

**FUNDAMENTALS OF OPERATING SYSTEMS
(CSEN 4121)**

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) Shell is a
(a) hardware component (b) command interpreter
(c) part of compiler (d) tool in CPU scheduling
- (ii) Which one of the following is not true?
(a) kernel remains in the memory during the entire computer session
(b) kernel is made of various modules which can not be loaded in running operating system
(c) kernel is the first part of the operating system to load into memory during booting
(d) kernel is the program that constitutes the central core of the operating system
- (iii) The time required to create a new thread in an existing process is
(a) equal to the time required to create a new process
(b) greater than the time required to create a new process
(c) less than the time required to create a new process
(d) none of the above
- (iv) Termination of the process terminates
(a) first thread of the process (b) all threads within the process
(c) no thread within the process (d) first two threads of the process
- (v) Which among the following does not create a new process?
(a) fork (b) excelp
(c) execve (d) execp
- (vi) The Need matrix is given by the formula
(a) Need = Max – Allocation (b) Need = Max + Allocation
(c) Need = Max * Allocation (d) Need = Max.
- (vii) Thrashing
(a) reduces page I/O (b) decreases the degree of multiprogramming
(c) implies excessive page I/O (d) improves the system performance.

- (viii) Which of the following page replacement algorithms suffers from Belady's anomaly?
 (a) Optimal Replacement (b) LRU
 (c) FIFO (d) both (a) and (b).
- (ix) If the page size increases, the internal fragmentation is also
 (a) decreases (b) increases
 (c) remains constant (d) none of these
- (x) In which of the following, memory is wasted?
 (a) Compaction (b) Fragmentation
 (c) Paging (d) Thrashing

Fill in the blanks with the correct word

- (xi) The FCFS algorithm is particularly troublesome for _____
- (xii) A system is in the safe state if _____
- (xiii) An un-interruptible unit is known as _____
- (xiv) The code that changes the value of the semaphore is _____
- (xv) Interprocess communication is _____

Group - B

2. (a) What is multiprocessor or tightly coupled system? In which situations would you prefer a multiprocessor system? [[CO5](Understand/LOCQ)]
- (b) Explain how multiprogramming operating system increases CPU utilization. [[CO1](Analyze/LOCQ)]
- (c) What is the main advantage of the microkernel approach to system design? How do user programs and system services interact in microkernel architecture? [[CO1](CO4)(Understand/IOCQ)]
- (2 + 3) + 3 + (2 + 2) = 12**
3. (a) What are the functions of OS from user's point of view? [[CO3](Analyze/LOCQ)]
- (b) What are the functions of OS from system point of view? [[CO4](Remember/LOCQ)]
- (c) Is time sharing system suitable for RTOS? [[CO2](Apply/IOCQ)]
- 4 + 4 + 4 = 12**

Group - C

4. (a) Draw and Explain 7-state model of process state diagram. Write the difference between suspended and blocked state of the process. [[CO2](CO3)(Remember/LOCQ)]
- (b) What do you mean by direct and indirect communication in terms of IPC? And what are the properties of communication link in both cases. [[CO2](Understand/LOCQ)]
- 6 + (3 + 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	10	3
P ₁	2	1
P ₂	4	2
P ₃	1	4
P ₄	5	2

Draw Gantt chart illustrating execution of these processes using FCFS and SJF Scheduling. Find out average turned around time and waiting time for both scheduling algorithm.

[[CO1](CO3)(Understand/IOCQ)]

- (b) With an example explain FCFS scheduling suffers from convoy effect.

[[CO6](Analyze/IOCQ)]

$$(4 + 4) + 4 = 12$$

Group - D

6. (a) What is semaphore? What are the operations on semaphore? How is semaphore used to execute one process after the other?

[[CO2](Remember/LOCQ)]

- (b) A system has two processes and three identical resources. Each process needs a maximum of two resources to complete. Is deadlock possible? Explain your answer.

[[CO1](Understand/IOCQ)]

- (c) Compare various recovery schemes for a system in deadlock.

[[CO1](Apply/IOCQ)]

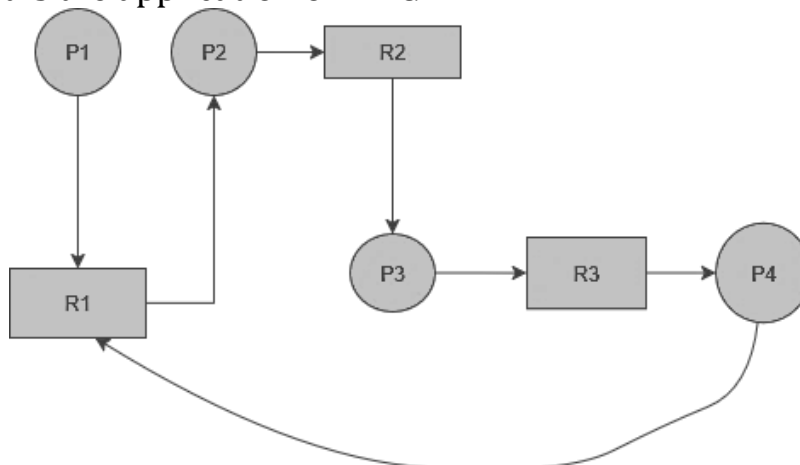
$$6 + 3 + 3 = 12$$

7. (a) Write deadlock detection algorithm. Consider a system with the following information. Determine whether the system is in deadlock or not.

Process	Allocation			Request		
	R1	R2	R3	R1	R2	R3
P1	1	0	2	1	0	0
P2	1	1	0	4	0	2
P3	1	1	0	0	1	2
P4	0	2	1	2	1	0
P5	1	2	0	3	1	4

[[CO2](Apply/IOCQ)]

- (b) For the following RAG find out WFG and explain the process of constructing WFG. What is the application of WFG?



[[CO2](Apply/LOCQ)]

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

Group - E

8. (a) Consider the following sequence of memory references from a 460 word program: 10, 11, 104, 170, 73, 309, 135, 245, 246, 434, 458, 364 Give the sequence of referred pages corresponding to the above memory references, assuming a page size of 100 words. [[CO1](Analyze/IOCQ)]
- (b) Consider a logical address space of sixteen pages of 1024 words each. If the physical memory has 32 page frames, then,
- (i) How many bits are there in the physical address space?
- (ii) How many bits are there in the logical address space? [[CO3](Understand/LOCQ)]
- (c) When multiple user want to use the same file, how is protection to the file provided by the operating system? [[CO2](Understand/LOCQ)]
- 4 + 4 + 4 = 12**
9. (a) Describe how a file directory system can be organized into a tree-structure and explain advantages of such arrangement. [[CO2](Understand/IOCQ)]
- (b) What are the advantages and disadvantages of a two-level verses tree-structured directories. [[CO2](Analyze/HOCQ)]
- (c) What is the difference between internal and external fragmentation? [[CO2](Understand/LOCQ)]
- 6 + 4 + 2 = 12**
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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	51	44.8	4.2