U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: AI&DS/CSE(IOT)/CSE(DS) **Duration: 3 hrs.**
Course Code: 23DC4PCOPS **Max Marks: 100**
Course: Operating Systems

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

				CO	PO	Marks
			UNIT - I			
1	a)		Explain the abstract view of the components of a computer system. Draw a neat labeled diagram showing the interaction among hardware, system software, application programs, and users	*CO1*	*PO1*	**10**
	b)		Describe the interrupt-driven I/O cycle in detail, including all the steps involved and how it improves efficiency over polling. Support your explanation with a diagram	*CO1*	*PO1*	**10**
			OR			
2	a)		Identify and explain the various operating system services, such as process management, memory management, file systems, and device management. Illustrate your answer with a diagram showing how these services interact within the system	*CO2*	*PO2*	**10**
	b)		Elaborate on the process of transitioning from user mode to kernel mode in an operating system. Use a diagram to illustrate the flow	*CO2*	*PO2*	**10**
			UNIT - II			
3	a)		Compare and contrast mutex locks and semaphores with examples.	*CO2*	*PO2*	**05**
	b)		List the key components of a Process Control Block (PCB) and represent them using a neat labeled diagram	*CO2*	*PO2*	**05**
	c)		Demonstrate a race condition in the assignment of a process ID (PID) in a multi process system, explaining the potential issues it can cause. Support your answer with a neat and well-labeled diagram showing concurrent access.	*CO2*	*PO2*	**10**

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<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>4</td><td>a)</td><td>Implement a small program that uses semaphores to manage the synchronization of multiple threads, demonstrating the use of sem wait() and sem signal() for mutual exclusion and signaling</td><td>CO2</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Differentiate data parallelism and task parallelism, explaining how each approach handles computation in parallel.</td><td>CO2</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - III</td><td></td><td></td><td></td></tr>
<tr><td></td><td>5</td><td>a)</td><td>Based on the results of CPU scheduling, discuss the impact of different time quantum values in the Round Robin scheduling algorithm. How does the time quantum influence the Average Waiting Time (AWT) and Average Turnaround Time (ATT)? Apply this to the following process set with time quantum = 2 ms and 5 ms:
<table>
<tr><th>Process</th><th>Burst Time(ms)</th><th>Arrival Time(ms)</th></tr>
<tr><td>P1</td><td>4</td><td>0</td></tr>
<tr><td>P2</td><td>5</td><td>2</td></tr>
<tr><td>P3</td><td>4</td><td>4</td></tr>
<tr><td>P4</td><td>2</td><td>6</td></tr>
<tr><td>P5</td><td>3</td><td>7</td></tr>
</table></td><td>CO2</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Consider the following snapshot of a system:
<table>
<tr><th>Process</th><th>Allocation (A,B,C)</th><th>Max (A,B,C)</th><th>Available (A,B,C)</th></tr>
<tr><td>T0</td><td>112</td><td>212</td><td>220</td></tr>
<tr><td>T1</td><td>201</td><td>212</td><td></td></tr>
<tr><td>T2</td><td>221</td><td>321</td><td></td></tr>
<tr><td>T3</td><td>100</td><td>221</td><td></td></tr>
<tr><td>T4</td><td>200</td><td>201</td><td></td></tr>
</table>
Answer the following questions using the Banker’s Algorithm:
A. What is the content of the matrix Need?
B. Is the system in a safe state? If Yes, what is the safe sequence?
C. If a request from thread T2 arrives for (1, 0, 1), can the request be granted immediately? If Yes, what is the safe sequence?</td><td>CO3</td><td>PO3</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
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<table>
<tr><td></td><td>6</td><td>a)</td><td>Given the following processes with their arrival times, burst times, and priorities:
<table><tr><th>Process</th><th>Arrival Time(ms)</th><th>Burst Time(ms)</th><th>Priority
(1 Highest)</th></tr><tr><td>P1</td><td>0</td><td>3</td><td>3</td></tr><tr><td>P2</td><td>1</td><td>2</td><td>2</td></tr><tr><td>P3</td><td>3</td><td>5</td><td>1</td></tr><tr><td>P4</td><td>5</td><td>2</td><td>4</td></tr><tr><td>P5</td><td>8</td><td>1</td><td>2</td></tr></table>Simulate the following CPU scheduling algorithms, draw Gantt charts, and compute the Average Waiting Time (AWT) and Average Turnaround Time (ATT) for each:
A. Preemptive Shortest Job First (SJF) (Exclude Priority).
B. Non-Preemptive Priority Scheduling.</td><td>CO3</td><td>PO3</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Describe the role of the dispatcher in process scheduling and Discuss the various scheduling criteria for process management. Explain their significance in selecting a suitable scheduling algorithm.</td><td>CO2</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - IV</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>Given a reference string 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2 and 4 frames, apply the following algorithms and count the page faults: (a) FIFO (b) Optimal (c) LRU Evaluate which performs best for this string and explain why. Use diagrams to support your explanation.</td><td>CO3</td><td>PO3</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>With a neat labeled diagram, explain how Hardware support for relocation and limit registers are done in MMU(Memory Management Unit).</td><td>CO2</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>8</td><td>a)</td><td>Explain how virtual memory is managed in modern operating systems. Discuss the role of the page table, TLB (Translation Lookaside Buffer) the management of virtual memory. Use diagrams to support your explanation.</td><td>CO1</td><td>PO1</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Demonstrate how the next-fit, best-fit, and first-fit algorithms work in dynamic storage allocation. Include a scenario with five memory partitions of sizes 500 KB, 250 KB, 300 KB, 700 KB, and 400 KB, and five processes of sizes 350 KB, 100 KB, 450 KB, 200 KB, and 150 KB. Illustrate your answer with appropriate diagrams.</td><td>CO3</td><td>PO3</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - V</td><td></td><td></td><td></td></tr>
<tr><td></td><td>9</td><td>a)</td><td>A developer wants to test software across multiple OS environments. Explain how virtual machines enable this and</td><td>CO1</td><td>PO1</td><td>10</td></tr>
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			what benefits they offer in this context.			
		b)	Explain how protection rings are utilized in virtualization to maintain security and privilege separation.	*CO2*	*PO2*	**10**
			OR			
	10	a)	Differentiate between Type 1 and Type 2 virtual machines using suitable diagrams. Describe their implementations and preferred usage scenarios.	*CO2*	*PO2*	**10**
		b)	Explain the difference between system models of a Non-Virtual Machine and a Virtual Machine using a comparative diagram. Highlight the role of abstraction in each.	*CO1*	*PO1*	**10**

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