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

**B.Tech**

**SEM: IV - THEORY EXAMINATION (2025 - 2026)**

**Subject: Operating Systems**

**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**

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1. Attempt all parts:-

- (1.1) Identify the type of kernel in which the entire operating system operates within a single address space:(CO1,K1) 1
- (a) Monolithic Kernel
- (b) Microkernel
- (c) Hybrid Kernel
- (d) Exokernel
- (1.2) If you were designing a time-sharing OS, which of the following would be essential to include:(CO1,K1) 1
- (a) Long job queues only
- (b) Fixed CPU allocation without interruption
- (c) Scheduling algorithm with preemption
- (d) No user authentication
- (1.3) Choose one of the disadvantages of the priority scheduling algorithm:(CO2,K1) 1
- (a) it schedules in a very complex manner
- (b) its scheduling takes up a lot of time
- (c) it can lead to some low priority process waiting indefinitely for the CPU
- (d) none of the mentioned
- (1.4) Identify the option that is true for SRTF scheduling compared to SJF:(CO2,K1) 1
- (a) SRTF can preempt a running process
- (b) SJF does not consider process arrival time
- (c) SRTF is non-preemptive
- (d) SJF is better at handling long processes

- (1.5) A binary semaphore can have the following values:(CO3,K1) 1
- (a) Any integer value
  - (b) 0 and 1
  - (c) Only positive integers
  - (d) None of the above
- (1.6) Strict alternation ensures synchronization between two processes using:(CO3,K1) 1
- (a) A turn variable
  - (b) A semaphore
  - (c) A shared lock
  - (d) Hardware interrupts
- (1.7) In fixed partitioning, the problem of internal fragmentation occurs because:(CO4,K1) 1
- (a) Partitions are not fully utilized
  - (b) A process is larger than the partition
  - (c) Partitions are dynamically allocated
  - (d) OS occupies too much space
- (1.8) Segmentation is different from paging in that:(CO4,K1) 1
- (a) Segments are fixed-size
  - (b) Pages vary in size
  - (c) Segments are variable-sized logical divisions
  - (d) Paging uses logical memory
- (1.9) A major drawback of contiguous file allocation is:(CO5,K1) 1
- (a) Fragmentation
  - (b) Inefficient file lookup
  - (c) Lack of security
  - (d) Increased CPU overhead
- (1.10) Grouping method improves:(CO5,K1) 1
- (a) CPU speed
  - (b) Disk access efficiency
  - (c) Memory size
  - (d) File naming

2. Attempt all parts:-

- (2.1) Mention four types of system calls with example(CO1,K1) 2
- (2.2) Differentiate between Shortest Job First (SJF) scheduling and Shortest Remaining Time First (SRTF) scheduling.(CO2,K4) 2
- (2.3) Describe race condition & explain the reason why it is problematic in concurrent programming.(CO3,K2) 2
- (2.4) Describe the concept of non contiguous memory allocation.(CO4,K2) 2
- (2.5) State the concept of seek time and latency time.(CO5,K1) 2

## **SECTION-B**

30

Answer any one of the following:-

- (3.1) Illustrate the role of the Process Control Block (PCB) and explain the key information it stores to manage process execution.(CO1,K3) 6
- (3.2) Analyze the differences between batch processing and interactive operating systems with examples.(CO1,K4) 6

Answer any one of the following:-

- (3.3) Sketch and discuss the working of the Multilevel Queue Scheduling algorithm with a neat diagram.(CO2,K3) 6
- (3.4) Compare and contrast long-term and short-term schedulers in an operating system. (CO2, K4) 6

Answer any one of the following:-

- (3.5) Illustrate the necessary conditions to be satisfied for the solution of critical section problem.(CO3,K3) 6
- (3.6) Illustrate the strategies used for deadlock prevention by breaking necessary conditions of deadlock.(CO3,K3) 6

Answer any one of the following:-

- (3.7) Compare and contrast contiguous and non-contiguous memory allocation in operating systems.(CO4,K4) 6
- (3.8) Outline the concept of paging and explain how logical pages are stored in physical memory frames.(CO4,K2) 6

Answer any one of the following:-

- (3.9) Sketch and describe linked allocation in file systems, and demonstrate its advantages and limitations.(CO5,K3) 6
- (3.10) Discuss grouping and counting techniques in free space management.(CO5,K2) 6

### **SECTION-C** 50

4. Answer any one of the following:-

- (4.1) Illustrate the concept of an operating system and analyze its key functions and services in modern computing.(CO1,K3) 10
- (4.2) 10
- Sketch and label the Process Transition Diagram. Describe the transitions between different process states.(CO1,K3)

5. Answer any one of the following:-

- (5.1) Classify the different scheduling criteria used in CPU scheduling with suitable explanations.(CO2,K4) 10
- (5.2) Consider the set of 6 processes whose arrival time and burst time are given below:(CO2,K4) 10

| Process Id | Arrival time | Burst time |
|------------|--------------|------------|
| P1         | 0            | 7          |
| P2         | 1            | 5          |
| P3         | 2            | 3          |
| P4         | 3            | 1          |
| P5         | 4            | 2          |
| P6         | 5            | 1          |

1. Calculate the average waiting time and average turnaround time using the First-Come, First-Served (FCFS) scheduling algorithm.
2. Calculate the average waiting time and average turnaround time using the Shortest Job First (SJF) scheduling algorithm (non-preemptive) .
3. Calculate the average waiting time and average turnaround time using the SRTF scheduling algorithm.

6. Answer any one of the following:-

(6.1) Illustrate the use of semaphores in solving the Readers-Writers problem with multiple reader and writer processes.(CO3,K3) 10

(6.2) Let us consider the following snapshot.(CO3,K3) 10

| Process | Current Allocation |    |    |    | Maximum Need |    |    |    | Available |    |    |    |
|---------|--------------------|----|----|----|--------------|----|----|----|-----------|----|----|----|
|         | R1                 | R2 | R3 | R4 | R1           | R2 | R3 | R4 | R1        | R2 | R3 | R4 |
| P1      | 0                  | 1  | 2  | 1  | 1            | 2  | 2  | 2  | 1         | 1  | 1  | 0  |
| P2      | 1                  | 0  | 0  | 2  | 2            | 1  | 2  | 2  |           |    |    |    |
| P3      | 1                  | 3  | 1  | 0  | 3            | 3  | 2  | 1  |           |    |    |    |
| P4      | 2                  | 1  | 1  | 1  | 3            | 2  | 2  | 2  |           |    |    |    |
| P5      | 0                  | 2  | 0  | 2  | 1            | 3  | 1  | 3  |           |    |    |    |

1. Determine the total amount of instances of each resource
2. Find the content of matrix need
3. Is the system in a safe state or not?

7. Answer any one of the following:-

(7.1) Given the following reference string: 5, 3, 1, 5, 4, 1, 6, 3, 4, 5, 1, and a frame size of 3 & 4 , calculate the number of page faults using the FIFO,Optimal and LRU page replacement algorithm.(CO4,K4) 10

(7.2) Outline the structure and functioning of segmentation in memory management and explain how it works in operating systems.(CO4,K2) 10

8. Answer any one of the following:-

(8.1) Illustrate Direct Memory Access (DMA) in detail and compare it with programmed I/O and interrupt-driven I/O in operating systems(CO5,K4) 10

(8.2) Suppose that the head of moving head disk with 200 tracks numbered 0 to 199 is currently serving the request at track 143 and has just finished a request at track 125. If the queue request is kept in FIFO order, 86, 147, 91, 177 , 94, 150,102, 175, 130. What is the total head movement to satisfy these requests for i)SCAN ii) FCFS iii) SSTF disk scheduling algorithm.(CO5,K3) 10