Reg. No. : | | | | | | | | | | | | |

Question Paper Code: R5I04

B.E./B.Tech. DEGREE EXAMINATION, NOV 2025

Fifth Semester

CSE (Internet of things)

R21UIO504-OPERATING SYSTEMS FOR IOT

(Regulations R2021)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1.	What is the main difficulty that a programmer must overcome in writing an operating system for a real-time environment?.	CO2- Ana
2.	What does PCB contain?	CO1-U
3.	The purpose of Scheduling Algorithm is to maximize or minimize the below Optimization Criteria • _____ CPU utilization • _____ Throughput • _____ Turnaround time • _____ Waiting time • _____ Response time	CO1-U
4.	Name two hardware instructions and their definitions which can be used for implementing mutual exclusion.	CO1-U
5.	A computer system has 6 tape drives, with 'n' processes competing for them. Each process may need 3 tape drives. The maximum value of 'n' for which the system is guaranteed to be deadlock free Calculate the n value.	CO2- App
6.	Differentiate logical memory from physical memory	CO1-U
7.	Consider the following page-replacement algorithms. Rank these algorithms on a five-point scale from "bad" to "perfect" according to their page-fault rate. Separate those algorithms that suffer fromBelady's anomaly from those that do not. a. LRU replacement b. FIFO replacement c. Optimal replacement d. Second-chance replacement	CO 1- U

8. What is meant by Demand Paging? CO1- U

9. Why must the bitmap for file allocation be kept on mass storage, rather than in main memory? CO1-U

10. Why is rotational latency usually not considered in disk scheduling? How would you modify SSTF, SCAN, and C-SCAN to include latency optimization CO1- U

PART – B (5 x 16= 80 Marks)

11. (a) Briefly explain the Operating system services CO1- U (16)

Or

(b) Describe the essential properties of the following types of Operating System and relate it with Real Time Examples CO1- U (16)

a. batch b. Time Sharing c. Real Time d. Network
e. Parallel f. Distributed g. Clustered h. Handheld

12. (a) Consider a five Philosophers who spend their lives thinking and eating, when a philosopher thinks, she does not interact with her colleagues, she gets to hungry and tries to pick up the two chopstick that are closest that are closest to her. She may pick up only one chopstick at a time and she cannot pick up a chopstick that is already in the hand of a neighbor and eats without releasing her chopsticks provide a solution to this problem using semaphores. CO2- App (16)

Or

(b) Consider the following set of processes, with the length of the CPU – burst time is given in ms: CO2- App (16)

Process	Burst Time
P0	10
P1	4
P2	8
P3	6

Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, Priority and RR (quantum=2) scheduling. Also calculate waiting time and turnaround time for each scheduling algorithms.

13. (a) Consider the following snapshot of a system: CO2- App (16)

Process	Allocation	Max	Available
	A B C D	A B C D	A B C D
P0	0 0 1 2	0 0 1 2	1 5 2 0
P1	1 0 0 0	1 7 5 0	
P2	1 3 5 4	2 3 5 6	
P3	0 6 3 2	0 6 5 2	
P4	0 0 1 4	0 6 5 6	

Answer the following questions using the banker's algorithm:

a. What is the content of the matrix *Need*? Is the system in a safe state?

b. If a request from process P1 arrives for (0, 4, 2, 0), can the request be granted immediately?

Or

(b) A system has three types of resources R1 R2 R3 and their number of units are 3, 2, 2respectively. Four processes P1 P2 P3 P4 are currently competing for these resources in following number. CO2- App (16)

1. P1 is holding one unit of R1 and is requesting for one unit of R2.
2. P2 is holding two units of R2 and is requesting for one unit each of R1 and R3.
3. P3 is holding one unit of R1 and is requesting for one unit of R2.
4. P4 is holding two units of R3 and requesting for one unit of R1.

Determine which if any of the processes are deadlock in this state.

14. (a) Consider a demand paging system with the following time measured utilizations — CO2- App — (16)

CPU utilization 20 %
Paging disk 97.7 %
Other I/O device 5%

For each of the following indicate whether it will improve CPU Utilization. Explain your answers

1.Install a faster CPU
b. Install a bigger paging disk
c. Increase the degree of multiprogramming
d. Decrease the degree of multiprogramming
e. Install more main memory
f .Install a faster hard disk or multiple controllers with multiple hard disks.
g. Add pre paging to the page fetch algorithms
h. increase page size.

Or

(b) Consider the following page reference string — CO2-App — (16)

7, 0,1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1

How many page faults would occur for the following replacement algorithms, assuming three frames that all frames are initially empty?

a. LRU page replacement.
b. FIFO page replacement
c. Optimal page replacement

15. (a) What are the various disk space allocation methods. Explain in detail. — CO1- U — (16)

Or

(b) (i) What are the characteristics of embedded operating systems? — CO1- U — (8)

(ii) Compare the general purpose OS with embedded OS. — CO1- U — (8)