N.B. 1) All questions are compulsory.
2) Figures to the right indicate marks.
3) Illustrations, in-depth answers and diagrams will be appreciated.
4) Mixing of sub-questions is not allowed.
5) Assume suitable data if required.

Q. 1 **Attempt All (Each of 5Marks)** (15M)
(a) Multiple Choice Questions.
i. To access the services of operating system, the interface is provided by the
a) system calls b) API c) library d) assembly instructions

ii. What is the ready state of a process?
a) when process is scheduled to run after some execution
b) when process is unable to run until some task has been completed
c) when process is using the CPU
d) none of the mentioned

iii. A process stack does not contain
a) function parameters b) local variables c) return addresses d) PID of child process

iv. When several processes access the same data concurrently and the outcome of the execution depends on the particular order in which the access takes place, is called
a) dynamic condition b) race condition c) essential condition d) critical condition

v. Which one of the following is a synchronization tool?
a) Thread b) pipe c) semaphore d) socket

(b) **Fill in the blanks and rewrite the sentence.**
(mutual exclusion, turnaround time ,c-scan ,starvation, multilevel queue scheduling algorithm)
i. The interval from the time of submission of a process to the time of completion is termed as----------

ii In disk scheduling, _____ scheduling moves the head from one end of the disk to the other, servicing requests along the way.

iii.---------- condition is required for deadlock to be possible?

iv. If the resources are always preempted from the same process, _____ can occur.

v. Process are classified into different groups in.....

(c) **Answer following questions in one or two sentences.**
i. What is deadlock?
ii. What is PCB?
iii. What is cascading termination?
iv. What is the use of base register and limit register?
v. What is aging?

Q. 2 **Attempt the following (Any THREE)** (15M)
(a) explain various multithreading models
(b) Write a note on real time operating system.
(c) Explain operating systems services.
(d) Explain Interprocess communication.
(e) Describe five state process diagram.
(f) Explain Scheduling criteria.

Q. 3 **Attempt the following (Any THREE)** (15M)
(a) Explain semaphores.
(b) Write a note on Dinning Philosophers problem.
(c) Consider the below processes available in the ready queue for execution, with **arrival time as 0** for all and given **burst times**. Process CPU burst time Arrival time
Calculate avg waiting time for SJF SCHEDULING

PROCESS	BURST TIME	ARRIVAL TIME
P1	21	0
P2	3	1
P3	6	2
P4	2	3

(d) Explain deadlock conditions.
(e) Considering a system with five processes P_0 through P_4 and three resources of type A, B, C. Resource type A has 10 instances, B has 5 instances and type C has 7 instances. Suppose at time t_0 following snapshot of the system has been taken:

Process	Allocation	Max	Available
	A B C	A B C	A B C
P_0	0 1 0	7 5 3	3 3 2
P_1	2 0 0	3 2 2	
P_2	3 0 2	9 0 2	
P_3	2 1 1	2 2 2	
P_4	0 0 2	4 3 3	

What will be the content of the Need matrix? Is the system in a safe state? If Yes, then what is the safe sequence?

(f) Explain FCFS scheduling algorithm.

Q. 4 **Attempt the following (Any THREE)** (15)
(a) Write a short note on Segmentation.
(b) Write short notes on:
1) DMA 2) Interrupt

(c) Consider the following reference string: 0, 2, 1, 6, 4, 0, 1, 0, 3, 1, 2, 1. Find page fault

Using FIFO page replacement algorithm. Frame size is 5

(d) Explain different file operations.

(e) Explain in detail multilevel queue scheduling.

(f) Explain SSTF scheduling with example.

Q. 5 **Attempt the following (Any THREE)** (15)

(a) Explain file Attributes.
(b) Write a note on paging.
(c) Describe directory structure.(any three)
(d) Write short note on 1.MMU 2.PAGE TABLE
(e) What is a thread? Write benefits of multithreaded programming