RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SIXTH SEMESTER EXAMINATION, MAY 2023

THIRD YEAR [BATCH 2020-23]

Date : 15/05/2023 **PHYSICS (HONOURS)**

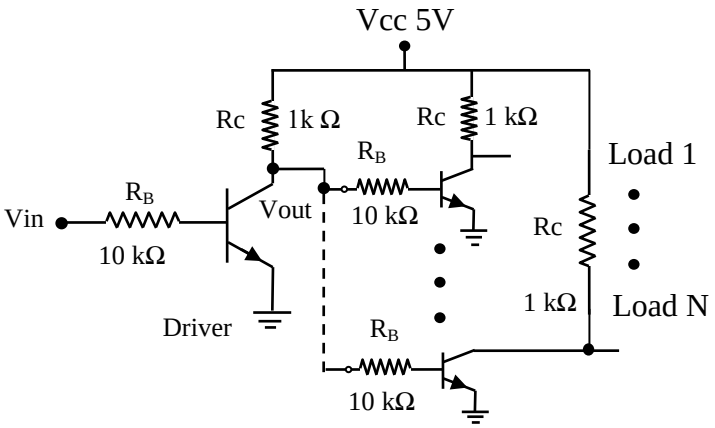
Time : 11 am – 1 pm **Paper : CC14** Full Marks : 50

Answer **any five** questions: [5×10]

1. a) Define Noise margin, and transition width.

   b) A particular logic family has $V_{OH} = 5V, V_{OL} = 1V, V_{IH} = 3.5V$ and $V_{IL} = 2V$. What are the values of NM_H and NM_L?

   c) In the given circuit, $V_{CE(sat)} = 0.2V, \beta_F = 50, V_{BE(ON)} = V_{BE(Sat)} = 0.7V, V_{IH} = 2.75V$.Compute the fan-out when (i) noise margin high (NM_H) = 0.1V and (ii) noise margin high (NM_H) = 1V



   d) If $(125)_R = (104)_5$, Find the value of R. [2+2+4+2]

2. a) Let $X * Y = \bar{X}Y$ then minimize expression for $\left[(x+y) * Y\right] * Z = ?$

   b) Distinguish between 1's and 2's complements.

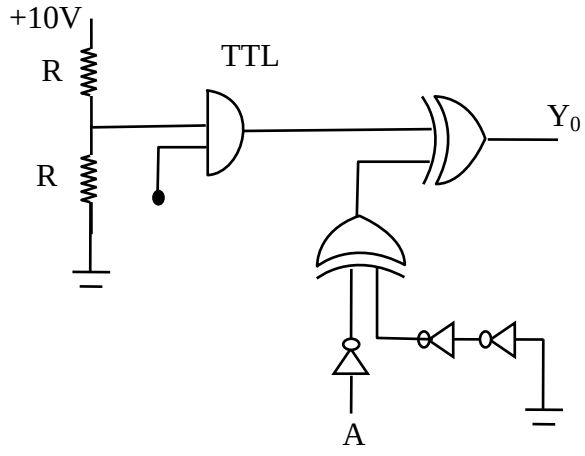
   c) Write concensus theorem. Prove using the basic postulates.

   d) Find out Implicants. Prime Implicants and essential prime Implicants of the logical expression

   $f(A,B,C) = \bar{A}C + A\bar{C} + \bar{B}C$

   e) Write the conditions for a functions to be a self dual function. [2+2+2+2+2]

3.



a) Find out Y_0?

b) Minimize the boolean expression using k-map is POS form

$$f(A,B,C,D) = \Pi M(3,4,5,7,11,12,13,15)$$

then convert the expression into SOP form.

c) Implement full adder using minimum no of NOR gate.

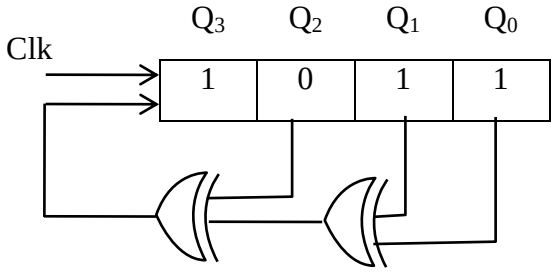
d) Write down the logical expression of Full substractor in the standard SOP form. [2+4+2+2]

4. a) Implement $f(A,B,C) = \sum m(0,1,2,6,7)$ using 4×1 max assuming A,B as select line.

b) Write down the logical expression for two bit comparator.

c) Design a JK flipflop using D flip flop with the help of excitation table.

d) Circuit shown in the figure below is a 4 bit SIPO register which loaded with 1011. If clock pulses are applied continuously then after how many clock pulses data will become 1011 again.



[2+2+4+2]

5. a) Show that amplitude modulated wave can be represented by a carrier and two side-frequencies for each of the modulation frequency.

b) In this context define DSBFC, DSBSC, SSBFC and SSBSC. Obtain power expressions for each of the modulation schemes.

c) When a broadcast AM transmitter is 50 percent modulated, its antenna current is 12 Amp. What will the current be when the modulation depth is increased to 80 percent? [3+(2+2)+3]

6. a) Derive an expression for frequency modulated wave with single tone modulation.

b) Obtain expression for modulation index for FM and compare it with that of PM.

c) Find the carrier and the message frequencies, the modulation index, and the maximum deviation of the FM represented by the equation $v = 12\sin(6 \times 10^8 t + 5\cos 1250t)$. What power will this FM wave dissipate in a 10 Ω resistor? [3+(1+2+4)]

7. a) Discuss the scheme of Frequency Shift Keying. Also mention one schematic method for obtaining FSK output.

b) Mention the working of a coherent FSK detector with suitable diagram.

c) A message containing frequencies in the range 1.2 kHz to 12 kHz in converted into digital message using 16 level PCM scheme. Find the Nyquest rate. If the sampling rate is taken as twice the Nyquest rate, then determine the PCM output bit rate. [(3+1)+3+3]

8. Write short note on **<u>any four</u>** of the following: [4×2.5]

a) Phase Modulation

b) Power of frequency modulated wave

c) Pulse Amplitude Modulation

d) Generation of PWM and PPM from PAM

e) Delta Modulation

f) Quaternary-PSK detection

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