

**B 2159**

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Third Semester

Mechatronics Engineering

EC 154 — DIGITAL ELECTRONICS

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Convert  $(1BF.25)_{16}$  into equivalent decimal number.
2. Write down the truth table of  $A \oplus BC$ .
3. Write down the truth table of a half adder circuit.
4. Give the basic structure of a PAL.
5. Draw the logic circuit of a T flip-flop.
6. What is a sequential circuit? Give an example.
7. What is a pulse mode sequential circuit?
8. Define the state of a system.
9. Draw the model of an algorithmic state machine.
10. What does the state box of an algorithmic state machine represent?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw an ASM chart to detect the sequence 01, 01, 11, 00 and realise it using JK flip-flops. (10)
- (ii) Realize the following Boolean function using a  $4 \times 1$  MUX,  
 $f(a, b, c) = \sum(0, 1, 3, 5, 7)$ . (6)

Or

- (b) (i) Draw the ASM chart for a binary multiplier. (10)  
(ii) Write the excitation tables of SR and T FFs. (6)

12. (a) (i) Simplify using boolean algebra

$$Z = \overline{(\overline{X + Y}) + (\overline{X \cdot \overline{Y}}) + \overline{X \cdot Y}}. \quad (6)$$

- (ii) Simplify the following switching function using Karnaugh map. Implement the function using NAND gates only. (10)

$$f(A, B, C, D, E) = \sum m(0, 1, 3, 6, 9, 12, 13, 18, 25, 26, 30, 31) + \sum d(2, 5)$$

Or

- (b) (i) Minimise the following switching function in product of sum form using Quine-Mc Clusky method. Realise the circuit using NOR gates only. (10)

$$f(w, x, y, z) = \pi M(0, 2, 3, 4, 5, 12, 13) + d(8, 10).$$

- (ii) State and prove De Morgan's laws. (6)

13. (a) (i) Implement the following functions using PLA. (8)

$$f_1 = \sum m(1, 2, 4, 6); f_2 = \sum m(0, 1, 6, 7); f_3 = \sum m(2, 6).$$

- (ii) Design a full subtractor circuit and realize it with two half subtractors. (8)

Or

- (b) (i) Design a 3 to 8 decoder circuit and a 4 to 1 multiplexer circuit. (12)  
(ii) Write notes on EPROM. (4)

14. (a) (i) Explain the design of a RAM cell. Explain the Read, Write cycles of a RAM. (10)

- (ii) Explain the problem encountered in SR flip-flop. How can it be overcome? (6)

Or

- (b) (i) Design a T flip-flop using JK flip-flop. Explain the design. Write the characteristic equation of TFF. (6)

- (ii) Design and explain the working of a mod-6 counter. Give its state diagram and timing diagram. (10)

15. (a) (i) What are races? Explain the kinds of races. (6)
- (ii) Design an asynchronous sequential circuit that has two inputs  $X_1$  and  $X_2$  and one output  $Z$ . When  $X_1$  is 0, the output  $Z$  is 0. The first change in  $X_2$  that occurs while  $X_1 = 1$  will make the output  $Z$  as 1 and the output  $Z$  will remain 1 until  $X_1$  returns to 0. (10)

Or

- (b) What are hazards? Explain the different kinds of hazards. With examples explain the elimination of these hazards. (16)
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