OPERATING SYSTEM
(CSEN 3103)

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

(ii) The time to move the disk arm to the desired sector in a hard disk is known as
(a) rotational latency (b) positioning time
(c) seek time (d) hashed time.

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

(iv) The scheduler which selects jobs from a pool of jobs and loads them to the ready queue is called
(a) short term scheduler (b) middle term scheduler
(c) long term scheduler (d) dispatcher.

(v) If a process has 24 K byte of logical address space and the page size is 4096 bytes, the number of pages in the process are
(a) 12 (b) 6 (c) 16 (d) 8.

(vi) Which of the following need not necessarily be saved on context switch between processes?
(a) General purpose register (b) Program Counter
(c) Translation Look-aside Buffer (d) All the above.

(vii) Which of the following schemes suffer from External Fragmentation?
(a) Segmentation (b) Paging
(c) Paged Segmentation (d) All of these.

(viii) System calls are usually invoked by
(a) software interrupt (b) indirect jump
(c) polling (d) privileged instruction.

(ix) To enable a process to be larger than the amount of memory allocated to it, one can use
(a) Overlays (b) Paging
(c) Compaction (d) Swapping.

(x) In which of the following case Banker's algorithm is used?
(a) Deadlock Avoidance (b) Context Switching
(c) Deadlock Rrecovery (d) Mutual Exclusion.

Group - B

2. (a) Describe briefly the microkernel architecture of an operating system. What are its benefits?

(b) What is the architecture of the LINUX operating system?

(c) Explain all the functions of an operating system.

(d) Explain the functioning of an interrupt driven operating system. What does the CPU do when it receives an interrupt? How does the operating system service the interrupt?

(2 + 1) + 1 + 5 + (1 + 1+ 1) = 12

3. (a) Mention one characteristic each of time-sharing system, real-time system, parallel processing system and multi-user system.

(b) Why is it necessary to enter Linux via a system call as opposed to a function call?

(c) Explain the functioning of a virtual machine operating system structure using a schematic diagram.

(d) State the advantages of a virtual machine for
(i) an operating system designer
(ii) an user

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

Group - C

4. (a) Explain indefinite postponement. How does it differ from deadlock?

(b) Consider the following snapshot of a system.

Process	Allocation				Max				Available			
	R_1	R_2	R_3	R_4	R_1	R_2	R_3	R_4	R_1	R_2	R_3	R_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) 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 answers.

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

5. (a) What is a thread? What is the difference between a thread and a process?

(b) Explain how semaphore solves the critical section problem for n number of processes.

(c) Consider the following set of processes, with the length of the CPU burst time is given in millisecond.

Process	Burst time	Arrival time
P1	6	0
P2	10	3
P3	8	5
P4	5	7
P5	6	10

(i) Draw a Gantt chart for a round robin scheduling policy with time quantum= 4units. Illustrate the execution of these processes using pre-emptive priority (higher number implies a higher priority) scheduling.

(ii) Find the completion time and response time.

(iii) Find the average waiting time and average turn around time.

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

Group – D

6. (a) Compare the best fit and first fit algorithm for memory allocation.

(b) What is TLB? Draw a block diagram and explain the operation of TLB.

(c) Consider the following reference string.

1, 2, 3, 4, 5, 3, 4, 1, 6, 7, 8, 7, 8, 9, 7, 8, 9, 5, 4, 5, 4, 2

Calculate the page fault rate for the following algorithms:

i) FIFO

ii) LRU

Assume that the memory size is 4 frames.

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

7.(a) What are the different types of DMA controllers and how do they differ in their functioning?

(b) What are blocking and non-blocking I/O? How is non-blocking I/O implemented?

(c) Assuming the current disk cylinder is 50 and the request is for cylinders 1, 36, 49,65, 58, 12, 23, 20, 55, 16, 78, find the sequence of servicing using shortest seek time first (SSTF) disk scheduling algorithm. What will be the sequence of servicing of request if C-SCAN is used instead?

(a) 2+2

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

Group – E

8.(a) What is shoulder surfing and password sniffing? Describe the operation of onetime password used for user authentication in enforcing security of computer system. Highlight how OTP protects against shoulder surfing and password sniffing.

(b) Describe how a Trojan horse program is used to steal user name (authentication code) and password. How does a non-trappable key sequence(Control + alt + del) prevent this stealing?

(c) For each of the following security attacks, say if public key encryption can help prevent the attack. (Justify your answer.)

i. Abuse of valid privileges ii. Denial of Service attack

iii. Listener or eavesdropper attack iv. Buffer overflow attack.

(2 +3) + (2+1) + 4 = 12

9. (a) What are the goals of protection? Explain how access matrix can be implemented using global table and access list.

(a) 1 + 2

(b) Explain 4 levels of security measurement to protect a system.

(2 +5) + 5 = 12