This question paper contains **6** printed pages]

Roll No. | | | | | | | | | | |

S. No. of Question Paper : **3329**

Unique Paper Code : **2344000005**

Name of the Paper : **Operating Systems**

Name of the Course : **Computer Science : Generic Elective (G.E.) (NEP-UGCF-2022)**

Semester : **V**

Duration : **3 Hours** Maximum Marks : **90**

(Write your Roll No. *on the top immediately on receipt of this question paper.)*

Section A is compulsory.

Attempt any **4** (*Four*) questions from **Section B.**

All parts of a question must be answered together.

SECTION-A

1. (*a*) What is the degree of multiprogramming ? 2

(*b*) What is demand paging ? How is it different from pure demand paging ? 1+2=3

(*c*) Consider the following statements executed by the processes P1 and P2 with initial value of counter = 10 : 3

P1 : counter ++

P2 : counter −−

Discuss the problem that can occur due to race condition in concurrent execution of these processes.

P.T.O.

(*d*) Write any *three* benefits of multithreaded programming. 3

(*e*) What is a system call ? Name any *two* types of system call. 1+2=3

(*f*) Differentiate between direct and sequential file access methods (any *two*). 4

(*g*) Write all the necessary conditions for the deadlock to occur. 4

(*h*) What is the kernel mode of Operating System operation ? How is it different from the user mode ? 2+2=4

(*i*) Write any *four* pieces of information stored in process control block. 4

SECTION-B

2. Consider the following set of processes, with the length of CPU-burst time given in milliseconds. The processes are assumed to have arrived in the order P1, P2, P3, P4, P5.

The arrival time of all processes is 0 ms : 6+3+3+3

Process	Burst Time (ms)	Priority
P1	10	3
P2	1	1 (highest)
P3	2	5
P4	1	4
P5	5	2

(*i*) Draw Gantt chart for illustrating the execution of these processes using a preemptive priority and RR (quantum=2) scheduling.

(*ii*) What is the turnaround time of processes P1 and P4 for each of the scheduling algorithms given in part (*i*) ?

(*iii*) What is the waiting time of processes P2 and P3 for each of the scheduling algorithms given in part (*i*) ?

(*iv*) Which of the scheduling algorithms given in part (*i*) will result in the minimal average waiting time ?

3. (*a*) Suppose there is a system with 150KB of memory with no memory initially allocated. Given the following sequence of requests by the processes, show the memory layout at intermediate stages. Assume that the system uses a best-fit allocation algorithm : 7

Process number	**Nature of request**	**Amount of memory requested (in KB)**
P0	Allocation	50
P1	Allocation	40
P2	Allocation	20
P0	Deallocation	
P2	Deallocation	
P3	Allocation	30
P4	Allocation	10

(*b*) Differentiate between acyclic-graph and tree-structured directory structure. 4

(*c*) Whawt is seek time ? How is it different from rotational latency ? 4

P.T.O.

4. (*a*) Consider the following scenario : 4+3=7

Process P1 is waiting for resource R1 and using (holding) R2

Process P2 is using resource R1

Process P3 is using resource R1 and waiting for resource R2

Process P4 is using resource R2

Draw the resource allocation graph. Is the system in a deadlock ? If yes, then mention the processes in deadlock else identify the sequence in which the processes can execute.

(*b*) Consider the following page reference string : 8

7, 2, 3, 1, 2, 5, 3, 4, 6, 7, 7, 1, 0, 0, 4, 2, 0, 1, 7

How many page faults would occur with Least Recently Used and Optimal Page Replacement algorithms assuming four frames in memory ? All frames are initially empty.

5. (*a*) Consider the following structure of the process. Write the code to be written in the 'Entry Section' and 'Exit Section' of the process to solve the critical section problem using Peterson's solution. Justify that how progress requirement is satisfied in this solution. 4+3=7

```
do
{
Entry Section
Critical Section
Exit Section
Remainder Section
} while (true);
```

(*b*) Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is : 4+4=8

86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130.

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 ? Show the head movement diagrammatically :

(*i*) First-come, first-served (FCFS)

(*ii*) SCAN.

6. (*a*) Consider a paging scheme with the page table stored in memory : 3+4=7

(*i*) If memory reference takes 50 ns, how long does a paged memory reference take ?

(*ii*) If we add Translation Lookaside Buffer (TLB) and 75 percent of all page-table references are found in the TLBs, what is the effective memory reference time ? Assume that finding a page-table entry in the TLBs takes 2 ns, if the entry is present.

(*b*) Consider the following segment table : 8

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses ?

(*i*) 0428

(*ii*) 115

(*iii*) 2500

(*iv*) 4012.

7. (*a*) What are different states of a process ? Explain it with the help of a neatly-labelled diagram. 5+2=7

(*b*) Write any *two* advantages and disadvantages of layered approach of Operating system design. How is it different from microkernel approach of operating system design. 4+2=6

(*c*) What is external fragmentation ? 2