 Time: 3 Hours   **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

*1. This Question paper comprises of **three Sections -A, B, & C.** It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A   20

1. Attempt all parts:-

1-a.   Which Linux scheduling policy uses time slices and dynamically adjusts process   1
          priorities?   (CO1,K2)

    (a)   Completely Fair Scheduler

    (b)   SCHED_FIFO

    (c)   SCHED_RR

    (d)   SCHED_DEADLINE

1-b.   Which function is used to cancel a POSIX thread?   (CO1,K2)   1

    (a)   pthread_exit()

    (b)   pthread_cancel()

    (c)   pthread_kill()

    (d)   cancel_thread()

1-c.   What is a disadvantage of RTOS?   (CO2,K2)   1

    (a)   Real-time responses

    (b)   Predictability

    (c)   Complex development

    (d)   Efficient task management

1-d.   Which is not an OS structure?   (CO2,K2)   1

    (a)   Monolithic

    (b)   Layered

  (c) Microkernel

  (d) Binary tree

1-e. Which system call is used to create a process in Unix/Linux? (CO3,K3) 1

  (a) exec()

  (b) fork()

  (c) start()

  (d) spawn()

1-f. In Linux, where is the PCB information stored?____K3,CO3 1

  (a) /proc directory

  (b) Kernel memory

  (c) User space

  (d) /etc/proc

1-g. Which of the following is not a condition for deadlock? (CO4,K2) 1

  (a) Mutual exclusion

  (b) Hold and wait

  (c) No preemption

  (d) Shortest job next

1-h. Which is an example of a software mutex implementation? (CO4,K2) 1

  (a) Test-and-set

  (b) Disabling interrupts

  (c) Peterson's algorithm

  (d) Interrupt handler lock

1-i. What does RTX stand for in CMSIS-RTOS? (CO5,K1) 1

  (a) Real-Time Extension

  (b) Real-Time Executor

  (c) Real-Time eXecution

  (d) Runtime Task eXchange

1-j. What is osSemaphoreNew() used for? (CO5, K2) 1

  (a) Create semaphore

  (b) Delete semaphore

  (c) Reset semaphore

  (d) Check semaphore count

2. Attempt all parts:-

2.a. Explain the concept of virtual memory in Linux. (CO1,K1) 2

2.b. Define embedded operating system. (CO2,K1) 2

2.c. What is the purpose of the exec() system call? (CO3,K3) 2

2.d. Define mutual exclusion. (CO4,K1) 2

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2.e.	Name one reason why a task might be in a "Blocked" state. (CO5,K2)	2

SECTION-B   30

3. Answer any <u>five</u> of the following:-

3-a.	Differentiate between character, block, and network device drivers in Linux. Provide examples of each. (CO1,K2)	6
3-b.	How are interrupts handled in Linux? Explain with the concept of interrupt handler registration in drivers. (CO1,K1)	6
3-c.	Explain real-time operating systems. What makes them different from general purpose OS? (CO2,K4)	6
3-d.	Discuss determinism and responsiveness in RTOS. Why are they important? (CO2,K1)	6
3.e.	How does Shortest Job First (SJF) scheduling work? Explain with an example. (CO3,K2)	6
3.f.	Discuss the segmentation with paging technique in memory management. (CO4,K2)	6
3.g.	What are mailboxes in RTX, and how do they differ from message queues? (CO5,K2)	6

SECTION-C   50

4. Answer any <u>one</u> of the following:-

4-a.	Compare various inter-process communication (IPC) methods in Linux (pipes, FIFOs, message queues, semaphores, shared memory). Explain their uses with example. (CO1,K1)	10
4-b.	What is a semaphore? Explain its role in process synchronization with an example. (CO1,K2)	10

5. Answer any <u>one</u> of the following:-

5-a.	Describe the architecture of a Real-Time Operating System. Use labeled diagram and explanation. (CO2,K2)	10
5-b.	Describe inter-task communication in RTOS. How is synchronization achieved? (CO2,K2)	10

6. Answer any <u>one</u> of the following:-

6-a.	Explain real-time scheduling. Differentiate between hard and soft real-time scheduling. (CO3,K4)	10
6-b.	Explain Rate Monotonic Scheduling (RMS) with a proper example and its use in real-time systems. (CO3,K3)	10

7. Answer any <u>one</u> of the following:-

7-a.	Describe process and its type in RTOS. Explain compile-time, load-time, and execution-time binding with examples. (CO4,K2)	10
7-b.	What is Direct Memory Access (DMA)? How does DMA improve system performance? Describe the DMA operation process. (CO4,K2)	10

8. Answer any <u>one</u> of the following:-

8-a.   Explain the layered architecture of CMSIS-RTOS and its benefits for embedded   10
         system development. (CO5,K2)

8-b.   Explain the task priority levels in RTX and how they influence task scheduling.   10
         (CO5,K3)