(b) Explain the Resource-Allocation Graph Algorithm for deadlock prevention.

(2 + 2 + 2) + 6 = 12

7. (a) Illustrate the page-replacement algorithms (i) FIFO (ii) Optimal Page Replacement use the reference string 7, 0,1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2,1, 2, 0, 1, 7, 0,1 for a memory with three frames.

(b) What is Thrashing? What is the cause of Thrashing? How does the system detect Thrashing? What can the system do to eliminate this problem?

6 + 6 = 12

Group – E

8. (a) Suppose a disk drive has 400 cylinders, numbered 0 to 399. The driver is currently serving a request at cylinder 120 and previous request was at cylinder 140. The queue of pending request in FIFO order is :
86, 147, 312, 91, 177, 48, 309, 222, 175, 130
Starting from the current head position, what is the total distance in cylinders that disk arm moves to satisfy all pending request for each of the disk scheduling algorithm.
(i) SSTF (ii) SCAN (iii) C-SCAN

(b) Explain with a diagram the *Interrupt-driven I/O cycle.*

(2 + 2 + 2) + 6 = 12

9. (a) Differentiate between character- and block-oriented devices.

(b) Explain the term Direct Memory Access (DMA). What is the use of a DMA controller?

(c) Explain the following:
(i) Boot block (ii) Data block (iii) Superblock (iv) Inode.

2 + 4 + 6 = 12

OPERATING SYSTEMS
(MCAP 2104)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) System calls are usually invoked by using
(a) Software interrupt (b) Polling
(c) An indirect jump (d) Privileged.

(ii) When several processes access the same data concurrently and the outcome of the execution depends on the particular order in which the access takes place, is called
(a) Critical section problem (b) Race condition
(c) Mutual exclusion (d) Starvation.

(iii) Excessively high paging activity is called
(a) Page fault (b) Thrashing (c) Context switch (d) Spooling.

(iv) The degree of multi-programming is
(a) The number of processes executed per unit time
(b) The number of processes in the ready queue
(c) The number of processes in the I/O queue
(d) The number of processes in memory.

(v) Which of the following condition is required for deadlock to be possible?
(a) Mutual exclusion
(b) A process may hold allocated resources while awaiting assignment of other resources
(c) No resource can be forcibly removed from a process holding it
(d) All of (a), (b) & (c).

(vi) Which one of the following is the deadlock avoidance algorithm?
(a) Banker's algorithm (b) Round-robin algorithm
(c) Elevator algorithm (d) Karn's algorithm.

(vii) What is compaction?
(a) A technique for overcoming internal fragmentation
(b) A paging technique
(c) A technique for overcoming external fragmentation
(d) A technique for overcoming fatal error.

(viii) In a system with 32 bit virtual addresses and 1 KB page size, use of one-level page tables for virtual to physical address translation is not practical because of
(a) the large amount of internal fragmentation
(b) the large amount of external fragmentation
(c) the large memory overhead in maintaining page tables
(d) the large computation overhead in the translation process.

(ix) A virtual memory system uses First In First Out (FIFO) page replacement policy and allocates a fixed number of frames to a process. Consider the following statements:
P: Increasing the number of page frames allocated to a process sometimes increases the page fault rate.
Q: Some programs do not exhibit locality of reference. Which one of the following is TRUE?
(a) Both P and Q are true, and Q is the reason for P
(b) Both P and Q are true, but Q is not the reason for P
(c) P is false, but Q is true
(d) Both P and Q are false.

(x) Consider a disk system with 100 cylinders. The requests to access the cylinders occur in following sequence: 4, 34, 10, 7, 19, 73, 2, 15, 6, 20. Assuming that the head is currently at cylinder 50, what is the time taken to satisfy all requests if it takes 1ms to move from one cylinder to adjacent one and shortest seek time first policy is used?
(a) 95 ms (b) 119 ms (c) 233 ms (d) 276 ms.

Group – B

2. (a) Differentiate between program and process. Explain the methodology by which a program converted to a process.

(b) Explain the different states of a process and discuss the change of states with suitable state transition diagram.

(4 + 2) + (3 + 3) = 12

3. (a) A computer has 2 GB of RAM of which the operating system occupies 256 MB. The processes are all 128 MB (for simplicity) and have the same characteristics. If the goal is 99% CPU utilization, what is the maximum I/O wait that can be tolerated?

(b) Consider the set of 4 processes whose arrival time and burst time are given in Table1.

Process Id	Arrival time	Burst time
P1	0	8
P2	1	4
P3	2	9
P4	3	5

Table 1

If the CPU scheduling policy is SJF (Both Preemptive and Non-Preemptive), then compare their average waiting time and average turnaround time.

4 + (4 + 4) = 12

Group – C

4. (a) What is critical section problem in process synchronization? What are the requirements that the solution to critical section problem must satisfy?

(b) Write pseudo code for solving the readers and writers problem using monitor.

(3 + 3) + 6 = 12

5. (a) Write the definition of wait () and signal () operation of Semaphore.

(b) How to implement a binary semaphore with a counting semaphore?

(c) Explain the solution to the Dining Philosophers Problem using semaphore.

4 + 1 + 7 = 12

Group – D

6. (a) Consider the snapshot of a system as in Table 2.

Processes	Allocation				Max				Available			
P_0	0	0	1	2	0	0	1	2	1	5	2	0
P_1	1	0	0	0	1	7	5	0				
P_2	1	3	5	4	2	3	5	6				
P_3	0	6	3	2	0	6	5	2				
P_4	0	0	1	4	0	6	5	6				

Table 2

Answer the following questions using Banker's Algorithm:
(i) What is content of need matrix?
(ii) Is the system in a safe state?
(iii) If a request from process P_1 arrives for (0, 4, 2, 0), can the request be granted immediately?