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N. C. College of Engg.

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ISRAK (anipat)

Roll No.

Total Pages : 4

BT-5/D02

7201

ECE-321 : Digital Electronics Circuits and Systems

Time : 3 Hours]

[Maximum Marks. : 100

1 (a) Show that $f(A,B,C) = \bar{A}BC + A\bar{B}C + \bar{B}\bar{C}$ is a universal operation. 5

(b) Find the values of the two valued variables A, B, C and D by solving the set of simultaneous equations. 5

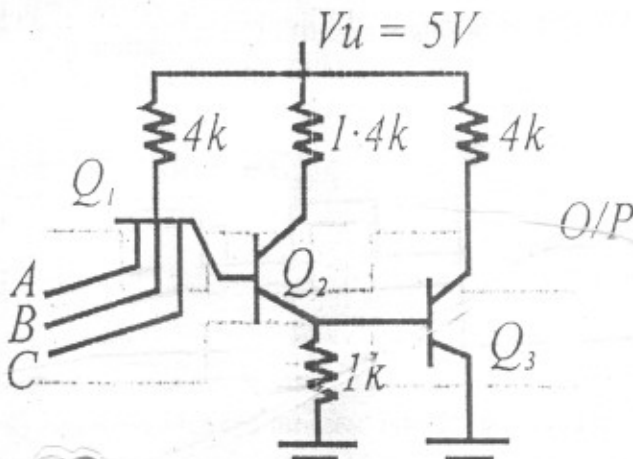
$$\bar{A} + AB = 0, AB = AC$$

$$AB + A\bar{C} + CD = \bar{C}D$$

(c) Find minimal expression using Q.M. method. 5

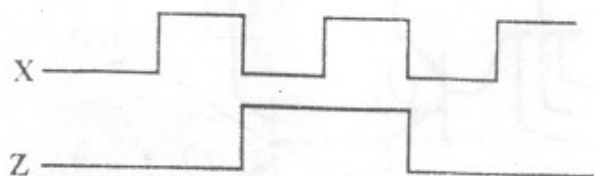
$$f(v, w, x, y, z) = \sum(0, 4, 12, 16, 19, 24, 27, 28, 29, 31)$$

2 For the IC positive TTL NAND gate shown in fig.

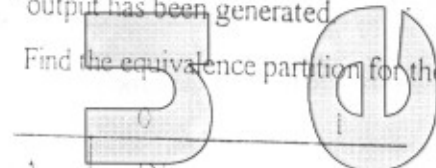
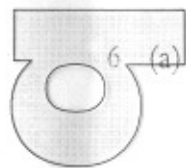


- (a) Calculate $h_{FE\min}$ for proper operation of the circuit.
- (b) Calculate Noise margin.
- (c) Calculate the fan out if $h_{FE\min} = 30$.
- (d) Why do we use TTL NAND gate with Totem pole arrangement (5 + 5 + 5 + 5)

- 3 (a) Implement a full adder with two 4×1 multiplexers. 7
- (b) Construct a BCD to excess - 3 code code converter with a 4 bit adder. What must be done to change circuit to an excess - 3 to BCD code converter. 6
- (c) Design a combinational circuit that compares two 4 bit numbers A and B to check if they are equal. The circuit has one output x so that $x = 1$ if $A = B$ and $x = 0$ if A is not equal to B. 7
- 4 (a) Define Race, critical race, Non-critical race and cycle. How will you avoid critical race. Explain with suitable example. 10
- (b) Design an Asynchronous circuit with an input x and one output z. z complements its state at every 0 - 1 - 0 transition of x. 10



- 5 (a) What are the capabilities and limitations of finite state machine. 6
- (b) Design a sequential circuit which produces an output $Z = 1$ whenever any of the following input sequences occur 1100, 1010 or 1001. The circuit resets to its initial state after a 1 output has been generated. 14



- 6 (a) Find the equivalence partition for the following machine— 10

A	D/0	H/1
B	F/1	C/1
C	D/0	F/1
D	C/0	E/1
E	C/1	D/1
F	D/1	D/1
G	D/1	C/1
H	B/1	A/1

- (b) A sequential circuit has three D flip flops A, B, C and one input x. It is described by the following flip flop input functions.

$$D_A = (B\bar{C} + \bar{B}C)x + (BC + \bar{B}\bar{C})\bar{x}$$

$$D_B = A$$

$$D_C = B$$

Draw the circuit and find state diagram. 10

- 7 (a) For the following function, specify the don't care combinations and determine the function F and ϕ so that it is disjunctively ϕ possible as follows :

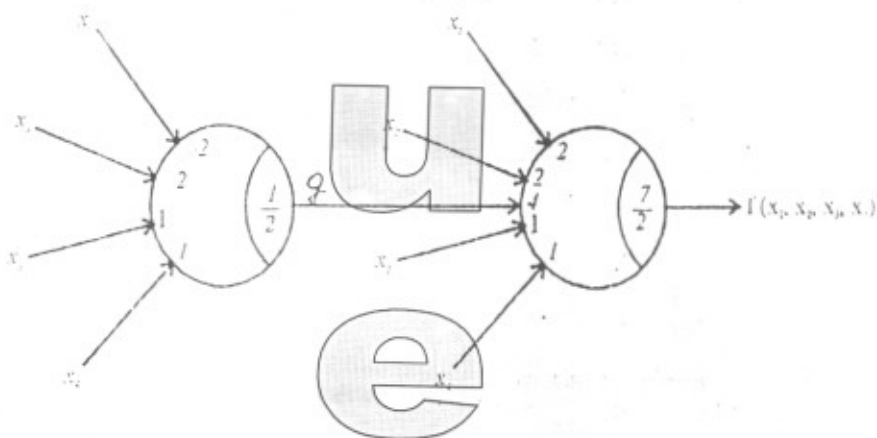
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$$f(v, w, x, y, z) = \sum (4, 8, 10, 16, 21, 27, 28) + \sum \phi(1, 5, 23, 25, 30, 31)$$

$$= F[\phi(v, x, z) w, y] \quad 10$$

- (b) Find the function $f(x_1, x_2, x_3, x_4)$ realised by the threshold network shown in fig. Show the map of the function. 10



- 8 (a) Draw the circuit diagram of successive approximation ADC and explain its operation. 10
- (b) Draw a schematic diagram of DAC. Use resistance values whose ratios are multiples of 2. Explain the operation of the converter. 10