K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

July-Aug ~~May - June~~ 2025

B. Tech Program: **Artificial Intelligence & Data Science** Scheme **III**

Supp ~~Regular~~-Examination: SY Semester: **III**

Course Code: AIC403 and Course Name: **Operating System**

Date of Exam: ~~23/05/25~~ 01-08-25   Duration: 02.5 Hours   Max. Marks: 60

Instructions:
(1) All questions are compulsory.
(2) Draw neat diagrams wherever applicable.
(3) Assume suitable data, if necessary.

Q. No.	Question	Max. Marks	CO	BT level
Q 1	Solve any **two** questions out of three: (05 marks each)	10		
a)	List types of OS structure. Explain any two with suitable diagrams.		CO1	Un
b)	What is a context switch? Describe the action taken by a kernel to context switch between processes.		CO2	Un
c)	What is a Semaphore? Explain wait() and signal() in detail with suitable examples.		CO3	Un
Q 2	Solve any **two** questions out of three: (05 marks each)	10		
a)	Given the following memory blocks (sizes in KB): 100,500,200,300,600 And the following processes need to be allocated memory: 212,417,112,426. Allocate memory to each process using: First Fit, Best Fit, Worst Fit. For each method: Show step-by-step allocation, Clearly mention which block each process gets assigned. Which method results in the most efficient use of memory?		CO5	Ap
b)	What is a Resource Allocation Graph (RAG)? How can it be used for deadlock detection? Explain with a diagram showing a deadlock situation.		CO4	Un
c)	What is DMA? Explain with a suitable diagram.		CO6	Un
Q.3	Solve any **two** questions out of three. (10 marks each)	20		
a)	Explain the Multilevel paging scheme with a suitable hardware architecture diagram and example.		CO5	Un
b)	Explain the layered architecture of the basic file system with its access methods.		CO6	Un
c)	Explain in detail the concept of threads in an operating system. Differentiate between user-level and kernel-level threads with suitable diagrams. Discuss the advantages and disadvantages of each type.		CO2	Un
Q.4	Solve any **two** questions out of three. (10 marks each)	20		
a)	Considering a system with five processes P_0 through P_4 and three resources of type A, B, and C. Resource type A has 9 instances, B has 4 instances, and type C has 7 instances. Suppose at time t_0 following snapshot of the system has been taken:		CO4	Ap

Info - AD̶S̶ ~~May June~~ 2025

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Process	Allocation			Max		
	A	B	C	A	B	C
P0	0	1	0	7	5	3
P1	0	0	2	4	3	3
P2	2	0	0	3	2	2
P3	2	1	1	2	2	2
P4	3	0	2	9	0	2

Available

A	B	C
2	2	2

a. What will be the content of the Need matrix?
b. Is the system in a safe state? If yes, then what is the safe sequence?
c. Request received from process P1 is 1 1 0, will it be granted immediately?

			CO2	Ap
b)	Consider the following set of processes, with the length of CPU burst time and arrival time given in milliseconds.			

Process	Arrival time	Burst Time	Priority
P1	0	4	3
P2	1	6	2
P3	3	3	4
P4	4	2	1
P5	5	3	2

Calculate Average Turnaround Time and Average Waiting Time along with a Gantt chart for each process, for the following two scheduling algorithms
    1) Non-preemptive priority
    2) Preemptive priority

		CO5	Ap
c)	Consider a main memory with three-page frames and the following sequence of page references: 3, 8, 2, 3, 9, 1, 6, 3, 8, 9, 3, 6, 2, 1, 3. Find the number of page faults and page hits using 1) First-In-First-out (FIFO), 2) Least Recently Used (LRU), and 3) Optimal page replacement policies.		

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