

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**  
**(END SEMESTER EXAMINATION)**

CLASS: BTECH  
BRANCH: CSE/AI

SEMESTER : IV/ADD  
SESSION : SP/2025

**SUBJECT: CS239 OPERATING SYSTEM**

TIME: 3 Hours

FULL MARKS: 50

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q.1(a) What is the main advantage of multiprogramming? Discuss the essential properties of the batch processing and time sharing operating systems? [2+3] CO1 BL2
- Q.1(b) Describe the differences between short-term, medium-term and long-term scheduling? Describe the actions taken by a kernel to context-switch between kernel level threads? [3+2] CO2 BL4

- Q.2(a) Define the difference between preemptive and non-preemptive scheduling? Consider the set of 5 processes whose arrival time and burst time are given below: [2+3] CO2 BL5

Process ID	Arrival Time	Burst Time
P1	3	1
P2	1	4
P3	4	2
P4	0	6
P5	2	3

If the CPU scheduling policy is i) Shortest Job First (SJF) non-preemptive, and ii) SJF preemptive. Calculate the average waiting time and average turnaround time for (i) and (ii).

- Q.2(b) Explain the differences in the degree to which the following scheduling algorithms discriminate in favor of short processes: i) FCFS ii) RR iii) Multilevel feedback queues. [5] CO2 BL4

- Q.3(a) Define Race condition? Discuss Readers/Writers problem of process synchronization? [1+4] CO3 BL3

- Q.3(b) Consider the following snapshot of a system with three distinct resource types: A = 10, B = 5, and C = 7. [5] CO3 BL5

	Allocation			Max-Need		
	A	B	C	A	B	C
P1	0	1	0	7	5	3
P2	2	0	0	3	2	2
P3	3	0	2	9	0	2
P4	2	1	1	4	2	2
P5	0	0	2	5	3	3

Answer the following questions using the banker's Algorithm:

- a. What is the content of the current availability.
- b. What is the content of the matrix Remaining need.
- c. Is the system in a safe state? If the state is safe, show the order in which the processes may be completed. Otherwise, illustrate why the state is unsafe.

Q.4(a) Why are page sizes always powers of 2? Consider the following segment table:

[2+3] CO4 BL4

<u>Segment</u>	<u>Segment base</u>	<u>Segment Limit</u>
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses:

- a. 0, 430
- b. 1, 10
- c. 2, 500
- d. 3, 400
- e. 4, 112

Q.4(b) When do page faults occur? Consider the following page reference string:

[2+3] CO4 BL5

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6

Find the hit ratio and miss ratio for the Optimal page replacement and Least Recently Used (LRU) page replacement algorithms, assuming 3 frames? Remember that frames are initially empty, so your first unique pages will all cost one fault each.

Q.5(a) Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is

[5] CO5 BL5

86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for A) FCFS Disk scheduling algorithm, B) SSTF Disk scheduling algorithm.

Q.5(b) Discuss Linked allocation and Index allocation methods of disk space?

[5] CO5 BL3

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