Department of Computer Science & Engineering
IIT(ISM)

Exam: End-Sem(Winter) **Session: 2023-2024**
Subject: Operating Systems(CSC209) **Semester: IV B.Tech(CSE)**
Max. Marks: 100 **Time: 3 Hours**

Instructions: All questions are compulsory. Each notation has usual meaning and use suitable/standard data in case of missing. **Mention Question/Answer number correctly.**

Q1.(a) Describe computer system architecture along with its suitable diagram briefly. (8)
(b) Consider a disk system with 200(0-199) cylinders. The request to access the cylinders occur as: 68, 35, 183, 14, 122, 65, 124, 60. Assume that the head is currently at cylinder 53. What is the time taken to satisfy all these requests if it takes 1ms to move from one cylinder to adjacent one using the following algorithms?
(i) First Come First Serve (4)
(ii) Shortest Seek Time First (4)
(iii) LOOK (4)

Q2.(a) Provide the comparison to all RAID levels in a tabular form with respect to the following parameters: Category, Level, Description, and Disks requirement (10)
(b) Consider a system with Physical address space = Logical address space = s bytes and page size = p bytes and the page table entry size = e bytes. What is the optimal value of page size by minimizing the memory overhead of maintaining the page table size and internal fragmentation in paging? (10)

Q3.(a) Describe hardware protection briefly. (8)
(b) Discuss Producer-Consumer problem and also provide the solution structures of both producer and consumer using both binary and counting Semaphores. (12)

Q4.(a) On a system using demand-paged memory, it takes 120ns to satisfy a memory request if the page is in memory. If the page is not in memory, the request takes 5ms (on average). What would the page fault rate need to be to achieve an effective access time of 1μs? Assume that the system is only running a single process and the CPU is the idle during page swaps. (10)
(b) Given memory partitions of 100KB, 500KB, 200KB, 300KB, and 600KB(in order), how would each of the **First-fit**, **Best-fit**, and **Worst-fit** algorithms place the processes of 212KB, 417KB, 112KB, and 426KB(in order)? (10)

Q5.(a) Show that by assigning a unique priority number to each resource, and prohibiting a process from requesting a resource with a priority less than or equal to the priority of any held resource, deadlock can be avoided. (6)
(b) What is the minimum number of resources needed to be available for the state described in below table to be safe (NOTE: The question is asking for the number of resources available, not how many resources exist). (8)

Process	Current Allocation	Maximum Allocation
	R1	R1
P1	1	3
P2	1	2
P3	3	9
P4	2	7

(c) On a system using non-preemptive scheduling, processes with expected run times of 5, 18, 9, and 12 are in the ready queue. In what order should they run to minimize the waiting time? (6)