Ref. No. : Ex/ET/T/2017

B. E. Electronics and Tele-communication Engineering 2nd Year 2nd Semester Examination 2017

Time : Three hours **Subject: Digital Circuits and Systems** **Full Marks : 100**

Answer any five questions

Q1 (a) Define Synchronous and Asynchronous Sequential logic circuits. Give 5 examples of each circuit (SLC & ASLC). 06

(b) Compare and contrast between SSLC and ASLC. 04

(c) How do you design a SLC (state the steps in proper sequence) and elaborate the design with an example. 10

Q2. (a). How will you design an ASLC (State the steps in proper sequence) and elaborate the design with an example. Which steps are additional compared to SSLC design steps and explain why? 15

(b). Distinguished between completely and incompletely specified machines. Give example of each of them. 05

Q3. (a) Give in tabular form the distinction between pulse and fundamental mode of ASLCs. 04

(b) What are cycles and Races? Distinguish between them in tabular form. Give examples of races and Cycles. 11

(c) What are critical and non-critical races? Explain them with suitable examples. 05

Q4 (a) Take a SLC circuit (give steps to analysis it) and analysis the ckt (complete). 04

(b) Design a Detecter to detect the repetitive non-overlapping sequence 110 with termination condition 010. 10

c) Design a parity generator to detect odd and even sequences. 06

Q5 (a) Explain, using example, a fault table and a fault dictionary. Discuss the advantages and disadvantages of fault table method. 04

(b) Discuss the Boolean difference method with suitable examples. Write the properties of Boolean differences and verify them . 16

Q6. (a) Design a controller for an electronic metro door which should have, besides clock and reset, four other inputs; remote (= '1', when the remote control is activated), open (= '1', when the door is completely open, provided by a sensor), closed(= '1', when the door is completely closed, also provided by a sensor), and timer (= '1', 30s after open= '1' occurs). At the output, the following signals must be produced: power (when '1' turns the electric motor on) and direction (when '0' the motor rotates in the direction to open the door, when 1 in the direction to close it). The controller shows the following features:

[Turn over

(a) If remote is pressed while the door is closed, immediately turn the motor on to open it

(b) If remote is pressed while the door is open, immediately turn the motor on to close it

(c) If remote is pressed while the door is opening or closing, immediately stop it. If pressed again, the remote should cause the door to go in the opposite direction

(d) The door should not remain open for more than a certain amount of time(for example 30s)this information is provided by an external timer. Design this system using the formal FSM design technique. Indicate, would any glitches be a problem for this system. Also estimate the no. of F/F_s necessary to implement this circuit. Does the clock frequency affect this number? Why? 20

Q7 a) The error obtained due to scaling can be reduced by using saturation logic. Let B=4A, where A and B are each expressed using 4 information bits and a sign bit. A and B may be positive or negative and are expressed usuing twos complement arithmetic. Design a system and an input A and output B which satisfies the equation :

$$B=\begin{cases} 15\ for\ A \geq 4 \\ 4A\ for\ |A| \leq 3 \\ -15\ for\ A \leq -4 \end{cases}$$

As A varies from -15 to +15.

14

(b) Compare the merits and demerits of Serial and parallel adders with reference to addition of two 4bit numbers. 06

Q8 (a) what are active- low and active - high output decoders ? Design a full adder using both of them separately. 08

b) E1 buses leave the 8B bus terminal every hour on the hour unless there are fewer than 20 passengers or if the driver/conductor is late. If there are fewer than 20 passengers, the bus will wait 10 min or until the number of passengers increase to 20.If the bus leaves on time ,it can travel at 60 Km/hr. If the bus leaves late, or if it rains, it can travel only at 30 Km/hr.

Under what conditions will the bus travel at 60 Km/hr?
Construct a special purpose computer using AND, OR, and NOT gates, switches, battery, and a light bulb. The bulb should glow if the bus can travel at 60 Km/hr. 12