[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2433 **L**

Unique Paper Code : 2342572401

Name of the Paper : Operating Systems

Name of the Course : **B.Sc. (P) Computer Science**

Semester : IV – NEP

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. The **first** question in **Section A** is compulsory.
3. Attempt any **four** questions from **Section B**.
4. Parts of a question must be answered together.

SECTION A

1. (a) Howdoesthedistinctionbetweenkernelmode andusermodefunction as a rudimentary form of protection (security) system? (3)

   (b) List the three components of an I/O subsystem of an operating system. (3)

   (c) What is the purpose of the command interpreter? Why is it usually separate from the kernel? (3)

   (d) Whichofthe following instructions should be privileged? Justify.
   i. Setvalue of timer. ii. Rename a file. iii. Issue a trap instruction. (3)

   (e) Describe three general methods for passing parameters to the operating system. (3)

   (f) Whatisthe purpose of system calls? Explain with a suitable example. (3)

   (g) What is the main advantage of the microkernel approach to system design? What are the disadvantages of using the microkernel approach? (3)

   (h) Provide three examples in which multithreading providesbetter performance than a single-threaded solution. (3)

   (j) Differentiate between the following:
   a) Thread and Process
   b) Pre-emptive and non-pre-emptive Kernel
   c) Message passing mode and Shared memory model (2 x 3)

P.T.O.

SECTION B

2. (a) Suppose that a disk drive has 5,000 cylinders, numbered 0 to 4,999. The drive is currently serving a request at cylinder 2,150, and the previous request was at cylinder 1805. The queue of pending requests, in FIFOorder, is:
2069, 1212, 2296, 2800, 544, 1618, 356, 1523, 4965, 3681
Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk-scheduling algorithms-

(i) SSTF

(ii) C-SCAN (Direction is towards lower track numbers) (6)

(b) Assume that you have a page-reference string for a process with m frames (initially all empty). The page-reference string has length p,and n distinct page numbers occur in it. Answer these questions for any page-replacement algorithms:

(i) What is a lower bound on the number of page faults?

(ii) What is an upper bound on the number of page faults? (5)

(c) What resources are used when a thread is created? How do they differ from those used when a process is created? (4)

3. (a) Compare the memory organization schemes of contiguous memory allocation, pure segmentation, and pure paging with respect to thefollowing issues:

(i) External fragmentation
(ii) Internal fragmentation (4)

(b) A computer system uses paging for memory management with the logical address space as 32 KB, page size as 1 KB and time to access memory as100 ns. Also, the page table is stored in memory. Answer the following:

(i) How many bits are there in the logical address space?

(ii) How many bits are required for the page number and page offset?

(iii) What is the effective memory access time (EMAT) for a paged system without a TLB?

(iv) If a TLB is introduced with a hit ratio of 80% and TLB access time of 20 ns, calculate the new EMAT. (8)

(c) Differentiate between paging and segmentation. (3)

4. (a) A solution to the critical-section problem must satisfy three requirements. Explain each of them with example. (7)

(b) Illustrate how the memory management unit implements dynamic relocation using a relocation register. (8)

5. (a) Illustrate the physical structure of a magnetic disk with a neat diagram. (7)

(b) Differentiate between data parallelism and task parallelism with a suitable example. (8)

6 (a) Consider the following page reference string:
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.
How many page faults would occur for the following replacementalgorithms, assuming four frames?Rememberthat all frames are initially empty, so your first unique pageswill cost one fault each.

(i) LRU Replacement

(ii) FIFO Replacement (6)

(b) Consider the following set of processes with the length of the CPU burst given in milliseconds, along with their arrival time and priority:

Process	Burst Time
P1	9
P2	6
P3	5
P4	3
P5	5

The processes are assumed to have arrived in the order P1, P2, P3, P4, P5 all at time0.

(i) Draw Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: pre-emptive SJF and FCFS.

(ii) What is the turnaround time of each process for each of the scheduling algorithms?

(iii)Which of the algorithms results in the minimum average waiting time(overall processes)? (4+2+3)

7. (a) Write short notes on any three of the following:

   (i) Sequential file access method

   (ii) Two-level directory structure

   (iii) File system mounting (6)

   (iv) File attribute

   (b) Elaborate briefly on each of the three methods for handling deadlocks. List any three necessary conditions for a deadlock to occur. (6+3)