

**OPERATING SYSTEM CONCEPT  
(CSBS 2201)**

**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) Banker's algorithm is used  
(a) to prevent deadlock (b) to deadlock recovery  
(c) to solve the deadlock (d) none of these.
- (ii) The real-time operating system, which of the following algorithm will be the most suitable scheduling scheme?  
(a) Round Robin (b) FCFS  
(c) SJF (d) Pre-emptive Priority Scheduling.
- (iii) An operating system uses the Shortest Remaining Time first (SRTF) process scheduling algorithm. Consider the arrival times and execution times for the following processes
- | Process | Execution time | Arrival time |
|---------|----------------|--------------|
| P1      | 20             | 0            |
| P2      | 25             | 15           |
| P3      | 10             | 30           |
| P4      | 15             | 45           |
- What is the total waiting time for process P2?  
(a) 5 (b) 40 (c) 15 (d) 55.
- (iv) The problem of indefinite blockage of lower priority job in general priority scheduling is solved by  
(a) starvation (b) aging  
(c) compaction (d) dirty bit.
- (v) Counting Semaphores  
(a) can only have positive integer value (b) can only have positive value  
(c) can have any integer value (d) cannot be 0.

- (vi) System calls are usually invoked by using
  - (a) software interrupt
  - (b) polling
  - (c) an indirect jump
  - (d) privileged.
- (vii) Which module gives control of the CPU to the process selected by the short-term scheduler?
  - (a) Dispatcher
  - (b) Loader
  - (c) Scheduler
  - (d) Linker.
- (viii) If one thread opens a file with read privileges then
  - (a) other threads in the another process can also read from that file
  - (b) other threads in the same process can also read from that file
  - (c) any other thread cannot read from that file
  - (d) any other thread cannot write from that file.
- (ix) Thrashing
  - (a) reduces page I/O
  - (b) decreases the degree of multiprogramming
  - (c) implies excessive page I/O
  - (d) improve the system performance.
- (x) Fragmentation is
  - (a) Dividing the secondary memory into equal sized fragments
  - (b) Dividing the main memory into equal sized fragments
  - (c) Fragments of memory words used in a page
  - (d) Fragments of memory words unused in a page.

**Group- B**

- 2. (a) Explain Microkernel operating system architecture. [[CO2](Understand/LOCQ)]
- (b) With proper example explain the difference between multiprogramming and multiprocessing. [[CO1](Understand/LOCQ)]
- (c) What is Bootstrapping? Describe with diagram how Bootstrapping works when the computer system starts. [[CO2](Understand/LOCQ)]
- 4 + 4 + 4 = 12**
- 3. (a) What is the purpose of interrupts? What are the differences between a trap and an interrupt? Can traps be generated intentionally by a user program? [[CO2](Understand/LOCQ)]
- (b) Draw and explain process life cycle. [[CO2](Understand/LOCQ)]
- (c) Compare and contrast between User Level threads & Kernel Level threads. [[CO2](Analyse/IOCQ)]
- (2 + 2 + 2) + 3 + 3 = 12**

**Group - C**

- 4. (a) How the readers' – writers' problem can be solved using semaphore? Explain the algorithm. [[CO3] (Analyse/IOCQ)]

- (b) “Race condition can only happen while some shared resource is shared among some processes who try to make some alteration to it.” – Justify. [[CO3](Evaluate/HOCQ)]
- (c) Compare and contrast between Process and Thread. [[CO2] (Analyse/IOCQ)]  
**6 + 3 + 3 = 12**

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

Process No	Arrival Time	Priority	Burst Time		
			CPU Burst	I/O Burst	CPU Burst
P1	0	2	1	5	3
P2	2	3	3	3	1
P3	3	1	2	3	1

If the CPU scheduling policy is Priority Scheduling, calculate the average waiting time and average turnaround time. (Lower number means higher priority)

- [[CO3](Apply/IOCQ)]
- (b) A system is having 3 user processes P1, P2 and P3 where P1 requires 2 units of resource R, P2 requires 3 units of resource R, P3 requires 4 units of resource R. What will be the minimum number of units of R that ensures no deadlock?  
[[CO3] (Apply/IOCQ)]  
**(4 + 4) + 4 = 12**

### Group - D

6. (a) What are the differences between internal and external fragmentation?  
[[CO4](Understand/LOCQ)]
- (b) Consider the following page reference string  
 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6  
 Find out the number of page faults if there are 4 page frames, using the following page replacement algorithm (i) LRU (ii) FCFS (iii) Optimal.  
[[CO4](Apply/IOCQ)]
- (c) What is demand paging? What are the benefits of using it? What is pure demand paging?  
[[CO4](Understand/LOCQ)]  
**2 + 6 + (2 + 1 + 1) = 12**
7. (a) What is thrashing? What are its causes? How can its occurrence be reduced?  
[[CO4](Understand/LOCQ)]
- (b) Suppose a disk drive has 300 cylinders, numbered 0 to 299. The drive is currently serving request at cylinder 90, and the previous request was at cylinder 80. The queue of pending requests, in FIFO order is 36, 79, 15, 120, 199, 270, 89 and 170.  
 Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk-scheduling algorithms?  
 (i) SSTF (ii) SCAN (iii) C-SCAN. [[CO5](Apply/IOCQ)]  
**(2 + 2 + 2) + 6 = 12**

**Group - E**

8. (a) Compare between working principles of Interrupt Driven and polling based IO using block diagram. [(CO5)(Remember/LOCQ)]  
 (b) Differentiate between virus, worm and trojan horse. [(CO6)(Understand/LOCQ)]  
**8 + 4 = 12**
9. (a) Explain VFS with diagram. [(CO4)(Remember/LOCQ)]  
 (b) Explain contiguous allocation, linked allocation and indexed allocation with example. [(CO4)(Understand/LOCQ)]  
 (c) What do you mean by vectored interrupt? [(CO5)(Remember/LOCQ)]  
**3 + 6 + 3 = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	59.37	37.5	3.12

**Course Outcome (CO):**

After the completion of the course students will be able to

- Analyse and differentiate between different types of operating systems (namely, batch, multi programmed,time-sharing, real-time, distributed, parallel processing system) based on their application domains andevolution.
- Demonstrate and describe system operations, internal structure of computer system and operating system.
- Design multiprocessing and multithreading environments based on inter-process/thread communication andsynchronization.
- Compare the different level of memory (Primary memory, cache, virtual memory, secondary storage) andhow they are correlated to improve the performance of the system.
- Demonstrate the operations of IO devices and how they are governed by the operating system.
- Discuss 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