MODULE 1
Introduction to Operating systems, system structures

1. Define OS. Discuss its role from different perspectives. [7M]

2. Distinguish among following terminologies: Multiprogramming systems, multitasking systems or Time Sharing systems. [6 M]

   OR

   Explain multiprogramming and time sharing operating system. [8 M]

3. Explain dual mode operation with a neat diagram [6M]
4. List out and explain the different services that an OS provides. [10M]
5. List and explain services provided by an operating system that are designed to make using computer system more convenient for users. [8 M]
6. List and explain the functions and services of an operating system and OS operations. [8 M]
7. Define a system call with an example of how they are used. [10 M]
8. Write and explain the sequence of system calls for copying a file to another (new) file. [5 M]
9. What are system calls? With examples explain different categories of system calls. [7 M]
10. Explain the different types of system calls. [10M]
11. Distinguish between the following pairs of terms:
    - i) CPU burst and I/O burst jobs
    - ii) User's view and system's view of OS.
    - iii) Batch systems and time sharing systems.
    - iv) User mode and kernel mode operation [10M]

MODULE 2

Process Management: Process concept, Multi-threaded programming, Process Scheduling

1. What do you mean by PCB? Where is it used? What are its contents? Explain. (10 Marks)

2. Differentiate between an program and a process. Draw and explain process state diagram. (10 Marks)

3. Explain the structure of process in memory. (4 Marks)

4. Consider the following set of processes : (10 Marks)

Process	Arrival Time	Burst Time
P1	0	14
P2	1	7
P3	3	2
P4	5	8

i. Draw Gantt charts showing the execution of these processes using FCFS, preemptive SJF.

ii. Draw Gantt charts showing the execution of these processes using non-preemptive SJF and RR (Quantum=1) scheduling schemes.

iii. Compute Turn-around time and waiting time for each process for each of the schemes above.

5. Explain the difference between long term and short term and medium term schedulers (10 Marks)

6. Suppose following jobs arrive, each job runs the listed amount of time. (10 Marks)

Job	1	2	3
Arrival Time	0.0	0.4	1.0
Burst Time	8	4	1

i. Give grant chart using non preemptive FCFS and SJF

ii. What is turn around and waiting time of each job?

7. a) Draw grant chart using preemptive SJF. Find average waiting time for following data. (8 Marks)

Process	P1	P2	P3	P4	P5
Arrival Time	0	2	3	6	30
Burst Time	10	12	14	16	5

b) Explain Context Switching with a neat diagram. (6 Marks)

8. Consider the following set of processes. (10 Marks)

Process	Arrival time	Burst time	Priority
P1	0	10	3
P2	0	1	1
P3	3	2	3
P4	5	1	4
P5	10	5	2

a)Draw the Gantt chart for SJF(Preemptive),SJF(Non Preemptive)
b)Find the Average Turnaround time and waiting time.

9. a)Discuss various multithreading models with diagram. (5 Marks)
b)Explain process scheduling with a help of a neat queuing diagram. (5 Marks)

10. a)Is CPU scheduling necessary? Discuss five different scheduling criteria used in comparing scheduling mechanism (5 Marks)
b)What is multithreading ?Explain the benefits of multithreading (5 Marks)

11. Consider the following set of processes with the length of CPU burst time in millisec (10 Marks)

Process	Arrival time	Burst time	Priority
P1	0	10	3
P2	0	1	1
P3	3	2	3
P4	5	1	4
P5	10	5	2

a) Draw the Gantt Chart and calculate the waiting time for round robin scheduling for Time quantum 2 mill sec
b)Draw the Gantt Chart and calculate the waiting time for Priority scheduling(Preemptive)

12. Differentiate between a) User level and Kernel level thread (10 Marks)
b) Process and Thread

14. Consider the following set of processes with CPU burst time (in m secs) (10 Marks)

Process	Arrival time	Burst time
P_0	0	6
P_1	1	3
P_2	2	1
P_3	3	4

a) Draw Gantt chart illustrating the execution of above processes using SRTF and non-preemptive SJF

b) Find the turnaround time for each process for SRTF and SJF. Hence show that SRTF is faster than SJF

Module 3: Process Synchronization, Deadlocks

1. What are semaphores? Explain two primitive semaphore operations. (06 Marks)
2. Explain binary and counting semaphore with example. (5 Marks)

3. Define race condition. Explain three requirements that a solution to critical –section problem must satisfy. (06 Marks)

4. What are semaphores? Explain solution to producer-consumer problem using semaphores (10 Marks)

5. Explain the Readers-writers problem of synchronization. (8 Marks)

6. Define: Critical Section. Explain the implementation of Wait ( ) and signal ( ) semaphore operation. (10 Marks)

7. What is busy waiting in critical section concept? How semaphore is used to solve the critical section problem. What are the advantages of semaphore? (10 Marks)

8. What is wait-for graph? How is it useful for detection of deadlock? (5 Marks)

9. Deadlock exists if cycle exits. Yes or no. Justify your answer with suitable example. (8 Marks)

10. Describe necessary conditions for a deadlock situation to arise. (10marks)

11. Show the system is not deadlocked by one safe sequence. At t2, p2 makes one additional request for type C, show that system is deadlocked if request is granted.

Process	Allocation	Request	Available
	A B C	A B C	A B C
P0	0 1 0	0 0 0	0 0 0
P1	2 0 0	2 0 2	
P2	3 0 3	0 0 0	
P3	2 1 1	1 0 0	
P4	0 0 2	0 0 2	

12. Consider the following snapshot of the system (10 Marks)

	Allocation	MAX	Available
	A B C D	A B C D	A B C D
P0	0 0 1 2	0 0 1 2	1 5 2 0
P1	1 0 0 0	1 7 5 0	
P2	1 3 5 4	2 3 5 6	
P3	0 6 3 2	0 6 5 2	
P4	0 0 1 4	0 6 5 6	

Using Bankers Algorithm , answer the following
(i)What is the content of a matrix NEED
(ii) Is the system in Safe state? If yes, give the safe state.
(iii) If a request from a process P1 arrives for (0,4,2,0) can the request be granted Immediately.

13. What is Resource Allocation Graph (RAG)? Explain how it is useful in describing deadlock situation.

14. Explain different methods to recover from deadlock. (10 Marks)

15. Briefly explain the methods for handling deadlock. (06 Marks)

16. Explain different methods for Preventing from deadlock. (10 Marks)

17. Why is deadlock state more critical than starvation? Describe resource allocation graph with a deadlock, with a cycle but no deadlock. (10 Marks)

18. What is wait-for graph? How is it useful for detection of deadlock? (5Marks)

19. Consider the following snapshot (10 Marks)

Process	Allocation	Request	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	00 2	4 3 3	

Answer the following using Banker's algorithm

(i) What is the content of matrix need?

(ii) Is the system us in a safe state?

(iii) If a request for process p1 arrives for (1 0 2), can the request be granted immediately?

20. Explain Banker's Algorithm (10 Marks)

21. Explain deadlock detection and considering single instance and several instances of a resource type. (10 Marks)

.

22. What is safe and unsafe state (5 Marks)

MODULE 4: MEMORY MANAGEMENT-Memory Management Strategies, Virtual Memory Management

1. What do you mean by fragmentation? Explain difference between internal and external fragmentation.

[6 M]

2. What is address binding? Explain with necessary steps, binding instructions and data to memory addresses.

[8 M]

3. Memory partitions of 100KB, 500KB, 200KB, 300KB, 600KB (in order) are available. How would first fit, best fit and worst fit algorithms place processes of 212KB, 417KB, 112KB and 426 KB(in order). Which algorithm makes the most efficient use of memory?

[6 M]

4. Assume we have a paged memory system with associative registers (TLBs) to hold the most active page table entries. If the page table is normally held in memory and memory

access time is 1 micro second, what would be the effective access time if 85% of all memory references find their entries in TLB. Assume that TLB search time is 0. [5M]

5. Explain Paging Concept with neat diagram. [10 M]

6. What is Translation-Look aside Buffer (TLB)? Explain TLB in detail with simple paging system with a neat diagram. [8 M]

7. Distinguish between:
   (i)Logical versus physical address space
   (ii)First fit and best fit and worst fit algorithm. [5 M]

8. Mention the problem with simple paging scheme. How TLB is used to solve this problem? Explain with supporting hardware diagram with an example . [8 M]

9. What do you mean by dynamic storage allocation problem? Explain the possible solution to this problem?

10. Discuss on the performance of demand paging. [5 M]
11. What is Belady's anomaly? Explain with an example. [5 M]

12. Consider the following page reference string 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6 . How many page faults would occur for the (i) LRU ii) FIFO iii) optimal page replacement algorithms assuming 3 and 5 frames? Which one of the above is efficient? [12 M]

13. For the following page reference string, calculate the page fault that occur using FIFO and LRU for 3 and 4 page frames respectively. 5,4,3,2,1,4,3,5,4,3,2,1,5. [10 M]

14. Consider the following page reference string 7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1. How many page faults would occur for the following page replacement algorithms assuming 3 and 5 frames (i)LRU ii) optimal. [10 M]

15. Explain demand paging .Describe the steps in handling the page fault, with the help of a neat diagram. [10 M]

16. Consider a paging system with page table stored in memory.
    (i) If a memory reference takes 200ns, how long does a paged memory reference take?

(ii) If we add associative register (TLB) and 75% of all page table references are found in the associative registers, what is the effective memory access time? (Assume that finding a page table entry in associative registers/memory takes zero time, if the entry is found). [5 M]

17. With a supporting paging hardware, explain in detail concept of paging with an example for 32-byte memory with 4-byte pages with a process being 16-bytes. How many bits are reserved for a page number and page offset in the logical address. Suppose the logical address is 5, calculate the corresponding physical address, after populating memory and page table. [10 M]

18. Explain the concept of page replacement. [5 M]

MODULE 5: STORAGE MANAGEMENT-FILE SYSTEM

1. What is a file? Explain in detail different file access methods. [8M]
2. Write a note on (i) File Types (ii) File attributes. [6 M]
3. Explain various file protection mechanisms. [7 M]
4. Explain in brief, the selection of disk scheduling algorithms. [4M]
5. Explain Magnetic disks and Magnetic Tapes with neat diagram [10M]
6. A disk drive has 200 cylinders numbered from 0 to 199. The disk head is initially at cylinder 53. The queue of pending requests in FIFO order is 98,183,37,122,14,124,65,67.Starting from the current position, what is the total distance travelled(in cylinders) by the disk arm to satisfy the request using the following disk scheduling algorithms and briefly explain each. [10M]
   i)SSTF ii)SCAN iii)LOOK
7. Let a disk drive has 5000 cylinders numbered from 0 to 4999. Currently drive is at 143rd cylinder, and the previous request was at cylinder 125.The queue of pending requests in FIFO order is 86,1470,913,1774,948,1509,1022,1750,130. what is the total distance travelled(in cylinders) by the disk arm to satisfy all the pending request using the following disk scheduling algorithms from current position i) FCFS ii)SCAN iii)LOOK [12M]
8. Suppose that disk drive has 50 cylinders numbered from 0 to 49. The R/W head is Currently serving at cylinder 15.The queue of pending requests are in the order:4, 40,

11, 35, 7, 14. Starting from the current head position, what is the total distance travelled (in cylinders) by the disk arm to satisfy the request using algorithms FCFS, SSTF and LOOK. Illustrate with figures in each case. [12 M]

9. Given the following queue 95, 180, 34, 119, 11, 123, 62, 64 with head initially at track 50 and ending at track 199. Calculate the number of moves using FCFS,SSTF, Elevator and C-LOOK algorithm.

10. Explain the following disk scheduling algorithms in brief:
(i) SSTF (ii)SCAN (iii)LOOK [9 M]

11. Describe the access matrix model used for protection in computer system. [10M]

12. Explain the following operations in access matrix with an example for each.
i) copy ii)owner iii)control. [6 M]

9. What is principle of protection? Explain goals of protection. [8 M]
10. Explain protection domain structure with an example in brief. [6 M]
11. Differentiate between protection and security. [4 M]
12. What is protection? Explain briefly access matrix with domains as objects. [5 M]
13. Write a note on:(i)Domains of protection (ii)Access Matrix [6 M]