Analog Electronic Circuits (EC2.103) : Quiz-2
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Date : 19^{th} May, 2023, Duration : 45 minutes, Max. Marks : 10

Instructions:

- Clearly write your valid assumptions (if any)
- You are only allowed to use own handwritten **single** A-4 sheet (both sides) as short notes
- Mobile phone, computers can not be used during the exam

1. As shown in figure 1, derive the expression for small signal input resistance R_{in} and fill in the blanks. Consider that both transistors (Q_1 & Q_2) are in active mode and symbols have their usual meanings. *(Hint: Draw small signal equivalent, apply v_{in}, measure i_{in}, then $R_{in} = \frac{v_{in}}{i_{in}}$)* [4 Mark]

$$R_{in} = (----)r_{\pi 1} + (----)r_{\pi 2} + (----)R_E$$

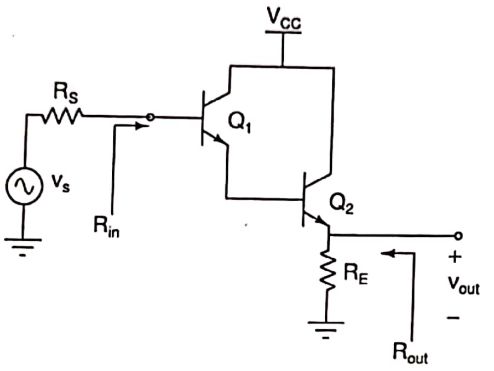

Figure 1

2. For the amplifier topology shown in figure 2, it is given that $\beta = 100$, $I_S = 6 \times 10^{-16}$ A and $V_A = \infty$.

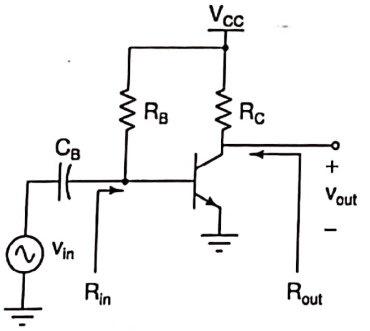

Figure 2

(a) Draw small signal equivalent and derive voltage gain ($A_v = \frac{v_{out}}{v_{in}}$). [1 Mark]

(b) Derive the expressions for R_{in} and R_{out}. [1 Mark]

(c) Design the amplifier to achieve following specifications: $A_v \geq 8$, $R_{out} = 1\ k\Omega$, $R_{in} \geq 5\ k\Omega$, $V_{CC} = 2.5\ V$, lowest signal frequency of interest ($f_{in_{min}}$) is 100 Hz and overall power dissipation $P_DC \leq 1\ mW$. Tabulate the final design parameters (A_v, R_{in}, R_{out}, P_{DC}) achieved in your design. *(Hint: Design means you need to find R_C, R_B & C_B values to satisfy the requirements. $I_C = I_S exp(\frac{V_{BE}}{V_T})$), $I_C = \beta I_B$)* [4 Mark]

Good luck !!