



**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: FYMTech	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) Explain different design metrics in real-time embedded systems. (6) CO1

**Question No. 2 Attempt following Question**

- 2a) Examine the role of the Memory Management Unit (MMU) in embedded systems. Discuss how MMUs manage memory resources, provide memory protection, and support virtual memory functionality. (6) CO3

**Question No. 3 Attempt following Question**

- 3a) a) 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) Define Real-Time Operating Systems (RTOS) and explain their significance in embedded systems. (8) CO4  
Discuss the key features and benefits of using an RTOS in embedded applications. Provide examples of popular RTOSs and describe their usage scenarios.

**OR**

- 4b) Explain the importance of both software and hardware testing in the embedded systems development lifecycle. (8) CO4  
Describe the challenges involved in testing embedded systems.

- 4c) Explain the concept of boundary scan in the context of testing embedded systems. Discuss the IEEE 1149.x standards and their significance in boundary scan testing. (8) CO4

**OR**

- 4d) Discuss the integration of Real-Time Operating Systems (RTOS) with testing strategies in embedded systems development. Explain how the characteristics of an RTOS influence testing methodologies and approaches. (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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