

① The diffusion constant for holes in Si is $13 \text{ cm}^2/\text{sec}$. What is diffusion current density if gradient of hole concentration, $\frac{dp}{dx} = -2 \times 10^{14} \text{ holes/cm}^2$. Ans $\rightarrow -0.416 \text{ mA/cm}^2$

② Calculate the factor by which reverse saturation current of diode is multiplied when temperature increases from 25°C to 80°C . Ans $\rightarrow 45.25$

③ A Ge pn junction diode is operating at a temperature of 125°C with saturation current of $30 \mu\text{A}$. Calculate the dynamic resistance when it is biased by a bias voltage of 0.2 V in forward direction. Ans $\rightarrow 3.366 \Omega$

④ Calculate barrier transition capacitance of a Ge diode whose area is $1 \text{ mm} \times 1 \text{ mm}$ and space charge thickness is $2 \times 10^{-4} \text{ cm}$ and $\epsilon_r = 16$. Ans $\rightarrow 70.832 \text{ pF}$

⑤ If a pure Si crystal has 1 million free e^- s inside it, how many holes does it have? Ans $\rightarrow 1 \text{ million}$

⑥ Given n_i for Si at 300 K is $1.5 \times 10^{10}/\text{cm}^3$, $\mu_n = 1300 \text{ cm}^2/\text{Vs}$, $\mu_p = 500 \text{ cm}^2/\text{Vs}$

(i) Find intrinsic conductivity Ans $4.32 \times 10^{-6} \text{ S/cm}$

(ii) Find no. of holes if no. of electrons are 5×10^{14}

(iii) Find resistivity if conductivity is 0.0224 S/cm Ans $\rightarrow 0.46 \times 10^6 \text{ cm}^{-3}$
Ans $\rightarrow 44.64 \Omega\text{cm}$

- ⑦ Find the no. of holes and electrons in n-type Si if conductivity is 300 S/cm . Given that for Si at 300K , $n_i = 1.5 \times 10^{10} / \text{cm}^3$
 $\mu_n = 1300 \text{ cm}^2/\text{Vs}$ and $\mu_p = 500 \text{ cm}^2/\text{Vs}$

Ans $\rightarrow 1.442 \times 10^{18} \text{ cm}^{-3}$, $1.56 \times 10^{12} \text{ cm}^{-3}$

- ⑧ When a reverse bias is applied to Ge, the reverse saturation current is $0.3 \mu\text{A}$. Determine current flowing in diode when 0.15 V forward bias is applied at room tempⁿ. Ans $\rightarrow 120.73 \mu\text{A}$

- ⑨ The diode current is 0.6 mA when applied voltage is 400 mV and 20 mA when applied voltage is 500 mV . Determine n .

Assume $\frac{kT}{q} = 25 \text{ mV}$. Ans $\rightarrow 1.14$

- ⑩ Determine forward resistance of a pn junction diode when the forward current is 5 mA at $T = 300\text{K}$. Assume Si. Ans $\rightarrow 10.34 \Omega$

- ⑪ The voltage across a Si diode at room tempⁿ (300K) is 0.7 V when 2 mA current flows through it. If voltage increases to 0.75 V , calculate the diode current. (Assume $V_T = 26 \text{ mV}$)

Ans $\rightarrow 5.23 \text{ mA}$ (or) 5.43 mA

- ⑫ A Si diode has a saturation current of $7.5 \mu\text{A}$ at room tempⁿ. Calculate the saturation current at 400K . Ans $\rightarrow 7.68 \text{ mA}$

- ⑬ The reverse saturation current of Ge diode is $2 \mu\text{A}$ at room tempⁿ of 25°C . Find the reverse saturation current at 75°C . Ans $\rightarrow 64 \mu\text{A}$.

- ⑭ A transistor has $\beta = 100$. If collector current is 40 mA . Find the value of emitter current. Ans $\rightarrow 40.4 \text{ mA}$

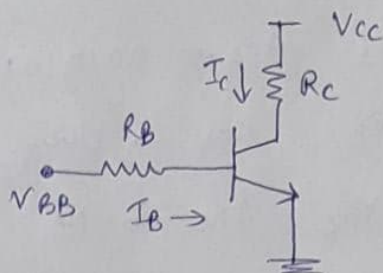
- ⑮ If $\beta = 150$ then find collector and base current, if $I_E = 10 \text{ mA}$
 Ans $\rightarrow 9.93 \text{ mA}$, 0.07 mA

⑫ For a transistor, $\alpha = 0.98$, $I_{CBO} = I_{CO} = 5 \mu A$ and $I_B = 100 \mu A$.
Find I_C and I_E Ans $\rightarrow 5.15 \text{ mA}, 5.25 \text{ mA}$

⑬ Calculate the values of I_C and I_E for a transistor with
 $\alpha = 0.99$, $I_{CBO} = 5 \mu A$, $I_B = 20 \mu A$ Ans $\rightarrow 2.48 \text{ mA}, 2.5 \text{ mA}$.

⑭ Determine base, collector and emitter current and V_{CE} for
CE circuit if $V_{CC} = 10 \text{ V}$, $V_{BB} = 4 \text{ V}$, $R_B = 200 \text{ k}\Omega$, $R_C = 2 \text{ k}\Omega$
 $V_{BE(ON)} = 0.7 \text{ V}$, $\beta = 200$

Ans $\rightarrow 16.5 \mu A, 3.3 \text{ mA}, 3.316 \text{ mA}, 3.4 \text{ V}$



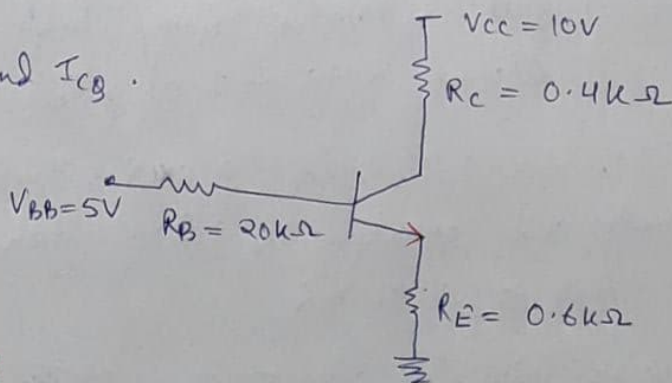
⑮ A transistor in CB configuration has $I_C = 2.98 \text{ mA}$, $I_E = 3 \text{ mA}$
and $I_{CO} = 0.01 \text{ mA}$. What current will flow in collector circuit
of transistor when connected in CE configuration with $I_B = 30 \mu A$.
Ans $\rightarrow 3.97 \text{ mA}$

⑯ Determine V_{CEQ} and I_{CQ} .

Ans \rightarrow

$$V_{CEQ} = 4.634 \text{ V}$$

$$I_{CQ} = 5.334 \text{ mA}$$



⑰ Find collector current and V_{CE} for fixed bias with $V_{BE} = 0.7 \text{ V}$,
 $R_B = 300 \text{ k}\Omega$, $R_C = 2 \text{ k}\Omega$, $\beta = 50$, $V_{CC} = 9 \text{ V}$ Ans $\rightarrow 1.38 \text{ mA}, 6.24 \text{ V}$
Find stability factor.

⑱ A Ge transistor has $\beta = 100$ and $V_{BE} = 0.2 \text{ V}$ in fixed bias
amplifier circuit when $V_{CC} = 16 \text{ V}$, $R_B = 790 \text{ k}\Omega$. Determine its
operating point if $R_C = 5 \text{ k}\Omega$. Ans $\rightarrow 2 \text{ mA}, 6 \text{ V}$
Find stability factor.

⑲ For emitter feedback bias, $V_{CC} = 10 \text{ V}$, $R_C = 1.5 \text{ k}\Omega$, $R_B = 270 \text{ k}\Omega$,
 $R_E = 1 \text{ k}\Omega$, $\beta = 50$ Find stability factor and V_{CE} .
Ans $\rightarrow 43.04, 6.38 \text{ V}$

- (24) $2768 \rightarrow X_2$ Ans $\rightarrow 010111110$
- (25) $11011010101_2 \rightarrow X_8 \rightarrow$ Ans $\rightarrow 3325_8$
- (26) $4448 \rightarrow X_{10}$ Ans $\rightarrow 292_{10}$
- (27) $120_8 \rightarrow X_{10}$ Ans $\rightarrow 80_{10}$
- (28) $23F_{16} \rightarrow X_{10}$ Ans $\rightarrow 575$
- (29) $2A_{16} \rightarrow X_2$ Ans $\rightarrow 001010100110$
- (30) $24_{16} \rightarrow X_8$ Ans $\rightarrow 044_8$
- (31) $24_8 \rightarrow X_{16}$ Ans $\rightarrow 14$
- (32) $1101110 \cdot 10111_2 \rightarrow X_{16}$ Ans $\rightarrow 6E.B8_{16}$
- (33) $73 \cdot 375_{10} \rightarrow X_8$ Ans $\rightarrow 111.30_8$
- (34) $376_{10} \rightarrow X_{16}$ Ans $\rightarrow 178_{16}$
- (35) Construct a full subtractor using half subtractor and OR gates. Ans $\rightarrow 2 \text{ HS} + 1 \text{ OR gate}$
- (36) For a BJT, $\alpha = 0.98$, $I_{CO} = 0.6 \mu A$. This BJT is connected in CE mode and operating in active region with $I_B = 20 \mu A$ find I_C . Ans $\rightarrow 1.01 \text{ mA}$
- (37) The reverse saturation current of collector base junction ~~I_{CBO}~~ $I_{CBO} = 10 \text{ nA}$ when $\alpha = 0.98$. Find I_{CEO} . Ans $\rightarrow 0.5 \mu A$.
- (38) A transistor has current gain of 0.99 in CB. Find its current gain in CC. Ans $\rightarrow 100$