

2025

COMPUTER SCIENCE — HONOURS

Paper : DSCC-7

(Operating System)

Full Marks : 75

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

1. Answer *any five* questions : 2×5
- (a) Define starvation in the context of CPU scheduling.
 - (b) Differentiate between counting semaphore and binary semaphore.
 - (c) State any two responsibilities of an operating system.
 - (d) Mention the purpose of the Process Control Block (PCB).
 - (e) Cycles are necessary, but not sufficient for deadlock. — Justify your answer.
 - (f) Differentiate between logical and physical address.
 - (g) Define seek time and rotational latency.
 - (h) Explain the role of a directory structure in file management.

Section - A

Answer *any three* questions.

2. Discuss the Five State Process Model with a neat diagram. 5
3. (a) Distinguish between pre-emptive and non-pre-emptive scheduling.
(b) What are the drawback of FCFS scheduling algorithm? 3+2
4. In the context of memory management, define page and frame. Is there any similarity between them? 3+2
5. Explain producer-consumer problem and how is it solved using semaphore. 5
6. (a) Explain segmentation in brief.
(b) Why are segmentation and paging sometimes combined into one scheme? 3+2

Please Turn Over

(2913)

Section - BAnswer *any five* questions.

7. Assume you have the following jobs to execute with one processor, with the jobs arriving in the order listed here :

Process	T(P _i)	Arrival Time
P ₀	80	0
P ₁	20	10
P ₂	20	80
P ₃	50	85

- (a) Suppose a system uses RR scheduling with a quantum of 15. Create a Gantt chart illustrating the execution of these processes.
- (b) What are the turnaround time for processes?
- (c) What is the average wait time for the processes? 2+4+4
8. (a) Consider six memory partitions of size 200 KB, 400 KB, 600 KB, 500 KB, 300 KB and 250 KB. These partitions need to be allocated to four processes of sizes of 357 KB, 210 KB, 468 KB and 491 KB in that order.
- Perform the allocation using each of these algorithms listed below :
- (i) First Fit Algorithm
- (ii) Best Fit Algorithm
- (iii) Worst Fit Algorithm.
- (b) Explain in detail, how logical addresses are being mapped into Physical addresses in Paging environment.
- (c) What type of fragmentation can be found in Paging system? 6+3+1
9. (a) What are the steps involved in handling a page fault in virtual memory environment? Explain in detail.
- (b) A system uses 3 page frames for storing process pages in main memory. It uses the Least Recently Used (LRU) page replacement policy. Assume that all the page frames are initially empty. What is the total number of page faults that will occur while processing the page reference string given below- 4, 7, 6, 1, 7, 6, 1, 2, 7, 2? Also calculate the hit ratio and miss ratio. 5+5
10. (a) Define CPU-bound and I/O-bound processes with examples.
- (b) What is the purpose of aging in the context of priority scheduling?
- (c) Compare between short-term scheduler and long-term scheduler.
- (d) List two key advantages of using threads over processes. 2+2+4+2

11. (a) Write down the Banker's safety Algorithm.
 (b) Consider the following snapshot of a system.

Allocation					Max					Available			
Processes	Tape Drive	Plotter	Scanner	CD ROMs	Processes	Tape Drive	Plotter	Scanner	CD ROMs	Tape Drive	Plotter	Scanner	CD ROMs
A	3	0	1	1	A	4	1	1	1	1	0	2	0
B	0	1	0	0	B	0	2	1	2	0	0	0	0
C	1	1	1	0	C	4	2	1	0	0	0	0	0
D	1	1	0	1	D	1	1	1	1	1	0	0	0
E	0	0	0	0	E	2	1	1	0	1	0	2	0

Based on Banker's safety algorithm, determine whether the system is in safe or unsafe state.
 5+5

12. (a) How are semaphores used in process synchronization?
 (b) A disk has 200 cylinders (0 to 199) and the disk head is currently at cylinder 53. The request queue is : 98, 183, 37, 122, 14, 124, 65, 67.
 using Shortest Seek Time First (SSTF) algo find out the total head movement. 4+6
13. (a) Differentiate between protection and security in the file system.
 (b) Explain in detail how free spaces get managed.
 (c) How can files be mounted? 3+5+2
14. Write short notes on (*any five*) : 2×5
 (a) Demand Paging
 (b) Belady's Anomaly (give example)
 (c) Fragmentation
 (d) Readers-Writers Problem
 (e) Deadlock Detection
 (f) Real Time System.