Reg. No:

VIT
Vellore Institute of Technology

Final Assessment Test – November 2026

Course: **BCSE303L - Operating Systems**

Class NBR(s): **2784, 2791, 2796, 2800, 2803, 2809, 2823, 2834, 2840, 2842, 2844, 2847, 2855, 2863, 2868, 2872, 2874, 2876, 2879, 2881, 2883, 2888, 2893, 3033**

Slot: **B1+TB1**

Time: **3 Hours**

Max. Marks: **100**

➢ KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE

➢ DON'T WRITE ANYTHING ON THE QUESTION PAPER

General Instruction

Course Outcomes:

CO1: Interpret the evolution of OS functionality, structures, layers and apply various types of system calls of various process states

CO2: Design scheduling algorithms to compute and compare various scheduling criteria

CO3: Apply and analyze communication between inter process and synchronization techniques.

CO4: Implement page replacement algorithms, memory management problems and segmentation

CO5: Differentiate the file systems for applying different allocation, access technique, representing virtualization and providing protection and security in OS

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

PART-A (10 X 10 = 100 Marks)

Answer all Question(s)

Q1.	A server runs file management, networking, and device drivers within a single kernel address space. A faulty driver causes the server to crash, interrupting all services. Answer the following: (i) Identify the OS structuring method described. **(2 Marks)** (ii) Explain why a driver failure can affect the entire system. **(2 Marks)** (iii) Compare the monolithic and microkernel approaches for this situation. **(3 Marks)** (iv) Recommend an architecture or a design improvement to increase fault isolation and reliability. **(3 Marks)**	**10M**	**CO1**	**BL1**
Q2.	a) Compare processes and threads in terms of resource sharing, execution, communication, and context switching. **(5 Marks)** b) A computer receives frequent interrupts from network devices while running CPU-intensive applications. Analyze the effects on performance and propose solutions.**(5 Marks)**	**10M**	**CO1**	**BL2**
Q3.	Consider the following set of processes with the length of the CPU burst time in Milliseconds.			

Process	Arrival Time	Burst Time	Priority
P1	0	11	2
P2	5	28	0
P3	12	2	3
P4	2	10	1
P5	9	16	4

10M CO2 BL3

i) Draw Gantt chart illustrating the execution of these processes using **preemptive SJF**, **non-preemptive Priority** (a small priority number implies a higher priority) and **Round Robin** (Time Quantum= 4) scheduling. **(5 Marks)**

(ii) Calculate the average waiting time and average Turnaround time for the above scheduling algorithms.**(5 Marks)**

Q4. Consider the following snapshot of a system and determine the following using Banker's algorithm. **10M CO2 BL3**

i) What are the contents of need matrix? **(2 Marks)**

ii) Find the safe sequence to avoid deadlock? **(4 Marks)**

iii) If a request from process P1 arrives for (1, 0, 1, 0), can the request be granted immediately? If yes, show the possible order of execution (Safe Sequence). **(4 Marks)**

Process	Allocated Instance				Maximum Need				Available Instance			
	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4
P1	1	3	1	2	5	4	2	5	3	3	2	1
P2	3	1	2	1	6	2	5	2				
P3	2	1	0	3	7	3	1	6				
P4	2	0	0	1	4	2	1	1				
P5	1	4	3	2	5	6	6	5				

Q5. A system consists of multiple concurrent processes that share a common bounded buffer. Producer processes generate data and insert it into the buffer, while consumer processes remove and process the data. The system must ensure that producers do not insert data when the buffer is full and consumers do not remove data when the buffer is empty. Mutual exclusion must be maintained while accessing the shared buffer to prevent race conditions. **10M CO3 BL3**

Design and implement a solution to the producer-consumer problem using a monitor and condition variables. Explain how your solution ensures mutual exclusion, prevents race conditions, and handles synchronization when the buffer is full or empty.

Q6. Consider the following page reference string
0,3,1,3,2,3,6,0,4,1,4,2,4,7,0,5,1,5,2,5,8,0,3,1,3

	How many page faults would occur for the following replacement algorithms assuming five frames and six frames? Remember that all frames are empty? (i) MFU replacement **(3 Marks)** (ii) LRU replacement **(3 Marks)** (iii)Optimal replacement **(4 Marks)**	**10M**	**CO4**	**BL3**
Q7.	Distinguish between Paging and Segmentation. with a neat sketch, explain the technique of 'Segmentation with paging'.	**10M**	**CO4**	**BL2**
Q8.	Assume the read-write head is at cylinder 99 and there are 200 cylinders numbered from 0-199. The disk head is moving towards cylinders with larger value. For the I/O request queue below, what is the total number of head movements when using the following disk scheduling algorithms? Queue request: 62, 155, 107, 39, 27, 33, 175, 189 (i) SSTF (2 Marks) (ii) SCAN (2 Marks) (iii) C-SCAN (2 Marks) (iv) C-LOOK (2 Marks) (v) Compare the performance of SCAN and C-SCAN disk scheduling algorithms (in terms of total distance the disk arm moves) and state which one among the two is more preferable (2 Marks)	**10M**	**CO5**	**BL5**
Q9.	**a)** A latency-sensitive application performs well on a physical machine but experiences delays inside a Virtual Machine (VM). Identify possible causes involving CPU scheduling, memory management, storage, and network virtualization. Recommend suitable improvements.	**10M**	**CO5**	**BL4**
	(OR)			
	b) A company plans to consolidate 50 physical servers into 10 virtualized servers. Analyze the benefits, performance risks, security concerns, and cost implications of this decision.	**10M**	**CO5**	**BL4**
Q10.	**a)** An organization defines a security policy that only authorized employees can access confidential files. However, its operating system provides weak enforcement mechanisms. Analyze the problem and explain the relationship between security policy and mechanism.	**10M**	**CO5**	**BL4**
	(OR)			
	b) A university operating system must control access to student records, examination files, and administrative applications. Design an access matrix specifying suitable subjects, objects, and access rights. Explain how the matrix prevents unauthorized access.	**10M**	**CO5**	**BL5**

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