

[Time: 2½ Hours]

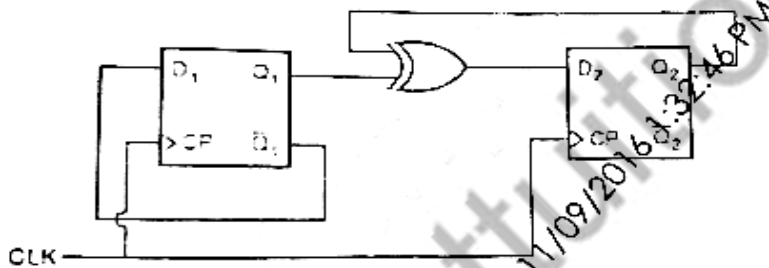
[ Marks:75]

- N.B:**
1. All questions are **compulsory**.
  2. Make **suitable assumptions** wherever necessary and **state the assumptions** made.
  3. Answers to the **same question** must be **written together**.
  4. Numbers to the **right** indicate **marks**.
  5. Draw **neat labeled diagrams** wherever **necessary**.
  6. Use of **Non-programmable** calculators is **allowed**

1. Attempt any three of the following:
  - a. What is analog signal? Explain frequency, amplitude with respect to analog signal.
  - b. Encode the following decimal number in binary number system.
    - i).25.45
    - ii).134
  - c. Express the 10101100 BCD code into Grey code and also in Excess -3 code.
  - d. i) Perform the subtraction using 1's complement method.
 
$$11011 - 10100$$
 ii) Perform the addition of given binary numbers.
  - e. Write a short note on HOLLERITH code.
  - f. i) Convert 45 from octal number into decimal.  
 ii) Convert 9A from hexadecimal number into decimal.  
 iii) Convert 46.23 from decimal to binary.
  
1. Attempt any three of the following:
  - a. For the logic expression  $Y=AB'+A'B$ . Obtain the truth table, name the gate and operation performed and symbol for it also realize this using AND, OR, NOT gates.
  - b. Prove the given Boolean expression using Boolean laws and draw the circuit for it using NAND gate only.
 
$$A.B + A'B + A'B' = A' + B$$
  - c. State and prove De-Morgan's theorem and realize it using basic gates.
  - d. Realize the given Boolean expression using NOR gate only.
 
$$Y = (A' + B + C).(A+B'+C').(A'+B'+C').(A'+B+C')$$
  - e. Using Karnugh's map simplify the following SOP function and implement it with basic gates.
 
$$F(A,B,C,D) = (2,3,6,7,8,10,11,12) + d(14,15)$$
  - f. Obtain product of sum expression for the following function and implements it using NOR gate.  $F(P,Q,R,S) = (1,2,4,5,6,7,12,13)$
  
2. Attempt any three of the following:
  - a. What is full adder? Draw logic circuit diagram explain it.
  - b. Design BCD to Excess-3 code converter.
  - c. With the help of IC-7483 block diagram explain BCD adder.
  - d. Describe Half subtractor with help of circuit diagram and truth table.
  - e. What is comparator circuit? Discuss detail working of it.
  - f. Design and implement binary to Gray code converter circuit.

3. Attempt any three of the following:
  - a. Draw logic circuit diagram of D flip-flop and explain its working.
  - b. Discuss clocked S-R flip flop using four NAND gate.
  - c. How JK flip flop is derived from S-R flip flop ? gates.
  - d. Write a short note on Multiplexer.
  - e. With the help of two 4:1 multiplexer how can we build 8:1 multiplexer? Explain.
  - f. Explain the role of ALU as a part of computer system.

4. Attempt any three of the following:
  - a. Explain the operation of SIPO shift register.
  - b. Design a synchronous decade counter using D flip flops.
  - c. Explain the working of Johnson counter.
  - d. Draw a schematic diagram of 4-bit bi-directional shift register using R-S flip flops and explain its working.
  - e. For the logic circuit show, draw the timing diagram of CP,  $Q_2$ ,  $Q_1 = 0$ .



- f. Design a ripple counter for the states shown-bellow:

