

B.TECH/AEIE/ECE/7TH SEM/CSEN 4121/2021
FUNDAMENTALS OF OPERATING SYSTEMS
(CSEN 4121)

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) A benefit of the microkernel organization is
(a) Extensibility (b) Portability
(c) Flexibility (d) All of these.
- (ii) Which scheduling algorithm is inherently pre-emptive?
(a) FCFS (b) SJF (c) RR (d) Priority Scheduling.
- (iii) In which of the following cases Banker's algorithm is used?
(a) Deadlock Avoidance (b) Context Switching
(c) Deadlock Recovery (d) Mutual Exclusion.
- (iv) The technique of gradually increasing the priority of a process that wait in a system for a long time is known as
(a) Blocking (b) Ageing
(c) Starvation (d) Convoy effect.
- (v) The time required to create a new thread in an existing process is
(a) greater than the time required to create a new process
(b) less than the time required to create a new process
(c) equal to the time required to create a new process
(d) none of the above.
- (vi) Which of the following schemes suffers from External Fragmentation?
(a) Segmentation (b) Paging
(c) Paged Segmentation (d) All of these.
- (vii) Termination of the process terminates
(a) first thread of the process (b) first two threads of the process
(c) all threads within the process (d) no thread within the process.

- (viii) Process can be terminated due to
 - (a) normal exit
 - (b) fatal error
 - (c) killed by another process
 - (d) all of the mentioned.
- (ix) CPU fetches the instruction from memory according to the value of
 - (a) program counter
 - (b) status register
 - (c) instruction register
 - (d) program status word.
- (x) To enable a process to be larger than the amount of memory allocated to it, one can use
 - (a) Thrashing
 - (b) Paging
 - (c) Compaction
 - (d) Swapping.

Group - B

- 2. (a) Name one essential property of the following types of operating systems: (i) Batch, (ii) Interactive, (iii) Time-sharing, (iv) Real time, (v) Network. [(CO4)(CO5)(Remember/IOCQ)]
- (b) What are the differences between a trap and an interrupt? What is the use of each function? [(CO2)(Understand/LOCQ)]
- (c) What is the purpose of the command interpreter? Why is it usually separate from the kernel? [(CO1)(Analyse/HOCQ)]

5 + 5 + 2 = 12

- 3. (a) What are the services provided by the operating system? [(CO4)(Remember/LOCQ)]
- (b) What do you understand by a microkernel operating system structure? Explain with the aid of suitable diagram. [(CO2)(Understand/IOCQ)]
- (c) What are the fundamental differences between mobile phone processing system and a multi-core desk top processing system? [(CO1)(Analyse/HOCQ)]

4 + 5 + 3 = 12

Group - C

- 4. (a) Consider the following set of processes, with the length of the CPU burst time is given in milliseconds.

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 preemptive 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. [(CO4)(Remember/LOCQ)]

- (b) What is a thread? What is the difference between a thread and a process? [(CO2)(Analyse/LOCQ)]
- (c) Explain how semaphore solves the critical section problem for n number of processes. [(CO3)(Analyse/HOCQ)]

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

5. (a) What are the various states of a process? Describe each state. [(CO4)(Remember/LOCQ)]
- (b) Compare ready queue and waiting queue. Do all processes in ready queue get into waiting queue? If yes, explain your answer. If no, why not. [(CO2)(Analyse/HOCQ)]
- (c) Contrast the three different types of process scheduling i.e short term scheduling, medium term scheduling, long term scheduling. [(CO3)(Analyse/HOCQ)]

$$5 + 4 + 3 = 12$$

Group - D

6. (a) Consider the following pseudo code:
- ```

semaphore S = 1;
semaphore E = 1;
If (thread_count++ < 100) spawnnewthread();
wait(E);
// critical section - begin

// critical section - end
signal(S);

```

Assume that above pseudocode gets called a hundred times, what is the count of semaphore E? [(CO4) (Understand/LOCQ)]

- (b) At a particular time of computation the value of a counting semaphore is 7. Then 20 P operations and 15 V operations were completed on this semaphore. Find out the resulting value of the semaphore. [(CO2) (Understand/IOCQ)]
- (c) Comment on the statement: 'The performance of the FCFS becomes poor when a smaller job is scheduled after a larger job.' [(CO1)(Analyse/IOCQ)]
- (d) 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. [(CO3)(CO4)(Analyse/HOCQ)]

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

7. (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)(Analyse/HOCQ)]

**6 + 3 + 3 = 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)(Remember/LOCQ)]
- (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)(CO6)(Understand/LOCQ)]
- (c) What is 'thrashing'? What is the effect of it on page fault frequency? What is the problem of fragmentation and how can it be solved? [(CO1)(Analyse/IOCQ)]
- (d) How many pages of size 512 words each, are contained in a program with a logical address having 16 bits? [(CO1)(Analyse/HOCQ)]

**3 + 4 + 3 + 2 = 12**

9. (a) Describe direct file access method. Where is it use recommended? [(CO1)(Remember/LOCQ)]
- (b) When multiple user want to use the same file, how is protection to the file provided by the operating system? [(CO2)(Understand/IOCQ)]
- (c) What are the advantages and disadvantages of a two-level versus tree-structured directories. [(CO2)(Analyse/HOCQ)]

**3 + 5 + 4 = 12**

| Cognition Level         | LOCQ   | IOCQ   | HOCQ   |
|-------------------------|--------|--------|--------|
| Percentage distribution | 42.70% | 26.05% | 31.25% |

**Course Outcome (CO):**

After the completion of the course students will be able to

1. Apply knowledge of mathematics, science and engineering in the areas of process management, memory management and storage management.
2. Understand the underlying technologies and features of memory management and storage management.
3. Understand the various design issues in process management..
4. Learn operating system operation, structures.
5. Be familiar with various types of operating systems.
6. Identify the concepts learned here which are used in their own field of work

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

| <b>Department<br/>&amp; Section</b> | <b>Submission link:</b>                                                                                                                                             |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AEIE, ECE                           | <a href="https://classroom.google.com/c/NDA1MjA4NDAYMTI2/a/NDYzOTIyNDk0MzU0/details">https://classroom.google.com/c/NDA1MjA4NDAYMTI2/a/NDYzOTIyNDk0MzU0/details</a> |