Q: The circuit given in Figure 1 has the following parameters:

\[ K_n = 0.25 \text{mA} V^2, \quad V_T = 1 \text{V}; \quad \beta = 100, \quad V_{BE} = 0.7 \text{V}. \]

Use: \[ I_D = K_n(V_{GS} - V_T)^2, \]
\[ g_m(MOS) = 2K_n(V_{GS} - V_T). \]

\textit{Ignore base current.}

Figure 1:

(i) Calculate: \( Q_1: (V_{CEQ}, I_{CQ}) \) \hspace{1cm} (10 Points)

(ii) Calculate: \( Q_2: (V_{DSQ}, I_{DSQ}) \) \hspace{1cm} (10 Points)

(iii) Identify the topology \hspace{1cm} (5 points)

(iv) Identify the B-Circuit to calculate \( A_{vf} = \frac{v_o}{v_i} \) \hspace{1cm} (5 Points)

(v) Using the topology method find \( R_1, R_2 \) and B. \hspace{1cm} (15 Points)

(vi) Draw the small-signal equivalent circuit and find \( A_{vf} = \frac{v_o}{v_i} \). \hspace{1cm} (30 Points)

(vii) Find \( A_{vf} = \frac{v_o}{v_i} \) using the T-method. \hspace{1cm} (20 Points)

(viii) Compare results of (v) and (vi), if different, why? \hspace{1cm} (5 Points)