ECE 2201
Term A-2023
Problem Set 6

Due: Monday, October 9, 2023

NOTES:
(1) You must show all work to receive credit. Answers alone are not sufficient.

(2) The book problems may have been used before and I am sure solutions are floating about. Be sure you know how to do these problems ON YOUR OWN, since you will be tested in each area.

Section 7.2: Small-Signal Operation and Models (p.480)

1. 7.36 *NOTE: I introduced the T-model in class with r_e. Another small-signal model covered in the book is the π-model, which uses r_π, where $r_\pi = (\beta+1)\, r_e$. Both models produce identical results.*

2. 7.42

3. 7.48

Section 7.3: Basic [BJT Amplifier] Configurations (p. 483)

4. D7.60 *A system-level question about voltage gain amplifiers, in general.*

*** Problems 5 & 6 have been graciously provided by Prof. McNeill (See Attached)**

5. BJT Biasing Options

6. β Independent Biasing

NOTE: Problems 5 and 6 have been graciously provided by Prof. John McNeill, who teaches the graduate level Analog Integrated Circuit Design Course ECE4902.

5) [BJT Biasing Options]

Figures 5-1a and 5-1b show two different ways of biasing a BJT common-emitter amplifier stage. For parts (a) through (c) below, assume β=100.

a) Find the DC operating point (I_C, V_{OUT}) for each circuit.

b) Verify the operating region (active, cutoff, saturation) for each BJT.

c) Find the small-signal gain v_{out}/v_{in} for each circuit (consider the capacitors as good "ac" short circuits, at the signal frequencies applied).

6) [β Independent Biasing]

Repeat problem (5) for transistors with β=250.

a) Again, find the DC operating point (I_C, V_{OUT}) for each circuit.

b) Verify the operating region (active, cutoff, saturation) for each BJT.

c) Find the small-signal gain v_{out}/v_{in} for each circuit (if possible).

d) Comparing results to problem (1), which circuit seems to be β independent? Explain why β independence is a desired feature of BJT amplifiers.

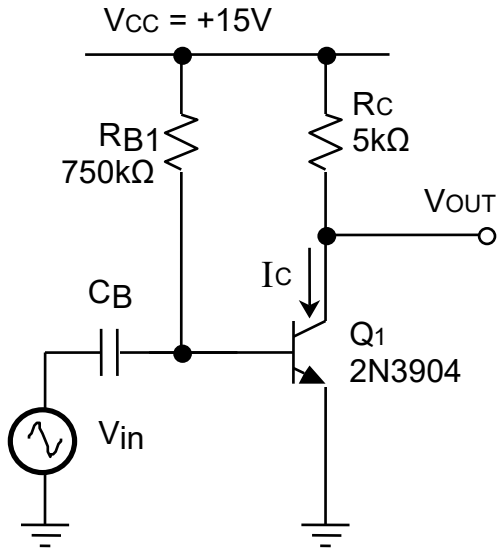

Fig. 5-1a

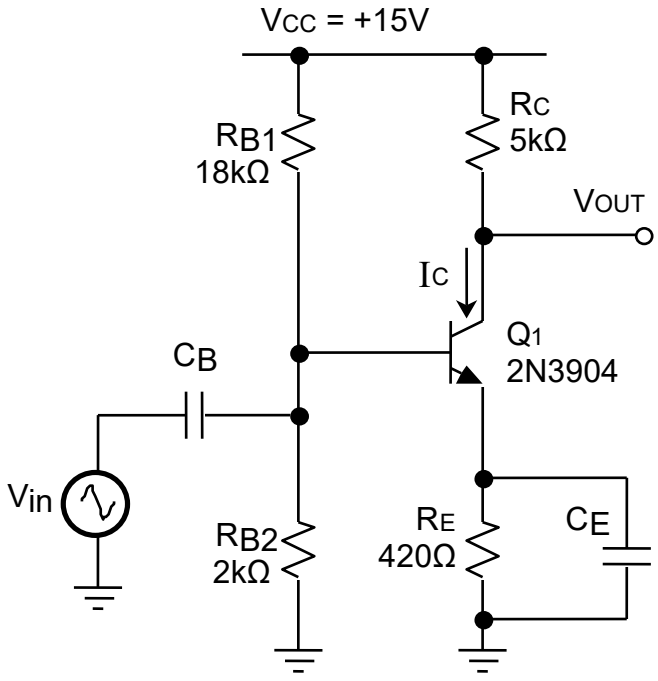

Fig. 5-1b