UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BMT 1043
COURSE	: ELECTRONICS
SEMESTER/SESSION	: 1-2022/2023
DURATION	: 3 HOURS

Instructions:

1. This booklet contains 4 questions. Answer **ALL** the questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 7 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) Answer the following questions:

i. List **two (2)** types of charge carriers. (2 marks)

ii. Describe the meaning of doping process. (2 marks)

iii. List **two (2)** types of semiconductor (2 marks)

b) Describe the concept of ideal diode in forward bias and reverse bias with the help of diagrams. (3 marks)

c) A silicon diode is connected in DC series configuration as shown in Figure 1. Determine:

i. The current ***I*** (3.5 marks)

ii. The voltage at V_1 (1.5 marks)

iii. The voltage at V_2 (1.5 marks)

iv. The voltage at V_o (1.5 marks)

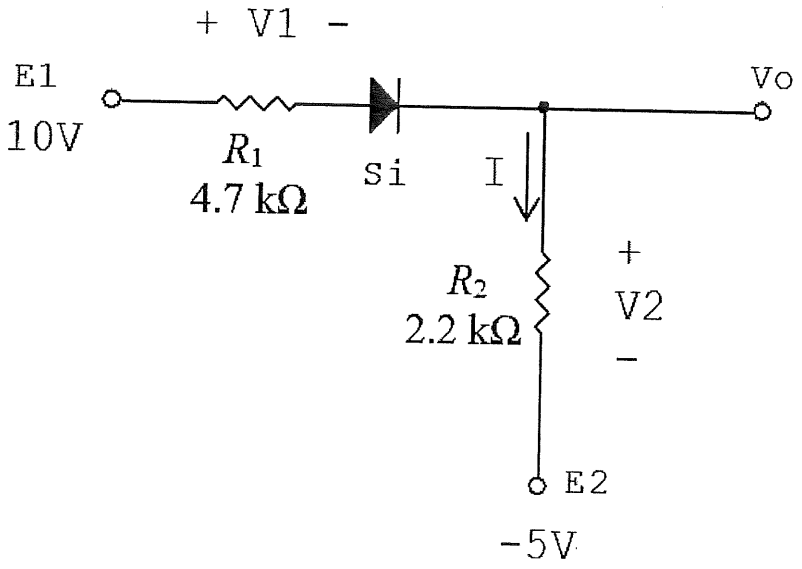

Figure 1

QUESTION 2

a) The silicon diode used in Figure 2 has the following characteristics:

$$I_D = I_S (e^{V_D/\mu V_T} - 1)$$

Using the concept of load line where I_S = 50 nA, V_T = 26 mV and μ = 2

i. Compute the value of the quiescent current and voltage, I_{DQ} and V_{DQ}. (Using graph paper) (10 marks)

ii. If V_S is reduced to 6 V, state the new value of R if I_{DQ} is to remain unchanged. (2 marks)

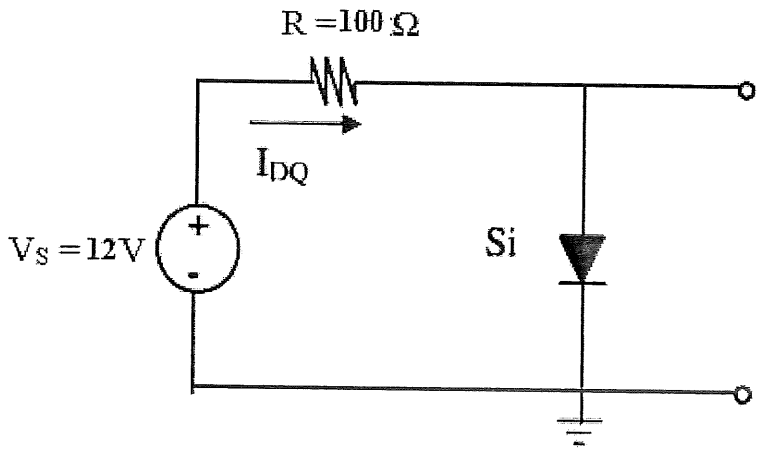

Figure 2

b) Figure 3 shows the major parts of a power supply unit.

i. Describe the operation of the rectifier and filter circuit. (3 marks)

ii. Draw the output waveform at point A, B, C, and D. (4 marks)

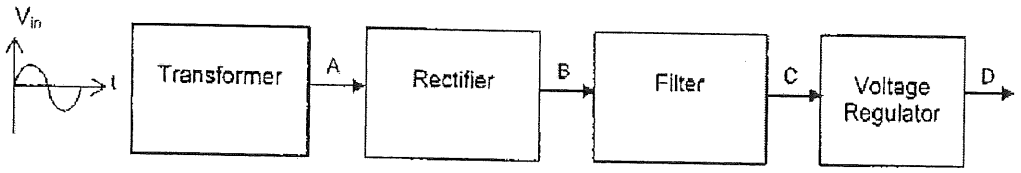

Figure 3

c) Answer the following questions:

i. State **three (3)** types of transistor configuration. (3 marks)

ii. Based on your answer in **(i)**, explain each of them by using appropriate figure. (6 marks)

d) For the circuit shown in Figure 4, given, β_{ac} **= 120**. Answer all the followings:

i. Solve the **Q**-point (I_{CQ} and V_{CEQ}). (5 marks)

ii. Compute the base voltage, V_B and emitter voltage, V_E. (4 marks)

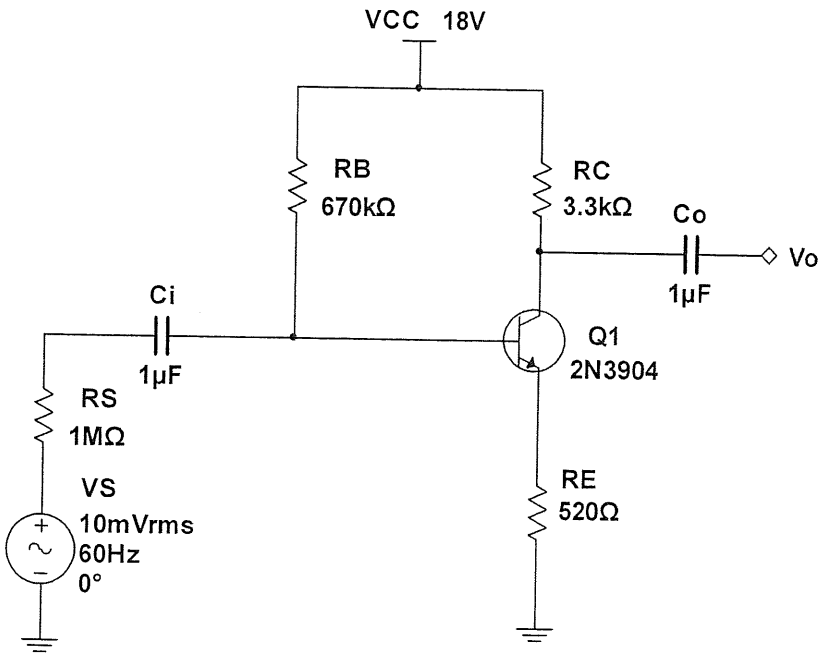

Figure 4

QUESTION 3

a) Express **three (3)** operation modes available for bipolar junction transistor **(BJT)**.

(3 marks)

b) For the circuit in Figure 5, answer all the following :

i. Find the value for Beta, **β** (3 marks)

ii. Determine the voltage supply, **Vcc** (2 marks)

iii. Determine the Base resistor, R_B (3 marks)

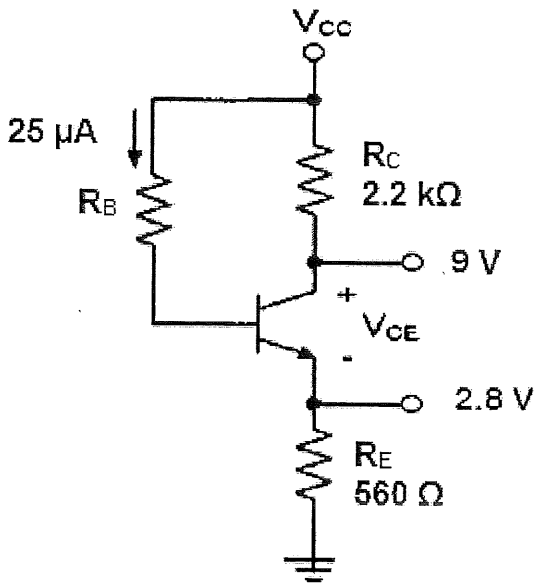

Figure 5

c) Figure 6 shows a collector characteristic curve for the Q-point operation for the **voltage-divider network**.

i. Find the Q-point (I_{CQ} and V_{CEQ}). (2 marks)

ii. Determine the value of R_C and R_E. Assume $R_C = 3R_E$. (3 marks)

iii. Calculate the value of V_E and V_B. (3 marks)

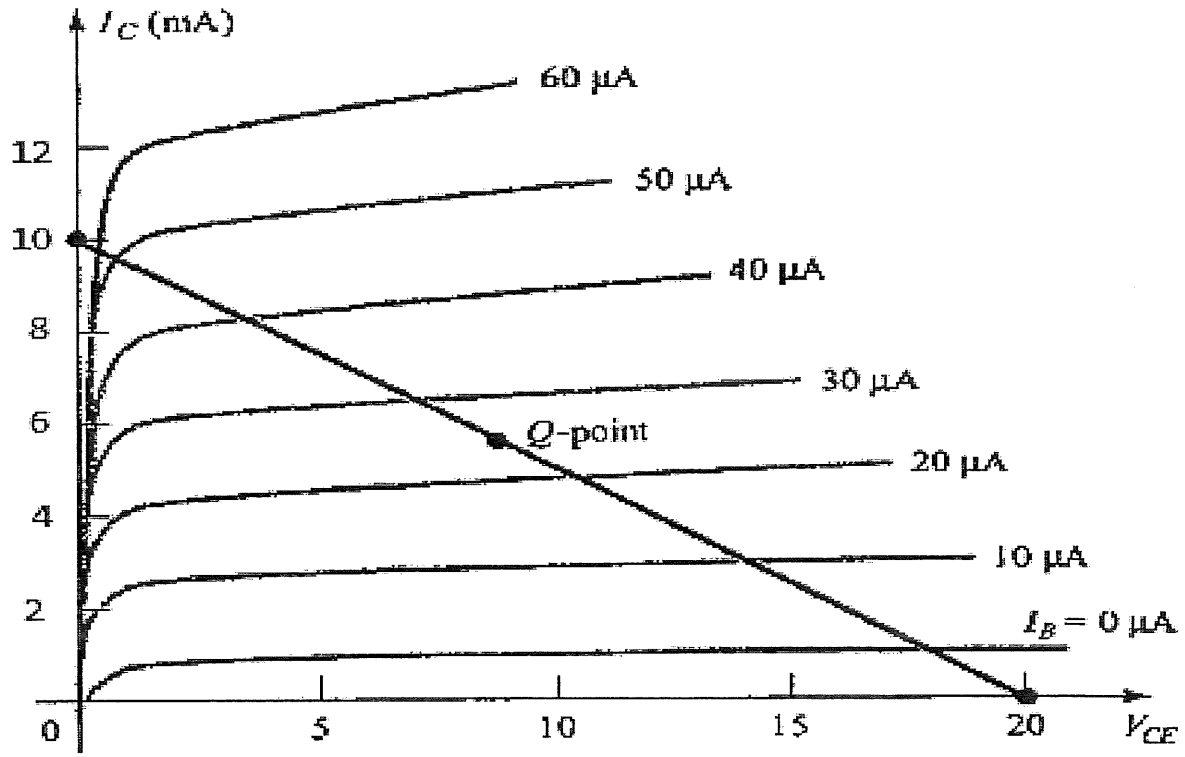

Figure 6

QUESTION 4

a) In the operation of bipolar junction transistor, there are three transistor currents which are I_E, I_C and I_B.

i. Define which of current is always the largest and which one is the smallest. (2 marks)

ii. State which two currents are relatively close in magnitude. (2 marks)

b) Answer the following questions:

i. Describe the term dc beta (β) and dc alpha (α). (2 marks)

ii. Describe the relationship between α and β. (2 marks)

c) Refer to the voltage divider system of Figure 7. Given **β = 110**.

i. Compute the **Q**-point (I_{CQ} and V_{CEQ}) (6 marks)

ii. Compute base voltage, V_B and emitter voltage, V_E. (4 marks)

iii. Find the value of r_e. (2 marks)

iv. Draw the ac equivalent circuit for the network of Figure 7. (3 marks)

v. Analyze the voltage gain, $A_V = V_{out}/V_{in}$. (4 marks)

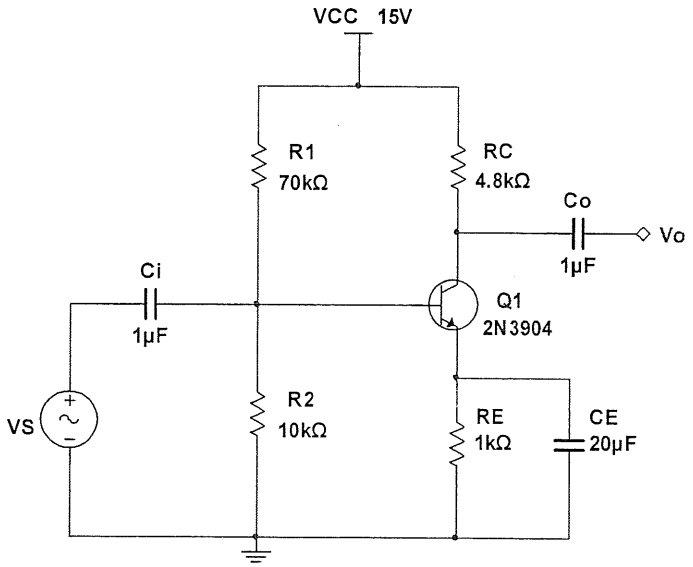

Figure 7

----------End of question----------