

KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.Sc.

Year : III

Course : COMP 306

Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date :

12 AUG 2024

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices

1. What is the primary function of the watchdog timer in an embedded system?
 - a. To keep track of time
 - b. To reset the system in case of failure
 - c. To manage power consumption
 - d. To facilitate communication between devices

2. Which of the following best describes an embedded system?
 - a. A standalone computer with a general-purpose OS
 - b. A combination of software and hardware designed for a specific function
 - c. A high-performance gaming PC
 - d. A system designed to perform multiple unrelated tasks

3. Which type of memory is typically used for firmware storage in embedded systems?
 - a. RAM
 - b. ROM
 - c. Cache
 - d. Hard Disk

4. How does an Interrupt Service Routine (ISR) enhance the performance of an embedded system?
 - a. By consuming less power
 - b. By increasing the processing speed
 - c. By providing real-time response to events
 - d. By improving the user interface

5. Which of the following is NOT a characteristic of embedded systems?
 - a. Real-time operation
 - b. High power consumption
 - c. Dedicated function
 - d. Limited user interface

6. In the context of embedded systems, what does DMA stand for and what is its purpose?
 - a. Direct Memory Access; to speed up data transfer
 - b. Data Memory Allocation; to allocate memory for data
 - c. Dynamic Memory Access; to dynamically access memory
 - d. Digital Media Adapter; to interface with digital media

7. Which bus is commonly used in automotive applications for communication?
 - a. SPI
 - b. I2C
 - c. CAN
 - d. UART

8. What role do actuators play in an embedded system?
 - a. Process input data
 - b. Store data
 - c. Perform physical actions
 - d. Facilitate communication

9. Why is power management crucial in embedded systems?
 - a. To increase processing power
 - b. To reduce heat generation
 - c. To prolong battery life
 - d. To enhance user interface
10. What is the main difference between hard real-time and soft real-time systems?
 - a. Hard real-time systems can tolerate delays
 - b. Soft real-time systems have stricter timing constraints
 - c. Hard real-time systems must meet deadlines precisely
 - d. Soft real-time systems never miss deadlines
11. How does an RTOS differ from a general-purpose operating system in terms of task scheduling?
 - a. RTOS uses random scheduling
 - b. RTOS prioritizes real-time tasks
 - c. General-purpose OS has no scheduling
 - d. RTOS uses a single-thread approach
12. Which communication protocol is typically used for short-range wireless communication in embedded systems?
 - a. Ethernet
 - b. Bluetooth
 - c. RS-232
 - d. USB
13. What is the primary purpose of a bootloader in an embedded system?
 - a. To execute user applications
 - b. To manage power supply
 - c. To initialize system hardware and load the OS
 - d. To perform data encryption
14. Which type of sensor is commonly used for detecting obstacles in autonomous vehicles?
 - a. Temperature sensor
 - b. Proximity sensor
 - c. Pressure sensor
 - d. Humidity sensor
15. What does PWM stand for and what is its use in embedded systems?
 - a. Pulse Width Modulation; for controlling the speed of motors
 - b. Peripheral Width Management; for managing peripheral devices
 - c. Processor Wait Mode; for reducing processor speed
 - d. Protocol with Modulation; for communication
16. Why is the use of a real-time clock (RTC) important in some embedded systems?
 - a. For increasing processing power
 - b. For keeping track of real-world time
 - c. For managing memory usage
 - d. For handling user inputs
17. What is the advantage of using a high-level language like C in embedded system programming?
 - a. Easier to manage memory directly
 - b. More efficient than assembly language
 - c. Easier debugging and maintenance
 - d. Direct control over hardware
18. What is the main function of a bootloader in an embedded system?
 - a. To execute user applications
 - b. To manage power consumption
 - c. To initialize hardware and load the main firmware
 - d. To interface with peripheral devices

19. Which component is responsible for converting digital signals to analog signals in embedded systems?
- a. ADC b. DAC c. GPIO d. PWM
20. In embedded systems, what is the function of a watchdog timer?
- a. To manage power consumption b. To reset the system in case of malfunction
- c. To synchronize data transfers d. To monitor user inputs

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Course : COMP 306
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SECTION "B"

[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Explain how the power supply unit is designed in an embedded system and discuss its impact on system performance and reliability.
2. Describe the advantages and disadvantages of using assembly language for programming embedded systems, compared to high-level languages like C.
3. Discuss the importance of real-time operating systems (RTOS) in embedded systems and provide examples of their applications.
4. How can you optimize the memory usage in an embedded system? Discuss various techniques and their trade-offs.
5. Explain the concept of interrupt latency and its significance in embedded system design. How can it be minimized?
6. Design a simple embedded system application using an 8051 microcontroller and explain the step-by-step development process.
7. Discuss the role of sensors and actuators in embedded systems and provide examples of their use in real-world applications.
8. Explain the concept of embedded system security and discuss various strategies to protect embedded systems from cyber threats.

SECTION "C"

[2Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

9. Explain the design and implementation of a communication interface using a suitable protocol in an embedded system. Discuss its advantages and limitations.
10. Discuss the challenges and considerations in designing an embedded system for automotive applications. Provide a case study to illustrate your points.
11. Explain the role of VHDL in embedded system design and describe a sample project where VHDL is used to design a custom processor.

