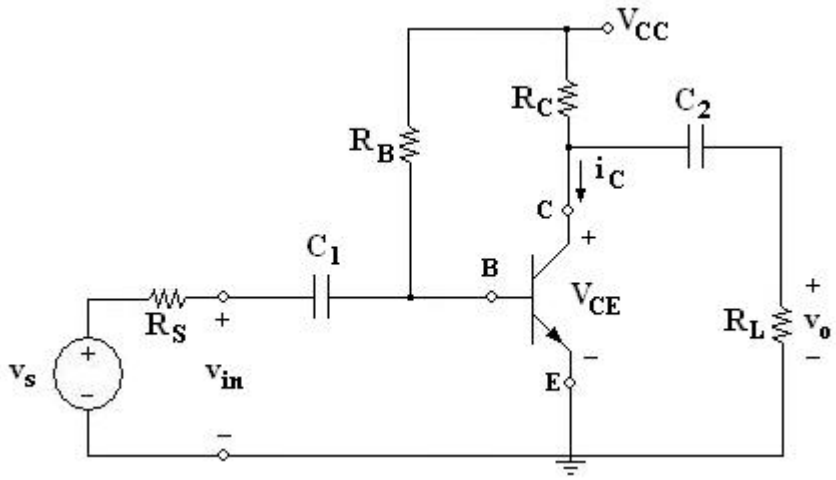
JEE2330 – Spring 2025
Lab #7 Problem

A grounded emitter transistor amplifier circuit using the 2N222A BJT is shown. A graphical analysis of the transistor shows that $\beta_{DC} = \beta_{AC} = 150$ and $r_{oc} = 50$ kΩ. Also, tests show that $V_{BE(on)} = 0.7$ V and $V_{CE(sat)} = 0.2$ V. The amplifier design characteristics are $V_{CC} = 10$ V, $R_B = 330$ kΩ, $R_C = 1.6$ kΩ, $R_L = 3.0$ kΩ, and $C_1 = C_2 = 2.5$ uF. Analyze the circuit following the steps given below.



1. Identify the transistor operating point (Q point).

V_{CEQ} = _____
I_{CQ} = _____
I_{BQ} = _____

2. Calculate the transistor small signal input resistance r_π assuming the operating temperature is 27°C.

r_π = _____

3. Find the small signal voltage amplifier circuit parameters r_i, r_o, and a_{vo} ($a_{vo} = v_o/v_{in}$ with $R_L = \infty$) and draw the equivalent circuit on the back of this sheet. Include on the equivalent circuit diagram the voltage source (v_s and R_S), the load resistance (R_L), as well as r_i, r_o, and a_{vo}. Assume $X_{C1} = X_{C2} = 0$.

r_i = _____
r_o = _____
a_{vo} = _____

4. Using the small signal voltage amplifier equivalent circuit diagram, find the small signal voltage gain ($a_v = v_o/v_{in}$) with $R_L = 3.0$ kΩ for the circuit at a midrange frequency of 40 kHz.

a_v = _____

5. Using the small signal voltage amplifier equivalent circuit diagram, find the overall small signal voltage gain ($A_v = v_o/v_s$) with $R_L = 3.0$ kΩ for the circuit at a midrange frequency of 40 kHz assuming $R_S = 50$ Ω.

A_V = _____