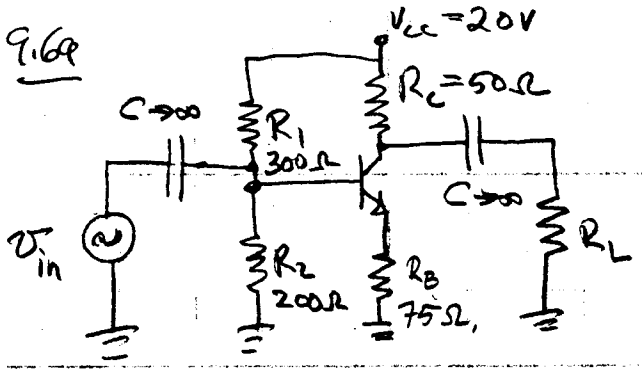
9.69

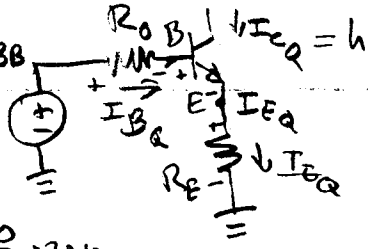


$h_{FE}=20$

(a) Find R_L for centered Q point (on AC load line).
See analysis on p. 625. For centered Q-point, " " ".

$$\frac{V_{CEQ}}{I_{CQ}} = R_T + R_E \quad \text{where } R_T = R_L \| R_C .$$

Find I_{CQ}: (use Thévenin)



[Note: r_e is negligible here]

$$V_{BB} = \frac{200}{500}\times 20V = 8V$$

$$R_0 = R_1 \| R_2 = 120\Omega$$

$$V_{BB} - I_{BQ}R_0 - 0.7V - I_{EQ}R_E = 0 .$$

Express in terms of I_{CQ} and solve

$$V_{BB} - \frac{I_{CQ}}{h_{FE}}R_0 - 0.7V - \frac{h_{FE}+1}{h_{FE}}I_{CQ}R_E = 0$$

$$I_{CQ} = (V_{BB}-0.7)h_{FE} / (R_0 + (h_{FE}+1)R_E)$$

$$I_{CQ} = 7.3V \times 20/(120\Omega + 21\times 75\Omega) = 86\ mA$$

$$V_{CEQ} = (V_{CC} - I_{CQ}R_C) - I_{EQ}R_E$$

$$V_{CEQ} = 20V - 86\ mA\times 50\Omega - \frac{21}{20}\times 86\ mA\times 75\Omega = \underline{8.9V}$$

$$R_T = \frac{V_{CEQ}}{I_{CQ}} - R_E = \frac{8.9V}{86mA} - 75\Omega = \underline{28.5\Omega}$$

$$\frac{1}{R_L} = \frac{1}{R_T} - \frac{1}{R_C} = 0.0151\,\mho \Rightarrow R_L = \underline{66\Omega}$$

(b) Max output signal power $= \frac{1}{2}I_{CQ}V_{CEQ}$

$$= \frac{1}{2}\times 86\ mA\times 8.9V = \underline{0.38W}$$

(c) Minimum $P_{D(max)}$ for transistor $= I_{CQ}V_{CEQ} = \underline{0.77W}$
(minimum transistor power dissipation rating)