

Exam. Level	Back (New Course)		
Programme	BE	Full Marks	60
Year / Part	BCT	Pass Marks	24
	II / II	Time	3 hrs.

Subject: - Operating System (ENCT 254)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Difference between UEFI and Legacy Boot. How does an operating system act as an intermediary between user applications and hardware components? Explain. [2+4]
2. Explain different components of process control block. For given process, draw a Gantt Chart and calculate average waiting time for: Shortest Job First (SJF) and Round Robin (with Quantum Time = 4). Their arrival time, service time in milliseconds. [3+5]

Process	Arrival Time	Burst Time
P1	0	10
P2	2	5
P3	4	2
P4	4	5
P5	0	8

- a) Define Critical Region and Mutex. Explain how producer-consumer problem can be solved using semaphore with its respective pseudo-code implementations. [2+5]
- b) Under what condition does the solution to the Dining philosopher using semaphore leads to a deadlock conditions? Consider a system with 5 processes (p0,p1,p2,p3,p4) and 4 resource types (R0,R1,R2,R3). The number of instances of each resource type in the systems are: 6,4,4,2 respectively. Allocation table and Maximum claim table are shown below. Is the state safe? If so, show the safe execution of the processes. [2+6]

Allocation

	R0	R1	R2	R3
P0	2	0	1	1
P1	1	1	0	0
P2	1	1	0	0
P3	1	0	1	0
P4	0	1	0	1

Maximum Need

	R0	R1	R2	R3
P0	3	2	1	1
P1	1	2	0	2
P2	1	1	2	0
P3	3	2	1	0
P4	2	1	0	1

4. a) Explain how Atomic Writes helps to achieve the concept of stable storage. A SATA HDD with capacity of 1 Tera Bytes costs NPR. 5,700 and A SATA SSD with capacity of 256 Giga Bytes cost NPR. 7,500. Now, calculate the cost of storing a file with capacity of 100 Mega Bytes on each device. Which device is cost efficient and by how much? Explain. [2+4]
- b) Given references to the following pages by a program 1, 2, 3, 2, 1, 5, 2, 1, 6, 2, 5, 6, 3, 1, 3, 6, 1, 2, 4, 3. How many page faults will occur if the program has three-page frames available to it and use LRU, FIFO and Optimal page replacement algorithm? [5]
5. Explain the advantages and disadvantages of a contiguous file allocation scheme. [3]
6. Explain private and public key cryptography with examples. [4]
7. Explain how Dockers and Kubernetes are used for containerization? [4]
8. State one real world application or device where your studied OS is used, and justify that why it is suitable for that environment. [3]
9. Write short notes on: (Any Two) [2×3]
- a) Type 1 hypervisor
 - b) Secure Boot
 - c) Sandboxing
 - d) PowerShell

TRIBHUVAN UNIVERSITY
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Examination Control Division
2082 Bhadra

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	II / II	Time	3 hrs.

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1. Difference between MBR and GPT Partitions. How does an operating system provide abstraction to user level application from underlying hardware? Explain. [2+4]
2. Describe the various states of the process. Schedule the following set of processes according to HRRN and Round Robin algorithm (Time quantum:4). [3+6]

Process	Arrival time	Burst time
A	0	12
B	2	8
C	5	7
D	10	9

- (i) Draw Gantt Chart
- (ii) Find average turnaround time and waiting time for each scheduling algorithm.
3. a) Define race condition. Explain how producer-consumer problem can be solved using semaphore with its respective pseudo-code implementations. [1+5]
- b) Consider a system with 5 concurrent processes (P_0, P_1, P_2, P_3, P_4) and 4 resources (R_0, R_1, R_2, R_3) types in the system are 6, 4, 4, 2 respectively. Current allocation and maximum need/claim table are as follows: [7]

Process	Allocation				Maximum Claim			
	R_1	R_2	R_3	R_4	R_1	R_2	R_3	R_4
P_0	2	0	1	1	3	2	1	1
P_1	1	1	0	0	1	2	0	2
P_2	1	1	0	0	1	1	2	0
P_3	1	0	1	0	3	2	1	0
P_4	0	1	0	1	2	1	0	1

Use Bankers algorithm to claim that the system is in safe state and show the safe sequence.

4. a) What is RAID? Explain how Write Ahead Logging (WAL) helps to achieve the concept of stable storage. A NVMe SSD with capacity of 2 Tera Bytes costs NPR. 15,000 and A SATA SSD with capacity of 1 Tera Bytes cost NPR. 5,500. Now, calculate the cost of storing a file with capacity of 160 Mega Bytes on each device. Which device is cost efficient and by how much? Explain [1+2+4]
- b) Consider the following page-reference storing 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1. Assuming 3 frames, how many page faults would occur for the following page replacement algorithms (i) FIFO (ii) Optimal (iii) LRU. [5]

5. What is file attribute? Describe different file allocation methods. [1+3]
6. Explain the types of attacks with suitable examples. [3]
7. Explain about the Type 1 and Type 2 hypervisors in virtualization. [4]
8. List any 2 key features of OS you studied as case study and explain how they contribute to its performance or usability. [3]
9. Write short notes on: (Any Two) [2×3]
- a) Kubernetes and Docker
 - b) Thrashing
 - c) Sandboxing
 - d) PowerShell
