VIT
Vellore Institute of Technology
CHENNAI

Reg. Number: 24 BAI 1631

Continuous Assessment Test(CAT) – I AUGUST 2025

Programme	:	B.Tech	Semester	:	Fall Semester 25-26
Course Code & Course Title	:	BCSE303L&Operating Systems	Class Number	:	CH2025260101391 CH2025260101393 CH2025260101437 CH2025260101441 CH2025260101495 CH2025260101723 CH2025260101726 CH2025260102020 CH2025260102023
Faculty	:	NIVETHITHA V YOGESH C REVATHI M MANJU G SANGEETHA N MONICA KUMAR R RAJESH R ANITA X	Slot	:	F1 + TF1
Duration	:	90 Minutes	Max. Mark		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks	CO	BT Level
1		An IoT-based smart city project is being developed to manage traffic lights, environmental sensors and emergency response systems. You are tasked with selecting and designing the most appropriate OS system structure (monolithic, microkernel, layered, or hybrid) for the IoT infrastructure. Evaluate the suitability of each structure in terms of scalability, security, fault tolerance and real-time responsiveness, then propose an optimal architecture with justification.	10	CO1	K5
2		A hotel is simulating its room service system where each floor has a service manager. A parent process represents the main hotel server, and each child process represents a service manager on one floor. The parent process receives the number of floors (n) and creates n child processes. Each child simulates processing a room service request by introducing a delay using sleep( ). If the floor number is even, the request completes successfully and the child calls exit(0), while if the floor number is odd, a simulated error occurs and the child calls exit(1). The parent waits for all n children to finish and	10	CO1	K3

		reports which floors' room service requests were successful and which floors experienced failures. Write a complete C program to implement this scenario and highlight the sample output for $n = 5$.			
3	a)	Assume you are a software developer running a program in a Linux environment. To start with, the program is executed as expected and enters the running state. During its execution, the program halts temporarily while waiting for user input, thus entering the waiting state. Afterwards, it creates a child process that finishes running, but the parent process neglects to gather its exit status, turning the child into a zombie. The zombie process eventually becomes an orphan when the parent process collapses, leaving it without a parent. With a neat diagram, explain the transitions between the different states in the process lifecycle, and describe how the operating system handles the zombie and orphan processes in this situation including how the Process Control Block (PCB) entries are created and maintained. [8 Marks]	10	CO1	K3
	b)	Explain the disadvantages of zombie and orphan and how it can be avoided. [2 Marks]			
4		In an international airport, passengers must wait in the queue for check in procedure of their luggage. The check in system has three separate queues assigned with priority based on their ticket class: First Class Ticket with highest priority, then Business Class and Economy Class with lowest priority. Before the check in starts the passengers will get the token with queue type and service time required for check in. The procedure for serving the passengers in the queues based on the token details is as follows: First class passengers are served immediately whenever they arrive, even if a business or economy class passenger is being served. Business class passengers are served only when first class queue becomes empty. Economy class passengers are served only when first class queue and business class queue become empty and also the servicing of economy class gets stopped whenever a passenger enters in a first class or business class queue. First class passengers are serviced based on the order they arrive and not stopped during their checking. In business class queue, passengers whose service time is minimum will get the chance first to check in. In Economy class queue, passengers will be serviced only for every 5 mins.	8	CO2	K3

Passenger	Class	Arrival Time (mins)	Service Time (mins)
P1	Economy	9.00 AM	10
P2	First	9.02 AM	4
P3	Business	9.03 AM	6

			P4	Business	9.03 AM	4	
			P5	Economy	9.05 AM	9	
			P6	First	9.07 AM	8	
			P7	Business	9.09 AM	7	
			P8	Economy	9.11 AM	12	
			P9	First	9.13 AM	6	
		Apply a suitable scheduling algorithm to service all the passengers waiting in various queues to finish their check-in procedure effectively. Calculate the Average waiting time and Average turnaround time for the suggested algorithm.					
5		A smart warehouse uses a scheduler to manage robotic tasks, where each task involves an initial CPU burst for route planning, followed by an I/O operation such as barcode scanning or sensor input, and then a final CPU burst for item placement and optimization. All tasks initially enter **Queue 1**, which follows the **Round Robin** scheduling policy with a **time quantum of 4 units**. If a task does not complete within this quantum, it is moved to **Queue 2**, which also uses Round Robin but with a **time quantum of 7 units**. Tasks that still require more processing are finally moved to **Queue 3**, which follows **First-Come, First-Served (FCFS)** and executes the tasks. Determine the Completion Time (CT), Turnaround Time (TAT), and Waiting Time (WT) for each robot task, and compute the average values of TAT and CT based on the data below.					12	CO2	K3

Task	CPU	I/O	CPU	Arrival Time	Queue
P1	6	4	6	0	1
P2	4	2	3	3	1
P3	2	3	5	4	1
P4	5	2	7	7	1
P5	3	2	4	15	1

**********All the best **********