

**Course: EEEN 222-Electrical and Electronic Circuits II**

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**Exam/Date: Final Exam/10.06.2016, 09:00**

**Duration: 150 min.**

**İstanbul Bilgi University**

**Faculty of Engineering and Natural Sciences**

**Department of Elecetrical and Electronics**

**Engineering**

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| **Question** | **1** | **2** | **3** | **4** | **5** | **Total** |
| **Maximum score** | **10** | **15** | **25** | **25** | **25** | **100** |
| **Course learning outcome** | **1** | **1,2** | **4,5** | **3** | **3** | **1,2,3,4,5** |

**Q.1) (10 points**) Consider a general Boolean algebra and use the axiom(s) and/or theorems of the general Boolean algebra to simplify the following functions:

1. **(5 points)**
2. **(5 points)**

**Q.2) (15 points)** Design a combinational circuit with three inputs A, B and C, and four outputs W, X, Y, and Z. The combinational circuit basically adds three to the input. Hence, the binary output of the circuit must be three greater than the binary input of the circuit.

1. Derive the truth table for the circuit. **(3 points)**.
2. Minimize the output boolean function by applying Karnaugh Map method. **(6 points)**.
3. Implement the circuit using only two input NAND Gates. **(6 points)**.

**Q.3) (25 points)** Consider the following three Boolean functions *F*, *G*, and *H* of the four variables *A*, *B*, *C*, and *D*, whose simplified Boolean expressions are listed below. Throughout, all variables are available only uncomplemented:



Implement the logic circuit diagram of these Boolean functions using a PLA with minimum number of product terms.

**Q.4) (25 points)** A sequential circuit with two *T* type flip-flops *M* and *N*, one input *X* and one output *Y* is specified by the following next state and output equations:



1. Tabulate the state table for the sequential circuit.
2. Draw the corresponding state diagram of the sequential circuit.

**Q.5) (25 points)** Design a 3-bit up/down modulo-8 counter using three JK type flip flops A, B and C and one input U. When U=0, the circuit goes through the state transitions . When U=1, the circuit goes through the state transitions .