Department of Electrical & Computer Engineering (ECE)

North South University

Course Code: 231, Section: 6

Course Title: Digital Logic Design

Mid Exam, Fall 2018

Time: 75 Minutes **Marks: 50**

Please read the questions very carefully and answer accordingly. All the answers should be written in the answer script that is provided. Calculators/pens/pencils are allowed. Adopting any unfair means during the exam will automatically result in expulsion without any prior/post notice. ***You must return back your question paper*** *with your answer script.*

Q1. Please answer all the following questions: **[CO 1]**

(a) Express the following output function $\boldsymbol{F}\ (\boldsymbol{x}, \boldsymbol{y}, \boldsymbol{z})$ in **minterms** and **maxterms**. **4**

I. $\boldsymbol{F}(\boldsymbol{x}, \boldsymbol{y}, \boldsymbol{z}) = \boldsymbol{x}$ **II.** $\boldsymbol{F}(\boldsymbol{x}, \boldsymbol{y}, \boldsymbol{z}) = \boldsymbol{x} + \boldsymbol{xy}$

(b) Draw the output function in relation to the inputs in a table and express the following output function in **minterms**. **3**

$$\boldsymbol{F}\ (\boldsymbol{A}, \boldsymbol{B}, \boldsymbol{C}) = \boldsymbol{M_0}.\boldsymbol{M_2}.\boldsymbol{M_4}.\boldsymbol{M_7}$$

(c) Write the expression of output function $\boldsymbol{F}(\boldsymbol{A}, \boldsymbol{B}, \boldsymbol{C})$ in **maxterms** for **XNOR** logic-gate. **3**

Q2. Please answer all the following questions: **[CO2]**

(a) Apply **K-map** to find out both **Sum of Product (SOP)** and **Product of Sum (POS)** for the following functions: **16**

i. $F(A,B,C,D) = \sum(0,5,10,15) + \sum d(2,7,8,13)$

ii. $F(A,B,C,D) = \sum(0,1,2,3,7,9,10,11,15)$

iii. $F(A,B,C,D) = (A+\bar{B}+C+\bar{D})(A+\bar{B}+\bar{C}+\bar{D})(\bar{A}+\bar{B}+C+\bar{D})(\bar{A}+\bar{B}+\bar{C}+\bar{D})$

iv. $F(A,B,C,D,E) = \prod(0,1,4,5,12,13,18,19,22,23,30,31)$

(b) Find the **Prime Implicant (PI)** and **Essential Prime Implicants (EPI)** for the following functions and also please indicate/mark clearly the **PI** and **EPI** in the K-map for the following functions. **4**

I. $F(w,x,y,z) = \sum(0,1,5,7,10,14,15)$ II. $F(A,B,C,D) = \prod(4,6,8,9,12,14)$

Q3. Please answer all the following questions: **[CO3]**

(a) Draw the truth table of a full-subtractor and implement it using a decoder. **3**

(b) Implement a higher order decoder $n \times 2^n$, using lower order decoder $n \times 2^n$. Here, the order of $n = 1$, and 3. **4**

(c) Implement a three-input variable XOR gate using 4×1 multiplexer. **5**

(d) Draw the truth table for 8×3 priority encoder. **3**

(e) Implement the higher order multiplexer $2^n \times 1$ using lower order multiplexer $2^n \times 1$. Here, the order of $n = 2,$ and 3. Basic gates i.e. AND, NOT, and OR gates can be incorporated with the design, if necessary. **5**
