Answer any Six(06) questions taking at least Three (03) from each section.

Section-A

1. a) What is 'Kernel' of an operating system? Explain the state transition diagram of process. — 4
   b) What are the main functions of an operating system? How does it govern the entire system? — 3
   c) Describe the actions taken by a kernel to context-switch between processes. — 1.75

2. a) Differentiate preemptive and non-preemptive scheduling techniques. — 1.5
   b) Illustrate the criteria used for comparing CPU scheduling algorithms. — 2
   c) Consider the processes with CPU burst $P_1=10ms$, $P_2=29ms$, $P_3=3ms$, $P_4=7ms$, $P_5=12ms$, and quantum=10ms. Draw the Gantt chart; find the average waiting time and average turnaround time for FCFS, SJF and RR scheduling algorithms. — 5.25

3. a) What is the difference between asymmetric and symmetric multiprocessing techniques? — 2
   b) Explain the different migration techniques for load balancing between different processors in multiprocessing environment. — 2.5
   c) What do you mean by 'race condition'? Explain how it occurs in case of cooperating multiprocessing environment. — 2.25
   d) What do you mean by 'busy waiting'? Propose some alternative approach in place of busy waiting to synchronize cooperating processes. — 2

4. a) Define deadlock. Consider three processes {P1, P2, P3}, four resource types {R1, R2, R3, R4} and six edges E={P1->R1, P2->R3, R1->P2, R4->P2, R3->P1, R2->P3}. Draw the resource allocation graph and explain whether the system is in deadlock or not. — 2.25
   b) What do you mean by safe sequence in resource allocation state? Apply the banker's algorithm to find out the safe sequence from the snapshot of a system as given below- — 5

Process↓	Allocation A B C D	Max A B C D	Available 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	

Where A, B, C and D are system resources, all others carry their conventional meanings.

   c) What are advantages of aborting one process at a time until the deadlock cycle is eliminated to recover a system from deadlock situation? — 1.5

Section-B

5. a) What do you mean by external and internal fragmentations?   2

    b) When do we need hierarchical paging? Explain the address translation for two level 32-   3.25
        bit paging architecture.

    c) Explain how the paging environment can be used for memory protection.   3.5

6. a) Define virtual memory. What are the advantages of it?   1.75

    b) Calculate the page fault for the given memory reference string for the following   6
        replacement algorithms and compare the results.

        i)   FiFO, ii) LRU and iii) Optimal

        Reference string: 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1

    c) What is Belady's anomaly?   1

7. a) What is a file? What are the common attributes maintained for a file?   3

    b) Describe the sequential access and direct access methods for file.   4

    c) What is the limitation of single level directory structure? Explain.   1.75

8. a) Define 'boot control block' and 'volume control block'.   2

    b) What is FCB? Explain its importance and uses for implementing a file system.   2.25

    c) Explain the different approaches for implementing indexed allocation technique for   3
        storage allocation.

    d) Explain how a bit vector can be used to manage free space in storage.   1.5