



# VIT<sup>®</sup>

Vellore Institute of Technology  
(Deemed to be University under section 3 of the UGC Act, 1956)

Reg. No. :

21BLC1122

## Final Assessment Test (FAT) - May 2024

Programme	B.Tech.	Semester	WINTER SEMESTER 2023 - 24
Course Title	OPERATING SYSTEMS	Course Code	BCSE303L
Faculty Name	Prof. ANANDAN P	Slot	D2+TD2
		Class Nbr	CH2023240502690
Time	3 Hours	Max. Marks	100
General Instructions:			
• Write only Register Number in the Question Paper where space is provided (right-side at the top) & do not write any other details.			

### Section - I

Answer all questions (4 X 10 Marks = 40 Marks)

01. A. Outline the key functionalities of the operating system for the smart home automation platform and describe how each functionality contributes to the seamless operation and management of smart devices in the home environment (5 Mark). [10]  
B. Additionally, discuss the challenges you might encounter in implementing these functionalities and propose strategies to address these challenges while ensuring reliability, security, and user convenience. ( 5 Mark)
02. Write a C program that demonstrates how threads can be used for multimedia processing without relying on mutexes for synchronization. Your program should include the following functionalities: [10]  
**Audio Playback Thread:** Create a thread that simulates playing audio. This thread should check a global variable **audio\_paused** before playing each audio segment. If **audio\_paused** is 1, the thread should skip audio playback.  
**Video Display Thread:** Create a thread that simulates displaying video frames. This thread should continuously display video frames without any interruptions.  
**User Input Thread:** Implement a thread to handle user input. This thread should wait for user commands and respond accordingly. The user can input commands to pause/resume audio or exit the program.  
a) Ensure proper handling of user input and thread management in your program. Utilize pthreads library for thread management. (6 marks)  
b) Use a global variable **audio\_paused** to control audio playback state. Explain how would you ensure the correctness and reliability of the program without implementing the concept of mutex. (4 marks)
03. The mobile phone repair shop needs to fix five different phones, each with unique repair requirements and arrival times: [10]  
Phones:



Phones:	Arrival Time(Minutes)	Repair Time(Minutes)
A	3	10
B	5	5
C	1	7
D	4	9
E	2	5

Create schedules for the mobile phone repair using two scheduling methods:

- One where phones are handled in the order they arrive.
  - Another where tasks are executed in a cyclical manner with each phone receiving a fixed time slice 5 minutes.
- Display the Gantt chart and Calculate the turnaround time for both scheduling methods mentioned above. (4 marks)
  - Calculate the waiting time and response time for both scheduling methods mentioned above. (4 marks)
  - Determine which scheduling method minimizes the average waiting time. (2 Marks)

04. The Barber's problem is a classic synchronization problem that involves multiple customers and a single barber. The barber has a limited number of chairs in the waiting room, and customers may enter the barber shop to get a haircut or wait in the waiting room if the barber is busy. As an expert answer the following [10]
- How would you optimize the management of chairs in the waiting room to minimize the waiting time for customers while ensuring that the barber is not overwhelmed with too many customers at once? (5 Mark)
  - How do you ensure that the solution is robust in a concurrent programming environment, avoiding potential issues such as deadlock while multiple threads/processes are accessing shared resources like chairs and the barber's services? (5 Mark)

## Section - II

Answer all questions (4 X 15 Marks = 60 Marks)

05. Imagine a cloud computing environment where multiple virtual machines (VMs) are running different applications and services. Each VM requires access to various resources such as CPU cycles in MIPS (R1), main memory in MB (R2), secondary storage in GB (R3), and network bandwidth in Mbps (R4). Suggest a suitable algorithm to ensure efficient resource utilization and prevent potential deadlock situations among VMs. At time  $t=3ms$ , the maximum resources that can request by each VM, already allocated, and available are given below: [15]

Process	Allocation				Maximum				Available (Work)			
	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4
VM1	3	1	1	1	4	1	1	2	3	2	5	4
VM2	2	2	1	1	2	2	1	1				
VM3	4	1	2	1	5	3	2	4				
VM4	2	4	1	1	3	5	3	3				
VM5	3	1	1	1	4	2	2	1				



- i. Find the next matrix. (2 marks)
  - ii. Check whether the system has a deadlock or not. Find the safety sequence if there is no deadlock. (8 marks)
  - iii. If VM2 requests an additional resource (1, 0, 1, 1), will it be granted immediately. Justify your answer. (5 marks)
06. Consider a dynamic library management system for a university with three bookshelves available for storage. The system dynamically tracks the availability of different books as students borrow and return items. A sequence of 20 book IDs (pages) is given as a reference string for this system. [15]
- Reference String: 6, 1, 1, 2, 0, 3, 4, 6, 0, 2, 1, 2, 1, 2, 0, 3, 2, 1, 2, 0
- (a) Evaluate the page replacement algorithms: FIFO, OPTIMAL, and LRU to manage these books efficiently in memory while minimizing requested book is not available. (12 marks)
  - (b) Estimate and comment on the miss ratio and hit ratio for each page replacement algorithms. (3 marks)
07. a) You are a system architect, tasked with implementing virtualization technology within a large enterprise environment that spans multiple departments and geographically dispersed offices. The company has decided to adopt hypervisor-based virtualization to consolidate its server infrastructure, optimize resource utilization, and improve scalability. Design and explain in detail about a comprehensive hypervisor deployment plan tailored to the company's needs. (10 Marks) [15]
- b) Some systems automatically delete all user files when a user logs off or a job terminates, unless the user explicitly requests that they should be kept. Other systems keep all files unless the user explicitly deletes them. Discuss the relative merits of each approach. (5 Marks)
08. In a fully automated car parking, for parking the cars, operator has to search and specify the shelf number, where each car is kept in the separate shelf. As the total number of shelf are too high (ie. 3000 so indexed from 0 to 2999), the car fetch will be done by the robots with the help of movable arms. Currently the robotic arm is in 120 shelf, the parking queue for the day is given here [15]
- 58, 2100, 990, 155, 108, 65, 420, 64, 333, 50
- Starting from the current arm position, what is the total distance (in shelf) that the robotic arm moves in the day for each of the following scheduling algorithms?
- a) SSTF (3 marks)
  - b) SCAN (3 marks)
  - c) C-SCAN (3 marks)
  - d) LOOK (3 marks)
  - e) C-SCAN (3 marks)
- Note: Arm direction will be from left to right (ie. from 0 to 2999)

