(2)

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**Class:-SE-Comp (SEM:III) -Choice Based Credit Grading System**

**Solution for Subject: Electronic Circuits and Communication Fundamentals**

Q. 1. A. The leakage current $I_{CO}$ is the minority carrier current in the collector.

$$I_B = \frac{1}{100} I_C \Rightarrow I_C = 100 I_B$$

$$I_E - I_C + I_B - 100 I_B + I_B - 101 I_B$$

$$I_B = \frac{I_E}{101} = \frac{8 \text{ mA}}{101} = \mathbf{79.21\ \mu A}$$

$$I_C = 100 I_B = 100(79.21\ \mu\text{A}) = \mathbf{7.921\ mA}$$

Q. 2 A.

$$I_{C_Q} = \tfrac{1}{2} I_{C_{sat}} = 4 \text{ mA}$$

$$R_C = \frac{V_{R_C}}{I_{C_Q}} = \frac{V_{CC} - V_C}{I_{C_Q}}$$

$$= \frac{28 \text{ V} - 18 \text{ V}}{4 \text{ m}A} = \mathbf{2.5\ k\Omega}$$

$$I_{C_{sat}} = \frac{V_{CC}}{R_C + R_E}$$

$$R_C + R_E = \frac{V_{CC}}{I_{C_{sat}}} = \frac{28 \text{ V}}{8 \text{ mA}} = 3.5 \text{ k}\Omega$$

$$R_E = 3.5 \text{ k}\Omega - R_C$$

$$= 3.5 \text{ k}\Omega - 2.5 \text{ k}\Omega$$

$$= \mathbf{1\ k\Omega}$$

$$I_{B_Q} = \frac{I_{C_Q}}{\beta} = \frac{4\text{ mA}}{110} = 36.36\ \mu\text{A}$$

$$I_{B_Q} = \frac{V_{CC} - V_{BE}}{R_B + (\beta + 1)R_E}$$

$$R_B + (\beta + 1)R_E = \frac{V_{CC} - V_{BE}}{I_{B_Q}}$$

$$R_B = \frac{V_{CC} - V_{BE}}{I_{B_Q}} - (\beta + 1)R_E$$

$$= \frac{28\text{ V} - 0.7\text{ V}}{36.36\ \mu\text{A}} - (111)(1\text{ k}\Omega)$$

$$= \frac{27.3\text{ V}}{36.36\ \mu\text{A}} - 111\text{ k}\Omega$$

$$= \mathbf{639.8\ k\Omega}$$

Standard Values:

$R_C = 2.4\text{ k}\Omega$

$R_E = 1\text{ k}\Omega$

$R_B = 620\text{ k}\Omega$

Q. 3 A.

$$r_e = \frac{26\text{ mV}}{I_E} = \frac{26\text{ mV}}{3.2\text{ mA}} = 8.125\ \Omega$$

and $Z_i = \beta r_e = (120)(8.125\ \Omega) = \mathbf{975\ \Omega}$

$$A_v = -\frac{R_L}{r_e} = -\frac{2\text{ k}\Omega}{8.125\ \Omega} = \mathbf{-246.15}$$

$$A_i = \frac{I_o}{I_i} = \beta = \mathbf{120}$$

D.

$$V_o = \left(\frac{20\text{ k}\Omega}{20\text{ k}\Omega + 20\text{ k}\Omega}\right)\left(\frac{100\text{ k}\Omega + 100\text{ k}\Omega}{100\text{ k}\Omega}\right)V_1 - \frac{100\text{ k}\Omega}{100\text{ k}\Omega}V_2$$

$$= V_1 - V_2$$

$V_0$=2 V

Q. 5 A. Hmax=3.32 bits/ message

r=120 messages/sec

C=398.64 bits/sec