Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (R) (FT/WP) Examinations April 2026 (2024 Scheme)

Course Code: PCCST403

Course Name: Operating Systems

Max. Marks: 60 Duration: 2 hours 30 minutes

PART A

(Answer all questions. Each question carries 3 marks)

		CO	Marks
1	Discuss how two modes of operations are implemented in operating systems.	CO1	(3)
2	Compare Linux with classic UNIX kernels.	CO1	(3)
3	Consider the methods used by Processes P1 and P2 for accessing their critical sections. The initial values of shared Boolean variables S1 and S2 are randomly assigned(either 0 or 1).	CO2	(3)

P1

```
while(S1==S2); //entry section
critical section
S1=S2;//exit section
```

P2

```
while(S1==S2); //entry section
critical section
S1=S2;//exit section
```

Analyse the code segment above and identify whether the mutual exclusion property of the Critical Section Problem is satisfied. Justify your answer.

4	A system uses Test-and-Set for synchronization. A student claims that it avoids starvation. Do you agree? Justify your answer.	CO3	(3)
5	Differentiate Logical address space and Physical address space.	CO4	(3)
6	Justify how paging solve the problem of external fragmentation.	CO4	(3)

7		A system transfers a large file using Programmed I/O and experiences high CPU usage. Describe any one technique to improve the CPU performance.	CO5	(3)
8		Compare and contrast different file access methods in modern Operating Systems.	CO5	(3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module -1

9	a)	What is meant by context switching? Illustrate the timeline of context switching between two processes P1 and P2, with the help of a diagram, in a multitasking environment.	CO1	(5)
	b)	What do you understand by system calls? List and explain the system calls used in process control.	CO1	(4)
10	a)	Eight independent processes P1–P8 arrive at time t = 0. CPU burst time is 40 ms for each process followed by an I/O operation that take 160 ms. The system uses Round Robin (RR) scheduling with time quantum of 10 ms and Context switch overhead is 2 ms. Compute the response time of process P1. How many times will P1 be preempted before its first I/O operation?	CO2	(6)
	b)	Identify and explain the sequence of process states a process goes through during execution, with the help of a neat diagram.	CO1	(3)

Module -2

11	a)	An online stock exchange maintains a shared memory segment for Live Stock Prices. Two types of processes access this data: Analyzers : Thousands of bots that read prices simultaneously. Processors : A few systems that update prices upon transaction. Explain the Readers-Writers Problem within this context, and provide a solution using semaphores that allows multiple Analyzers to read concurrently but ensures exclusive access for a Processor.	CO2	(6)

b) At a particular instant, the value of a counting semaphore is 7. Subsequently, 20 sem_wait() operations and 15 sem_post() operations are performed on the semaphore. Find the resulting value of the semaphore. CO2 (3)

12 a) Consider the following snapshot of the system with five processes P1,P2,P3,P4,P5 and four resources A,B,C,D. Using Banker's algorithm, check whether the system is in safe state or not ? What happens when the process P3 raises a new request <0 0 0 1> ? CO3 (6)

	Allocation				Max				Available			
P1	A	B	C	D	A	B	C	D	A	B	C	D
	1	0	2	2	3	2	5	2	3	0	0	1
P2	0	2	1	2	3	4	1	2				
P3	2	4	5	0	2	7	7	3				
P4	3	0	0	0	5	5	0	7				
P5	4	2	1	3	6	2	1	4				

b) A computer has 6 tape drives , with n processes competing for them. Each process may need 2 drives. What is the maximum value of n for the system to be deadlock free? CO3 (3)

Module -3

13 a) In a demand paging memory system, page table is held in registers. The time taken to service a page fault is 8 ms if an empty frame is available or if the replaced page is not modified, and it takes 20 ms, if the replaced page is modified. What is the average access time to service a page fault, assuming that the page to be replaced is modified 70% of the time? CO4 (4)

b) Consider the following page reference string: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6 With a frame allocation of 4,determine the number of page faults for the FIFO and LRU page replacement policies. CO4 (5)

14 a) How does Translation Look-aside Buffer(TLB) help to speed up the page access? Illustrate address translation using TLB CO4 (5)

b) Consider the following segment table and find the physical addresses corresponding to the following Virtual Addresses (VA). Assume that the logical address space is 16KB. CO4 (4)

(i) VA 4200 (ii) VA 1K

Segment	Base	Size	Grows Positive?
Code 32K 2K 1	32K	2K	1
Heap	34K	2K	1
Stack	28K	2K	0

Module -4

15 a) A disk has pending requests at tracks: 98, 183, 37, 122, 14, 124, 65, 67. If the disk head is initially at 53, explain how SCAN (Elevator algorithm) services these requests and why it is better than FCFS in this scenario. CO5 (4)

b) A disk uses fixed sectors of 512 bytes and has 256 sectors per track. The disk rotates at 720 rpm. A processor reads one sector from the disk using interrupt-driven I/O, where one interrupt is generated for each byte transferred. The processor requires 3μs(micro seconds) to service each interrupt. Assume that the desired sector is equally likely to be anywhere on the track when the read request is issued. Ignoring seek time, determine the percentage of the total time for this I/O operation during which the processor is busy servicing interrupts. CO5 (5)

16 a) Discuss the concept of Virtual File System. CO5 (4)

b) A UNIX file system has 1 KB block size and 4 byte disk addresses. What is the maximum file size if the inode contains ten direct block entries, one single indirect block entry, one double indirect block entry and one triple indirect block entry? CO5 (5)

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