ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4307
Course Title: Digital Electronics

Winter Semester, A. Y. 2022-2023
Time: 90 Minutes
Full Marks: 75

There are 3 **(three)** questions. Answer all 3 **(three)** questions. The symbols have their usual meanings. Programmable calculators are not allowed. Marks of each question and corresponding COs and POs are written in the brackets.

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1. a) A **Senary numeral system** (also known as base-6 or heximal) has six as its base and 0, 1, 2, L, M and N as its independent digits. **12 (CO1, PO1)**
   (i) Determine the decimal equivalent of $(12NLM.M2)_6$,
   (ii) Show the subtraction operation, A-B, using (r-1)'s complement where A = $(ML2N)_6$ and B = $(N21)_6$.

   b) Using Boolean algebraic manipulation, show that, **6 (CO2, PO1)**
   $A\bar{B}C + \bar{A}BC + ABC + A\overline{BC} = A + BC.$

   c) Show that the dual of the exclusive-OR is equal to its complement. **5 (CO2, PO1)**

2. a) Find the simplified expression of the following function using K-Map and implement the simplified function using two level NOR-gates. **7 (CO2, PO2)**
   $F(A,B,C,D) = A\bar{C} + \bar{B}D + \bar{A}CD + ABCD$

   b) Design a "full-adder". Hence, Construct an eight-bit parallel adder using eight "full-adder" circuits. What is the draw-back of using this parallel adder? Design the 8-bit parallel adder using *look-ahead* carry generator. Show all the necessary Boolean expressions and logic diagrams. **15 (CO3, PO2)**

3. a) An 8 × 1 multiplexer has inputs *A*, *B* and *C* connected to the selection inputs S_2, S_1 and S_0 respectively. The data inputs, I_0 through I_7 are as follows: **10 (CO2, PO2)**
   $I_1 = I_2 = I_7 = 0;$
   $I_3 = I_5 = 1,$
   $I_0 = I_4 = D;$ and $I_6 = D'$.

   Determine the Boolean function that the multiplexer implements.

   b) For the Senary numeral system mentioned in question 1(a), design a Binary Coded Senary (BCS) adder where the adder will take two BCS numbers, $A = A_2A_1A_0$ and $B = B_2B_1B_0$, and the results are to be shown in BCS form. **20 (CO3, PO2)**
   (Hint: The BCS form of a Senary number $(L2N)_6$ is 011 010 101)