PULSE & DIGITAL CIRCUITS

***Time**: Three Hours*

***Maximum Marks**: 100*

Answer five questions, taking ANY TWO from Group A, any two from Group B and all from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches.

Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Transform the following: 8

   (i) $(6715)_8 = (-)_{10}$

   (ii) $(6A0C)_{16} = (-)_{10}$

   (iii) $(238)_{10} = (-)_{16}$

   (b) If X = 1010100 and Y = 1000011, find (X – Y) and (Y – X) using (i) 1s compliment method (ii) 2s compliment method. Also give a design to have X.Y where "." shows a binary multiplication. 6

   (c) Convert the following 6

   (i) $X = ABC + AD$ into SOP format

   (ii) $Y = (A + B + C)(A + D)$ into POS format.

   Also minimise the function X + Y for Boolean X and Y.

2. (a) What do you mean by universal gates? Name universal gates. Justify your answer. Design the logic $A + BC + \overline{A}\,\overline{C}$ using only NAND gates. 6

   (b) Define the following: 8

   (i) Karnaugh map

   (ii) Quine McClusky table

   (iii) Negative OR logic gate

(iv) Limitations of Karnaugh maps

(c) Minimise the following switching functions using Karnaugh map. List all prime implicants and essential prime implicants (non redundant group). 6

(i) $F = \Sigma(1, 3, 5, 6, 7)$

(ii) $F = \Sigma(0, 1, 3, 6, 14, 15)$

3. (a) Define the terms "prime implement", "non prime implement", essential prime implicant" and "non essential prime implicant". 10

(b) Implement the function 10

$$f = \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D} + A\bar{B}C\bar{D} + A\bar{B}\bar{C}D + AB\bar{C}\bar{D} + ABC\bar{D} + AB\bar{C}D + \bar{A}BC\bar{D}$$

using a 8 to 1 multiplexer with A, B and D as select inputs.

4. (a) Design a 4 to 1 multiplexer using 2 x 1 multiplexers and explain its functions. 10

(b) What is ROM? How does it differ from RAM? Draw block diagram of ROM. 10

Group B

5. (a) Write short note on monostable multivibrator. 10

(b) Convert the following: (i) SR to J-K flip flop (ii) D to S-R flip flop (iii) J-K flip flop to T flip flop. 10

6. (a) State the basic difference between a Mealy and a Moore model for representing a state diagram. Use the example of a D flip flop to illustrate this. Also draw the related excitation table. 10

(b) Explain the following terms: 10

(i) Synchronous sequential circuit

(ii) Finite state machine

(ii) Incompletely specified machine

(iii) Compatible states

7. (a) What are asynchronous sequential circuits and their advantages? Draw the block diagram of such a circuit using the basic model for the fundamental mode circuit and explain its operation with reference to stable and unstable states. 10

   (b) Write notes on following: 10

   (i) Deterministic recognisers

   (ii) Graphs

   (iii) Regular expressions

8. (a) What is the difference between synchronous and asynchronous counters. What are advantages of synchronous counter over asynchronous counter? 10

   (b) Design an asynchronous mod 9 counter using JK flip-flop. 10

Group C

9. Answer the following in brief: 20

   (i) $A + \bar{A}B$ is

   (a) A

   (b) B

   (c) A + B

   (d) $\bar{A} + \bar{B}$

   (ii) In $(0.3125)_{10} = (x)_2$ the value of x is

   (a) 0.0101

   (b) 0.1010

   (c) 0.1001

   (d) 0.0010

   (iii) The canonical sum of product form of the function F = A + B is

   (a) $AB + A\bar{B} + \bar{A}B$

   (b) AB + BA

   (c) $AB + A\bar{B}$

   (d) $A\bar{B} + \bar{A}B$

   (iv) The canonical product of sum form of $F = (A + \bar{B})(B + C)$ is

(a) $(A+\overline{B}+C)(A+\overline{B}+\overline{C})$

(b) $(A+\overline{B}+C)(A+\overline{B}+\overline{C})(A+B+C)(\overline{A}+B+C)$

(c) $(A+\overline{B}+C)(A+\overline{B}+\overline{C})(A+B+C)$

(d) $(A+\overline{B}+\overline{C})(\overline{A}+B+C)$

(v) The JK flip flop acts as a T flip flop when

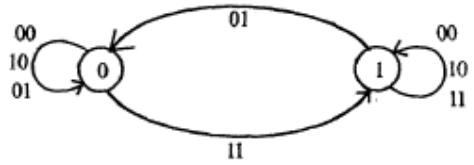
(a) J =1, K = 0

(b) J = 0, K = 0

(c) J = 1, K = 1

(d) J = 0, K = 1

(vi) The state diagram of an asynchronous sequential circuit is shown below.



The number of outputs of the circuit is

(a) 2

(b) 4

(c) 6

(d) 1

(vii) Multiplexer can be expressed as

(a) one-to-many

(b) many to one

(c) many to many

(d) one to one

(viii) Tabular method of simplification is convenient as long as the number the number of variables does not exceed

(a) 6

(b) 8

(c) 10

(d) 12

(ix) The characteristic equation of a T flip flop is

(a) $T \oplus Q_n$

(b) $T + Q_n$

(c) TQ_n

(d) none of these

(x) Hazards in switching circuits are caused by

(a) varying input signal

(b) constant output

(c) zero propagation time

(d) delays of switching components

(Refer our course material for answers)