B.E. Computer Science and Engineering Third Year First Semester Examination 2025

Time: 3 hours **Full Marks: 100**

OPERATING SYSTEM

Group A [CO2: Total Marks: 35]

Question no. 1 is COMPULSORY [Marks: 20]

Answer Question No. 2 OR Question No. 3 [Marks: 15]

1. [(4+4)+3+3+3+3=20]

a. What are the necessary conditions for deadlock to occur? Explain any one deadlock prevention technique and its disadvantages.

b. Suppose requests for disk access are concentrated in the middle of the disk. Which disk scheduling technique will be advantageous in this scenario. Justify your answer.

c. What will be the advantage/s and disadvantage/s if the CPU time slice is very small in Round Robin process scheduling technique?

d. Distinguish between the two types of memory fragmentation with respect to their occurrences and management.

e. What are fixed equal size partitioned memory and fixed variable size partitioned memory?

2. [3*2+2*2+5=15]

a. What are the challenges and/or disadvantages of implementing (i) *Shortest Job First (SJF)* scheduling policy, and (ii) *Shortest Remaining time Next (SRTN)* scheduling policy?

b. What is the ideological difference between *Segmentation memory allocation technique* and *Paging memory allocation technique*? How are the logical addresses interpreted in both the above cases?

c. Mention the techniques for keeping information about free space on disk and briefly explain any one of them.

3. [3*2+2*2+5=15]

a. What are the advantages and disadvantages of implementing (i) *First Come First Served (FCFS)* scheduling policy, and (ii) *Shortest Remaining time Next (SRTN)* scheduling policy?

b. What are the two basic problems of *Contiguous File Allocation technique* that are addressed in *Linked File Allocation technique* and how are the problems handled?

c. How can *Segmentation memory allocation technique* be combined with *Paging memory allocation technique*? How will the information be kept? What will be the components of the virtual address?

Group B [CO3: Total Marks: 35]
Question no. 4 is COMPULSORY [Marks: 25]
Answer Question No. 5 OR Question No. 6 [Marks: 10].

4. [3*2+(2+1+1+5)+(3+3)+4=25]

a. Consider a system with four processes as shown below with corresponding arrival time and execution time:

Process	Arrival time	Execution time
P_0	0	5
P_1	2	4
P_2	4	6
P_3	7	3
P_4	8	4

Calculate waiting time and turnaround time of each process using (i) *First Come First Served (FCFS)* scheduling policy, and (ii) *Shortest Remaining time Next (SRTN)* scheduling policy. Show the scheduling decisions using Gantt chart for both cases. Mention any assumption/s that you take.

b. Consider the following system state with 3 instances each of R1, R2 and R3 are available at present. What are the total instances of each of R1, R2 and R3? What are the further requirements of each of the processes? Is the following system deadlocked? Find a safe sequence, if any, using Banker's Algorithm.

Allocation matrix (resources already allocated to processes)

	R1	R2	R3
P0	1	0	1
P1	1	1	2
P2	1	0	3
P3	2	0	0

Max (Maximum requirement of processes)

	R1	R2	R3
P0	4	3	1
P1	2	1	4
P2	1	3	3
P3	5	4	1

c. A process refers to 5 pages A1, B2, C3, D4, E5 in the order : A1, B2, C3, D4, A1, B2, E5, A1, B2, C3, D4, E5. If the page replacement algorithm is Least Recently Used (LRU), what is the number of page transfers with an empty internal store of 4 frames? Show the successive memory contents. How can LRU be implemented?

d. The following disk requests are received by the disk controller at the same time:
[150, 4, 0], [120, 34, 4], [160, 10, 1], [202, 7, 3], [236, 19, 5], [138, 73, 2], [152, 2, 0], [120, 15, 4], [160, 6, 1], [202, 20, 3]
Disk requests come in the form [sector number, cylinder number, platter number]. Currently head is positioned at sector number 100 of cylinder 50. Using *Shortest Seek Time First* (SSTF), find out the time required to service all requests if time taken to move from one cylinder to another is 1 ms.

5. [5+3+2=10]

a. Consider Lamport's bakery algorithm, in which each process waiting to enter its critical section gets a token number, and the process with the lowest number enters the critical section. If two processes have the same token number, the process with a lower process ID enters its critical section. After coming out of the critical section, the process sends a signal. Mention the conditions for the solution to *Critical-Section problem*. Do you think these are met by Lamport's Bakery algorithm? Why/why not?

b. How does *Buddy System memory allocator* work?

c. what is the *Effective Access Time (EAT)* in *Demand paging*?

6. [3+2+5=10]

a. What is *Translation Lookaside Buffer (TLB)* and how is it used?

b. What do the following mean and in which table these occur: (i) valid/invalid bit, (ii) dirty bit

c. Show the implementation of *Wait* and *Signal* operations without busy waiting. Why is binary semaphore initialized to 1 in order to allow only one process to enter the Critical section?

Group C [CO4: Total Marks: 15]

Answer any three (3) questions [5*3=15]

7.

a. What is *Access Matrix*? What are its contents?

b. Why are *Capability lists* called so? What are its contents?

c. Differentiate between *Public/Asymmetric key cryptography* and *Symmetric key cryptography.*

d. What does *Access Control List* contain?

e. What is the limitation of *Symmetric key cryptography*? Is it possible to derive *private key* from the corresponding *public key*?

Group D [CO1: Total Marks: 05]

Answer any one (1) question [5*1=05]

8.

a. What are the problems with *monolithic kernel*?

b. What are the problems with *microkernel*?

Group E [CO5: Total Marks: 10]

Answer any one (1) question [10*1=10)]

9.

a. What are the different types of inodes in Unix? What are their respective contents?

b. With the help of the block diagram of the Unix kernel architecture, mention the subsystems.