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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

END TERM EXAMINATION AUGUST-2024

Even Semester: II

Course Code: ECE5007

Course Name: Embedded Real Time Operating Systems

Program & Sem: M.Tech (ESV)

Date: 14/08/2024

Time: 09:30 AM to 12:30 PM

Max Marks: 100

Weightage: 50%

Instructions:

- (i) Read the all questions carefully and answer accordingly. All parts are compulsory.
- (ii) Do not write any information on the question paper other than Roll Number.

Part A [Memory Recall Questions]

Answer any 3 Questions. Each question carries 5 marks.

(3Qx 5M= 15M)

- 1 The Embedded Real Time Operating Systems (RTOS) are specially designed operating systems (OS) are for embedded hardware devices to accomplish the specified task. What are important differences in desktop OS and embedded RTOS.
[5M] (C.O.No.1) [Comprehension]
- 2 The Embedded Real Time Operating Systems (RTOS) operations are controlled with the help of various tasks. Explain the various types of tasks in embedded RTOS.
[5M] (C.O.No.2) [Comprehension]
- 3 The task execution in embedded RTOS is controlled by task scheduler. As an embedded system engineer, elaborate the role task scheduler in any embedded RTOS.
[5M] (C.O.No.2) [Comprehension]
- 4 The RTOS uses inter-task and inter-process communication for data transfer and synchronization between various tasks and processes. Elaborate the importance of inter-task and inter-process communication in RTOS with necessary examples.
[5M] (C.O.No.3) [Comprehension]
- 5 The scheduling of the tasks in RTOS is taken care by scheduling algorithms. Elaborate Rate Monotonic Scheduling (RMS) algorithm and also explain the importance of task execution time in RMS.
[5M] (C.O.No.4) [Comprehension]

Part B [Thought Provoking Questions]

Answer any 4 Questions. Each question carries 10 marks.

(4Qx10M=40M)

- 6 Embedded RTOS supports various inter-task communication and synchronization techniques to facilitate the signaling and data transfer between them. Compare any four inter-task communication techniques in brief.
[10M] (C.O.No.2) [Comprehension]
- 7 Task priority plays an important role in embedded RTOS task execution process. Briefly describe the concept of priority inversion.
[10M] (C.O.No.2) [Comprehension]
- 8 Memory management is an important activity in RTOS workflow. Elaborate the role of memory management in RTOS operations.
[10M] (C.O.No.2) [Comprehension]
- 9 During the task execution workflow, the concept of deadlock appears during the resource sharing and synchronization. Write brief note on deadlock in embedded RTOS.
[10M] (C.O.No.3) [Comprehension]
- 10 Kernel is a primary module in the embedded RTOS. As an embedded system design engineer, write brief note on selection of kernel while developing an embedded software RTOS.
[10M] (C.O.No.3) [Comprehension]
- 11 As an embedded software developer engineer, write brief note on selection of scheduling algorithm for embedded application development.
[10M] (C.O.No.3) [Comprehension]

Part C [Problem Solving Questions]

Answer any 3 Questions. Each question carries 15 marks.

(3Qx15M=45M)

- 12 There are several embedded RTOS options available in market for an embedded software developer. Compare various operating systems with respect to various features which can help embedded software engineers in their application development.
[15M] (C.O.No.3) [Comprehension]
- 13 For the following enlisted tasks, compute the processor utilization and comment on schedulability of the tasks enlisted in the table.

Process	Execution Time (C)	Time Period (T)
P1	3	20

P2	2	5
P3	2	10
P4	3	10
P5	2	15

[15M] (C.O.No.3) [Comprehension]

- 14** As an embedded software development engineer, write brief note on selection of inter-process communication algorithm for an embedded system with three temperature sensors, a heating element as actuator and LCD display in temperature control system.

[15M] (C.O.No.3) [Comprehension]

- 15** The RTOS scheduling algorithm always gives high priority to the Interrupt service routine (ISR) during task execution. Elaborate the detailed procedure in RTOS to serve ISR and context switching during the ISR execution.

[15M] (C.O.No.4) [Comprehension]

- 16** An embedded software developer has been given a task of development of Embedded RTOS for designing the Automated Driver Assistance System (ADAS) for car drivers. The system consists of four cameras and a radar system. Write in brief how you will plan Embedded RTOS structure, task scheduler, inter-task communication and any other important points in RTOs development.

[15M] (C.O.No.4) [Comprehension]