KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

Marks Scored:

Level : B.E.
Year : III

Course : COMP 306
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 27 FEB 2025

SECTION "A"

[20 Q. × 0.5 = 10 marks]

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

1. Which of the following is NOT a characteristic of an embedded system?
   a. Dedicated function
   b. Real-time operation
   c. Large storage capacity
   d. Compact size

2. What is the primary difference between a microcontroller and a microprocessor?
   a. Microcontroller has integrated peripherals; microprocessor does not.
   b. Microprocessor is faster than microcontroller.
   c. Microcontroller is used in PCs; microprocessors are used in embedded systems.
   d. Microcontroller cannot process instructions.

3. Which of the following best describes a hard real-time system?
   a. Tolerates some delays in processing.
   b. Must meet strict deadlines.
   c. Operates intermittently.
   d. Uses multitasking for efficiency.

4. In an embedded system, what is the primary role of an RTOS?
   a. Managing multitasking and ensuring task deadlines.
   b. Providing graphical user interface (GUI).
   c. Running the device driver.
   d. Optimizing system speed.

5. What type of memory is typically used for firmware storage in an embedded system?
   a. SRAM
   b. DRAM
   c. EEPROM
   d. Flash memory

6. What is the purpose of a watchdog timer in embedded systems?
   a. Synchronize multiple processors.
   b. Ensure the system resets in case of a failure.
   c. Optimize power consumption.
   d. Measure external inputs.

7. Which of the following is a wireless communication protocol used in embedded systems?
   a. UART
   b. SPI
   c. ZigBee
   d. I2C

8. In VHDL, which construct is used to describe the behavior of a component?
   a. Entity
   b. Process
   c. Architecture
   d. Configuration

9. What does DMA stand for in embedded systems?
   a. Direct Memory Access
   b. Dynamic Memory Allocation
   c. Dual Mode Architecture
   d. Data Management Application

10. Which scheduling algorithm is most suitable for hard real-time systems?
    a. Round-robin
    b. Rate Monotonic Scheduling
    c. First-Come-First-Serve
    d. Multilevel Queue Scheduling

11. What is the primary advantage of using an 8051 microcontroller in embedded applications?
    a. Large instruction set
    b. High processing speed
    c. Integrated peripheral features
    d. Compatibility with modern interfaces

12. What does an FSMD model typically consist of?
    a. Memory and Logic Blocks
    b. State Machine and Datapath
    c. ALU and Registers
    d. Scheduler and Peripherals

13. Which type of testing ensures the system works as intended under actual operating conditions?
    a. Unit Testing
    b. Integration Testing
    c. Functional Testing
    d. Field Testing

14. Which language is commonly used for low-level programming in embedded systems?
    a. Python
    b. Assembly
    c. JavaScript
    d. SQL

15. What is the maximum addressable memory in a system with a 16-bit address bus?
    a. 16 KB
    b. 32 KB
    c. 64 KB
    d. 128 KB

16. Which of the following is NOT a communication interface used in embedded systems?
    a. UART
    b. I2C
    c. Ethernet
    d. SQL

17. What is the purpose of using a semaphore in RTOS?
    a. Task synchronization
    b. Memory allocation
    c. Processor optimization
    d. Power management

18. In a system using preemptive scheduling, when can a higher-priority task interrupt another task?
    a. When the lower-priority task is blocked.
    b. Anytime.
    c. When a task reaches a deadline.
    d. Only during idle states.

19. Which technique reduces power consumption in embedded systems?
    a. Increasing clock frequency
    b. Disabling unused peripherals
    c. Running all tasks in parallel
    d. Reducing memory allocation

20. What does ADC stand for in embedded systems?
    a. Arithmetic Data Conversion
    b. Analog to Digital Converter
    c. Active Data Compression
    d. Asynchronous Data Control

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SECTION "B"
[6 Q. × 4 = 24 marks]

Attempt ANY SIX questions.

1. Define and classify embedded systems with examples.
2. Explain the structure and role of clock circuitry in embedded systems.
3. Differentiate between wired and wireless communication interfaces in embedded systems.
4. Write an 8051 assembly code to toggle an LED on a port pin.
5. Explain VHDL programming advantages in embedded system design.
6. Derive the functionality of a custom single-purpose processor using an FSMD representation.
7. Analyze the potential causes of embedded system project failures.

SECTION "C"
[2 Q. × 8 = 16 marks]

Attempt ANY TWO questions.

8. Design an embedded system for temperature monitoring, outlining hardware and software requirements.
9. Describe the architecture and scheduling algorithm of a real-time operating system.
10. Discuss the design and implementation process model for embedded systems with a practical example.