Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: B.Tech/IDD
Sub_Code: CSPC3002

5th Semester Regular Examination: 2025-26
SUBJECT: Operating Systems
BRANCH(S): CE, CSE, CSEAI, CSEAIML, CSEDS, CSIT, CST, ELECTRICAL & C.E, IT, CSE
Time: 3 Hours
Max Marks: 100
Q.Code: U124

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Define a time-sharing system with an example.
b) What is context switching?
c) What is a system call? Give any two examples.
d) What is logical address and physical address?
e) What are operating system services? List any four.
f) What do you mean by swapping?
g) What is disk scheduling?
h) Define real-time operating system?
i) What is a daemon process?
j) Define clock synchronization in distributed systems.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Discuss different multithreading models (user-level, kernel-level, hybrid).
b) Explain various operations on processes.
c) Explain Peterson's solution for two processes with a neat diagram.
d) Write a short note on semaphores with examples.
e) Explain the resource-allocation graph method for deadlock avoidance.
f) Explain the concept of thrashing. Causes and prevention.
g) Discuss page replacement algorithms: FIFO, LRU, Optimal.
h) Explain kernel I/O subsystem in detail.
i) Write a short note on swap space management.
j) Define process control block (PCB) in detail?
k) Explain contiguous memory allocation schemes (Fixed Partitioning and Variable Partitioning). Discuss internal and external fragmentation with examples.

I) Four processes arrive in the ready queue at different times. Their arrival times and CPU burst times are given in the table below:

Process	Arrival Time (ms)	Burst Time (ms)
P1	0	7
P2	2	4
P3	4	1
P4	5	4

Using Preemptive Shortest Remaining Time First (SRTF) scheduling, compute the following for each process:

I. Completion Time (CT)
II. Turnaround Time (TAT)
III. Waiting Time (WT)

Finally, construct the Gantt chart and show all intermediate steps clearly.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Describe in detail the critical section problem, requirements, and all major hardware and software solutions. Compare them with advantages and limitations. **(16)**

Q4 Explain the deadlock system model, four necessary conditions, and discuss handling strategies (prevention, avoidance, detection, recovery) with diagrams and examples. **(16)**

Q5 A system has 32-bit virtual addresses and page size = 4 KB. Calculate number of pages. Compute size of page table if each page table entry is 4 bytes. For a reference string, compute page faults using LRU vs FIFO, if number of frames is 3 and reference string is 1, 2, 3, 4, 1, 2, 5, 1, 2, 3, 4, 5. **(16)**

Q6 A disk drive has cylinders numbered from 0 to 199. **(16)**
The current position of the disk head is at cylinder 50.
A sequence of disk I/O requests arrives in the following order:
Request Queue: 55, 58, 60, 70, 18
Using the above information:

a) Compute the total head movement using the FCFS (First-Come First-Served) disk scheduling algorithm.
b) Compute the total head movement using the SSTF (Shortest Seek Time First) disk scheduling algorithm.
c) Assume the disk arm is currently moving towards higher-numbered cylinders. Compute the total head movement using the SCAN (Elevator) disk scheduling algorithm.

Finally, compare the total head movements obtained by all three algorithms and comment on their relative performance for this request sequence.