QP Code:CS2T04-2 **(Pages:4)**

Reg No : ..... Name : .....

MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM

(Govt. Aided Autonomous Institution)

Fourth Semester B.Tech. Degree Examination, May, 2026

Course Code: B24CS2T04

Course Name: OPERATING SYSTEMS

Max. Marks: 100 Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)

Answer all questions

1. A user program attempts to access hardware devices directly without going through the operating system. Explain why this is generally not allowed in modern computer systems.
2. A program running in user mode attempts to execute a privileged instruction. Explain what will happen and why.
3. Illustrate the concepts of preemptive and non-preemptive scheduling.
4. Explain how synchronization is achieved in Shared Memory systems.
5. What happens if the buffer is full and the producer continues producing?
6. How can the operating system detect whether a deadlock has occurred?
7. Explain the difference between compile time binding and load time binding.
8. A system has limited physical memory, but users need to run multiple large programs simultaneously. Explain how virtual memory helps the operating system handle this situation.
9. Enumerate the different types of files?
10. Explain the significance of Access Control List in files?

PART - B: 70 Marks (5 Qns x 14 Marks)

Answer any One full question from each module.

Module 1

11. (a) Explain dual-mode operation in an Operating System. How does it ensure system protection?

(7 Marks)

(b) A user is running a word processor on a computer system and attempts to save a file and print the document. Explain how operating system services are involved in this process and describe how user

mode and kernel mode work together to ensure secure and efficient execution. (7 Marks)

OR

12. Explain the evolution of Operating System structures from simple monolithic design to modular and microkernel architectures. Discuss the need for structural improvements.

Module 2

13. Explain the Priority Scheduling algorithm in detail. Discuss how the algorithm works in both preemptive and non-preemptive modes. Explain the concept of starvation and describe how the aging technique can be used to overcome lower-priority processes in the system.

OR

14. (a) Explain the process concept in detail. Describe the various states of a process with a neat state transition diagram. (7 Marks)

(b) A system running multiple real-time applications shows performance degradation due to frequent process switching. Explain how context switching contributes to this problem and suggest ways to reduce overhead. (7 Marks)

Module 3

15. (a) Compare software-based solutions (Peterson's) and hardware-based synchronization mechanisms. (7 Marks)

(b) Consider the following pseudo code:

```
int counter = 0;
Thread 1:
counter++;
Thread 2:
counter++;
```

- Identify the critical section.
- Explain why race condition occurs.
- Rewrite the program structure using synchronization to ensure mutual exclusion. (7 Marks)

OR

16. a) Define deadlock. Explain in detail the four necessary conditions that must hold simultaneously for a deadlock to occur. (5 Marks)

b) Consider a system has 4 processes (P0–P3) and 3 resource types (A, B, C) and let the total System Resources be A = 4, B = 7, C = 4

Process	Allocation (A B C)	Maximum (A B C)
P0	0 2 1	4 3 1
P1	1 0 0	2 2 2
P2	1 3 2	3 3 2
P3	0 1 1	1 2 2

a) Find the Available resource vector

b) Compute the Need matrix

c) Check whether the system is in a safe state

d) Define a safe sequence in the context of deadlock avoidance

(9 Marks)

Module 4

17. a) Consider the following page reference string:

7, 2, 3, 1, 2, 5, 3, 4, 6, 7, 7, 1, 0, 5, 4, 6, 2, 3, 0, 1.

Assuming demand paging with three frames, how many page faults would occur for the following replacement algorithms?

• LRU replacement

• FIFO replacement

• Optimal replacement (9 Marks)

b) Explain the need for page replacement in a paging system. (5 Marks)

OR

18. a) Consider a logical address space of 256 pages with a 4-KB page size, mapped onto a physical memory of 64 frames.

a. How many bits are required in the logical address?

b. How many bits are required in the physical address?

c. How many bits are required for page offset?

d. Find the number of entries in the page table. (8 Marks)

b) A system uses segmentation memory management. The segment table of a process is given below.

Segment No	Base Address	Limit
0	1000	400
1	1400	300
2	2000	500
3	2600	200

Find the physical address corresponding to (0, 350), (1, 250) and (3, 210). (6 Marks)

Module 5

19. Consider a disk queue with requests for I/O to blocks on cylinders 98, 183, 41, 122, 14, 124, 65, 67. The head is initially at cylinder number 53. The cylinders are numbered from 0 to 199. Find out the total head movement incurred while servicing these requests, if following scheduling algorithms are used-(i) FCFS (ii) SSTF (iii) C-SCAN (iv) LOOK (v) C-LOOK (14 Marks)

OR

20. a) Discuss the in-memory structures used to implement the File system? (8 Marks)

b) Discuss in detail the different methods of allocation on files. (6 Marks)

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