

		<b>Parul University</b> <b>Faculty of Engineering and Technology</b> <b>Parul Institute of Engineering and Technology</b> <b>Artificial Intelligence and Data Science Department</b>		
Subject Name	Operating System		A.Y	2025-2026
Subject Code	303105251		Semester	4
<b>Chapter-1</b>				
Sr No	<b>Question</b>		<b>COs</b>	<b>B.T</b>
1	What is the key difference between a trap and an interrupt?		1	Remember
2	What are the types of System calls?		1	Remember
3	List any four-process management system call.		2	Understand
4	Define user mode and kernel mode. Why two modes are required?		1	Remember
5	What is the O.S features required for multiprogramming?		2	Remember
6	What are the advantage and disadvantage of multiprocessor system?		2	Analyze
7	Describe the difference between symmetric and asymmetric multiprocessing?		2	Analyze
8	Distinguish between the client-server and peer-to-peer models of distributed system.		3	Analyze
9	What difference is between loosely coupled and tightly coupled system.		3	Understand
10	What are advantages of distributed System?		3	Understand
11	What are the requirements of hard real time and soft real time system?		4	Understand
12	What are the drawbacks of monolithic system?		4	Analyze
13	What are the advantages of layered structure over monolithic structure?		4	Remember
14	Give examples of microkernel.		5	Remember

15	What are differences between macro kernel and micro kernel?	4	Analyze
16	Justify whether following statements are true or false The user application interacts directly with O.S. a. The user application interacts directly with O.S. b. Shell is part of operating System	5	Evaluate

## Chapter-2

Sr No	Question	COs	B.T
1	Define process and Explain process states in details with diagram.	1	Understand
2	Explain process states and process control block in details.	1	Understand
3	Explain the process state transition diagram used in multiprogramming environment. Describe the fields in a process control block (PCB). What is switching overhead?	1	Understand
4	What is thread? Explain classical thread model OR Explain threads in detail.	2	Analyze
5	Explain and differentiate between user level and kernel level thread.	2	Analyze
6	List the main difference and similarities between threads and process.	2	Apply
7	What are various criteria for a good process scheduling algorithm? Explain any two pre-emptive scheduling algorithms in brief.	2	Apply
8	Explain the following process scheduling algorithm a. Priority scheduling b. Shortest job first scheduling	3	Analyze
9	Explain the effect of increasing the time quantum to an arbitrary large Number and decreasing the time quantum to an arbitrary small number for round robin scheduling algorithm with suitable example?	3	Apply
10	Consider following processes with length of CPU burst time in milliseconds  Process Burst time P1 5 P2 10	3	Understand

	<p>P3      2      P4      1      All process arrived in order p1, p2, p3, p4 all time zero</p> <p>a.     Draw Gantt charts illustrating execution of these processes for SJF and round robin (quantum=1)      b.     Calculate waiting time for each process for each scheduling algorithm      c.     Calculate average waiting time for each scheduling algorithm</p>																				
11	<p>Consider following processes with length of CPU burst time in millisecond</p> <table border="1"> <thead> <tr> <th>Process</th> <th>Burst time</th> <th>Priority</th> </tr> </thead> <tbody> <tr> <td>P1</td> <td>10</td> <td>3</td> </tr> </tbody> </table> <table border="1"> <tbody> <tr> <td>P2</td> <td>1</td> <td>1</td> </tr> <tr> <td>P3</td> <td>2</td> <td>3</td> </tr> <tr> <td>P4</td> <td>1</td> <td>4</td> </tr> <tr> <td>P5</td> <td>5</td> <td>2</td> </tr> </tbody> </table> <p>All processes arrived in order p1, p2, p3, p4, p5 all at time zero.</p> <ol style="list-style-type: none"> <li>1. Draw Gant charts illustrating execution of these processes for SJF, non preemptive priority (smaller priority number implies a higher priority) &amp; round robin(quantum=1)</li> <li>2. Calculate turnaround time for each process for scheduling algorithm in part (1)</li> <li>3. Calculate waiting time for each scheduling algorithm in part (1)</li> </ol>	Process	Burst time	Priority	P1	10	3	P2	1	1	P3	2	3	P4	1	4	P5	5	2	3	
Process	Burst time	Priority																			
P1	10	3																			
P2	1	1																			
P3	2	3																			
P4	1	4																			
P5	5	2																			
12	Explain the following term related to IPC: a) Race condition b) critical region.	4	Understand																		
13	What are critical sections? Why mutual exclusion required? Explain any 2 methods of achieving mutual exclusion in detail.	4	Understand																		
14	Explain the terms related to IPC – a) Race condition b) critical section c) Mutual exclusion d) Semaphores	4	Remember																		

15	Explain in detail the following solutions for achieving mutual exclusion a) Look variable b) TSL instruction	5	Understand
16	Explain Peterson's solution for achieving mutual exclusion	5	Understand
17	Discuss in detail following solution for achieving mutual exclusion a) Disabling interrupts b) Strict alteration	5	Understand
18	Explain semaphore in detail.	5	Apply
19	What is semaphore? Discuss product-consumer problem with semaphore.	5	Remember
20	Write short note on: a) Dining philosopher problem b) System calls c) Monitors d) Peterson's solution for achieving mutual exclusion e) Semaphores f) Readers & writers' problem.	5	Remember
21	Explain the terms: a) time sharing b) mutual exclusion	4	Apply
22	What is monitor? Explain solution for producer-consumer problem using monitor. Explain monitors in detail.	5	Remember
23	Write short on: a) message passing b) shell	6	Understand
24	How message passing is used in IPC.	6	Apply
25	What is message passing? Discuss procedure consumer problem with message passing.	6	Analyze
26	Explain use of message passing & semaphore for inter process communication?	6	Understand

27	Explain dinning philosopher problem & its solution.	5	Understand
28	What is dinning philosopher problem? Explain its solution with monitor.	5	Apply
29	What is dinning philosopher problem? Explain its solution with semaphore.	5	Apply
30	Explain readers & writers' problem? Give its solution with semaphore.	5	Apply
31	Write short notes on: a) Process states b) Critical section c) Race condition d) Starvation e) PCB f) Two level scheduling g) Round robin scheduling	1	Remember

### Chapter-3

Sr No	Question	COs	B.T
1	What are the objectives and minimal set of requirements for the file management system?	3	Understand
2	What criteria are important in choosing a file organization?	2	Understand
3	Explain briefly file system architecture & file management function.	3	Understand
4	List& briefly explain 5 file organization.	2	Remember
5	Compare file organization methods.	4	Analyze
6	Which are the typical information elements of a file directory?	3	Remember
7	Which are the typical operations performed on directory?	3	Remember
8	What are the typical access rights that may be granted or denied to a particular user for a particular file?	1	Remember

9	What are methods of free space management of Disk?	3	Understand
10	Explain linked list allocation using index in details.	3	Understand
11	Explain file system consistency in detail.	2	Understand
12	Explain file system reliability & performance in detail.	2	Understand
13	What is directory? Explain directory operation in details.	1	Understand
14	Explain linked list allocation of file in detail.	3	Understand
15	Explain file system performance in detail.	3	Understand
16	Explain the following techniques to improve file system performance.  a) Block read ahead and b) Reducing disk arm motion	4	Analyze
17	Explain file system implementation using linked list with index and i-node in detail?	3	Understand
18	Explain the following file allocation methods a) Contiguous allocation b) i-node	3	Analyze
19	What are points to be consider in file system design? Explain linked list allocation & index allocation in detail.	3	Analyze
20	Differentiate between windows and unix file system. 2 MARKS/SHORT ANSWER QUESTIONS	4	Analyze
21	What is the difference between field and record?	3	Remember
22	What is the difference between file and database?	2	Remember
23	What is file management system?	2	Remember
24	What is relation between pathname & a working directory?	1	Remember

Chapter-4																																																																																						
Sr No	Question													COs	B.T																																																																							
1	What are the conditions for deadlock? Explain deadlock detection and recovery in detail.													5	Understand																																																																							
2	Explain deadlock prevention in detail.													5	Understand																																																																							
3	Write short notes on: a) Deadlock modeling b) Bankers algorithm.													5	Remember																																																																							
4	Explain deadlock avoidance using banker's algorithm in details.													5	Analyze																																																																							
5	What is deadlock? Explain deadlock detection with multiple resources of each type.													5	Understand																																																																							
6	Explain bankers algorithm for multiple resources to avoid deadlock.													5	Analyze																																																																							
7	Explain various methods for recovery from deadlock.													5	Understand																																																																							
8	Discuss deadlock detection with one resource of each type.													5	Understand																																																																							
9	Write short notes on- a) Bankers algorithm for single resources. b) Ostrich algorithm.													5	Remember																																																																							
10	Explain deadlock avoidance with suitable example using banker's algorithm.													5	Apply																																																																							
11	28. Consider the following snapshot-  Allocated      Max      Available  <table border="1"> <tr> <td></td><td>A</td><td>B</td><td>C</td><td>D</td><td>A</td><td>B</td><td>C</td><td>D</td><td>A</td><td>B</td><td>C</td><td>D</td><td></td> </tr> <tr> <td>P0</td><td>0</td><td>0</td><td>1</td><td>2</td><td>0</td><td>0</td><td>1</td><td>2</td><td>1</td><td>5</td><td>2</td><td>0</td><td></td> </tr> <tr> <td>P1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>7</td><td>5</td><td>0</td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>P2</td><td>1</td><td>3</td><td>5</td><td>4</td><td>2</td><td>3</td><td>5</td><td>6</td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>P3</td><td>0</td><td>6</td><td>3</td><td>2</td><td>0</td><td>6</td><td>5</td><td>2</td><td></td><td></td><td></td><td></td><td></td> </tr> </table>															A	B	C	D	A	B	C	D	A	B	C	D		P0	0	0	1	2	0	0	1	2	1	5	2	0		P1	1	0	0	0	1	7	5	0						P2	1	3	5	4	2	3	5	6						P3	0	6	3	2	0	6	5	2						5	Apply
	A	B	C	D	A	B	C	D	A	B	C	D																																																																										
P0	0	0	1	2	0	0	1	2	1	5	2	0																																																																										
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	<table border="1"> <tr> <td>P4</td><td>0</td><td>0</td><td>1</td><td>4</td><td>0</td><td>6</td><td>5</td><td>6</td><td></td><td></td><td></td><td></td><td></td></tr> </table> <p>Answer the following questions using banker's algorithm:</p> <ol style="list-style-type: none"> <li>What are contents of matrix end?</li> <li>Is the system in safe state?</li> <li>If request for process p1 arrives for (0,4,2,0). Can the request be granted immediately?</li> </ol>	P4	0	0	1	4	0	6	5	6							
P4	0	0	1	4	0	6	5	6									
12	What are deadlock? Explain its model with example. Explain any three methods of dealing with deadlock. N/D 2008 8M.	5	Understand														
13	<p>A system has three types of resources R1 R2 R3 and their number of units are 3, 2, 2 respectively. Four processes P1 P2 P3 p4 are currently competing for these resources in following number.</p> <ol style="list-style-type: none"> <li>P1 is holding one unit of R1 and is requesting for one unit of R2.</li> <li>P2 is holding two units of R2 and is requesting for one unit each of R1 and R3.</li> <li>P3 is holding one unit of R1 and is requesting for one unit of R2.</li> </ol> <p>P4 is holding two units of R3 and requesting for one unit of R1. Determine which if any of the processes are deadlock in this state. M/J 2012 8M.</p>	5	Analyze														
14	Explain swap space management methods of disk in detail. N/D 2008 8M.	4	Understand														
15	<p>Consider system with total of 150 minutes of memory allocated to three processes as shown. Apply banker's algorithm to determine whether it would be safe to grant each of following request. If yes-Indicate sequence of termination that could be possible. If no-Show reduction of resulting allocation table.</p> <ol style="list-style-type: none"> <li>A 4<sup>th</sup> process is arrived with maximum need of 60 and initial need of 25 units.</li> </ol>	5	Analyze														

	<p>2. A 4<sup>th</sup> process is arrived with maximum need of 60 and initial need of 35 units.</p> <table border="1"> <thead> <tr> <th>Process</th><th>Max</th><th>Hold</th></tr> </thead> <tbody> <tr> <td>P1</td><td>70</td><td>45</td></tr> <tr> <td>P2</td><td>60</td><td>10</td></tr> <tr> <td>P3</td><td>60</td><td>15</td></tr> </tbody> </table>	Process	Max	Hold	P1	70	45	P2	60	10	P3	60	15		
Process	Max	Hold													
P1	70	45													
P2	60	10													
P3	60	15													
16	Explain history of windows operating system.	2	Remember												
17	<p>Write short notes on-</p> <ul style="list-style-type: none"> <li>a) Features of windows- 7.</li> <li>b) WINDOWS -7 architecture</li> <li>c) WINDOWS -7 Registry</li> </ul>	2	Remember												
18	Explain architectural features of WINDOWS-7.	2	Understand												
19	Explain system structure of WINDOWS- 7.	2	Understand												
20	Explain process and thread management WINDOWS- 7 in detail.	5	Understand												
21	Explain in brief concurrency control supported by WINDOWS -7.	5	Apply												
22	Briefly explain security features of WINDOWS7.	2	Analyze												
23	Explain memory management and I/O management.	2	Apply												

### Chapter-5

Sr No	Question	COs	B.T
1	What are the memory management requirements?	4	Understand
2	Explain multiprogramming with fixed partition.	4	Understand
3	Explain multiprogramming with dynamic partition.	4	Understand

4	Write short note on: Relocation problem for multiprogramming with fixed partitions.	3	Remember
5	Explain static partitioned allocation with partition sizes 300,150, 100, 200, 20. Assuming first fit method indicate the memory status after memory request for sizes 80, 180, 280, 380, 30.	2	Analyze
6	Discuss in details memory management with buddy system.	3	Apply
7	A 1MB block of memory is allocated using the buddy system.  i) Show the results of the following sequence in a figure: Request 70; Request 35; Request 80; Return A; Request 60; Return B; Return D; Return C. ii) Show the binary tree representation following Return B.	3	Apply
8	Explain memory management with bit maps in detail.	3	Understand
9	Explain memory management with linked list in details.	3	Apply
10	What are the differences of internal and external memory Fragmentation?		Remember
11	Explain following allocation algorithm.  a) First fit b) Best fit c) Worst fit d) Next fit	4	Understand
12	Explain the difference between logical and physical addresses?	4	Remember
13	What is paging? Discuss basic paging technique in details.  OR Explain paging in detail.	3	Apply
14	Explain hierarchical page table and inverted page table.	3	Understand
15	What is segmentation? Explain the basic segmentation method.	3	Apply

	Or Explain Segmentation in details.		
16	What is demand paging? Explain it with address translation mechanism used. What are its specific advantages? How a page table is implemented?	4	Apply
17	What is virtual memory? How it is implemented.	4	Apply
18	Write short on:  a) Multiprogramming with fixed & variable partition. b) Relocation problem for multiprogramming with fixed partition. c) Use of multiprogramming in memory management. d) TLB. e) Paging. f) Design issues of paging system. g) Relocation and protection. h) Policy driven scheduling.	4	Remember
19	Write short note on:  a) Segmentation b) Page table c) Compaction d) Working set model e) Fragmentation	4	Apply
20	Write short note on:  a) Not-recently used page replacement algorithm. b) Optimal page replacement algorithm. c) Swapping. d) Relocation and protection.	4	Remember
21	Explain following page replacement algorithm in detail. i. LRU ii. FIFO	2	Remember
22	Explain the following page replacement algorithm.  a) Optimal page replacement b) Least recently used page replacement.	2	Apply

23	Explain difference between internal external fragmentations in detail.	3	Understand
24	Consider the following page reference string. 1,2,3,4,5,3,4,1,6,7,8,7,8,9,7,8,9,5,4,5,4,2How many page faults would occur for the following replacement algorithm, assuming four and six frames respectively? A) page replacement. B) FIFO page replacement.	3	Remember
25	Describe the term page fault frequency. What is thrashing? How is it controlled by OS?	4	Evaluate
26	Free memory holes of sizes 15K, 10K, 5K, 25K, 30K, 40K are available. The processes of size 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.	2	Understand
27	On a simple paging system with $2^{24}$ bytes of physical memory, 256 pages of logical address Space, and a, page size of $2^{10}$ bytes, how many bits are in logical address?	2	Evaluate
28	A certain computer provides its user with a virtual memory space of $2^{32}$ bytes. The computer has $2^{35}$ bytes of physical memory. The virtual memory is implemented by paging the page size is 4096 bytes. A user process generates the virtual address 11123456. Explain how the system establishes the corresponding physical location.	1	Apply
29	Calculate page faults for (LRU, FIFO, OPT) for following sequences where page frame is three. 0,1,2,1,4,2,3,7,2,1,3,5,1,2,5.	3	Apply

### Chapter-6

Sr No	Question	COs	B.T
1	Discuss briefly the following issues related to device independent i/o software.  a) Uniform interfacing for device drivers. b) Buffering.	2	Understand
2	Discuss in details devices drivers.	3	Understand

3	<p>Write short notes on:</p> <ul style="list-style-type: none"> <li>a) Devices independent I/O software</li> <li>b) Goals of I/O software</li> <li>c) Interrupt handler</li> <li>d) I/O Devices.</li> <li>e) Device drivers</li> <li>f) Device controllers</li> <li>g) Disk space management</li> <li>h) Disk arm scheduling algorithm</li> </ul>	2	Remember
4	<p>Discuss the following:</p> <ul style="list-style-type: none"> <li>a) Magnetic disk</li> <li>b) CDs</li> <li>c) RAID</li> <li>d) DVDs</li> <li>e) Formatting Disk</li> </ul>	2	Understand
5	<p>Discuss the following related to disk space management</p> <ul style="list-style-type: none"> <li>a) Block size</li> <li>b) Keeping track of free blocks.</li> </ul>	2	Understand
6	<p>Suppose a disk drive has 400 cylinders , numbered 0 to 399.The driver is currently serving a request at cylinder 143 and previous request was at cylinder 125 .The queue of pending request in FIFO order is: 86,147,312,91,177,48,309,222,175,130.</p> <p>Starting from the current head position what is the total distance in cylinders that the disk to satisfy all the pending request for each of the following disk scheduling algorithms?</p> <p>1] SSTS      2] SCAN      3] C-SCAN</p>	2	Apply