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

MID SEMESTER EXAMINATION
DURATION: 1 HOUR 30 MINUTES

SUMMER SEMESTER, 2021-2022
FULL MARKS: 75

CSE 4205: Digital Logic Design

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) Convert the following numbers to the designated bases: — 2 × 5 (CO1) (PO1)

   i. $(40.876)_{10} = (?)_2$ iii. $(124425)_9 = (?)_3$ v. $(123.123)_{10} = (?)_2$
   ii. $(ABBA.AC)_{16} = (?)_8$ iv. $(CACCA)_{16} = (?)_4$

   The answer should contain the intermediate steps for the calculation of the conversion.

   b) Answer the following questions: — 5 × 3 (CO1) (PO1)
      i. Draw the block diagram of a digital computer.
      ii. Prove the following Boolean equation using the truth table: $AB + ABC = AB$.
      iii. The formal definition of Boolean Algebra follows Huntington's postulates. These postulates are arranged in pairs. Describe the property for which the postulates are listed in pairs.

2. a) Write down the Boolean expression for the following logic operations: — 1 × 5 (CO1) (PO1)

      i. x/y ii. $x \oplus y$ iii. $x \downarrow y$ iv. $x \subset y$ v. $(x \oplus y)'$

   b) A majority gate is a digital circuit whose output is equal to 1 if the majority of the inputs are 1's. The output is 0 otherwise. By means of a truth table, find the Boolean function implemented by a 3-input majority gate. Simplify the function. — 9 (CO2) (PO2)

   c) Design a combinational circuit that detects an error in the representation of a decimal digit in BCD. In other words, obtain a logic diagram whose output is logic-1 when the inputs contain an <u>unused combination</u> in the code. Use the fundamental gates to show the logic diagram. — 9 (CO2) (PO2)

   d) Using the block diagram method, convert the solution logic diagram of question 2.c) to NAND implementation and NOR implementations. — 2 (CO1) (PO1)

3. a) Simplify the Boolean expression using K-map and show it in SOP form for — 12 (CO1) (PO1)
      $$F(p,q,r,s,t) = \prod(1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31)$$

   b) Design a combinational circuit that converts a decimal digit from 8,4,-2,-1 code to BCD. — 13 (CO2) (PO2)