(b) Design a MOD10 asynchronous counter. Explain its working using JK Flip-Flops. (6)

(c) With the logic diagram explain the working of a 4-bit serial-in, parallel-out shift register. (6)

6. (a) State and prove commutative and Associative laws of Boolean algebra. (6)

(b) With the help of a logic diagram explain a 4-bit binary parallel Adder. (6)

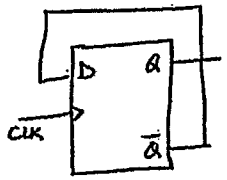
(c) Distinguish between :

(i) Combinational and sequential logic

(ii) Multiplexer and Demultiplexer (6)

7. (a) Write the VHDL code for 3 to 8 decoder. (6)

(b) Assume the clock frequency in the circuit to be 1KHz. Write the truth table. Draw the output waveforms at Q and $\overline{Q}$. What is the frequency of the output waveform?



(6)

(c) Draw the logic diagram for a 4-bit Johnson counter. Also draw the timing diagram and the sequence. (6)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6040 **H**

Unique Paper Code : 2514001201

Name of the Paper : Digital System Design

Name of the Course : **B.Sc. (H) Electronics – Generic Elective (GE)**

Semester : II

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. Question No. **1** is compulsory.
4. Use of non-programmable scientific calculator is allowed.

1. (a) Obtain the truth table of the function f = (A+B) ($\overline{B}$+C) and implement it with logic gates. (3)

(b) Convert decimal 258 into its binary, hexadecimal and octal code. (3)

(c) State and prove De Morgan's theorem by taking an example. (3)

(d) An 8bit shift register contents are 11000011. What are the contents after 3 right shifts? Assume $D_{in} = 1$. (3)

(e) If the clock frequency to a 3-bit ripple counter is 12 kHz, what will be the frequency of the LSB (Q0), Q1 and Q2(MSB). (3)

(f) What is the difference between a synchronous and asynchronous counter? (3)

2. (a) Do the following :

(i) Subtract 14_{10} from 46_{10} using the 8-bit 2's complement arithmetic.

(ii) Add -75_{10} to $+26_{10}$ using the 8-bit 2's complement arithmetic. (6)

(b) Simplify the following expression using Boolean algebra and implement them with NAND gate :

$F = A\bar{B}C + B + B\bar{D} + AB\bar{D} + \bar{A}C$ (6)

(c) Express the following function in a sum of product and a product of Sum.

$F = AB + AC + \bar{B}C$ (6)

3. (a) Convert the following :

(i) 100110110_2 to Gray Code

(ii) 110110010_2 to BCD (6)

(b) Reduce the expression using K-map method and implement with universal gate NAND logic :

$F = \sum m(0,2,3,4,6,8,10,11,12,14)$ (6)

(c) Show that

(i) $(A \text{ xor } B) = A\bar{B} + \bar{A}B$

(ii) $(A + \bar{B})(\bar{A} + B) = A \text{ xnor } B$

and construct the corresponding logic diagram. (6)

4. (a) Design a 4-bit Gray to Binary code converter. (6)

(b) Explain with the help of logic diagram and functional table a 4-input multiplexer. (6)

(c) Implement the function $f(A,B,C) = \sum(0,2,5,7)$ with a decoder and an OR gate (6)

5. (a) Draw and explain the working of JK Flip-Flop using NAND gates. Give its truth table. What is race around condition and how it can be avoided? (6)

P.T.O.