PROBLEMS

P.18.1

DATA. $I_B = 100\,\mu A = 100 \times 10^{-6} = 10^{-4}\,A$

$\beta = 100$

(i) current flowing through collector $= I_c = ?$

(ii) Current flowing through emitter $= I_E = ?$

(iii) $I_c / I_B = ?$

Sol. (i) As $\dfrac{I_c}{I_B} = \beta = 100$

$I_c = 100\, I_B = 100 \times 10^{-4} = 10^{-2} A = \boxed{10\,mA}$

(ii) $I_E = I_c + I_B$

$= 10^{-2} + 10^{-4} = 10^{-2}(1 + 0.01)\,A$

$= 10^{-2}(1.01)\,A = 10^{-2}(1.01) \times 10^{3}\,mA$

$= 10(1.01) = \boxed{10.01\,mA}$

(iii) $\dfrac{I_c}{I_E} = \dfrac{10\,mA}{10.01\,mA} = \boxed{0.999}$

P.18.2

DATA: $I_c = 10\,mA = 10^{-2}A$ = collector current

current gain $= \beta = 200$

Base emitter voltage $= V_{BE} = 0.6V$

$V_{cc} = 9V$

$R_B = ?$

Sol. As $\beta = I_c/I_B$

$$I_B = \frac{I_c}{\beta} = \frac{10^{-2}}{200} = 0.5 \times 10^{-4}A \quad \text{——— (1)}$$

we know that

$$V = V_{cc} - V_{BE} \quad \text{——— (2)}$$

$$V = 9 - 0.6 = 8.4 \text{ volt} \quad \text{——— (3)}$$

Using the relation;

$$V = I_B R_B$$

$$R_B = \frac{V}{I_B} = \frac{8.4}{0.5 \times 10^{-4}} = 16.8 \times 10^{4}\,\Omega$$

$$R_B = \boxed{168\,K\Omega}$$

P.18.3.

DATA: $V_{cc} = 9V$

$V_{cE} = 7.875V$

$R_c = 1K\Omega = 10^{3}\,\Omega$

$R_B = 100\,K\Omega = 10^{5}\,\Omega$

$\beta = 100$

(i) Base current $= I_B = ?$

(ii) collector current $= I_c = ?$

(iii) Potential drop across $R_c = V_c = ?$

Sol. (ii) Potential drop across $R_c = V_{cc} - V_{cE}$

$$= 9 - 7.875 = 1.125V \quad \text{(1)}$$

$$\therefore \; I_c = \frac{V_{cc} - V_{cE}}{R_c} = \frac{1.125}{10^{3}} = 1.125 \times 10^{-3}A = \boxed{1.125\,mA}$$

(i) put $\beta = \frac{I_c}{I_B}$

or $$I_B = \frac{I_c}{\beta} = \frac{1.125 \times 10^{-3}A}{100} = 11.25 \times 10^{-6}A$$

$$I_B = \boxed{11.25\,\mu A}$$

(P.T.O)

(iii) As Potential drop across R_c = $\boxed{1.125\ V}$

OR Potential drop across $R_c = I_c R_c$

$= 1.125 \times 10^{-3} \times 10^{3}$

$= \boxed{1.125 V}$

P.18.4 :

DATA. $R_1 = 10 K\Omega = 10 \times 10^3 \Omega$

$R_2 = 4 K\Omega = 4 \times 10^3 \Omega$

output of op-amp circuit $= V_o = ?$

Sol. Using Kirchhoff's law

(current through R_1) + (current through R_2) = (current through R_3)

I_1 = Current through $R_1 = \frac{(5-0)V}{10 \times 10^3} = 0.5 \times 10^{-3} A$ ——— (1)

I_2 = Current through $R_2 = \frac{-2V-0}{4 \times 10^3} = -0.5 \times 10^{-3} A$ ——— (2)

I = Total current through $R_3 = I_1 + I_2$

$= 0.5 \times 10^{-3} - 0.5 \times 10^{-3} = 0$

$\therefore V_o$ = output $= \boxed{0}$ $\because I = \frac{V_o - 0}{R_3} = \frac{V_o}{20 \times 10^3}$

$0 = \frac{V_o}{20 \times 10^3}$

$V_o = 0$

P.18.5.

DATA: $R_1 = 10 K\Omega = 10 \times 10^3 \Omega$

$R_2 = 40 K\Omega = 40 \times 10^3 \Omega$

Gain of non inverting amplifier $= G = ?$

Sol. Using the rel.;

$G = 1 + \frac{R_2}{R_1}$

$= 1 + \frac{40 \times 10^3}{10 \times 10^3}$

$= 1 + \frac{40}{10}$

$G = 1 + 4 = \boxed{5}$