24-4-2021

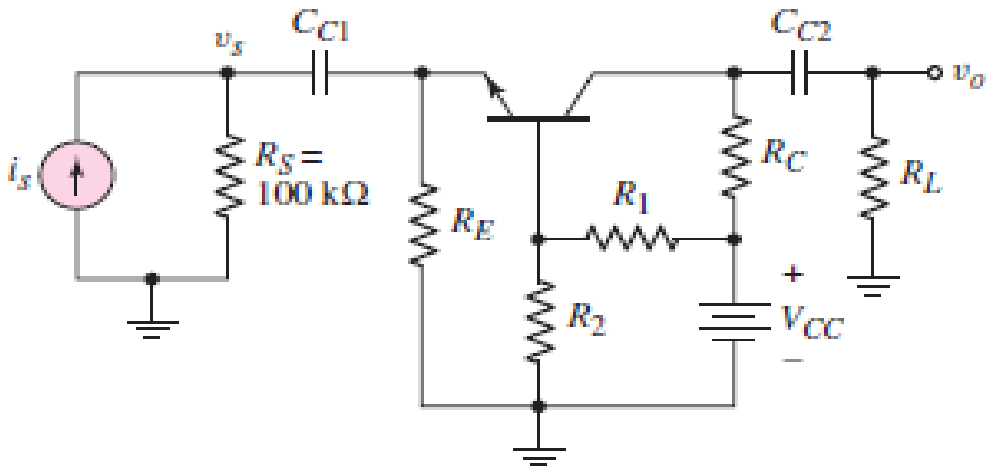
BILKENT UNIVERSITY Department of Electrical and Electronics Engineering

EEE313 Electronic Circuit Design MidTerm Exam #2

3 questions 120 minutes

Part-1 One question 40 minutes

- **Instructions:**
- Calculators without extensive memory are allowed
- Clearly explain all your answers in order to receive credit
- Put a box around your final answer
- Cheat sheets are not allowed
- Indicate the units for your final answers
- Write your name and student ID on the bottom of every page
- Mail your pdf solutions to eee313exam@bilkent.edu.tr with your student ID number as subject
- Also upload your pdf solutions to Moodle



Q1. (35 points)

The parameters of the shown amplifier are V_{CC} = 9V, R_L=4kΩ, R_C=6kΩ, R_E=3kΩ, R_1=150kΩ, R_2=50kΩ, C_{C1}=1μF, and C_{C2}=1μF. The transistor parameters are β=125, V_{BE}(ON)=0.7V, V_{CE}(SAT)=0.2V, V_A=∞, and V_T=0.026V. The input signal is a small-signal ac current source.

a) Derive and numerically determine the Q-point values of I_C and V_{CE}. Verify the state of the transistor.

b) Derive and numerically determine the small-signal ac midband transresistance function $R_m = v_o / i_s$.

c) Derive and numerically determine the small-signal ac midband voltage gain $A_v = v_o / v_s$

d) Derive and numerically determine the small-signal ac midband input impedance R_{in} of the amplifier. Note that R_s is part of the source.

e) Derive and numerically determine the -3dB lower cut-off frequency f_L.