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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: VI - THEORY EXAMINATION (2025 - 2026)

Subject: Real Time Operating System

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:-

- (1.1) Which Linux system call is used to create a new process? (CO1,K1) 1
- (a) exec()
- (b) fork ()
- (c) wait()
- (d) clone ()
- (1.2) Which Linux scheduling policy uses time slices and dynamically adjusts process priorities?(CO1, K1) 1
- (a) Completely Fair Scheduler
- (b) SCHED_FIFO
- (c) SCHED_RR
- (d) SCHED_DEADLINE
- (1.3) Which OS structure runs most components in user space? (CO2, K2) 1
- (a) Monolithic
- (b) Microkernel
- (c) Layered
- (d) Distributed
- (1.4) The component that manages file systems in an OS is_____.(CO2, K1) 1
- (a) Scheduler
- (b) Shell
- (c) Loader
- (d) File manager

- (1.5) The stack segment in process memory is used for_____.(CO3, K2) 1
- (a) Storing user input
 - (b) Function calls and local variables
 - (c) Kernel execution
 - (d) Process ID
- (1.6) The exec() system call is used to_____.(CO3, K1) 1
- (a) Create a new process
 - (b) Replace a process's memory
 - (c) Pause a process
 - (d) Kill a process
- (1.7) Which of these is a solution to the consistency problem in multiprocessing? (CO4, K1) 1
- (a) Mutual exclusion
 - (b) Disk scheduling
 - (c) Multi-level feedback queue
 - (d) Context switching
- (1.8) What causes a deadlock? (CO4, K1) 1
- (a) Excessive CPU usage
 - (b) I/O wait states
 - (c) Circular wait and resource holding
 - (d) Thread starvation
- (1.9) Which file typically defines task priorities in RTX?(CO5, K1) 1
- (a) rtx_config.h
 - (b) rtx_os.h
 - (c) rtx_core.c
 - (d) rtx_priority.h
- (1.10) What happens when a mutex is unavailable? (CO5,K2) 1
- (a) Task continues
 - (b) Error occurs
 - (c) Kernel restarts
 - (d) Task waits

2. Attempt all parts:-

- (2.1) Explain the concept of virtual memory in Linux.(CO1, K2) 2
- (2.2) Explain the use of priority inversion in RTOS.(CO2,K2) 2
- (2.3) List two differences between a process and a program.(CO3,K2) 2
- (2.4) Define compile-time and load-time.(CO4,K1) 2
- (2.5) What is the purpose of the osDelay() function in RTX?(CO5,K1) 2

SECTION-B

30

Answer any one of the following:-

- (3.1) Compare and contrast different IPC mechanisms in Linux: Pipes, FIFOs, 6

Semaphores, and Shared Memory.(CO1,K1)

- (3.2) Differentiate between character, block, and network device drivers in Linux. Provide examples of each. (CO1,K2) 6

Answer any one of the following:-

- (3.3) Explain the major components of an operating system. Differentiate between RTOS and General Purpose Operating System. (CO2,K2) 6
- (3.4) Compare and contrast microkernel and monolithic kernel architectures with a proper diagram.(CO2,K3) 6

Answer any one of the following:-

- (3.5) List and explain the key components of the Process Control Block (PCB). How it is used in process tracking.(CO3,K2) 6
- (3.6) Explain priority-based scheduling and Earliest deadline first scheduling. How does it lead to starvation? (CO3,K2) 6

Answer any one of the following:-

- (3.7) Explain the concept of address binding and its types. (CO4,K2) 6
- (3.8) What is paging? Describe the paging mechanism with a diagram showing address translation.(CO4,K2) 6

Answer any one of the following:-

- (3.9) What is CMSIS-RTOS? Explain its architectural layers briefly.(CO5,K2) 6
- (3.10) What are mailboxes in RTX? How are messages passed between tasks?(CO5,K2) 6

SECTION-C

50

4. Answer any one of the following:-

- (4.1) Describe is Preemptive scheduling. Five tasks arrive at time =0: Time quantum = 3 ms Find-Order of execution, Completion time of each process, Average turnaround time. by the round robin scheduling (CO1,K3) 10

TASK	BURST TIME (ms)
P1	4
P2	10
P3	6
P4	8
P5	7

- (4.2) Describe in detail the components and architecture of the Linux kernel. Include the roles of process scheduler, memory manager, and device drivers. (CO1,K2) 10

5. Answer any one of the following:-

- (5.1) Describe the architecture of a Real-Time Operating System. Use labeled diagram and explanation.(CO2,K2) 10
- (5.2) Describe different types of Real Time Operating system. Describe one scheduling algorithms used RTOS.(CO2,K2) 10

6. Answer any one of the following:-

- (6.1) Describe process creation and execution in Linux using system calls like fork(), 10

exec(), and wait(). Why is it important in process? (CO3, K2)

(6.2) What are zombie and orphan processes? How are they handled in operating systems like Linux? (CO3, K2) 10

7. Answer any one of the following:-

(7.1) Explain the necessary conditions for deadlock and discuss how deadlock can be prevented or avoided. Describe Banker's algorithm with example. (CO4, K3) 10

(7.2) What are race conditions? Explain with a practical example. How can race conditions be prevented in concurrent systems? (CO4, K2) 10

8. Answer any one of the following:-

(8.1) Describe the purpose and types of files used in an RTX-based embedded application. (CO5, K2) 10

(8.2) Describe binary and counting semaphores in RTX with use cases. (CO5, K2) 10

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