Total No. of printed pages = 4

CAI-303/DC/3rd Sem/2017/ M

DIGITAL CIRCUITS

Full Marks – 70

Pass Marks – 28

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Convert the following : 1×5=5

(i) $(101F)_{16} = (?)_2$

(ii) $(10F)_{16} = (?)_{10}$

(iii) $(10101)_2 = (?)_{16}$

(iv) $(102)_8 = (?)_{10}$

(v) $(10111)_2 = (?)_{10}$.

(b) Perform addition : 1

10101 + 10001.

(c) Subtract using 1's complement Method : 2

1010 – 1101.

[Turn over

(d) Subtract using 2's complement Method :
$1100 - 1011$. 2

(e) Simplify using Boolean algebra : 4
$f(x,y,z) = (x+y)(x+y'z)(x+xy)(x'+\overline{xy})$.

2. (a) Simplify using K-map method : 5
$f(A,B,C,D) = \sum m(0,1,4,5,9,10,12,14)$.

(b) $f(x,y,z) = x'y'z + xy'z + xyz + xyz'$. 4

(c) $f(w,x,y,z) = \sum m(0,1,5,9,12,14) + d(2,3,10,11)$. 5

3. (a) Use basic gates only to implement the below Boolean function : 4
$Y = f(a,b,c) = (a+b)cd + \overline{ab}$.

(b) Use only NAND gate to implement : 4
$Y = a + bc'$.

(c) Why NAND, NOR gates are called Universal Logic gates ? 2

(d) State and prove De-Morgan's Law. 4

4. (a) Design a 8 :1 Multiplexer. 5

(b) Design a 2 to 4 Decoder. 5

(c) State commutative, distributive, associative law of Boolean algebra. 4

5. (a) Convert the following into SOP form : $1 \times 2 = 2$

(i) $(a+b)(c+d)(a+b')$

(ii) $(a+b+c)(a+b+c')$.

(b) Explain the truth table of J-K latch along with its logic diagram. 5

(c) Distinguish between sequential and combinational logic. 2

(d) Explain the operation of a S-R latch with its logic diagram. 5

6. (a) Draw the block diagram of the following : $2 \times 2 = 4$

(i) 1 : 4 demultiplexer.

(ii) 2 bit ripple carry adder.

(b) Write down the truth table of the following : $2 \times 2 = 4$

(i) 4 to 2 Encoder

(ii) Full Subtractor.

(c) Explain the operation of a 2 bit asyneromous counter with timing diagram. 6

7. (a) Design a Full Adder. 5

(b) Design a 3 bit binary to gray converter 5

(c) Use only NOR gate to implement : 4

$Y=(a+b)\,(c+d)\,(e+f)$.