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BEEE Assignment -1

Q.1. (1) Transistor is used as an amplifier is active mode

~~Q.2.~~ (2). "If the external reverse bias voltage is increased to a value called the Breakdown Voltage Reverse current will decrease."

is False.

Reverse current should drastically Increase.

(3). $V_{cc} = 15\ V$

$R_1 = 4.7\ K\Omega \quad R_2 = 1.5\ K\Omega$

Base Voltage will be,

$$\left(\frac{R_2}{R_1 + R_2}\right) V_{cc} = \left(\frac{1.5}{1.5 + 4.7}\right) 15$$

$$= 3.629\ V$$

~~Q.4.~~ (4). In a PNP BJT, Emitter is heavily doped and Base is lightly doped.

(5) Cutoff Region

(6.) $I_E = I_c + I_B$

largest current flows in the Emitter

(7) B. "Zener diodes are used in forward Biased condition for voltage regulators"

is false. They are used in reverse Bias.

(8) $I_E = 4.2$ mA

$I_c = 4.0$ mA.

For CB config,

$$\alpha_{DC} = \frac{I_c}{I_E} = \frac{4}{4.2} = \underline{0.9523}$$

(D) option

(9) D. " ~~The emitted light tends to be monochromatic and that depends on the band gap and impurities added during the LED construction.~~ A small exposed area on one layer of the semiconducting material permits photons to be emitted as visible light in an LED.

(10) h_{ie} stands for input impedance in CE arrangement with output shorted.

q.(2) Voltage $V(t) = 300 \cos 100(\omega t)$ is applied to half wave Rectifier. with $R_L = 5\ k\Omega$. Diodes are Ideal. is series with source Resistance $R_S = 54\ k\Omega$.

Find all parameters.

Ans.

$$V_t = 300 \cos(100\omega t)\ V$$

$$R_L = 5\ k\Omega$$

$$R_S = \underline{54}\ k\Omega \quad (\text{Roll NO} : 54)$$

Here,

$$V_t = 300 \cos 100\omega t$$

$$V_{max} = 300 = V_{peak}$$

As diode is ideal. R_D is ignored,

$$R_{total} = R_L + R_S$$

$$= 54 + 5 = 59\ k\Omega$$

So

$$I_{max} = \frac{300}{59} \times 10^{-3}\ A.$$

$$= 5.08 \times 10^{-3}\ A$$

$$= \cancel{5.08}\ \underline{5.08\ mA}$$

$$I_{\cancel{RMS}\ DC} = \frac{5.08}{\pi} = \frac{I_m}{\pi} = \underline{1.61\ mA}$$

$$I_{\cancel{dc}\ rms} = \frac{I_M}{2} = \underline{2.54\ mA}$$

Power in load due to DC component of current $= P_{DC} = I_{DC}^2 \times R_L$

$$= 1.61^2 \times 5\,k\Omega$$

$$= 12.9\ W \times 10^{-3}$$

Power is dissipated due to AC current,

$$P_{AC} = I_{rms}^2 \times (R_L + R_S)$$

$$= 2.54^2 \times (59000) \times 10^{-6}$$

$$= 380.64\ W \times 10^{-3}$$

Efficiency of Rectifier $= \dfrac{P_{DC}}{P_{AC}} = \eta$

$$\eta = \frac{12.9 \times 10^{-3}}{380.6 \times 10^{-3}} = \underline{3.39\ \%}$$

Ripple factor :

$$r = \sqrt{\left(\left(\frac{I_{rms}}{I_{DC}}\right)^2 - 1\right)}$$

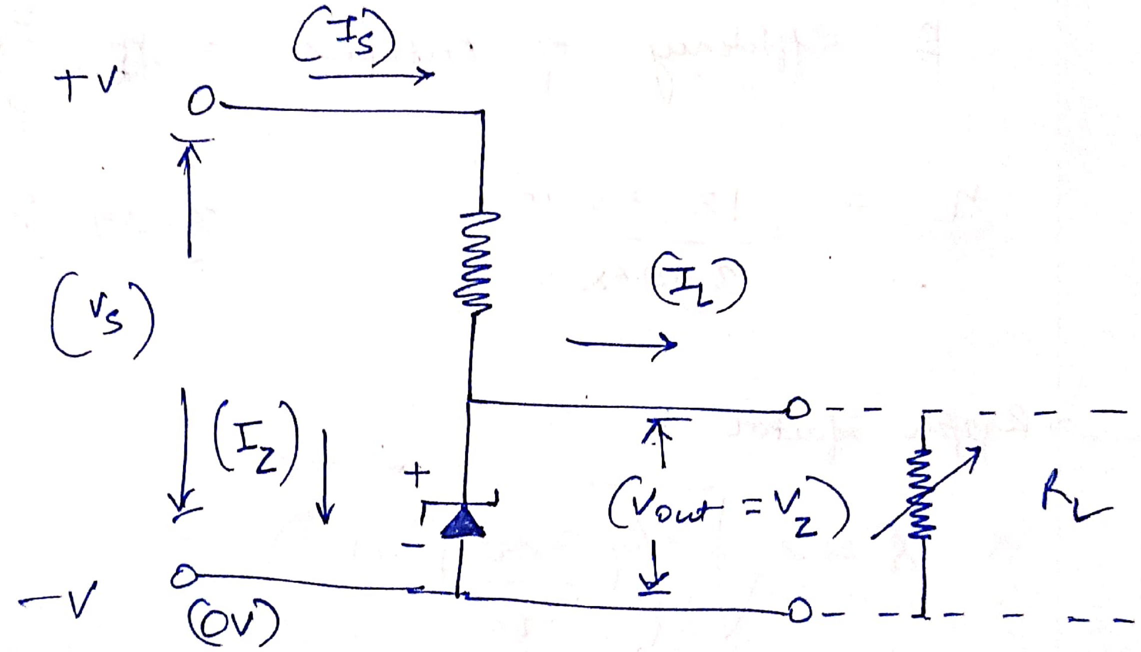
$$= \sqrt{\left(\frac{2.54}{1.61}\right)^2 - 1}$$

$$= \sqrt{1.488} = \underline{\underline{1.22}}$$

Load current (I_m)	$= I_{DC}$	=	1.61 mA
DC Power	P_{DC}	=	12.9 mW
AC Power	P_{AC}	=	380.64 mW
Rectifier efficiency	η	=	3.39 %
Ripple factor	r	=	1.22

Q(3). Using Zener Regulation circuit shown Below, Calculate

1. Max current through diode.
2. The value of the series resistor R_s with No load.
3. Load current I_L if a load Resistor of ~~1kΩ~~ 1 KΩ is connected across Zener diode
4. Zener current I_Z at full load.



$5 + 4 = 9V$

$V_Z = \cancel{54 (V)}$ [Roll NO. 54]

$18 + 2 = 20V$

$V_S = 2.(V_Z) + 2 = \cancel{110 V}$

$P_{Z_{max}} = 9$ ~~(B)~~ [Div < 10] [P = Div ~~mag~~]

$=$ ~~9 (W)~~

$\underline{9W}$

(1) Maximum current through zener diode

$$I_{Z_{max}} = \frac{P_{max}}{Voltage} = \frac{9}{9} = 1A.$$

(2) Value of R_S with No load

$$R_S = \frac{V_S - V_Z}{I_{Z_{max}}} = \frac{20-9}{1}$$

$$= 11\ \Omega$$

(3) Load current if I_L is $1 k\Omega$.

$$I_L = \frac{V_Z}{R_L} = \frac{9}{1000} = 9\ mA$$

(4) I_Z at full load

$$I_Z = I_S - I_L$$

$$= 1000\ mA - 9\ mA$$

$$= 991\ mA$$

Q.4. CE config Voltage divider Bias circuit is shown

$V_{CC} = 15 V$

$R_1 = 54\ k\Omega$

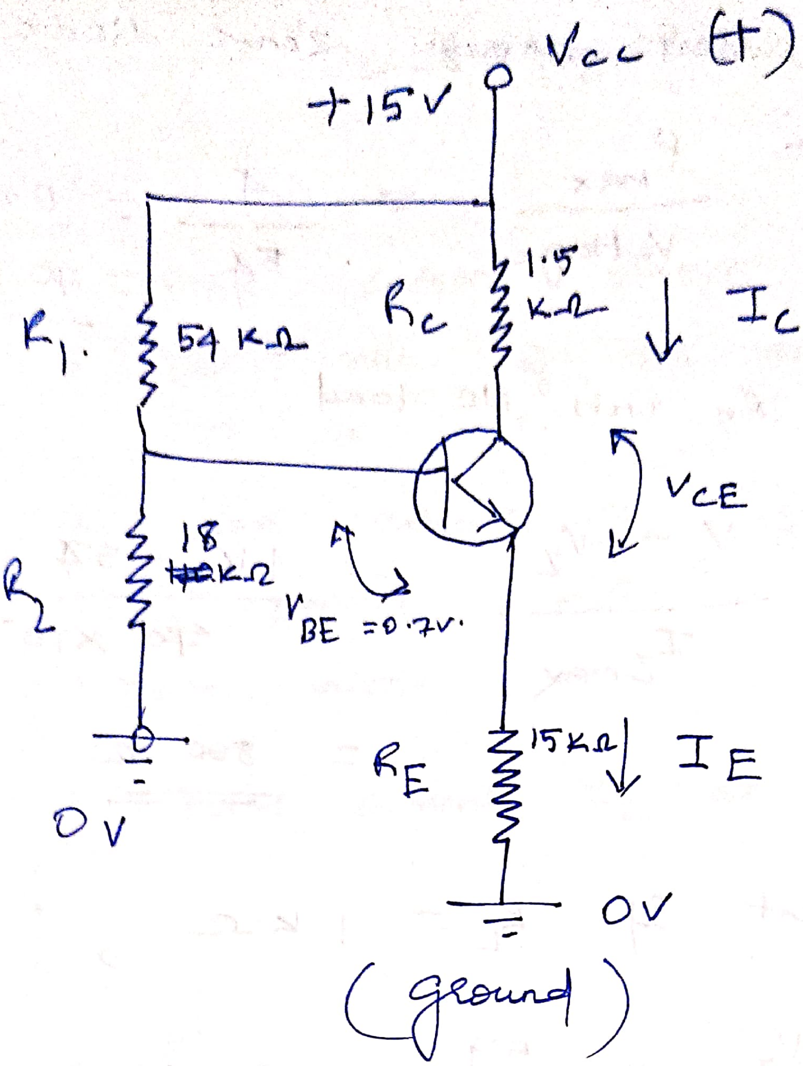
$R_2 = 9 \times 2 = 18\ k\Omega$

$R_C = 1.5\ k\Omega$

$R_E = 15\ k\Omega$

$\beta = 160$

Find Q point.



$$V_{BB} = V_{cc}\left(\frac{R_2}{R_1+R_2}\right) = \cancel{15}\left(\frac{18}{18+54}\right)$$

$$= 15\left(\frac{18k}{18k+54k}\right) = \cancel{10.06V} \quad \cancel{0.25V}$$

$$= \underline{\underline{3.75V}}$$

$$V_E = V_{BB} - 0.7 = 3.75 - 0.7 \text{ V}$$

$$= \underline{\underline{3.05V}}$$

$$\cancel{I_{EQ} = \frac{V_E}{R_E}} \quad \text{So } I_E = \frac{V_E}{R_E} = \frac{3.05}{15000} = \underline{0.20\,mA}$$

But $I_c \approx I_E = \underline{0.20\,mA} = I_{CQ}$.

$$V_{CE} = V_{cc} - I_c R_c = 15 - (0.20)(1.5 \times 10^3) \times 10^{-3}$$

$$= 15 - 0.3 = \underline{\underline{14.7V}} \quad \cancel{Q = (0.20, 14.7)}$$

$$V_{CE} = V_c - V_E$$

$$= 14.7\,V - 3.05\,V$$

$$= \cancel{11.6V}\ 11.65\,V$$

So Q point $= (I_c, V_{CE})$

$$= (0.20\ mA, 11.65\,V)$$