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Paper Code :EC(EI)-301

DIGITAL ELECTRONIC CIRCUITS

Time Allotted:3 Hours | *Full Marks*: 70

The figures in themargin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Group – A

(Multiple Choice Type Questions)

1. Answer *any ten* questions: http://www.makaut.com 1×10=10

(i) The minimum number of NAND gate required to design a single XOR gate is

(a) 5 (b) 3

(c) 4 (d) 6

(ii) The logic family which gives the fastest switching speed is

(a) ECL (b) Schottky TTL

(c) CMOS (d) Low Power Schottky TTL

(iii) $Y = AB + \overline{A}B + A\overline{B}$

(a) All are minterms (b) The function is in canonical form

(c) Both are true (d) None of them

(iv) The following operation is equivalent to http://www.makaut.com

(a) A buffer or delayed gate (b) An inverter

(c) Adder (d) None of them

(v) 10MHz clock signal is applied to a MOD- 4 counter followed by a MOD-5 counter then the output clock frequency will be

(a) 50 kHz
(b) 5 MHz
(c) 5 kHz
(d) 500 kHz

(vi) BCD equivalent of $(293)_{10}$ is

(a) 011100100011
(b) 101100100011
(c) 011100100101
(d) 011101000011

(vii) If $(511)_x = (777)_8$ then the value of x is

(a) 6
(b) 7
(c) 5
(d) 3

(viii) A single bit memory device is

(a) ROM
(b) RAM
(c) FLIP-FLOP
(d) PROM

(ix) The operation of a flip-flop is analogous to

(a) Astable multivibrator
(b) Monostable multivibrator
(c) Bistable multivibrator
(d) None of these

(x) For a N-bit weighted register D/A converter number of resistors required is

(a) 2N
(b) N
(c) 2N-1
(d) N-1

(xi) The minterms for $F(A,B,C) = A + \overline{BC} + BC$ are

(a) $\sum m(0,1,2,3,4,6)$
(b) $\sum m(0,3,4,5,6,7)$
(c) $\sum m(1,3,4,5,6,7)$
(d) $\sum m(0,2,3,4,5,7)$

(xii) A ring counter consists of 6 flip-flops will have

(a) 12 states
(b) 6 states
(c) 11 states
(d) 5 states

Group – B

(Short Answer Type Questions)

Answer *any three* of the following. 5×3=15

2. Using the theorem of Boolean logic prove that

$$(A + B).(\overline{AB} + C).(\overline{AC + B}) = \overline{A}B + B\overline{C}$$

3. Simplify F(A,B,C,D) = $\sum m$ (1,3,7,11,15) + $\sum m$ (0,2,5) using k-map and realize the simplified expression using NAND gates only 2+2+1=5

4. Design a 4 bit adder/subtractor module using full adder and necessary gates with an add/subtract control line

5. Implement the function F(A,B,C,D) = $\sum m$(1,2,3,7,8,9,11,15) using a single 8:1 MUX considering A,B,D as select lines

6. Design a 4 bit universal shift register using 4:1 MUX and other gates

Group – C

(Long Answer Type Questions)

Answer *any three* of the following. 15×3=45

7. Find the minimal expression for the function F(A,B,C,D) = $\sum m$(1,3,4,5,9,10,11) + $\sum d$(6,8) using Quine McCluskey method and also realize the expression using only two input basic logic gates 12+3=15

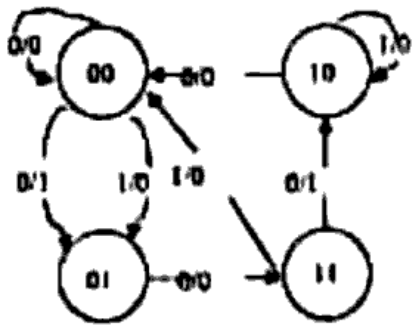
8. (a) What did you mean by Race around condition? How it can be eliminated using Master Slave flip-flop?

   (b) Realize a T flip-flop using SR flip-flop

   (c) How do you cascade two 2:4 decoders to make one 3:8 decoder? Draw the necessary circuit.

   (2+4)+6+3=15

9. (a) Designed a clocked synchronous sequential network using J-K flip-flop and other gates whose state diagram is given below



   (b) Design a mod-5 ripple counter using J-K flip-flop. 10+5=15

10. (a) Explain the operation of a 4 bit R-2R ladder digital to analog converter.

(b) For the same circuit assume that the feedback resistance of the op amp is variable, the resistance R=10K-ohm and reference voltage V_R =10V. Determine the value of R_f that should be connected to achieve the following output conditions:

(i) The value of 1 LSB at the output is 0·5 V

(ii) An analog output of 6 V for a binary input of 1010.

(iii) The full scale output voltage of 12 V.

(iv) The actual maximum output voltage of 10 V. 7+8=15

11. Write short notes on *any three* of the following: 5×3=15

(i) Basic principle of successive approximation type A/D converter

(ii) Parity Generator

(iii) Johnson counter

(iv) Parallel in Serial Out Register

(v) EEROM