Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	ANALOG ELECTRONICS
COURSE CODE	:	BEJ10503/BEL10203/BEV10503
PROGRAMME CODE	:	BEJ/BEV
EXAMINATION DATE	:	JULY 2022
DURATION	:	3 HOURS
INSTRUCTION	1.	ANSWER ALL QUESTIONS
	2.	THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSED BOOK.**
	3.	STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 The Zener regulator circuit in **Figure Q1** has the following values: $R_L = 0.22\ k\Omega$, Zener voltage, $V_Z = 8$ V and the maximum power rating of the Zener diode is 400 mW. In order to maintain this regulator circuit with load voltage, V_L at 8 V and not exceed the maximum power rating of the Zener diode; determine the:

(a) minimum input voltage, $V_{i\,min}$

(6 marks)

(b) maximum input voltage, $V_{i\,max}$

(9 marks)

Q2 (a) The emitter-stabilized bias circuit has the output characteristics as shown in **Figure Q2(a)**. The circuit is biased at $I_{CQ} = 6$ mA and $V_{CEQ} = 10$ V.

(i) From the graph, determine I_{BQ}, I_{EQ}, $I_{C(sat)}$, $V_{CE(cutoff)}$, V_{CC} and beta (β).

(7 marks)

(ii) Hence, use the values in **part Q2(a)(i)** to calculate V_E, R_B, and R_C. Assume $V_{BE} = 0.7$ V.

(6 marks)

(b) **Figure Q2(b)** shows a BJT amplifier with $\beta = 120$ and $V_{BE} = 0.7$ V.

(i) Calculate current, I_B, I_C and I_E and output voltage, V_{CE} for the circuit using exact analysis.

(8 marks)

(ii) Sketch the midband AC equivalent circuit using r_e model.

(3 marks)

(iii) Determine the input impedance, Zi, output impedance, Zo, voltage gain, A_V and current gain, A_i for the obtained answer in part **Q2(b)(ii)**.

(6 marks)

Q3 Based on the FET amplifier circuit shown in **Figure Q3**,

(a) name the transistor and its configuration.

(3 marks)

(b) plot the transfer characteristics of the transistor.

(6 marks)

(c) determine V_{GSQ} and I_{DQ} using the graphical approach. (Given the I_{DSS} = 9mA, V_p = -4.5V, rd = ∞ and g_m = 2.4 mS.)

(12 marks)

(d) skecth the AC small-signal equivalent circuit of the FET amplifier circuit.

(3 marks)

(e) calculate the input impedance, Z_i, output impedance, Z_o and voltage gain, A_v.

(6 marks)

Q4 (a) Capacitive impedance changes with frequency. Therefore, the effect of the capacitors in an amplifier circuit must be considered for the whole frequency region of operation.

(i) Describe how capacitances affect the gain of a BJT amplifier during the low, mid, and high frequency regions.

(6 marks)

(ii) For the common emitter amplifier circuit in **Figure Q4(a)**, determine the low cut-off frequency for each coupling and bypass capacitor. Next, determine the dominant low cut-off frequency of the circuit. (Assume β = 150, and r_e = 22.7 Ω.)

(7 mark)

(b) There are different ways to describe amplifiers. For instance, they can be described by their class of operation, by their inter-stage coupling, or by their frequency range.

(i) Explain **THREE (3)** classes of amplifier operation.

(3 marks)

(ii) Calculate the maximum efficiency, η for the class B push-pull amplifier shown in **Figure Q4(b)**.

(5 marks)

(iii) Crossover distortion is seen as a problem arising from a class B push-pull amplifier. Elaborate the concept of the crossover distortion by using any appropriate illustration and labels.

(4 marks)

- END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER / SESSION : SEM II 2021/2022
COURSE NAME: ANALOG ELECTRONICS

PROGRAMME CODE : BEJ/BEV
COURSE CODE: BEJ10503/BEL10203/BEV10503

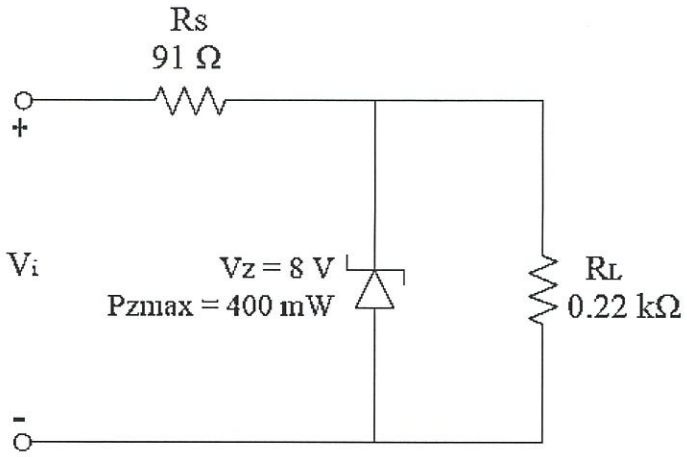

Figure Q1

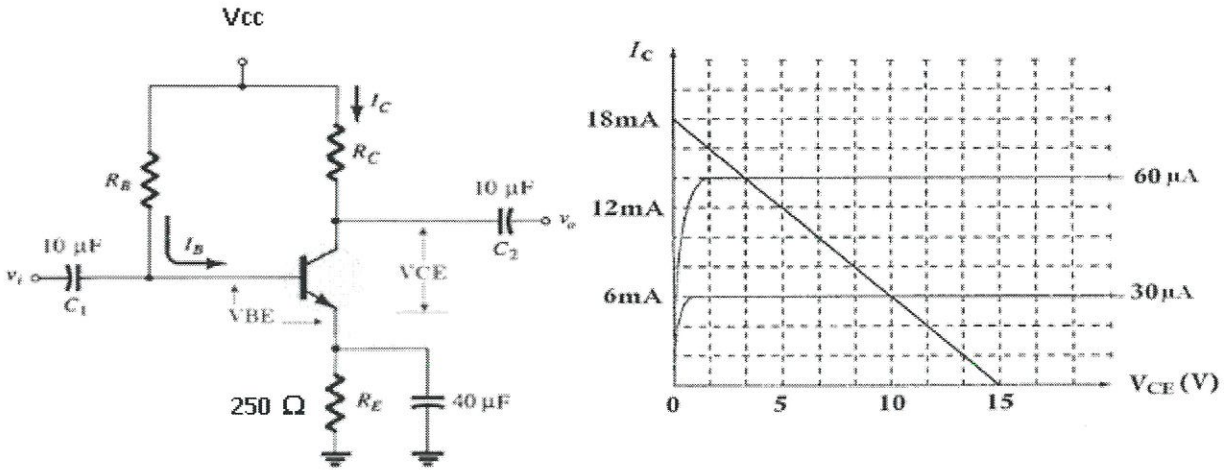

Figure Q2(a)

FINAL EXAMINATION

SEMESTER / SESSION : SEM II 2021/2022
COURSE NAME: ANALOG ELECTRONICS

PROGRAMME CODE : BEJ/BEV
COURSE CODE: BEJ10503/BEL10203/BEV10503

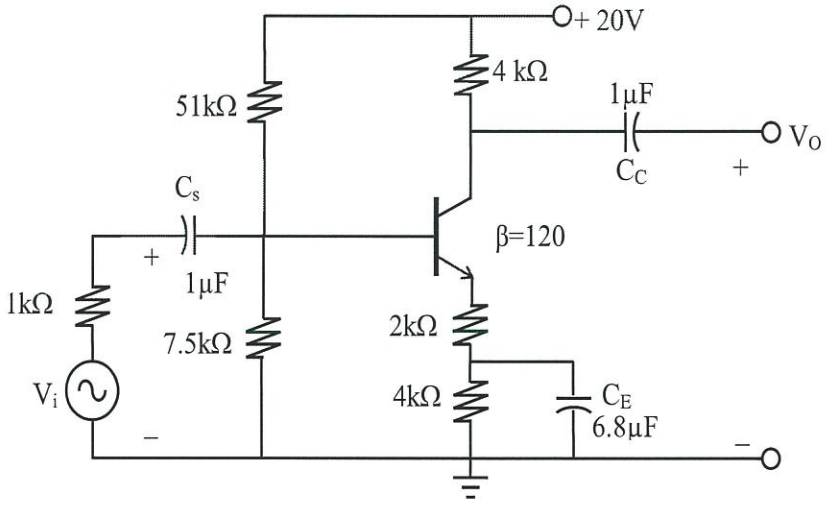

Figure Q2(b)

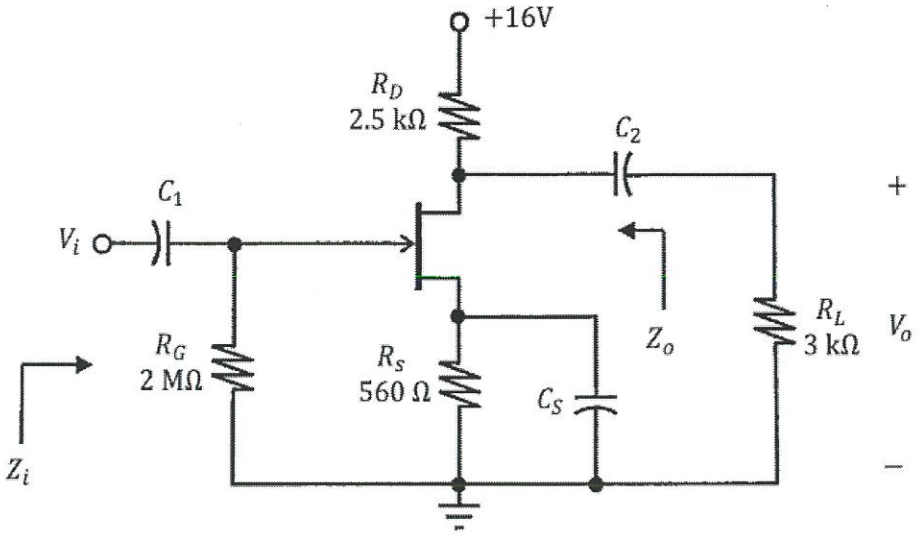

Figure Q3

FINAL EXAMINATION

SEMESTER / SESSION : SEM II 2021/2022
COURSE NAME: ANALOG ELECTRONICS

PROGRAMME CODE : BEJ/BEV
COURSE CODE: BEJ10503/BEL10203/BEV10503

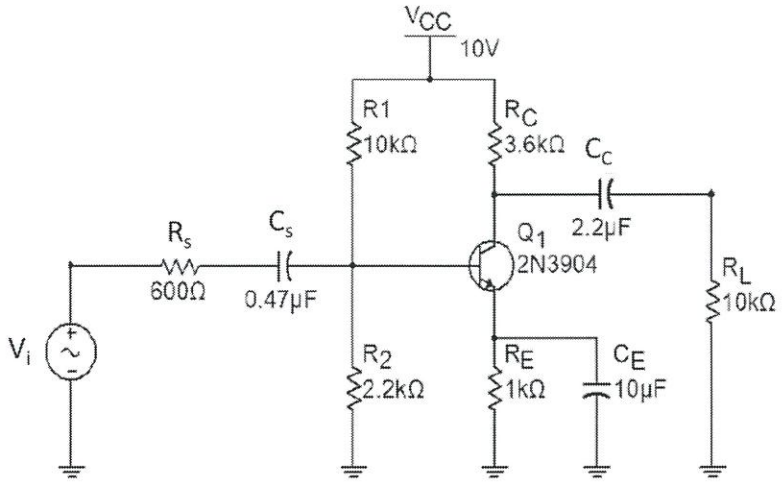

Figure Q4(a)

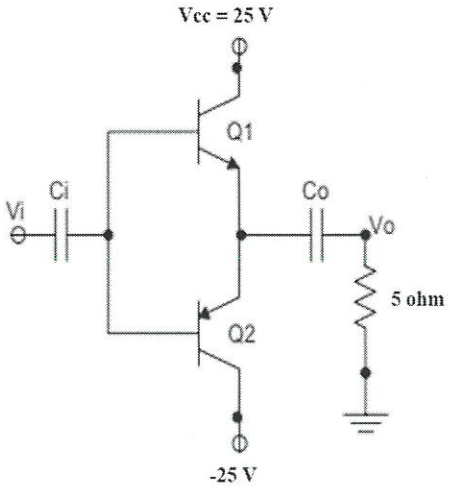

Figure Q4(b)