N.B. 1) All questions are compulsory.
  2) Figures to the right indicate marks.

Q. 1 **Attempt the following (Any four)**   (20M)
  (a) Define operating system and list the basic services provided
    by operating system.
  (b) Explain different types of operations.
  (c) Describe process state diagram.
  (d) What is system call? Explain types of system call. (any two).
  (e) Explain various multithreading models.
  (f) Explain the essential properties of
    a) Batch System b) Time sharing c) Real time d) Distributed

Q. 2 **Attempt the following (Any four)**   (20M)
  (a) Explain deadlock detection.
  (b) What is semaphore? Explain product-consumer problem.
  (c) Consider the processes which are given below in the table
    having arrival time is 0 and burst time is given . Calculate
    avg waiting time for SJF SCHEDULING

Process	Burst time
P1	5
P2	10
P3	
P4	

  (d) 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 take**n:**

Process	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P0	0	1	0	7	5	3	3	3	2
P1	2	0	0	3	2	2			
P2	3	0	2	9	0	2			
P3	2	1	1	2	2	2			
P4	0	0	2	4	3	3			

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

  (e) Give the condition necessary for a deadlock situation to arise?
  (f) Find the average waiting time using FCFS for the processes given in the table below.

Process	CPU burst time(in ms)
P1	24
P2	3
P3	3

Q. 3 **Attempt the following (Any four)**   (20M)

   (a) Reference string = 7,0,1,2,0,3,0,4,2,3,0,3,0,3,2,1,2,0,1,7,0,1
      and Memory = 3 frames. Find the number of page faults using FIFO.

   (b) Describe the term page fault. What is thrashing? How it is controlled by OS?

   (c) Explain Different File operations.

   (d) Explain SCAN disc Scheduling with example.

   (e) What are the allocation methods of a disk space? Explain contiguous allocation.

   (f) What is single directory and two-level directory? Explain it.

Q. 4 **Attempt the following (Any five)**   (15M)

   (a) What are the various scheduling criteria for CPU scheduling?

   (b) Write a short note on multicore programming?

   (c) Write short note on 1.MMU 2. PAGE TABLE

   (d) Explain DMA.

   (e) Explain Different File type.

   (f) What is first fit and worst fit.