

**OPERATING SYSTEM CONCEPT
(CSBS 2201)**

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

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

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) The address of the next instruction to be executed by the current process is provided by the _____
(a) CPU registers (b) Program counter
(c) Process stack (d) Pipe
- (ii) If a process is executing in its critical section, then no other processes can be executing in their critical section. What is this condition called?
(a) Mutual exclusion (b) Critical exclusion
(c) Synchronous exclusion (d) Asynchronous exclusion
- (iii) A semaphore is a shared integer variable _____
(a) That can not drop below zero (b) That can not be more than zero
(c) That can not drop below one (d) That can not be more than one
- (iv) A Process Control Block (PCB) does not contain which of the following?
(a) Code (b) Stack (c) Bootstrap program (d) Data.
- (v) The page table contains _____.
(a) Base address of each page in physical memory
(b) Page offset
(c) Page size
(d) Segment Size
- (vi) The bounded buffer problem is also known as _____.
(a) Readers – Writers Problem (b) Dining – Philosophers Problem
(c) Producer – Consumer Problem (d) Sleeping barber problem.
- (vii) What is compaction?
(a) A technique for overcoming internal fragmentation
(b) A paging technique
(c) A technique for overcoming external fragmentation
(d) A technique for overcoming fatal error.

- (viii) Which one of the following is the deadlock avoidance algorithm?
 (a) Banker's algorithm (b) Round-robin algorithm
 (c) Elevator algorithm (d) FCFS algorithm
- (ix) The circular wait condition can be prevented by _____
 (a) Defining a linear ordering of resource types
 (b) Using thread
 (c) Using pipes
 (d) Entering in critical section.
- (x) A process is thrashing if _____.
 (a) It is spending more time paging than executing
 (b) It is spending less time paging than executing
 (c) Page fault occurs
 (d) Swapping cannot take place

Fill in the blanks with the correct word

- (xi) Effective access time is directly proportional to _____.
- (xii) A problem encountered in multitasking when a process is perpetually denied necessary resources is called _____.
- (xiii) For most computers, the bootstrap is stored in _____.
- (xiv) The mounting of file system is _____.
- (xv) The disk arm starts at one end of the disk and moves toward the other end, servicing requests till the other end of the disk. At the other end, the direction is reversed and servicing continues, in the algorithm _____.

Group - B

2. (a) What are the advantages and disadvantages of using multi-programming systems? [[CO1](Understand/LOCQ)]
- (b) What is degree of multiprogramming? What is fault tolerance? [[CO2](Understand/LOCQ)]
- (c) What resources are used when a thread is created? How do they differ from those when a process is created? Justify your answer. [[CO2](Analyse/HOCQ)]
- 4 + (2 + 2) + 4 = 12**
3. (a) Compare and contrast the different ways of thread implementation. [[CO2](Apply/IOCQ)]
- (b) Why medium term scheduler is required? Explain device queue with proper diagram. [[CO2](Apply/IOCQ)]
- (c) When CPU switches from process to process, explain in details what happens with proper diagram. Write the name of above technique? [[CO2](Apply/HOCQ)]
- 4 + 4 + 4 = 12**

Group - C

4. (a) Consider the set of 4 processes whose arrival time and burst time are given the below table -

Process Id	Arrival time	Burst time
P1	0	6
P2	1	1
P3	2	4
P4	3	3

If the CPU scheduling policy is SJF (Both Preemptive and Non-Preemptive), then compare their average waiting time. *[[CO3](Apply/IOCQ)]*

- (b) Write down the solution of the Sleeping Barber Problem using semaphore. *[[CO3](Analyse/IOCQ)]*
6 + 6 = 12

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

	Allocation	Max	Available
	A B C D	A B C D	A B C D
P0	0 1 1 0	0 2 1 0	1 3 1 0
P1	1 4 4 1	1 6 5 2	
P2	1 3 6 5	2 3 6 6	
P3	0 6 3 2	0 6 5 2	
P4	0 0 1 4	0 6 5 6	

Answer the following questions using the banker's algorithm:

- (i) What is the content of the matrix Need?
(ii) Is the system in a safe state?
(iii) If a request from process P1 arrives for (0, 2, 1, 0), can the request be granted immediately? *[[CO3](Apply/IOCQ)]*
- (b) Define Mutual-exclusion implementation with test_and_set() instruction. Explain with suitable example. *[[CO3](Apply/IOCQ)]*
(2 + 2 + 2) + (3 + 3) = 12

Group - D

6. (a) Given six memory partitions of 300 KB, 600 KB, 350 KB, 200 KB, 750 KB, and 125 KB (in order), how would the first-fit, best-fit, and worst-fit algorithms place processes of size 115 KB, 500 KB, 358 KB, 200 KB, and 375 KB (in order)? Rank the algorithms in terms of how efficiently they use memory. *[[CO4](Apply/IOCQ)]*

- (b) Consider the following page reference string:
5, 8, 4, 0, 2, 8, 4, 9, 6, 5, 6, 4, 5, 8
Assuming 4 frames are available, what is the page fault ratio for (i) FCFS,
(ii) MFU, (iii) LRU replacement algorithms? [[CO4](Apply/IOCQ)]
6 + (2 + 2 + 2) = 12
7. (a) What is thrashing? What can the system do to eliminate this problem? [[CO4](Analyse/IOCQ)]
- (b) Suppose a disk drive has 400 cylinders, numbered 0 to 399. The driver is currently serving a request at cylinder 120 and previous request was at cylinder 140. The queue of pending request in FIFO order is:
86,147, 312, 91, 177, 48, 309,222, 175, 130
Starting from the current head position, what is the total distance in cylinders that disk arm moves to satisfy all pending request for each of the disk scheduling algorithm.
(i) SSTF, (ii) SCAN, (iii) C-SCAN. [[CO5](Apply/IOCQ)]
6 + (2 + 2 + 2) = 12

Group - E

8. (a) What is Super Block ? Why it is required? [[CO6](Remember/LOCQ)]
(b) Explain the different ways adapted for free space management in a disk. [[CO6](Remember/LOCQ)]
6 + 6 = 12
9. (a) What is Capability List? Why it is required, explain with an example. [[CO6](Remember/LOCQ)]
(b) What is authentication? Discuss the different types of token based authentication and biometrics based authentication. [[CO6](Remember/LOCQ)]
6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	33.33	58.33	8.33

Course Outcome (CO):

After the completion of the course students will be able to

- CSBS2201.1. Differentiate different types of operating systems (namely, batch, multi programmed, timesharing, real-time, distributed, parallel processing system) based on their application domains and evolution.
- CSBS2201.2. Describe system operations, internal structure of computer system and operating system.
- CSBS2201.3. Illustrate multiprocessing and multithreading environments based on inter-process/thread communication and synchronization.
- CSBS2201.4. Compare the different level of memory (Primary memory, cache, virtual memory, secondary storage) and how they are correlated to improve the performance of the system.
- CSBS2201.5. Describe the operations of IO devices and how they are governed by the operating system
- CSBS2201.6. Define the activity and impact of threat, virus, worm and how the system could be protected from them.

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