(Set-A_1)

B.Tech-1st

Basic Electronics

Full Marks : 70

Time : 3 hours

Answer six questions including Q.No.1 which is compulsory.

The figures in the right-hand margin indicate marks.

Symbols carry usual meaning.

1. Answer *all* questions : 2×10

   (*a*) What is time base voltage ? Why the time base voltage is generally given to X plate of a CRO ?

   (*b*) 2's complement representation of a 16 bit number (one sign bit and 15 magnitude bits) is FFFF. Represent its magnitude in decimal.

   (*c*) What is biasing ? What should be the condition for proper biasing ?

   (*d*) What is the significance of virtual ground of an OPAMP ?

(*e*) What are the tools used to draw the spectrum of a signal ? Draw the spectrum of a sinusoidal periodic signal of period T.

(*f*) Is JFET is more advantageous than the BJT ? Justify.

(*g*) Realise an EX-OR gate using NOR gate.

(*h*) What is slew rate of an operational amplifier ? What is its significance ?

(*i*) Convert $(0.275)_{10}$ into its binary equivalent and $(1001001)_2$ into its decimal equivalent No.

(*j*) What is the range of signed decimal numbers that can be represented by 6 bit 1's complement form ?

2. (*a*) With a neat sketch, compare RC low-pass circuit with RC high-pass circuit. 5

(*b*) Draw the circuit diagram of the bridge type full-wave rectifier and explain how it works. 5

3. (*a*) Define I_{CBO} and I_{CEO}. Derive an expression to find the relation among them. 5

(*b*) With the help of a diagram, describe the basic structure of an *n* channel junction FET. Give the biasing arrangement. 5

4. (*a*) With neat diagram, explain the principle of operation of a CRO. Mention two application of it. 5

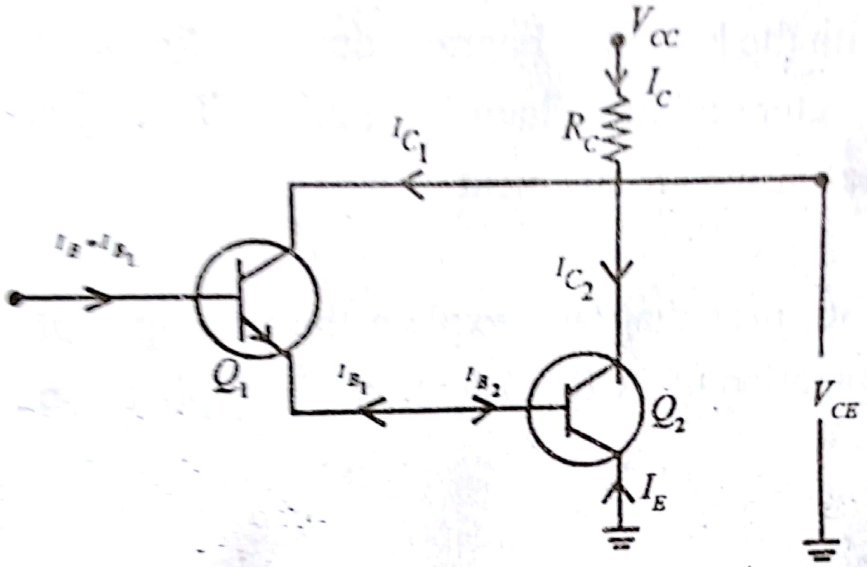
(*b*) The four variable function '*f*' is given in terms of min-terms as

$f(A, B, C, D) = \Sigma m\,(2, 3, 8, 10, 11, 12, 14, 15)$.

Convert this function in the sum of products (SOP) form and minimize it. 5

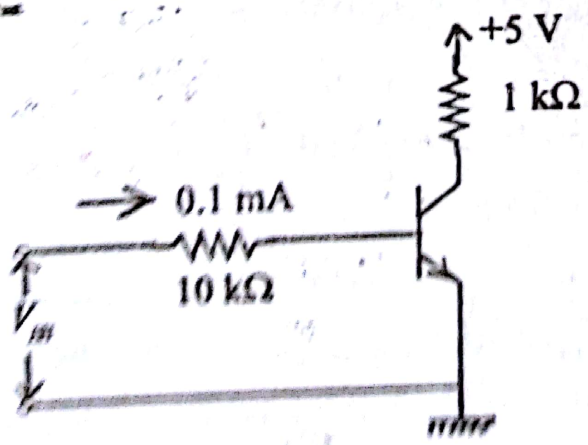
5. (*a*) Can you realize a BJT by joining two diodes back to back ? Justify. 3

(*b*) For the circuit shown in the figure below $\alpha_1 = 0.98$, $\alpha_2 = 0.96$, $V_{CC} = 24$, $R_C = 120\ \Omega$ and $I_E = -100$ mA. Calculate the current and voltage I_{C1}, I_{B1}, I_{B2}, I_{E1}, I_{C2}, I_C, V_{CE} and the ratios I_C/I_B and I_C/I_E. Neglect reverse saturation currents. 7

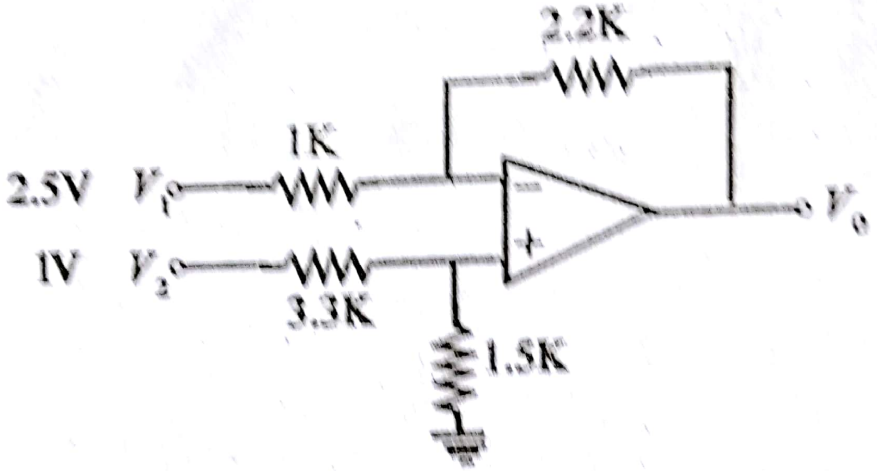


6. (*a*) What do you mean by race around condition ? Explain the working of JK flip-flop. 5

(*b*) In the circuit shown in Figure below, what would be the minimum value of β such that the transistor is in saturation ? Assume $V_{CE_{sat}} = 0.2$ V. 5



7. (*a*) Calculate the output voltage V_0 of the circuit shown in the Figure. The input voltages are $V_1 = 2.5$ V and $V_2 = 1$ V. 5



(*b*) With appropriate block diagram, explain the principle operation of AM receiver. 5

8. Write short notes on any *two* : 5×2

(*a*) Resistance measurement in CRO

(*b*) Needs of modulation

(*c*) Inverting and non inverting configuration of OPAMP

(*d*) RC coupled amplifier.