



**K. K. Wagh Institute of Engineering Education & Research, Nashik**  
(An Autonomous Institute From A.Y. 2022-23)

SUMMER-2024	
Exam Seat No.:	
Academic Year:2023-2024	Semester: II
Class:F.Y. M.Tech.	Program: M.Tech
Branch Code: ETC	Pattern:2022
Name of Course: Real Time Embedded System	Course Code: ETC225107
Max. Marks:60	Duration:2.30 Hrs.

**Instructions:** Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 2 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

**Question No. 1 Attempt following Question**

- 1a) How do real-time embedded systems differ from non-real-time systems? Give examples to illustrate these differences and explain why they are important in various applications. (6) CO1

**Question No. 2 Attempt following Question**

- 2a) Explain the concept of cache memory and describe the different types of cache mappings used in embedded systems. (6) CO2

**Question No. 3 Attempt following Question**

- 3a) Discuss the importance of timers in embedded systems and explain how high-speed I/O interfacing is achieved. Highlight the challenges associated with high-speed interfacing. (8) CO3

**OR**

- 3b) Explain the operation of analog-to-digital converters (ADC) and digital-to-analog converters (DAC) in embedded systems. Discuss factors influencing their selection and compare their advantages and limitations. (8) CO3

- 3c) Describe common communication protocols like UART, SPI, and I2C in embedded systems. Compare them in terms of speed, complexity, and application suitability. (8) CO3

**OR**

- 3d) Discuss the functions of USB signals and their transfer modes. Compare CAN and Ethernet protocols in embedded systems regarding data rates and network topologies. (8) CO3

**Question No. 4 Attempt following Question**

- 4a) Explain the role of interrupts in Real-Time Operating Systems (RTOS) and how they contribute to (8) CO4

responsiveness. Discuss strategies for managing interrupts effectively within an RTOS environment.

**OR**

4b) Describe the process of firmware testing in embedded systems development, highlighting the differences between firmware and software testing. Discuss the challenges specific to testing firmware and propose solutions to address them. (8) CO4

4c) Describe the process of firmware testing in embedded systems development, highlighting the differences between firmware and software testing. Discuss the challenges specific to testing firmware and propose solutions to address them. (8) CO4

**OR**

4d) Explain the concept of boundary scan testing and its significance in ensuring the quality and reliability of printed circuit board (PCB) assemblies in embedded systems. Discuss the limitations of boundary scan testing. (8) CO4

**Question No. 5 Attempt following Question**

5a) Design the software architecture for a mobile phone, incorporating a Real-Time Operating System (RTOS), to efficiently handle user inputs, multitasking, and ensure real-time responsiveness, thus ensuring a seamless user experience. (8) CO5

**OR**

5b) Design an automatic cruise control system incorporating a Real-Time Operating System (RTOS). (8) CO5

5c) Design A Digital camera incorporating a Real-Time Operating System (RTOS). (8) CO5

**OR**

5d) Design any IoT application incorporating a Real-Time Operating System (RTOS). (8) CO5

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