

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) In operating system, each process has its own
 - (a) address space and global variables
 - (b) open files
 - (c) pending alarms, signals and signal handlers
 - (d) all of the mentioned.
 - (ii) Which is not the state of the process?
 - (a) Running
 - (b) Ready
 - (c) Privileged
 - (d) Blocked.
 - (iii) A semaphore count of negative n means ($s=-n$) that the queue contains _____ waiting processes.
 - (a) $n+1$
 - (b) n
 - (c) $n-1$
 - (d) 0
 - (iv) Which of the following schemes suffers from External Fragmentation?
 - (a) Segmentation
 - (b) Paging
 - (c) Paged Segmentation
 - (d) All of these.
 - (v) A state is safe, if
 - (a) the system does not crash due to deadlock occurrence
 - (b) the system can allocate resources to each process in some order and still avoid a deadlock
 - (c) the state keeps the system protected and safe
 - (d) all of these.
 - (vi) Threads within the same process can share
 - (a) only global variable of the process
 - (b) local variables of the process
 - (c) only objects allocated to their stack
 - (d) all the objects in the address space of the process.

- (vii) A Memory Management Unit (MMU), is a piece of hardware that
 - (a) removes external fragmentation
 - (b) removes internal fragmentation
 - (c) translates virtual address into physical address
 - (d) translates register values to stack values.

- (viii) A process executes the code
fork();
fork();
fork();
The total number of child processes created are
(a) 3 (b) 4 (c) 7 (d) 8.

- (ix) If a process has 32k bytes logical address space and the page size is 2048 bytes then the number of frames of that process is
(a) 4 (b) 16 (c) 8 (d) 32.

- (x) Dirty bit for a page in a page table
 - (a) helps avoid unnecessary writes on paging device
 - (b) helps maintain LRU information
 - (c) allows only read on a page
 - (d) None of the above.

Group- B

- 2. (a) What is a bootstrap loader? How is it different from a bootstrap program?
[[CO1](Develop/LOCQ)]
- (b) What are two main responsibilities of an operating system?
[[CO1](Develop/LOCQ)]
- (c) What are protection and security? How they are different from one another?
[[CO1](Develop/LOCQ)]
4 + 4 + 4 = 12

- 3. (a) Discuss about microkernel architecture of operating system and what are the advantages of this approach?
[[CO1](Remember/LOCQ)]
- (b) What do you mean by system calls? What are various types of system calls?
[[CO1] (Remember,Understand/IOCQ)]
- (c) What is the purpose of the command interpreter? Why is it usually separate from the kernel?
[[CO1](Analyse/HOCQ)]
6 + 3 + 3 = 12

Group - C

- 4. (a) Can a child of one process become a child of another process? Explain your answer.
[[CO2] (Analyze/IOCQ)]

- (b) Consider the following scenario of processes with time quantum = 1.

Process	Arrival time	Execution time
P1	0	3
P2	2	3
P3	3	2
P4	5	4
P5	7	2

Draw the Gantt chart for the execution of the processes, showing their start time and end time, using RR scheduling. Calculate turnaround time and waiting time for each process and average turnaround time and average waiting time for the system. [(CO2)(Analyze/IOCQ)]

- (c) Between FCFS and RR, which one induces more context switches? Justify your answer with examples. [(CO2)(Analyze /IOCQ)]
 $2 + 8 + 2 = 12$

5. (a) Consider the following snapshot of a system.

Process	Allocation				Max				Available			
	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4
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) 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? Explain your answer. [(CO2)(CO3)(Analyse/HOCQ)]
- (b) Write Dining philosopher problem using semaphore. What is the drawback of this algorithm? What are the possible solutions to solve the problem? [(CO2)(CO3)(Understand, Analyze/HOCQ)]
 $(4 + 2) + 6 = 12$

Group - D

6. (a) Consider a system with a 32-bit logical address space, a two-level paging scheme, 4 byte page table entries, and 4 KB pages. The page-table base register access time is 0 ns, TLB access time 5 ns and memory access time is 200 ns. The TLB hit ratio is 90%.
- (i) How many address bits are needed for the page offset?
 (ii) How much memory in bytes is required to store the outer page table entirely in main memory?
 (iii) What is the average memory access time? [(CO4)(CO5)(Understand, Analyze/IOCQ)]
- (b) Given memory partition of 100 K, 600 K, 200 K, 300 K and 400 K. How would each of the First Fit, Best Fit and Worst Fit algorithm place processes of 312K, 217 K, 95 K and 426 K. Which algorithm makes the most efficient use of memory? [(CO4)(CO5)(Analyse/IOCQ)]
 $(2 + 3 + 3) + 4 = 12$

7. (a) Suppose a disk drive has 300 cylinders (0 to 299). The current position of the drive is 60. Calculate the total head movement and average head movement for the following request queue for I/O

87,170,40,150,36,72,66,15

SSTF scheduling

Scan Scheduling.

[[CO6](Understand/IOCQ)]

- (b) Calculate the number of page faults for the following reference string using optimum scheduling algorithm with frame size as 3. [[CO4](Analyse/IOCQ)]

5	0	2	1	0	3	0	2	4	3	0	3	2	1	3	0	1	5
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

$(3 + 3) + 6 = 12$

Group - E

8. (a) What is the purpose of DMA devices? How does a DMA device handle virtual addresses? [[CO6](Be Familiar/IOCQ)]

- (b) Describe direct file access method. Where is it use recommended?

[[CO1](Remember/LOCQ)]

- (c) Explain the difference between blocking and non-blocking I/O.

[[CO1](Analyse/IOCQ)]

$6 + 2 + 4 = 12$

9. (a) What is mount point? Why do we need it? [[CO6](Be Familiar /IOCQ)]

- (b) Can we mount the same file system on two different directories? If the answer is yes, what problems will the system have? [[CO6](Be Familiar /IOCQ)]

$6 + 6 = 12$

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	20.83	63.54	15.63

Course Outcome (CO):

After the completion of the course students will be able to

CSEN2203.1. Develop knowledge about the importance of computer system resources and the role of operating system in their management policies and algorithms.

CSEN2203.2. Understand processes and its management policies and scheduling of processes by CPU.

CSEN2203.3. Acquire an understanding of the need of process synchronization, evaluate the requirement for process synchronization and coordination handled by operating system.

CSEN2203.4. Analyse the memory management and its allocation policies and compare different memory management approaches.

CSEN2203.5. Use system calls for managing processes, memory, file system etc.

CSEN2203.6. Be familiar with different storage management policies and storage technologies.

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