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Printed Page:-4 **Subject Code:- BCSE0303B**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: III - THEORY EXAMINATION (2025 - 2026)
Subject: Operating Systems

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*
1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*
2. *Maximum marks for each question are indicated on right -hand side of each question.*
3. *Illustrate your answers with neat sketches wherever necessary.*
4. *Assume suitable data if necessary.*
5. *Preferably, write the answers in sequential order.*
6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

1-a. The command used to remove a file in Linux is: (CO1, K1) 1

(a) rm
(b) cp
(c) ls
(d) mv

1-b. A fundamental way to interact with a Linux system is through the: (CO1, K1) 1

(a) GUI
(b) CLI
(c) web browser
(d) system preferences menu

1-c. Recognize the scheduling algorithm affected by the convoy effect. (CO2, K1) 1

(a) Shortest Job First (SJF)
(b) First Come First Serve (FCFS)
(c) Round Robin
(d) Multilevel Queue

1-d. Determine which scheduler selects the next process for execution. (CO2, K1) 1

(a) Long-term scheduler
(b) Short-term scheduler
(c) Medium-term scheduler
(d) Dispatcher

1-e. A race condition occurs in concurrent execution due to (CO3, K2) 1

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(a) Improper synchronization of processes
(b) Multiple threads executing at the same speed
(c) All processes waiting indefinitely
(d) Lack of memory allocation

1-f. A strategy that can be used to detect a deadlock in a system is (CO3, K2) 1

(a) Resource allocation graph
(b) Priority-based scheduling
(c) First-Come, First-Serve scheduling
(d) Round-Robin scheduling

1-g. The process of converting a logical address to a physical address is called: (CO4, K1) 1

(a) Address binding
(b) Paging
(c) Swapping
(d) Fragmentation

1-h. In fixed partitioning, the problem of internal fragmentation occurs because: (CO4, K2) 1

(a) Partitions are not fully utilized
(b) A process is larger than the partition
(c) Partitions are dynamically allocated
(d) OS occupies too much space

1-i. When multiple processes access the same memory region to exchange data, the system uses which concept? (CO5, K1) 1

(a) Virtual memory
(b) Shared memory
(c) Swapping
(d) Paging

1-j. A software layer that manages virtual machines and enables multiple OS instances to run on a host system is identified as which component? (CO5, K2) 1

(a) Kernel
(b) Emulator
(c) Hypervisor
(d) Loader

2. Attempt all parts:-

2.a. List two functions of an operating system. (CO1, K1) 2

2.b. Compare preemptive and non-preemptive scheduling with an example of each. (CO2, K2) 2

2.c. List the four necessary conditions for a deadlock to occur. (CO3, K2) 2

2.d. State the meaning of thrashing in virtual memory systems. Mention one condition that causes it. (CO4, K2) 2

2.e. State two disadvantages of FCFS in disk scheduling. (CO5, K1) 2

SECTION-B 30

3. Attempt all parts:-

3.a. Answer any one of the following:-

3.a.(i) Write a shell program to exchange the values of two variables. (CO1, K3) 6

3.a.(ii) Give description of the Linux commands that: (CO1, K2) 6
(a) Display the present working directory
(b) Create, view, and navigate directories
(c) Display system information

3.b. Answer any one of the following:-

3.b.(i) Examine the various CPU scheduling criteria. (CO2, K2) 6

3.b.(ii) Make a process-state-transition diagram. Elaborate the role of different process states. (CO2, K2) 6

3.c. Answer any one of the following:-

3.c.(i) Elaborate the readers-writers problem in detail with a suitable code. (CO3, K2) 6

3.c.(ii) Illustrate the concept of Inter-process communication with its advantages and disadvantages. (CO3, K2) 6

3.d. Answer any one of the following:-

3.d.(i) Distinguish between internal and external fragmentation with a suitable example. (CO4, K2) 6

3.d.(ii) Describe the role of page table in paging. How effective memory access time can be improved in paging? Discuss with a suitable diagram. (CO4, K3) 6

3.e. Answer any one of the following:-

3.e.(i) Demonstrate the working of the Shortest Seek Time First (SSTF) disk scheduling algorithm for the following sequence of requests: 55, 58, 39, 18, 90, 160 starting from head position 50. (CO5, K4) 6

3.e.(ii) Describe the various file access mechanisms with suitable diagrams. (CO5, K2) 6

SECTION-C 50

4. Answer any one of the following:-

4-a. Write a shell script program (CO1, K3) 10
1. To display the digits which are in odd position in a given 5-digit number.
2. To count the number of characters in a file.

4-b. Compare Monolithic Kernel and Microkernel architecture with examples. (CO1, K2) 10

5. Answer any one of the following:-

5-a. Consider the following set of processes {P1, P2, P3, P4 } with their respective arrival times (AT){ 0,1,2,3} and burst times (BT) {8,4,9,5} scheduled using the First-Come, First-Serve (FCFS) algorithm. Calculate: (CO2, K4) 10
1.The completion time (CT) for each process.
2.The average waiting time (AWT).
3.The average turnaround time (TAT).

5-b. Four processes arrive with the following details: P1(AT=0,BT=7), P2(AT=2,BT=4), P3(AT=4,BT=1), P4(AT=5,BT=4). Schedule them using SRTF. Draw the Gantt chart and calculate Completion Time (CT), Turnaround Time (TAT), Waiting Time 10

(WT), Average TAT, and Average WT. (CO2, K4)

6. Answer any one of the following:-

6-a. Assume a system with four resource types R1, R2, R3 and R4 with these many units (6,4,4,2), respectively, and the maximum claim on resources and the current allocation given below. Calculate Need matrix and determine whether the system is in safe state? If yes, give the safe sequence. (CO3, K4) 10

Max = [
[3, 2, 1, 1], # P1
[1, 2, 0, 2], # P2
[1, 1, 2, 0], # P3
[3, 2, 1, 0], # P4
[2, 1, 0, 1] # P5
] Allocation = [
[2, 0, 1, 1], # P1
[1, 1, 0, 0], # P2
[1, 1, 0, 0], # P3
[1, 0, 1, 0], # P4
[0, 1, 0, 1] # P5
]

6-b. Discuss the methods for deadlock detection and recovery. (CO3, K2) 10

7. Answer any one of the following:-

7-a. 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 Compare the number of page faults for FIFO, LRU and optimal page replacement algorithms. Assume number of frames are 4. (CO4, K4) 10

7-b. Consider a three-level paging scheme with a TLB. Assume no page fault occurs. It takes 20 ns to search the TLB and 100 ns to access the physical memory. If TLB hit ratio is 80%, Calculate the effective memory access time. (CO4, K4) 10

8. Answer any one of the following:-

8-a. Compare different file allocation methods using suitable diagrams. (CO5, K3) 10

8-b. Consider a disk queue with requests for I/O to blocks on cylinders 98, 183, 41, 122, 14, 124, 65, 67. The FCFS, SSTF, SCAN scheduling algorithms are used. The head is initially at cylinder number 53. The cylinders are numbered from 0 to 199. Calculate the total head movement (in number of cylinders) incurred while servicing these requests. (CO5, K4) 10