$$V_C = V_E = V_P = V_D + \eta V_{BB} \quad (4)$$

For ideal diode $V_D = 0$

$$V_P = \eta V_{BB} \quad (5)$$

$$\eta = \frac{R_{B1}}{R_{B1} + R_{B2}} \quad (6)$$

- اذا طلب بالسؤال اقصى تردد maximum frequency يعني يجب استخراج اقل زمن minimum time واقل مقاومة R_{min} وتكون القوانين كالاتي

$$F_{max} = \frac{1}{T_{min}} \quad (1)$$

$$T_{min} = R_{min} C_1 Ln \frac{1}{1-\eta} \quad (2)$$

$$R_{min} = \frac{V_{BB} - V_V}{I_V} \quad (3)$$

- اذا طلب بالسؤال اقل تردد minimum frequency يعني يجب استخراج اقل زمن maximum time واقل مقاومة R_{man} وتكون القوانين كالاتي

$$F_{min} = \frac{1}{T_{max}} \quad (1)$$

$$T_{max} = R_{max} C_1 Ln \frac{1}{1-\eta} \quad (2)$$

$$R_{max} = \frac{V_{BB} - V_p}{I_p}$$

- اذا لم يعط قيمة V_P نستخرجها من العلاقة التالية

$$V_P = V_D + \eta V_{BB}$$

3.6 Exercises and Problems

Q1] A UJT (UNJUNCTIONAL TRANSISTOR) is used as a relaxation oscillator where V_{BB}=20v, I_V= 10mA, V_v= 0.6v, I_p=40µF, C_1=1µF, and $\eta = 0.65$. Find the value of maximum and minimum frequency.

Ans

$$R_{1min} = \frac{V_{BB} - v_V}{I_V} = \frac{20 - 0.6}{10 \times 10^{-3}} = 19.4 \times 10^2$$

$$T_{min} = R_{1min}\, C_1 \ln\left(\frac{1}{1-\eta}\right)$$

$$= 19.4 \times 10^2 \times 1 \times 10^{-6} \ln\left(\frac{1}{1-0.65}\right) = 2.035 \times 10^{-3}$$

$$F_{max} = \frac{1}{T_{min}}\ , F_{max} = \frac{1}{2.035 \times 10^{-3}}\ ,\ F_{max} = 492.6Hz$$

$$v_p = \eta V_{BB} = 0.65 \times 20 = 13volt$$

$$R_{1max} = \frac{V_{BB} - v_p}{I_p} = R_{1min} = \frac{20-13}{40 \times 10^{-6}} = 1.7 \times 10^5 \Omega$$

$$T_{max} = R_{1max}\, C_1 \ln\left(\frac{1}{1-\eta}\right)$$

$$= 1.75 \times 10^5 \times 1 \times 10^{-6} \ln\left(\frac{1}{1-0.65}\right) = 1.83575sec$$

Q2] A UJT (UNJUNCTIONAL TRANSISTOR) has the following data: V_{BB}=30v, R_1=100KΩ,V_D= 0.6v, $\eta = 0.65$.

1- What is the value of C_1 that gives 1KHz output frequency?
2- Calculate the maximum value of the capacitor voltage.

Ans

$$F_{max} = \frac{1}{T_{min}} = \frac{1}{1 \times 10^3} = 1 \times 10^{-3}$$

$$T_{min} = R_{1min}\, C_1 \ln(\frac{1}{1-\eta})$$

$$1 \times 10^{-3} = 1 \times 10^3 \times C_1 \ln(\frac{1}{1-0.6}),\ C_1 = 0.01\mu F$$

$$V_c = V_p = V_D + \eta V_{BB} = 0.6 + (0.6 \times 30) = 18.6\ volt$$

Q3] A UJT (UNJUNCTIONAL TRANSISTOR) is used as a relaxation oscillator where V_{BB}=12v, I_V= 11.4mA, V_v= 0.6v, C_1=1uF, and $\eta = 0.65$. Find the value of maximum frequency.

Ans

$$F_{max} = \frac{1}{T_{min}}$$

$$R_{1min} = \frac{V_{BB} - v_V}{I_V} = R_{1min} = \frac{12-0.6}{11.4\times10^{-3}} = 1K\Omega$$

$$T_{min} = R_{1min}\, C_1 \ln(\frac{1}{1-\eta}) = 1 \times 10^3 \times 1 \times 10^{-6} \ln(\frac{1}{1-0.65}),\ T_{min} = 1.049\ msec$$

$$F_{max} = \frac{1}{1.049\times10^{-3}},\ F_{max} = 953.3Hz$$

Q4] A UJT (UNJUNCTIONAL TRANSISTOR) is used as a relaxation oscillator where V_{BB}=30v, R_1=1001$K\Omega$ C_1=10uF, and $\eta = 0.6$. Find the value of frequency.

Ans

$$F = \frac{1}{T}$$

$$T = R_1 C_1 \ln(\frac{1}{1-\eta}) = 100 \times 10^3 \times 1 \times 10^{-6} \ln(\frac{1}{1-0.6}),\ T = 0.916\ sec$$

$$F = \frac{1}{0.916},\ F = 1.09\ Hz$$

Q5] Sketch the input forward characteristic curve of UJT and point to the regions of operation.

Q6] Fill the following blanks with the suitable words:-

1- UJT is also called double ---------- and ----------
2- Intrinsic stand off ratio is the coefficient of UJT of typical value lies between ---------- and ----------.
3- UJT interbase resistance of N block of several thousand of ohms when positive voltage is applied to ----------at ----------=0.
4- Condition of operation of UJT is ----------
5- The UJT has three operation regions, they are ----------, ----------and----------
6- The oscillation condition of UJT oscillator is ---------- .
7- The voltage on the charging capacitor may be expressed by ----------.