OPERATING SYSTEMS
(CSEN 2203)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Shell is a
(a) hardware component (b) command interpreter
(c) part of compiler (d) tool in CPU scheduling

(ii) Which scheduling algorithm is inherently pre-emptive
(a) FCFS (b) SJF
(c) RR (d) Priority Scheduling

(iii) PCB stands for
(a) Process control block (b) Program control block
(c) Program counter block (d) Process common box

(iv) The time spent by a process in the ready queue is called
(a) Waiting time (b) Turnaround time
(c) Throughput (d) Response time

(v) Page fault occurs when?
(a) Page is corrupted by application software
(b) Page is not in main memory
(c) Page is in the main memory
(d) One tries to divide a number by 0

(vi) Very high paging activity is known as
(a) Demand paging (b) Demand Segmentation
(c) Thrashing (d) None of (a), (b) & (c).

(vii) The Need matrix is given by the formula
(a) Need = Max – Allocation (b) Need = Max + Allocation
(c) Need = Max * Allocation (d) Need = Max

(viii) The technique of gradually increasing the priority of a process that wait in a system for a long time is known as
(a) Blocking (b) Ageing
(c) Starvation (d) Convoy effect

(ix) Bakery algorithm provides
(a) Two process solution for process synchronization
(b) Multiple process solution for process synchronization
(c) Solution for deadlock avoidance
(d) Solution for demand paging

(x) Which of the following page replacement algorithms suffers from Belady's anomaly?
(a) Optimal replacement (b) FIFO
(c) LRU (d) Both (a) and (c).

Group- B

2. (a) Explain the batch processing and multiprogramming operating system.
[(CO5) (Remember/LOCQ)]

(b) What do you mean by layered approach operating system structure? Explain with an example. What is micro-kernel? State some advantages of micro-kernel structure.
[(CO1) (Remember/LOCQ)]

4 + (2 + 2 + 2 + 2) = 12

3. (a) Define thread. What is the difference between thread and process?
[(CO1) (Remember/LOCQ)]

(b) Explain the role of operating system as a resource manager.
[(CO2) (Understand/LOCQ)]

(c) Explain 5 different process states with the help of a diagram.
[(CO1) (Remember/LOCQ)]

(d) What is context switching? Why is it considered to be an overhead?
[(CO2) (Understand/LOCQ)]

(1 + 2) +2 +3 + (2 + 2) = 12

Group - C

4. (a) Explain indefinite postponement? How does it differ from deadlock?
[(CO4)(Analyze/IOCQ)]

(b) Consider the following snapshot of a system.

Process	Allocation	Max	Available
	$R_1R_2R_3R_4$	$R_1R_2R_3R_4$	$R_1R_2R_3R_4$
P1	0 0 1 2	0 0 1 2	2 1 0 0
P2	2 0 0 0	2 7 5 0	
P3	0 0 3 4	6 6 5 6	
P4	2 3 5 4	4 3 5 6	
P5	0 3 3 2	0 6 5 2	

(i) What is the content of Need matrix? Is the system in a safe state? Justify your answer.

(ii) If a request from process P3 arrives for (0,1,0,0), can it be granted immediately?

[(CO5)(Apply/IOCQ)]

(2 + 2) + (5 + 3) = 12

5. (a) Consider the following set of processes , with given CPU burst time and arrival time

Process	CPU Burst	Arrival Time
P_0	7	0
P_1	5	1
P_2	3	2
P_3	2	6
P_4	3	12

Draw Gnatt chart illustrating execution of these processes using SRTF Scheduling. Find out Average turn around time and average waiting time and response time. *[(CO1,CO3) (Understand/IOCQ)]*

(b) How next CPU burst is predicted in SJF algorithm? Write the formula and explain. Suppose, P1,P2, P3, P4 are 4 processes with actual burst time 4, 8,5,6 unit respectively and α= 0.5 and ε_1 =5. Then calculate Expected burst time(ε_5) of P5. *[(CO6) (Analyze /HOCQ)]*

(c) Write an algorithm to solve Reader-Writer problem using semaphore.

[(CO3)(Understand/LOCQ)]

(2 + 3) + (2 + 2) + 3 = 12

Group - D

6. (a) Consider a system with physical address 256MB, Logical address space 4GB, frame size is 4KB and each page table entry is 2B and there is a 4-entry TLB. TLB access time is 10ns and memory access time is 100 ns, TLB hit ratio is 0.4

(i) How many level of paging scheme is required?

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

(iii) How much memory in bytes is required for outer and inner page table?

(iv) What is the average memory access time? *[(CO1, CO2) (Understand/HOCQ)]*

(b) Consider the following logical address for page size 1KB.
1025, 2099, 4057, 4090, 2049, 2020, 5150, 7100, 3000, 1029, 3050, 4001, 7190, 7100, 3098, 2065, 1000, 1029, 3061, 3066, 6279.
Generate reference string for memory reference. How many page fault occurs for the following replacement algorithm assuming number of frames=4. LRU and Optimal. *[(CO2) (Understand/IOCQ)]*

(c) What is thrashing? *[(CO2)(Understand/LOCQ)]*

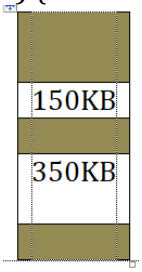
6 + (1 + 2 + 2) + 1 = 12

7. (a) Draw the diagram and explain how logical address is mapped to physical address in segmentation with paging? *[(CO1,CO2) (Understand/IOCQ)]*

(b) What is pure demand paging? What is Belady's anomaly?

[(CO2) (Understand/LOCQ)]

(c) Request from process are 300K, 25K, 125K and 50K respectively. If these requests can be satisfied in following available 150 Kb and 350 KB partition using First fit and Best fit algorithm? Which algorithm makes the best use of memory? (Memory partition is variable size partition.)



[(CO1, CO2) (Remember/IOCQ)]

(2 + 2) + (2 + 2) + 4 = 12

Group - E

8. (a) What is the average access time for transferring 512 bytes of data with the following specifications- Average seek time = 5 msec, Disk rotation = 6000 RPM, Data rate = 40 KB/sec and Controller overhead = 0.1.

[(CO1, CO2)(Understand/HOCQ)]

(b) Suppose a disk drive has 1000 cylinders (0-999). The last request served at track 345 and head is moving towards track 0. Calculate the total head movement and average head movement for the following request queue for I/O ?
123, 874, 692, 475, 105, 376 using SCAN and C-LOOK scheduling.

[(CO1,CO2) (Understand/IOCQ)]

(c) Describe how a file directory system can be organized into a tree-structure and explain advantages of such arrangement. *[(CO2) (Understand/LOCQ)]*

4 + 4 + 4 = 12

9. (a) Explain basic DMA operations to transfer data. *[(CO5) (Analyze/IOCQ)]*

(b) What are blocking and non-blocking I/O? How is non-blocking I/O implemented? *[(CO5) (Analyze/IOCQ)]*

(c) Explain polling bus arbitration technique. *[(CO6) (Design/HOCQ)]*

4 + (2 + 2) + 4 = 12

Cognition Level	*LOCQ*	*IOCQ*	*HOCQ*
Percentage distribution	*37.5*	*43.75*	*18.75*

Course Outcome (CO):

After the completion of the course students will be able to

1. Apply knowledge of mathematics, science and engineering in the areas of process management, memory management and storage management.
2. Understand the underlying technologies and features of memory management and storage management.
3. Understand the various design issues in process management.
4. Learn operating system operation, structures.
5. Be familiar with various types of operating systems.
6. Identify the concepts learned here which are used in their own field of work.

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*