Unit 1: Operating System Overview

1. Define the terms **shell** and **system call**. How is it handled? Illustrate a suitable example.

2. What are different **types of operating systems**? Explain each in detail.

3. What is a **system call**? Discuss the process of handling system calls briefly.

4. What is the system call in the OS? What are the different categories to invoke system calls in the OS? Explain different types of system calls in the OS?

5. What is a shell in an operating system? What is the function of a shell ?

6. What is a **virtual machine**? Explain in detail.

7. Explain different **types of kernel structure** in detail with suitable diagrams and advantages and disadvantages.

8. What is **Kernel in OS**? Explain its functionality.

9. What is a **layered Operating System (OS)**? Explain in detail.

10. Explain **microkernels** and **exokernels**.

Unit 2 Process Management

1. Explain the Sleeping Barber problem. Illustrate how it can be solved.

2. Calculate the average waiting time and turnaround time using priority algorithm (Priority 1 being the highest) for the given scenario:

PID	Brust Time	Arrival Time	Priority
A	3	0	3
B	2	2	3
C	4	3	2
D	2	3	1

3. Explain how semaphore solves the problem of critical section.

4. Explain microkernels and exokernels.

5. What is a system call ? Describe the transition between different states of process.

6. How is the lock variable used in achieving mutual exclusion? Describe.

7. Why do we need to schedule the process? Find the average waiting time and average turnaround time for the following set of processes using FCFS, SJF, RR (Quantum = 3) and shortest remaining time next.

Process	CPU brust time	Arrival time
P1	20	0
P2	25	15
P3	10	30
P4	15	45

8. How do threads differ from processes? Explain thread usages.

9. What are the main goals of interactive system scheduling? Discuss priority scheduling along with its pros and cons.

10. What makes thread different from process? Draw the transition diagram between states of a process.

Unit 3 Process Deadlocks

1. How do you think deadlock can be avoided? Explain.

2. How do you distinguish between deadlock and starvation? Describe. Explain the working mechanism of TLB.

3. Illustrate the term safe and unsafe state in deadlock prevention with scenarios.

4. Define the term race condition. Justify that race condition leads to data loss or incorrect data.

5. How does starvation differ from deadlock? Consider the following situation of processes and resources:
   a. What will happen if process P3 requests 1 resource?
   b. What will happen if process P4 requests 1 resource?

Process	Has	Max
P1	2	6
P2	1	5
P3	2	5
P4	2	6

6. What is sleep and wakeup? Demonstrate problems with suitable code snippet and illustration.

7. Can deadlock occur in case of preemptive resources? List the conditions for deadlock. Define allocation graph with example.

8. Distinguish between starvation and deadlock . How does the system schedule process using multiple queues?

9. When does race condition occur in inter process communication? What does busy waiting mean and how can it be handled using sleep and wakeup strategy?

10. Explain between deadlock detection and avoidance.

Unit 4 Memory Management

1. Consider a swapping system in which memory consists of the following hole sizes in memory order:
   15 MB, 2 MB, 10 MB, 6 MB, 8 MB and 20 MB.
   Which hole is taken for successive segment requests of:
   (a) 10 MB
   (b) 10 MB
   For first fit, next fit and best fit.

2. Write short notes on:
   a. Virtual Memory.
   b. Race Condition

3. Explain the translation of logical address into physical address using segment table with necessary diagram. List advantages and disadvantages of segmentation.

4. Find the number of page faults using FIFO and LU for the reference string 4, 7, 6, 1, 7, 6, 1, 2, 7, 2 with frame size 3.

5. Why do we need virtual memory? Describe the structure of a page table.

6. Define a working set. How does the clock replacement algorithm work?

7. Consider the segment table:
   What are the physical addresses for the following logical addresses?
   a. 0,430
   b. 1,10
   c. 1,11
   d. 2,500

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	965

8. When page fault occurs and how is it handled? Demonstrate second chance and LU page replacement algorithm for memory with three frames and following reference string: 1,3,7.4,5,2,3,6,4,5,7,8,5,1,4

9. When does a page fault occur? Give a structure of a page table.

10. Differentiate between paging and segmentation.

Unit 5 File Management

1. List different file structures and explain them.

2. Discuss about contiguous and linked list file allocation techniques.

3. Why do we need a hierarchical directory system? Explain the structure of the disk.

4. Explain directory implementation techniques employed in operating systems briefly.

5. Differentiate between contiguous and linked list file allocation techniques.

6. Explain how Peterson's solution helps to achieve process synchronization.

7. What is meant by file attributes? Discuss any one technique of implementing directories in detail.

8. How can you manage free disk space? Explain the linked list approach of managing free disk space with examples.

Unit 6 Device Management

1. Explain memory-mapped I/0.

2. Find the seek time using SCAN, C-SCAN, Look and C-Look disk scheduling algorithms for processing the following request queue:
   35, 70, 45, 15, 65, 20, 80, 90, 75, 130.
   Suppose the disk has tracks numbered from 0 to 150 and assume the disk arm to be at 30 and moving outward.

3. Write short notes on :
   a. Inode
   b. RAID

4. How is the DMA operation performed? Consider a disk with 200 tracks and the queue has random requests from different processes in the order : 45, 48, 29, 17, 80, 150, 28 and 188. Find the seek time using FIFO, SSTF and SCAN. Assume the initial position of head as 100.

5. What is the main purpose of disk scheduling algorithms? Which disk scheduling technique is best but impractical? Explain the algorithm with an example.

6. What does Belady's anomaly mean? What are the benefits of multiprogramming over uniprogramming?

7. What are the advantages of using interrupt? Describe.

8. Suppose a disk has 201 cylinders, numbered from 0 to 200. At the same time the disk arm is at cylinder 10, and there is a queue of disk access requests for cylinders 30, 85, 90, 100, 105, 110, 135, and 145. Find the total seek time for the disk scheduling algorithm FCFS and SSTF. Assume the head is moving inward.

9. Define shell and system call. Suppose a disk has 201 cylinders, numbered from 0 to 200. At the same time the disk arm is at cylinder 95, and there is a queue of disk access requests for cylinders 82,170,43,140,24,16 and 190. Calculate the seek time for the disk scheduling algorithm FCFS,SSTF,SCAN and C-SCAN.

10. What is the task of the disk controller ? List some drawbacks of segmentation.

Unit 6 Linux Case Study

1. Explain Inter-Process Communication in Linux.

2. Write the structure and advantages of TLB.

3. Write short notes on:
   a. IPC in Linux
   b. Disk access

4. Write short notes on:
   a. Linux File System
   b. Resource Allocation Graph