Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 30544

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Seventh/Eighth Semester

Electronics and Communication Engineering

EC 8791 – EMBEDDED AND REAL TIME SYSTEMS

(Common to: Biomedical Engineering / Medical Electronics)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the differences between microcontroller and microprocessor?
2. Why is platform compatibility critical when analyzing requirements for consumer electronics architecture?
3. How are subroutines used in ARM Assembly Language?
4. Using LPC214X, how do you generate a 1 kHz PWM Signal with 50% duty cycle?
5. Bring out the difference between black box testing and white box testing.
6. List the major software optimization techniques used in embedded systems.
7. What is meant by priority inversion?
8. Compare hard real-time and soft real-time systems.
9. State the role of multi-rate systems.
10. List the various power optimization strategies for processes in embedded systems.

PART B — (5 × 13 = 65 marks)

11. (a) Examine the quality assurance techniques relevant to embedded systems. Identify the critical factors to be assessed for ensuring reliability and performance. (8+5)

Or

(b) Design a state diagram for a model train controller that handles the transmission of command bits on the track. The controller should generate the appropriate address, select the correct message type, include any necessary parameters, and compute the error-correcting code (ECC) for the communication.

12. (a) Discuss the significance of the ARM Instruction Set in optimizing performance and power efficiency. Provide examples of how specific instructions are used in embedded system applications. (7+6)

Or

(b) Describe the role of UART in ARM-based microcontrollers like the LPC 214X family. Explain how to configure UART for serial communication with specific baud rates and include an example scenario. (6+7)

13. (a) Explain the process of assembly, linking and loading in the context of embedded programming. How does this process differ from traditional software development? (8+5)

Or

(b) Considering an embedded program that is experiencing slow performance, what techniques would you use to perform program level energy and performance analysis and identify bottlenecks?

14. (a) Discuss the various fault tolerant techniques used to ensure that the system continues to function correctly hardware or software failures.

Or

(b) (i) Discuss the steps involved to estimate the worst-case execution time (WCET) for each task in a system and ensure that the system can meet deadlines under all possible execution scenarios. (7)

(ii) Describe the importance of estimating program run times in real-time systems. (6)

15. (a) Describe the key inter process communication (IPC) mechanisms used in embedded system applications. Highlight their roles, advantages and applications. (7+6)

Or

(b) Explain the concept of distributed embedded systems, highlighting their architecture and applications. Discuss how MPSoCs and shared memory multiprocessors contribute to enhancing their performance. (6+7)

PART C — (1 × 15 = 15 marks)

16. (a) Consider the following set of four independent real-time periodic tasks.

Task	Processing Time (msec)	Period (msec)
T1	25	150
T2	10	50
T3	15	50
T4	25	200

Assume that task T3 is more critical than task T2. Check whether the task set can be feasibly scheduled using Rate Monotonic Scheduling (RMS) and Earliest Deadline First (EDF) and and Rate Monotonic Scheduling (RMS) algorithms.

Or

(b) Write an ARM assembly program to calculate the expression:

RESULT = $5A^2 + 3B + 2C - 6D$ where $A = 3$, $B = 4$, $C = 2$ and $D = 5$. The program should store the final result in a register.