B.E. INFORMATION TECHNOLOGY THIRD YEAR FIRST SEMESTER – 2025

Subject: Operating Systems

Full Marks - 100 **Time - 3 Hours**

CO1 (15 Marks)

Question No. 1

i. What is the key difference between a trap and an interrupt? [3]

ii. Explain the dual mode operation of an operating system. [3]

iii. What are the differences between the following: (a) synchronous and asynchronous I/O methods (b) multiprogramming and multitasking (c) Polling and Vectored interrupt [3 + 3 + 3]

CO2 (20 Marks)

Question No. 2

i. What are the differences between the following: (a) CPU bound and I/O bound processes (b) fork() and exec() system calls (c) independent and cooperating processes (d) Direct and Indirect communication (e) Message passing and shared memory. [3 X 5 = 15]

ii. What do mean by context switching? [3]

iii. What is the role of medium-term scheduler in process scheduling? [2]

CO3 (30 Marks)

Question No. 3 (Answer ANY ONE from either i or ii and the rest)

i. Consider the set of 6 processes whose arrival time and burst time (in milliseconds) are given below:

Process ID	Arrival Time	Burst Time
P1	0	7
P2	1	5
P3	2	3
P4	3	1
P5	4	2
P6	5	1

Draw Gantt charts and calculate the average waiting time and average turnaround time, considering each of the following scheduling algorithms: (a) FCFS (b) Non-preempted SJF (c) Preempted SJF [4 X 3 = 12]

ii. Assume there are 5 processes, P0 through P4, and 4 types of resources, At To, we have the following system state:

Max Instances of Resource Type A = 3 (2 Allocated + 1 Available)

Max Instances of Resource Type B = 17 (12 Allocated + 5 Available)

Max Instances of Resource Type C = 16 (14 Allocated + 2 Available)

Max Instances of Resource Type D = 12 (12 Allocated + 0 Available)

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	0	1	1	0	0	2	1	0	1	5	2	0
P1	1	2	3	1	1	6	5	2				
P2	1	3	6	5	2	3	6	6				
P3	0	6	3	2	0	6	5	2				
P4	0	0	1	4	0	6	5	6				

Use the Banker's algorithm to test if the system is in a safe state or not? If yes, determine the safe state sequence.

	iii. Explain the following terms related to IPC: (a) Race condition (b) Critical section (c) Mutual exclusion (d) Semaphores. [3 X 4 =12] iv. What is Dining philosopher problem? Explain its solution with monitor. [2+4]
CO4 (20 Marks)	**Question No. 4 (Answer ANY ONE from either i or ii and the rest)** i. Consider the following page reference string. 1, 2, 3, 4, 5, 3, 4, 1, 6, 7, 8, 7, 8, 9, 7, 8, 9, 5, 4, 5, 4, 2 How many page faults would occur for the following replacement algorithms, assuming four and six frames respectively? (a) FIFO page replacement (b) Optimal page replacement (c) LRU page replacement. [4 X 3 = 12] ii. Free memory holes of sizes 15K, 10K, 5K, 25K, 30K, 40K are available. Four processes P1, P2, P3 and P4 of sizes 12K, 2K, 25K, 20K is to be allocated. How processes are placed in first fit, best fit, worst fit? Calculate internal as well as external fragmentation. [(3 + 3 + 3) + 3] iii. Write short notes on (**ANY TWO**): (a) Demand Paging [4+4] (b) Segmentation (c) Belady's Anomaly (d) Internal and External Fragmentation
CO5 (15 Marks)	**Question No. 5** i. Discuss, in brief, about file allocation methods [5] ii. Consider an imaginary disk with 51 cylinders. A request comes in to read a block on cylinder 11. While the seek to cylinder 11 is in progress, new requests come in for cylinders 1, 36, 16, 34, 9, and 12, in that order. 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 each of the following disk scheduling algorithms: (a) FCFS (First come first serve) (b) SSTF (Shortest seek time first) (c) SCAN (d) C-SCAN (e) LOOK (Elevator) [2 X 5 = 10]

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CO1: Discuss technologies used in different operating systems.
CO2: Appraise and **illustrate** process management & thread management strategies along with their Operations.
CO3: Recognize and **analyze** process scheduling, synchronization and Deadlock.
CO4: Asses and **demonstrate** primary memory management techniques and virtual memory.
CO5: Examine file system interface and secondary memory management with case studies.