
 - D) LDR

Answer: C) HC-SR04

8. The HC-SR04 calculates distance mainly from the:
- A) Amplitude of the echo
 - B) Time taken by the ultrasonic echo to return
 - C) Resistance of the target
 - D) Temperature of the target

Answer: B) Time taken by the ultrasonic echo to return

9. A potentiometer connected to an Arduino analog input can be used to measure angular position because:
- A) Its resistance changes with temperature
 - B) Its output voltage changes with shaft rotation
 - C) It produces ultrasonic waves
 - D) It detects infrared radiation

Answer: B) Its output voltage changes with shaft rotation

10. If the potentiometer shaft is rotated, the Arduino can determine the angle by observing the change in:
- A) Analog input value
 - B) Digital communication speed
 - C) Serial baud rate
 - D) Program memory

Answer: A) Analog input value

11. Which sensor is commonly used with Arduino to measure relative humidity?
- A) DHT22
 - B) LDR
 - C) LM35
 - D) HC-SR04

Answer: A) DHT22

12. The DHT22 sensor can provide Arduino with:
- A) Temperature and humidity data
 - B) Distance and speed data
 - C) Light and pressure data
 - D) Angle and resistance data

Answer: A) Temperature and humidity data

13. Which communication technology is most suitable for sending Arduino sensor data directly to a nearby Android phone without using a Wi-Fi network?
- A) Bluetooth
 - B) Ethernet
 - C) HDMI
 - D) VGA

Answer: A) Bluetooth

14. In a Bluetooth-based Arduino application, the Android phone can be used to:
- A) Receive sensor data from Arduino
 - B) Increase Arduino clock frequency

- C) Replace the Arduino microcontroller
- D) Program the Arduino without any communication interface

Answer: A) Receive sensor data from Arduino

15. An Arduino-based Wi-Fi application can be used to connect devices within a:
- A) Local Area Network
 - B) Mechanical transmission system
 - C) Hydraulic network
 - D) Pneumatic circuit

Answer: A) Local Area Network

16. Which of the following is a suitable application of Arduino with Wi-Fi?
- A) Monitoring sensor values through a local network
 - B) Increasing the resistance of an LDR
 - C) Converting DC motor into a transformer
 - D) Measuring resistance without any circuit

Answer: A) Monitoring sensor values through a local network

17. To send Arduino sensor data to a remote server through the Internet, the system generally requires:
- A) Internet connectivity
 - B) Only an LED
 - C) Only a potentiometer
 - D) Only a seven-segment display

Answer: A) Internet connectivity

18. Which protocol is commonly associated with sending sensor data from an IoT device to a web server or cloud service?
- A) HTTP
 - B) VGA
 - C) USB Mass Storage only
 - D) PS/2

Answer: A) HTTP

19. An Arduino measures an analog sensor voltage using `analogRead()`. If the ADC value increases, the measured voltage generally:
- A) Decreases
 - B) Increases
 - C) Becomes zero
 - D) Remains unchanged

Answer: B) Increases

20. A system measures temperature using an LM35 and sends the result to a mobile phone through Bluetooth. Which sequence is most appropriate?
- A) Sensor → Arduino → Bluetooth → Android phone
 - B) Bluetooth → Sensor → Arduino → Android phone
 - C) Android phone → Sensor → Bluetooth → Arduino
 - D) Sensor → Android phone → Arduino → Bluetooth

Answer: A) Sensor → Arduino → Bluetooth → Android phone

21. An Arduino measures temperature and humidity and sends the readings to a cloud server using Wi-Fi. Which combination represents the main functions of the system?
- A) Sensing → Processing → Wireless communication → Internet/cloud
 - B) Display → Heating → Motor control → Amplification
 - C) Switching → Rectification → Oscillation → Filtering
 - D) Measurement → Mechanical transmission → Audio output → Heating

Answer: A) Sensing → Processing → Wireless communication → Internet/cloud

Analytical Reasoning

22. An unknown resistor is connected with a known resistor to form a voltage divider. Arduino measures the voltage across the unknown resistor. Which principle is mainly used to determine its resistance?
- A) Faraday's law
 - B) Ohm's law and voltage-divider principle
 - C) Kirchhoff's current law only
 - D) Coulomb's law

Answer: B) Ohm's law and voltage-divider principle

23. An LM35 sensor produces an analog voltage proportional to temperature. Arduino reads the voltage using its ADC. If the sensor sensitivity is known, what is the next step to determine temperature?
- A) Compare the voltage with a digital HIGH level
 - B) Convert the ADC reading into voltage and use the sensor's voltage-temperature relationship
 - C) Send the ADC value directly to a relay
 - D) Apply PWM to the sensor

Answer: B) Convert the ADC reading into voltage and use the sensor's voltage-temperature relationship

24. An LDR is connected in a voltage-divider circuit. When light intensity increases, its resistance changes and consequently the Arduino's analog reading changes. How can the Arduino estimate light intensity?
- A) By observing the change in analog reading and calibrating it against light intensity
 - B) By using `digitalWrite()` only

- C) By measuring the LCD voltage
- D) By counting the number of digital pins

Answer: A) By observing the change in analog reading and calibrating it against light intensity

25. An HC-SR04 sensor measures the distance to an object. If the measured echo time increases, what can be concluded?
- A) The object is closer
 - B) The object is farther away
 - C) The object has become brighter
 - D) The sensor temperature has decreased

Answer: B) The object is farther away

26. A potentiometer is connected to an Arduino analog input and its knob is rotated from minimum to maximum position. How can the Arduino determine the angle of rotation?
- A) By measuring the change in analog voltage and mapping the ADC value to the angular range
 - B) By using `digitalWrite()` to count rotations
 - C) By measuring the USB voltage
 - D) By using only a buzzer

Answer: A) By measuring the change in analog voltage and mapping the ADC value to the angular range

27. A DHT22 sensor is used to measure humidity. Unlike an LDR, the humidity value is obtained through a digital communication process. Which statement is most appropriate?
- A) Arduino must estimate humidity only from resistance
 - B) Arduino reads the humidity data transmitted by the DHT22
 - C) Arduino measures humidity using PWM output
 - D) Arduino calculates humidity from LCD brightness

Answer: B) Arduino reads the humidity data transmitted by the DHT22

28. An Arduino-based system needs to send sensor readings to an Android phone without using Wi-Fi or the Internet. Which communication method is most suitable?
- A) Bluetooth
 - B) Ethernet only
 - C) HDMI
 - D) VGA

Answer: A) Bluetooth

29. An Arduino device is connected to a Wi-Fi network and needs to exchange data with another device on the same local network. Which situation best describes this

application?

- A) Local Area Network (LAN) communication
- B) Bluetooth-only communication
- C) Offline data logging
- D) Analog signal conditioning

Answer: A) Local Area Network (LAN) communication

30. An Arduino sends temperature readings to a cloud server so that the readings can be viewed from a different location through the Internet. Which communication arrangement is required?

- A) Sensor → Arduino → Internet → Cloud server
- B) Sensor → Arduino → LCD only
- C) Arduino → potentiometer → relay
- D) Sensor → Arduino → seven-segment display only

Answer: A) Sensor → Arduino → Internet → Cloud server

Descriptive Questions

Unit I

1. Explain the basic structure of an embedded system with a neat block diagram. Describe the functions of the processor, memory, input/output devices.
2. Classify embedded systems into small-scale, medium-scale, and sophisticated embedded systems. Explain the features and applications of each category with suitable examples.
3. Explain the major application areas and purposes of embedded systems. Discuss the important quality attributes that determine the performance and reliability of an embedded system.
4. Differentiate between a microprocessor and a microcontroller. Explain the roles of compiler, cross compiler, assembler, and simulator in embedded system development.
5. Analytical Reasoning

A. State whether the following statements are True or False: (2 Marks)

- a) A microcontroller is generally preferred over a microprocessor in many embedded applications because it integrates memory and I/O peripherals on a single chip.
- b) A general-purpose computer is normally designed to perform only one dedicated function throughout its lifetime.

B. Match Column A with the most appropriate option in Column B: (2 Marks)

Column A	Column B
1. Small-scale embedded system	a. Converts assembly language into machine code
2. Cross compiler	b. Usually uses an 8-bit/16-bit microcontroller
3. Assembler	c. Generates target-machine code on a different host system
4. Simulator	d. Models the operation of a system without the actual hardware

C. Consider the following Assertion (A) and Reason (R): (2 Marks)

Assertion (A): A washing machine controller is considered an embedded system.

Reason (R): It is designed to perform a specific control function and operates as part of a larger appliance.

Choose the correct answer:

- 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

D. Identify the most appropriate embedded device/system from the following statement: (2 Marks)

"This device continuously monitors the patient's vital parameters, processes the sensor signals, and provides an alarm when an abnormal condition is detected. It is designed mainly for this dedicated medical application."

- A) Desktop computer
- B) Patient monitoring system
- C) General-purpose calculator
- D) Office printer

E. Arrange the following steps in the correct sequence for developing and executing an embedded program: (2 Marks)

1. Convert source program into target machine code
2. Write the source program
3. Test/debug the program using a simulator or target hardware
4. Load the machine code into the target embedded system

Choose the correct sequence:

- A) 2 → 1 → 4 → 3

- B) $1 \rightarrow 2 \rightarrow 3 \rightarrow 4$
- C) $2 \rightarrow 4 \rightarrow 1 \rightarrow 3$
- D) $4 \rightarrow 1 \rightarrow 2 \rightarrow 3$

Unit II

1. Explain the Arduino family by comparing Arduino Nano, Arduino Uno, and Arduino Mega with respect to processor, memory, I/O pins, analog inputs, and applications.
2. Describe the Arduino Nano board in detail. Explain the functions of its important pins, power supply, digital I/O, analog pins, and communication interfaces.
3. Describe the Arduino Uno board with a neat diagram. Explain the functions of its digital pins, analog pins, power pins, reset pin, USB interface, and communication facilities.
4. Explain the procedure for installing and configuring an Arduino board. Also discuss communication interfaces used with Arduino.
5. Analytical Reasoning

A. State whether the following statements are True or False: (2 Marks)

a) Arduino Uno is generally suitable for basic prototyping, while Arduino Mega is preferred when an application requires a larger number of I/O pins and serial communication interfaces.

b) Analog input pins of Arduino Uno can directly produce a continuous analog output voltage without using any additional hardware.

B. Match Column A with the most appropriate option in Column B: (2 Marks)

Column A

Column B

- | | |
|-----------------|--|
| 1. Arduino Nano | a. Large number of I/O pins |
| 2. Arduino Uno | b. Compact form factor |
| 3. Arduino Mega | c. Commonly used for basic prototyping |
| 4. UART | d. Serial communication |

C. Consider the following Assertion (A) and Reason (R): (2 Marks)

Assertion (A): Arduino Mega is more suitable than Arduino Uno for an application requiring many sensors and several serial communication devices.

Reason (R): Arduino Mega provides more I/O pins and multiple hardware serial interfaces compared with Arduino Uno.

Choose the correct answer:

- 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

D. Identify the most appropriate Arduino board from the statement: (2 Marks)

"This board is compact and provides functionality similar to a basic Arduino development board. Its small physical size makes it suitable when space is limited, such as in compact embedded prototypes."

- A) Arduino Mega
- B) Arduino Uno
- C) Arduino Nano
- D) Arduino Ethernet Shield

E. Arrange the following steps in the correct sequence for installing and using an Arduino board: (2 Marks)

1. Connect the Arduino board to the computer
2. Install Arduino IDE
3. Select the appropriate board and communication port
4. Write/verify and upload the sketch

Choose the correct sequence:

- A) 2 → 1 → 3 → 4
- B) 1 → 2 → 4 → 3
- C) 3 → 2 → 1 → 4
- D) 2 → 3 → 1 → 4

Unit III

1. Explain the procedure for setting up the Arduino IDE. Describe the structure of an Arduino sketch with suitable examples.
2. Explain the types and structure of arithmetic, comparison, Boolean, bitwise, and compound operators used in Arduino programming.
3. Explain the different control statements syntax used in Arduino programming.
4. Explain the variable scope in the Arduino and give examples.
5. Analytical Reasoning

A. State whether the following statements are True or False: (2 Marks)

- a) A variable declared inside a function can normally be accessed directly from another function.
- b) `analogRead()` is used to obtain an analog input value, whereas `digitalRead()` is used to read the HIGH or LOW state of a digital input.

B. Match Column A with the most appropriate option in Column B: (2 Marks)

Column A

Column B

- | | |
|--------------------------------|--|
| 1. <code>pinMode()</code> | a. Reads an analog input |
| 2. <code>digitalWrite()</code> | b. Configures a pin as input or output |
| 3. <code>digitalRead()</code> | c. Writes HIGH or LOW to a digital pin |
| 4. <code>analogRead()</code> | d. Reads the state of a digital pin |

C. Consider the following Assertion (A) and Reason (R): (2 Marks)

Assertion (A): A for loop is suitable when a set of statements must be executed a known number of times.

Reason (R): The for loop contains initialization, condition checking, and updating of the loop variable as part of its structure.

Choose the correct answer:

- 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

D. Identify the most appropriate Arduino data type from the statement: (2 Marks)

"A sensor application needs to store a decimal value such as 27.56 representing temperature. The value may contain a fractional part."

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

E. Arrange the following steps in the correct sequence for creating and uploading an Arduino sketch: (2 Marks)

1. Connect the Arduino board to the computer
2. Write the Arduino sketch
3. Select the appropriate board and port
4. Verify/compile the sketch
5. Upload the sketch to the Arduino board

Choose the correct sequence:

- A) 2 → 4 → 3 → 1 → 5
- B) 1 → 2 → 3 → 4 → 5
- C) 2 → 3 → 4 → 5 → 1
- D) 3 → 1 → 2 → 4 → 5

Unit IV

1. Explain the hardware configuration and Arduino sketch for interfacing a 16 × 2 LCD display. Draw the circuit diagram and write a suitable Arduino program to display a given message.
2. Explain the interfacing of a HC-SR04 ultrasonic sensor with Arduino. Describe their working principles, circuit connections, and write suitable Arduino sketch.
3. Describe the hardware connections and Arduino sketches for controlling a DC motor and servo motor.
4. Explain the interfacing of input/output devices with Arduino. Discuss the hardware and Arduino sketches for seven-segment display and buzzer.
5. Analytical Reasoning

A. State whether the following statements are True or False: (2 Marks)

- a) An Arduino digital pin can directly drive a high-current DC motor safely without a driver circuit because the motor requires only a digital HIGH or LOW signal.
- b) An HC-SR04 determines the distance of an object by measuring the time taken for an ultrasonic pulse to return as an echo.

B. Match Column A with the most appropriate option in Column B: (2 Marks)

Column A	Column B
1. LM35	a. Light intensity
2. DHT22	b. Distance measurement
3. HC-SR04	c. Temperature measurement
4. LDR	d. Temperature and humidity measurement

C. Consider the following Assertion (A) and Reason (R): (2 Marks)

Assertion (A): A servo motor is suitable for applications where a specific shaft position, such as 90°, must be obtained.

Reason (R): A servo motor can be controlled by a suitable control signal to position its shaft at a required angular position.

Choose the correct answer:

- 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

D. Identify the most appropriate device from the following statement: (2 Marks)

"This sensor changes its electrical resistance according to the amount of light falling on it. Arduino can read the resulting voltage through an analog input to estimate light intensity."

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

E. Arrange the following steps in the correct sequence for measuring temperature using an LM35 and displaying the result through Arduino: (2 Marks)

1. Convert the ADC reading into voltage
2. Read the analog value from the LM35
3. Convert the voltage into temperature

4. Display the temperature value

Choose the correct sequence:

- A) 2 → 1 → 3 → 4
- B) 1 → 2 → 4 → 3
- C) 3 → 2 → 1 → 4
- D) 2 → 3 → 1 → 4

Unit V

1. Explain the measurement of unknown resistance using Arduino. Describe the voltage-divider method, circuit connections, calculation of resistance, and write a suitable Arduino sketch.
2. Explain how Arduino can be used for measuring temperature. Describe the sensors used, interfacing circuits, working principles, and suitable Arduino sketch.
3. Explain the measurement of angular rotation using a potentiometer with Arduino. Draw the interfacing circuit, explain the conversion of analog voltage into angular displacement, and write a suitable Arduino sketch.
4. Explain an Arduino-based application for communicating with an Android phone through Bluetooth. Describe the hardware required, Bluetooth communication procedure, circuit connections, and Arduino sketch for sending and receiving data.
5. Analytical Reasoning

A. State whether the following statements are True or False: (2 Marks)

- a) In a voltage-divider method for measuring an unknown resistance, the Arduino can calculate the unknown resistance by measuring the voltage at the divider point.
- b) Increasing the light falling on a typical LDR generally increases its resistance, so the Arduino will always read a higher analog value regardless of the circuit connection.

B. Match Column A with the most appropriate option in Column B: (2 Marks)

Column A	Column B
1. LM35	a. Humidity measurement
2. LDR	b. Angular position measurement
3. DHT22	c. Temperature measurement
4. Potentiometer	d. Light intensity measurement

C. Consider the following Assertion (A) and Reason (R): (2 Marks)

Assertion (A): An Arduino-based temperature monitoring system can send measured temperature data to an Android phone through Bluetooth.

Reason (R): A Bluetooth module can provide wireless serial communication between the Arduino and a nearby Android phone.

Choose the correct answer:

- 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

D. Identify the most appropriate technology from the following statement: (2 Marks)

"An Arduino-based monitoring system sends sensor readings to a remote cloud server through an Internet-connected network so that the readings can be accessed from another location."

- A) Bluetooth only
- B) Wi-Fi/Internet communication
- C) Seven-segment display
- D) Potentiometer

E. Arrange the following steps in the correct sequence for measuring an unknown resistance using Arduino and a voltage-divider circuit: (2 Marks)

1. Calculate the unknown resistance
2. Connect the known and unknown resistors as a voltage divider
3. Read the divider voltage using `analogRead()`
4. Convert the ADC reading into voltage

Choose the correct sequence:

- A) 2 → 3 → 4 → 1
- B) 3 → 2 → 1 → 4
- C) 2 → 4 → 3 → 1
- D) 4 → 3 → 2 → 1