


**Final Assessment Test – April 2025**

Course: BCSE305L - Embedded Systems  
 Class NBR(s): 1429/1434/1436/1438/1442/1446/1450/  
 1455/1461/1464/1469/1474/1478/1484/1488/1494/  
 1501/1507/1514/1519/1523/1528/1532/1536

Slot: A1+TA1

Time: Three Hours

Max. Marks: 100  
AS EXAM MALPRACTICE

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE  
 ➤ DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer ALL Questions  
 (10 X 10 = 100 Marks)

- How do the different execution modes in ARM architecture optimize system performance, enable efficient multitasking, and ensure robust security in embedded and real-time applications?
- Explain the operation of an R-2R ladder DAC (Digital to Analog converter) in embedded systems when a 3-bit DAC is given an input value of  $V_{ref}$  equal to 101 with a neat sketch.
- Identify and evaluate the constraints and challenges in designing any special purpose embedded system and choose the appropriate identified parameters for the following system with enough justifications:-  
ATM (Automated Teller Machine) System.
- Propose a model to capture the behavior of a heartbeat monitoring system that continuously tracks a person's pulse and activates an alert to the doctor's interface when the heart rate exceeds a predefined threshold. The system involves two key tasks: pulse monitoring and notifying the doctor.
- Classify and analyze various types of signals with an example for each, and design a system that works with periodic and aperiodic signals.
- Evaluate how the following parameters affect the schedulability of real time tasks:-
  - Arrival Time
  - Current Time / Scheduling point
  - Execution Time
  - Rate or Period
  - Deadline

Suggest an optimal scheduling scheme using any three parameters mentioned above and apply it for the following dataset:-

Task	Arrival Time	Execution Time	Period	Deadline
T1	0	3	20	7
T2	0	2	5	4
T3	0	2	10	8

**Note:** Consider current time as per the scheduling points. Illustrate the task time-line graph.

7. Discuss the importance of timers in the 8051 microcontroller and their applications in embedded systems. And, write a code snippet to generate a square wave on PORT1.0 with a 200  $\mu$ s time period using Timer 1 in Mode 2 (8-bit auto-reload mode) on the 8051 microcontroller uses 11.0592 MHz crystal oscillator.
8. Design and illustrate with neat explanation a smart robotic arm (to mimic a human arm) using available interfaces (relevant sensors and actuators).
- 9.a) Analyze the key limitations of the CAN Bus protocol, including the structure of its frame format, and discuss how these factors impact the efficiency of data transmission. Provide a real-life example to illustrate their effects.

OR

- 9.b) Design and illustrate inter vehicular communication network to manage the following activities using CAN standard:-
- Steering control
  - Window control
  - Wiper control
  - AC, light control

Deliverables: - Network topology, Frame format and operational flow chart.

- 10.a) Design a complete data acquisition system which comprises of sensors, converters and encoders for Smart Weather station to measure the following variables.
- Temperature
  - Rain
  - Cloud pattern
  - Fog
  - Wind direction
  - Wind speed
  - Humidity
  - Light intensity

Deliverables:- Detailed encoding schemes as well as table, complete interface diagram, pseudocode.

OR

- 10.b) Design an "Industrial Temperature Control System" used in industrial environments to maintain temperature within safe operational limits and avoid equipment damage, product spoilage, or safety hazards.

Requirements:

- The system must accurately measure temperature.
- Temperature readings must be updated and displayed in real-time.
- Threshold Alarms- an audible and/or visual alarm must be triggered when the temperature exceeds these thresholds.
- Relevant states, events and actions to be considered.

Deliverables: - Detailed Hardware architecture, software architecture, flow of operations, and pseudocode.

⇔⇔⇔ U/D/TY ⇔⇔⇔