Graphic Era HILL UNIVERSITY

End Term (Odd) Semester Examination November 2025

Roll no.....

Name of the Course and semester: MCA/MCA (AI&DS) **Semester:** I

Name of the Paper: *Advanced Operating Systems*

Paper Code: TMC 104 /TMD 105

Time: 3 hour Maximum Marks: 100

Note:

(i) All the questions are compulsory.
(ii) Answer any two sub questions from a, b and c in each main question.
(iii) Total marks for each question is 20 (twenty).
(iv) Each sub-question carries 10 marks.

Q1. (2X10=20 Marks)

a. An operating system is often described as a resource manager. Analyze this statement by discussing how an OS manages CPU, memory, and process when multiple applications are running simultaneously. Use a real-world analogy to strengthen your explanation. **CO1**

b. The kernel is the "core" of the Operating System. Explain its role in process management, memory allocation, and file management. **CO1**

c. UNIX System V Release 3 (SVR3) employs a multilevel feedback queue (MLFQ) scheduling algorithm. Explain how this algorithm operates and discuss the reasons it is considered effective. **CO1**

Q2. (2X10=20 Marks)

a. Explain the importance of a file system in an operating system. How does a file system manage the storage, retrieval, and organization of files? Illustrate your answer with suitable examples from Windows, UNIX, or Linux operating systems. **CO3**

b. Access Control Lists (ACLs) and Capability Lists are two widely used mechanisms derived from the Access Control Matrix. Critically examine their comparative advantages and disadvantages. **CO3**

c. Modern operating systems often aim to balance *functionality* and *security*. Discuss the essential requirements of a protection mechanism in OS design, and analyze how the absence of one or more of these requirements can impact system reliability. **CO3, CO6**

Q3. (2X10=20 Marks)

a. Explain how the concepts of deadline and response time influence the design and performance of a Real-Time Operating System (RTOS). Analyze how missing a

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deadline affects system behavior in Hard, and Soft, RTOS with suitable real-life examples. **CO6**

b. Describe the working of the Rate Monotonic Scheduling (RMS) algorithm used in real-time systems. Explain how task priorities are assigned, and how the algorithm ensures schedulability of periodic tasks. Support your answer with a suitable example showing the order of task execution. **CO6**

c. Consider an automated airbag control system in a modern vehicle. The system continuously monitors crash sensors and must trigger airbag deployment within a few milliseconds when a collision is detected. Analyze the scenario and identify which tasks in this system can be classified as real-time tasks. Explain whether this system represents a hard or soft real-time system, justifying your answer with reasoning related to deadline and response time. **CO6**

Q4. (2X10=20 Marks)

a. Describe the structure of a file system as used in Windows, UNIX, or Linux operating systems. Explain and highlight the main components or layers involved in managing data within the file system. **CO2**

b. Explain the difference between contiguous and non-contiguous (linked or indexed) file allocation methods. Suppose a large file is frequently modified and grows in size, which allocation method would be more efficient and why? Justify your answer with proper reasoning. **CO2**

c. Describe the UNIX/Linux directory structure in detail, explaining the role of important directories such as /bin, /etc, /home, and /usr. In your answer, also define absolute and relative pathnames and illustrate their differences with suitable examples. You may use a neat labeled diagram to support your explanation. **CO2**

Q5. (2X10=20 Marks)

a. What do you understand about parallel systems and distributed systems? Explain the key differences between the two in terms of architecture, communication mechanism, degree of coupling, and performance objectives. **CO5**

b. Define virtualization. Explain in detail how virtualization allows multiple operating systems to run on a single physical machine. **CO4**

c. Describe the role of a hypervisor in cloud computing. Also describe Type-1 and Type-2 hypervisors. **CO4**