[This question paper contains 4 printed pages.]

Your Roll No.....

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Sr. No. of Question Paper : 13201

Unique Paper Code : 2344000005

Name of the Paper : OPERATING SYSTEMS

Name of the Course : **GE – Computer Science**

Semester : V

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. **Section A** is compulsory.
3. Attempt any **4 (four)** questions from **Section B.**
4. **All** parts of a question must be answered together.

Section A

1. (a) Explain any two methods of deadlock handling. 3

(b) 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.

(c) Differentiate between function call and system call. Explain why system call is comparatively slower. 3

(d) Consider the following code: 3

```
#include <iostream.h>
#include <unistd.h>
int main() {
    cout<<"A\n";
    fork();
    cout<<"B\n";
    fork();
    cout<<"C\n";
    return 0;
}
```

How many times will "B" and "C" be printed. Write the possible output sequence?

P.T.O.

(e) What is context switching in Operating Systems? Write the sequence of steps performed by the kernel while switching from one process to another. 3

(f) How a single-threaded process differs from a multithreaded process. Explain using a suitable diagram. 3

(g) Explain diagrammatically how a logical address is translated into a physical address using a page table. 3

(h) Explain Microkernel structure of Operating System. Also write any one advantage and one disadvantage of using a Microkernel. 3

(i) Consider a disk pack with 32 surfaces, 64 tracks per surface and 512 sectors per track. 256 bytes of data are stored in a bit serial manner in a sector. Calculate the capacity of the disk pack. 3

(j) Compare the advantages and disadvantages of using a tree-structured directory over a single-level directory structure. 3

Section B

2. (a) Given 3 memory frames and reference string: 2, 1, 2, 3, 1, 2, 4, 1 6+4=10

I. Simulate First in First Out (FIFO) and calculate total page faults.

II. State whether Belady's anomaly occur for this reference pattern or not, if number of frames is increased to 4.

(b) Discuss the problem of Cache Coherency with an example. 5

3. (a) A system has five processes with arrival time and CPU burst time as follows: 4+2+4=10

Process	Arrival (ms)	CPU Burst (ms)
P1	0	24
P2	0	3
P3	0	3
P4	2	6
P5	4	4

I. Draw the Gantt chart and compute average turnaround time for First Come First Serve (FCFS).

II. Draw the Gantt chart for Shortest Job First (SJF) (Non-preemptive).

III. For Round Robin (quantum = 4 ms), show execution order until completion and compute average waiting time.

(b) A system has 3 processes (P1, P2, P3) and 2 resource types R1(2 units), R2(1 unit). 3+2=5

At a given instant:

- P1 holds 1 unit of R1
- P2 holds 1 unit of R1 and requests R2
- P3 holds R2 and requests R1

Draw a resource allocation graph and state whether a deadlock exists or not. Give appropriate reasoning.

4. (a) A disk queue contains the following pending cylinder requests: 98, 183, 41, 122, 14, 124, 65, 67 4+4+2=10

The disk head is currently positioned at cylinder 53 and the total disk size is 0–199 cylinders.

Calculate the total head movement (in cylinders) by showing the head movement diagrammatically using the following disk scheduling algorithms:

a) Shortest Seek Time First (SSTF)
b) SCAN (Assume initial head movement direction is towards 0)

Identify which algorithm results in the least seek time and justify your answer.

(b) Explain Random and Indexed file access methods. Also, provide examples of applications that access files according to these methods 2+3=5

5. (a) Consider the following segment table: 2*4=8

Segment	Base	Length
0	519	500
1	1800	95
2	170	300
3	1920	780
4	1860	50

What are the physical addresses for the following logical addresses?

I. 0,240
II. 2,320
III. 3,670
IV. 4,10

(b) What are the advantages of Multi-Threaded Programming. Explain any two of its models with the help of suitable diagrams. 3+4=7

6. (a) Why the dual-mode is necessary for operating system operation? Identify the privileged instructions from the following: 2+3=5
   i. Set the Timer
   ii. Read the System Clock
   iii. Call the Interrupt

(b) A memory layout contains the following free blocks: 120 KB, 25 KB, 60 KB, 30 KB, 75 KB. 5
Processes request memory in order:

P1 = 50 KB
P2 = 70 KB
P3 = 20 KB

Show memory allocation of given processes and compute external fragmentation using Best Fit memory management strategy.

(c) Can two processes be in a deadlocked state? Explain using suitable example 5

7. (a) For a paged system, Translation Look Aside Buffer (TLB) hit ratio is 80%. Let memory access time be 150 ns and TLB buffer access time be 2 ns. Calculate the following: 2+3=5
   i. Effective memory access time without TLB
   ii. Effective memory access time with TLB

(b) Write the structure of process (P_i) to solve the critical section problem using Peterson's solution. 5

(c) Explain the components of a Process Control Block (PCB) in an Operating System. 5