ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION	WINTER SEMESTER, 2022-2023
DURATION: 1 HOUR 30 MINUTES	FULL MARKS: 75

CSE 4501: Operating Systems

Programmable calculators are not allowed. Do not write anything on the question paper.
Answer all 3 (three) questions. Figures in the right margin indicate full marks of questions whereas corresponding CO and PO are written within parentheses.

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1. a) What are the core functions of an Operating System (OS), and how do these functions play a vital role in managing hardware resources and providing a user-friendly interface in every-day computing? Provide examples to illustrate these functions' significance?   5 + 5 (CO1) (PO1)

   b) Consider the assembly language instructions in Code Snippet 1.

   ```
   1  LOAD R1, NUM1  ;Load the value at memory address NUM1 into register R1
   2  LOAD R2, NUM2  ;Load the value at memory address NUM2 into register R2
   3  ADD R1, R2     ;Add the values in registers R1 and R2
   4  STORE R1, RESULT ;Store the result in R1 to memory address RESULT
   ```

   Code Snippet 1: Assembly Instructions for Question 1.b)

   2 + 8 (CO2) (PO1)

   Show the execution steps of each instruction with the help of CPU registers maintaining their execution order.

   c) Islamic University of Technology (IUT) has recently deployed sensor-based roadside lamps. IUT plans to deploy IoT devices to monitor their functionality. As an OS designer, which type of system would you choose for these IoT devices: single-processor, multi-processor, or clustered systems? Justify your choice.   5 (CO2) (PO2)

2. a) Differentiate between System Calls and System Services in an operating system. Discuss how System Services facilitate higher-level application development and how they contribute to the overall efficiency and functionality of the operating system.   3 + 7 (CO1) (PO1)

   b) Why are applications Operating System specific? Provide examples on how differences in operating systems can influence the design and functionality of applications and how developers address these challenges to ensure broader compatibility.   4 + 6 (CO2) (PO2)

   c) How does the modular kernel approach compare to the layered approach in terms of similarities and differences?   5 (CO1) (PO1)

3. a) Explain the concept of Process and the role of the Process Control Block (PCB) in process management. Describe the importance of PCB for efficient context switching in a multitasking operating system.   5 (CO1) (PO1)

   b) Compare and contrast message passing and shared memory as Inter-Process Communication (IPC) mechanisms in concurrent computing. With proper justification, choose between the two IPC techniques for each of the following scenario:
      i. In a High-Performance Computing (HPC) cluster, where multiple nodes collaborate on complex simulations like weather forecasting or molecular modeling.
      ii. In a Relational Database Management System (RDBMS), where multiple processes need concurrent access and modification of data.   4 + 6 (CO2) (PO2)

   c) Explain the concepts of zombie processes and orphan processes in an Operating System. Discuss the potential implications of leaving these processes unmanaged.   5 (CO2) (PO2)