Sir Syed University of Engineering & Technology (SSUET)

Computer Engineering Department

Course Name: Basic Electronics

Semester: Spring 2011, 3rd

Batch: 2010(Sections: A,B)

Assignments # 5

Course Responsible

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SIR SYED UNIVERSITY OF ENGINEERING AND TECHNOLOGY
COMPUTER ENGINEERING DEPARTMENT
BASIC ELECTRONICS
20109 BATCH (Sections: A, B)
Last Submission Date: 3rd May, 2011.

Assignment # 5

Q1. Using the characteristics of Fig. 3.7, determine V_{BE} at I_E = 5 mA for V_{CB} =1, 10, and 20 V. Is it reasonable to assume on an approximate basis that V_{CB} has only a slight effect on the relationship between V_{BE} and I_E?

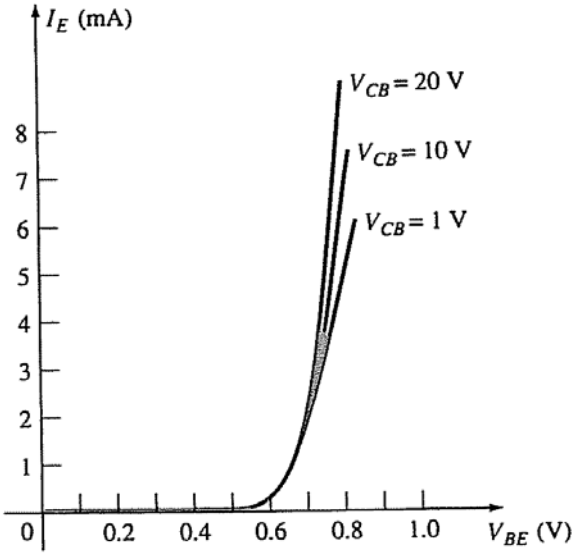


FIG. 3.7
Input or driving point characteristics for a common-base silicon transistor amplifier.

Q2. (a) Using the characteristics of Fig. 3.8, determine the resulting collector current if I_E = 4.5 mA and V_{CB} = 4 V.
(b) Repeat part (a) for I_E = 4.5 mA and V_{CB} = 16 V.
(c) How have the changes in V_{CB} affected the resulting level of I_C?
(d) On an approximate basis, how are I_E and I_C related based on the results above?

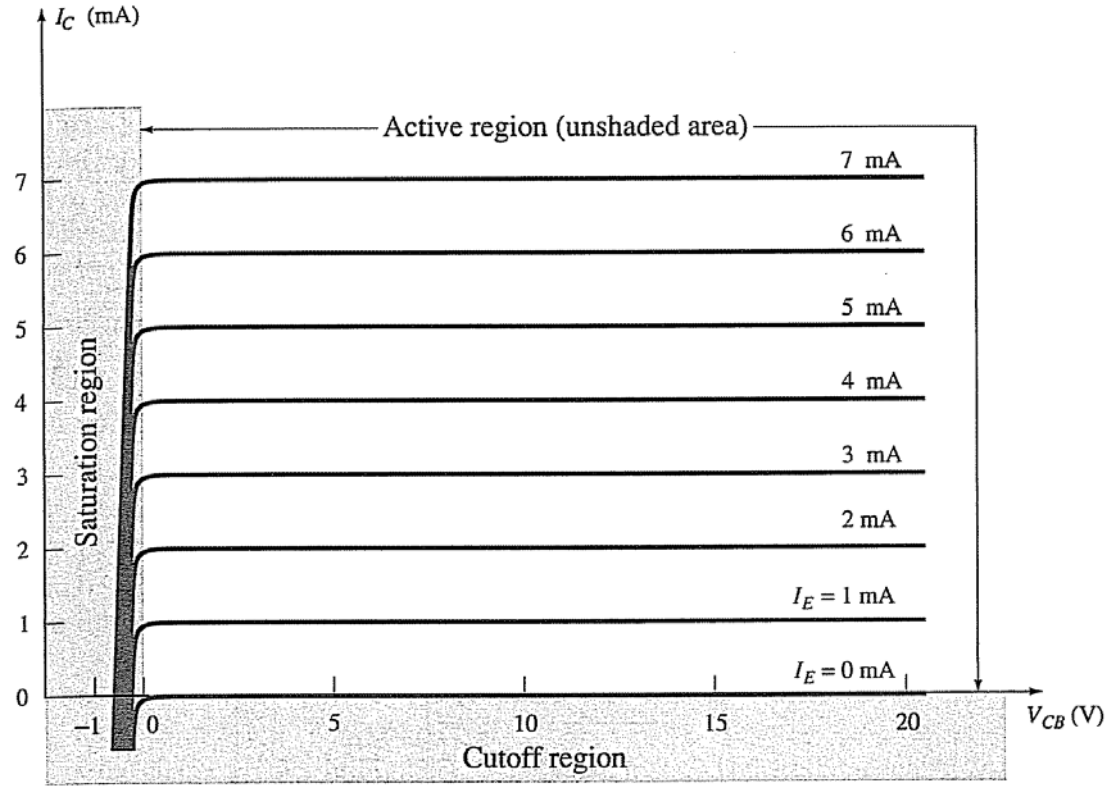


FIG. 3.8

Output or collector characteristics for a common-base transistor amplifier.

Q3. (a) Using the characteristics of Figs. 3.7 and 3.8, determine I_C if V_{CB} = 10 V and V_{BE} = 800 mV.

(b) Determine V_{BE} if I_C = 5 mA and V_{CB} = 10 V.

(c) Repeat part (b) using the characteristics of Fig. 3.10b.

(d) Repeat part (b) using the characteristics of Fig. 3.10c.

(e) Compare the solutions for V_{BE} for parts (b), (c), and (d). Can the difference be ignored if voltage levels greater than a few volts are typically encountered?

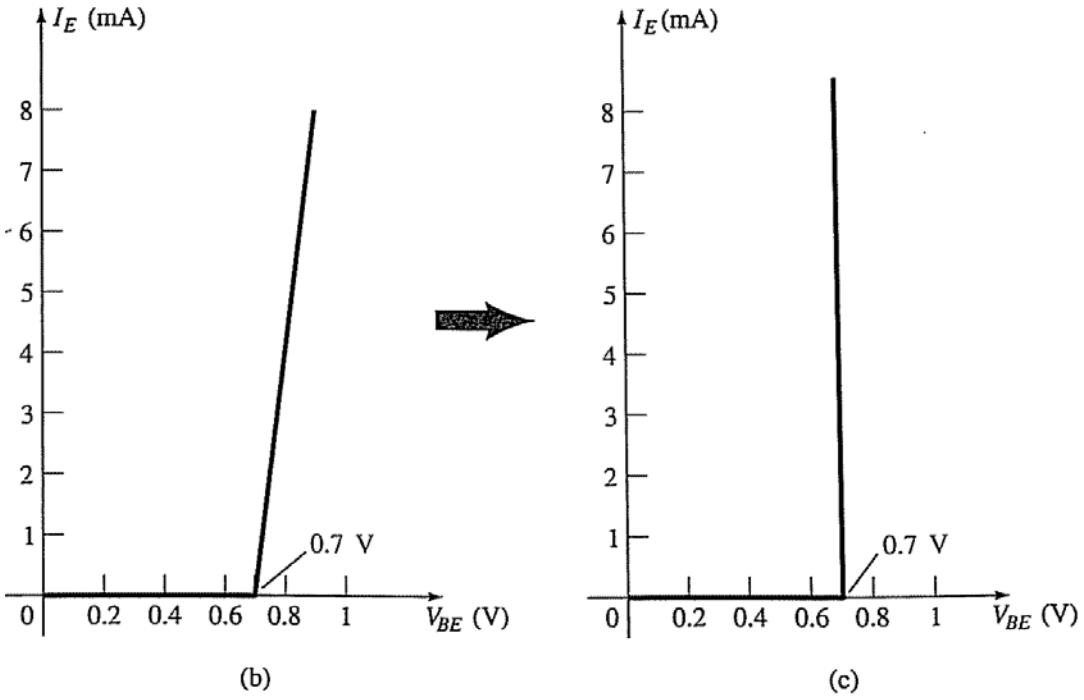
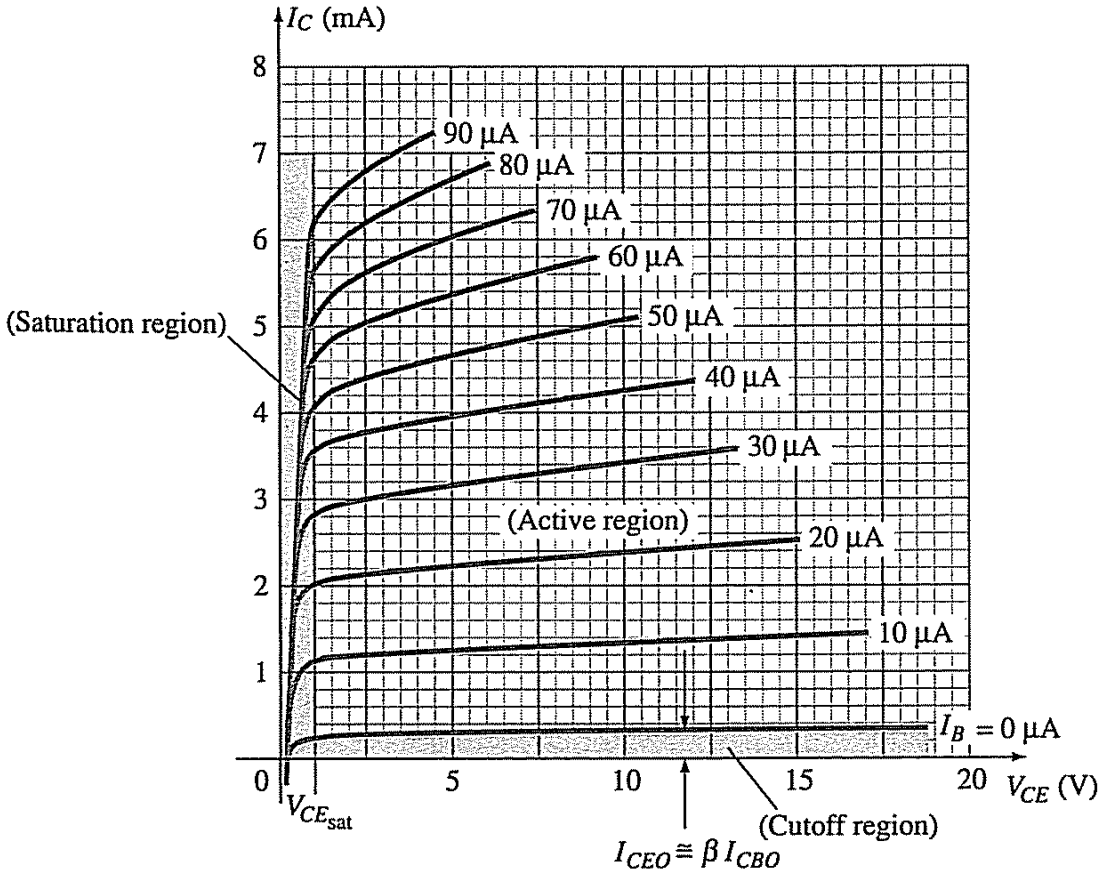


FIG. 3.10

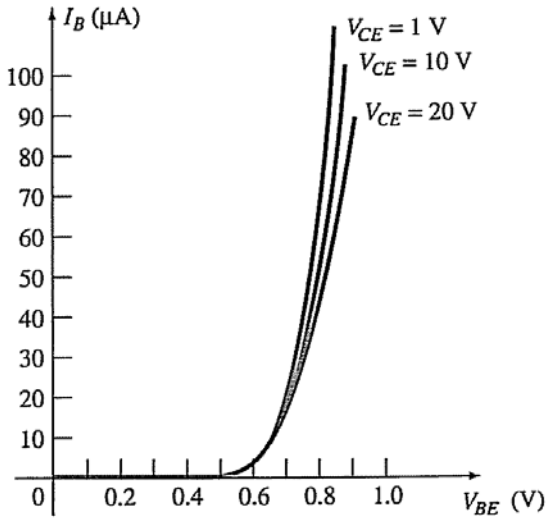
Q4. (a) Given an α_{dc} of 0.998, determine I_C if I_E = 4 mA.
(b) Determine α_{dc} if I_E = 2.8 mA and I_B = 20μA.
(c) Find I_E if I_B = 40μA and α_{dc} is 0.98.

Q5. Define I_{CBO} and I_{CEO}. How are they different? How are they related? Are they typically close in magnitude?

Q6. Using the characteristics of Fig. 3.14:
(a) Find the value of I_C corresponding to V_{BE} =750 mV and V_{CE} = 5 V.
(b) Find the value of V_{CE} and V_{BE} corresponding to I_C = 3 mA and I_B = 30 μA.



(a)



(b)

Figure 3.14. Characteristics of a silicon transistor in the common-emitter configuration: (a) collector characteristics; (b) base characteristics.

Q7. (a) For the common-emitter characteristics of Fig. 3.14, find the dc beta at an operating point of V_{CE} =8 V and I_C = 2 mA.
(b) Find the value of _ corresponding to this operating point.
(c) At V_{CE} = 8 V, find the corresponding value of I_{CEO}.
(d) Calculate the approximate value of I_{CBO} using the dc beta value obtained in part (a).

Q8. (a) Using the characteristics of Fig. 3.14a, determine I_{CEO} at V_{CE} = 10 V.
(b) Determine β_{dc} at I_B = 10 μA and V_{CE} = 10 V.
(c) Using the β_{dc} determined in part (b), calculate I_{CBO}.

Q9. (a) Using the characteristics of Fig. 3.14a, determine β_{dc} at I_B = 80 μA and V_{CE} = 5 V.
(b) Repeat part (a) at I_B = 5 μA and V_{CE} = 15 V.
(c) Repeat part (a) at I_B = 30 μA and V_{CE} = 10 V.
(d) Reviewing the results of parts (a) through (c), does the value of dc change from point to point on the characteristics? Where were the higher values found? Can you develop any general conclusions about the value of β_{dc} on a set of characteristics such as those provided in Fig. 3.14a?

Q10. (a) Using the characteristics of Fig. 3.14a, determine β_{ac} at I_B = 80 μA and V_{CE} = 5 V.
(b) Repeat part (a) at I_B = 5 μA and V_{CE} = 15 V.
(c) Repeat part (a) at I_B = 30 μA and V_{CE} = 10 V.
(d) Reviewing the results of parts (a) through (c), does the value of β_{ac} change from point to point on the characteristics? Where are the high values located? Can you develop any general conclusions about the value of β_{ac} on a set of collector characteristics?

Q11. Using the characteristics of Fig. 3.14a, determine dc at I_B = 25 μA and V_{CE} = 10 V. Then calculate α_{dc} and the resulting level of I_E. (Use the level of I_C determined by $I_C = \beta_{dc} I_B$.)
26. (a) Given that α_{dc} = 0.987, determine the corresponding value of β_{dc}.
(b) Given β_{dc} = 120, determine the corresponding value of α_{dc}.
(c) Given that β_{dc} =180 and I_C = 2.0 mA, find I_E and I_B.

Q12. (a) Given that α_{dc} = 0.987, determine the corresponding value of β_{dc}.
(b) Given β_{dc} = 120, determine the corresponding value of α_{dc}.
(c) Given that β_{dc} = 180 and I_C = 2.0 mA, find I_E and I_B.

Q13. Determine the region of operation for a transistor having the characteristics of Fig. 3.14 if I_{Cmax} = 7 mA, V_{CEmax} = 17 V, and P_{Cmax} = 40 mW.

Q14. Determine the region of operation for a transistor having the characteristics of Fig. 3.8 if I_{Cmax} = 6 mA, V_{CBmax} = 15 V, and P_{Cmax} = 30 mW.