KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS
MAIN CAMPUS

FIRST SEMESTER, 2019/2020 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN TELECOMMUNICATION , BACHELOR OF EDUCATION SCIENCE, BACHELOR OF SCIENCE IN COMPUTER FORENSICS,BACHELOR OF SCIENCE IN COMPUTER SCIENCE

PHYS 120: BASIC ELECTRONICS

STREAM: Y1S2 **TIME: 9:00-11:00AM**

EXAMINATION SESSION: SEP-DEC **DATE:4/12/2019**

INSTRUCTIONS TO CANDIDATES

1. **Answer Question 1 and any other two questions in the answer booklet provided.**
2. **Do not write on your question papers. All rough work should be done in your answer booklet.**
3. **Clearly indicate which question you are answering.**
4. **Write neatly and legibly.**
5. **Edit your work for language and grammar errors.**
6. **Follow all the instructions in the answer booklet**

SECTION A: (Compulsory) TOTAL MARKS FOR THIS SECTION IS 30.

Question 1 (30 marks)

a) Explain the difference between a PNP and an NPN transistor. [2]

b) Why are metals better conductors of electricity than semiconductors? [2]

c) You are given figure 1 below. Copy the diagram and label it to obtain

i. pnp transistor [2]

ii. npn transistor [2]

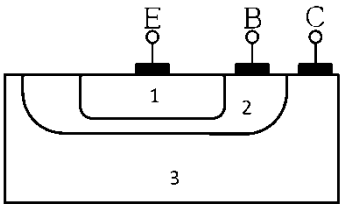


Figure 1

d) What is the source of the leakage current in a transistor? [1]

e) Give two examples for each of the following:

i) donor impurity. [2]

ii) acceptor impurity. [2]

f) Determine the diode current at 20°C for a silicon diode with I_s =0.1 A at a reverse-bias potential of 10 V. Take: Fundamental charge q = 1.6×10^{-19} C; Boltzmann's constant K_B = 1.38×10^{-23} J/K. [4]

g) Determine α_{DC} of a transistor if I_E 2.8 mA and I_B =20μA. [3]

h) Justify the following statements giving specific examples:

i. "Semiconductor devices can serve as source of power". [2]

ii. "Semiconductor based devices saves energy" [2]

i) In Figure 2, V_{in} = 12 Volts.

i. Give the name of the circuit. [1]

ii. Explain the operation of the circuit. [3]

iii. Find voltage across AB. [2]

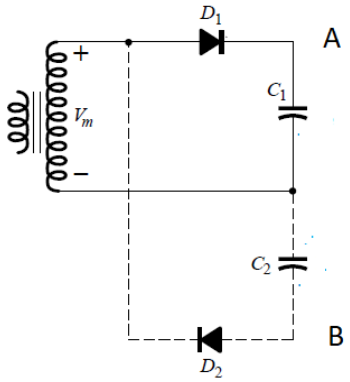


Figure 2

SECTION B. TOTAL MARKS FOR THIS SECTION IS 40.

ANSWER ANY TWO QUESTIONS FROM THIS SECTION. EACH QUESTION IN THIS SECTION CARRIES 20 MARKS.

Question 2 (20 marks)

a) Draw the 2D structure illustrating boding Ge and explain why it is an insulator at 0K. [5]

b) Describe the difference between *n*-type and *p*-type semiconductor materials. [6]

a) Draw a voltage regular circuit and explain its operation. [6]

b) Determine *ID*, and *Vo*for the circuit of Fig. 3. Take the threshold of silicon to be 0.6 V. [3]

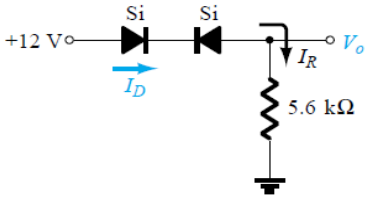


Figure 3

Question 3 (20 marks)

a) Using the characteristics of Fig. 4: Find

i. The value of I_C corresponding to V_{BE}=750 mV an d V_{CE}= 5 V. [2]

ii. The value of V_{CE} and V_{BE} corresponding to I_C =3 mA and I_B =30 μA. [2]

iii. The dc beta at an operating point of V_{CE}= 8 V and *IC* =2 mA. [3]

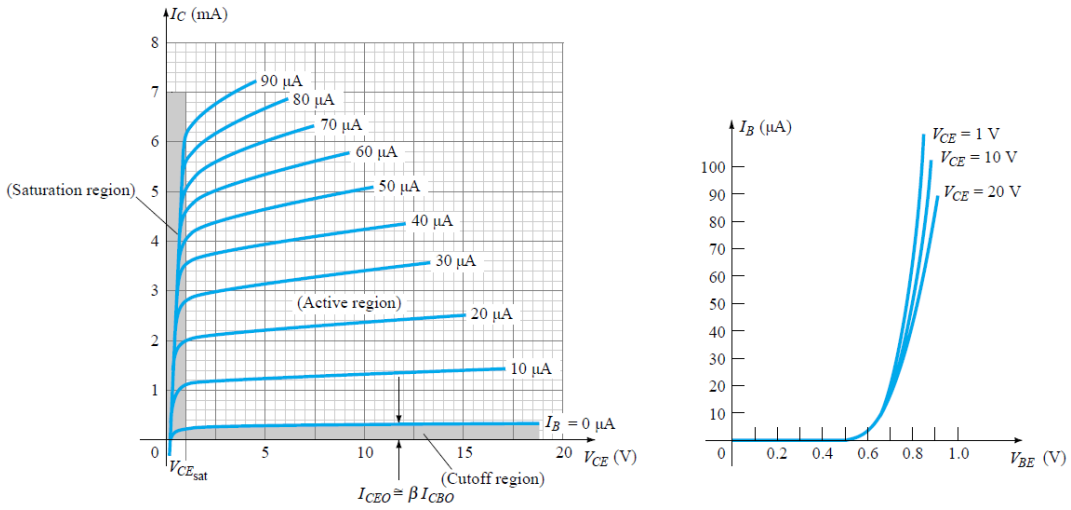


Figure 4

b) Explain the desired bias condition for the three labeled operating points in Figure 4. [6]

c) Determine the Q point for the circuit below (Figure 5): [7]

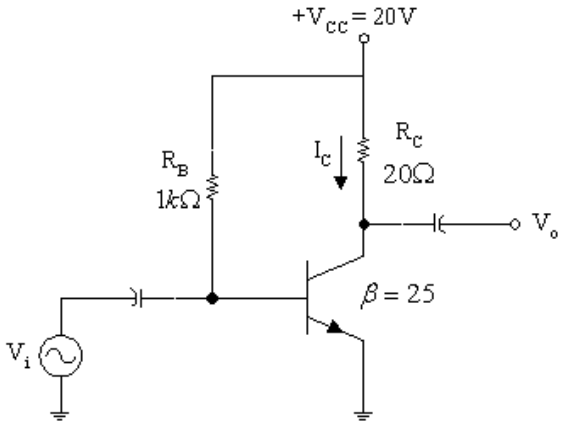


Figure 5

Question 4 (20 marks)

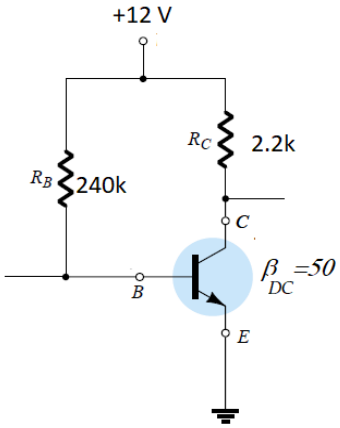
a) Define the Q point of of a transistor circuit. [2]

b) Explain factors which affect the Q point of a transistor circuit. [4]

c) A Fixed Bias circuit is presented in Figure 6.

i. Show that the bias method is unstable. [5]

ii. Draw its load line and mark the Q-point. (Take VBE=7 V). [9]



Question 5 (20 marks)

a) Draw a well-biased circuit –n channel JFET and sketch the transfer curve defined by I_{DSS} =12 mA and V_P= 6 V. [8]

b) Use transistor equations to draw similarities between JFET and BJT [6]

c) Derive the voltage gain of an amplifier with feedback. [6]