



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : ANALOG ELECTRONICS
COURSE CODE : BEJ 10503/BEL 10203
PROGRAMME CODE : BEJ/BEV
EXAMINATION DATE : DECEMBER 2019/JANUARY 2020
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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

- Q1** (a) In your own words, define an intrinsic material. (1 mark)
- (b) Describe the difference between majority and minority carriers in an n-type material. (2 marks)
- (c) Determine the range of input voltage, V_i that will maintain the load voltage, V_L at 8 V and not exceed the maximum power rating of the Zener diode in **Figure Q1(c)**. Show your calculations to support your answers. (12 marks)

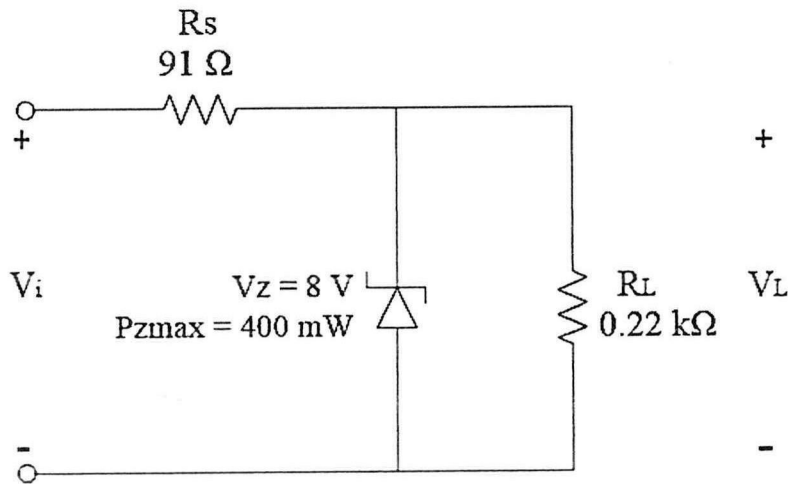


Figure Q1(c)

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

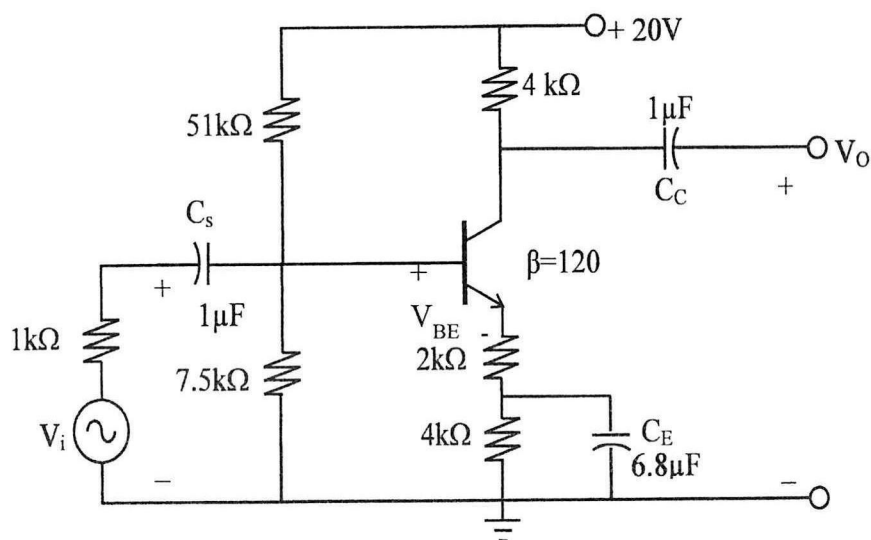


Figure Q2(a)

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- (a) (i) Calculate current, I_B , I_C and I_E and output voltage, V_{CE} for the circuit using exact analysis. (10 marks)
- (ii) Draw the midband AC equivalent circuit using r_e model. (3 marks)
- (iii) Determine the input impedance, Z_i , output impedance, Z_o , voltage gain, A_V and current gain, A_i for the obtained answer in part Q2(a)(ii). (10 marks)
- (b) State the drawback of r_e model. (2 marks)

Q3 (a) Based on the amplifier circuit shown in Figure Q3(a),

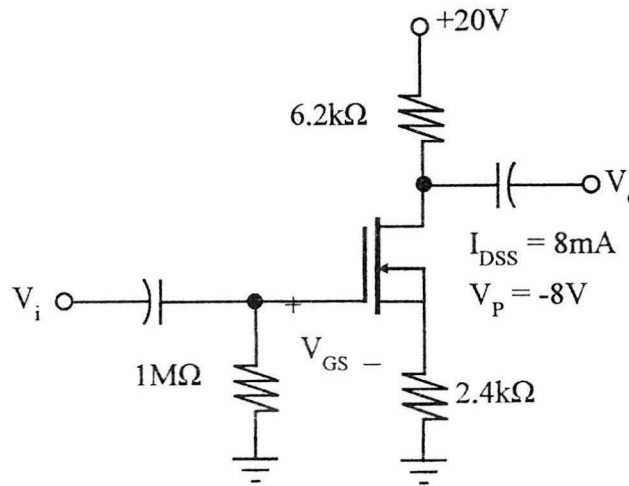


Figure Q3(a)

- (i) name the transistor and its configuration. (2 marks)
- (ii) plot the transfer characteristics of the transistor. (3 marks)

(b) Figure Q3(b) shows an FET amplifier circuit.

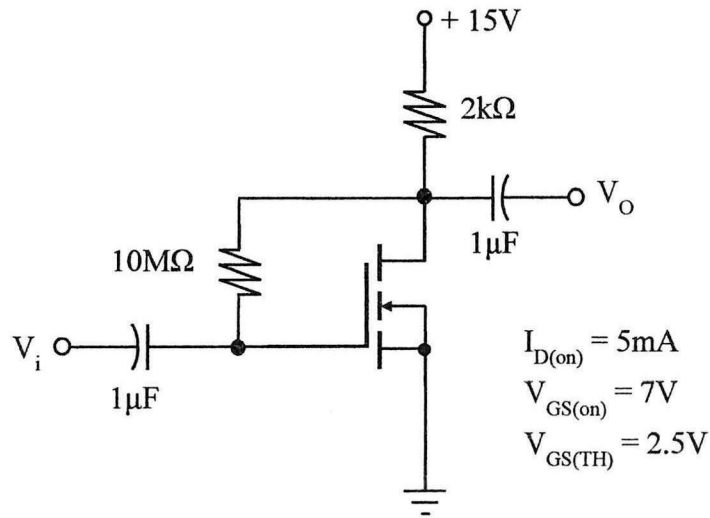


Figure Q3(b)

- (i) Determine the I_{DQ} , V_{GSQ} and V_{DSQ} . Show all the calculations. (8 marks)
- (ii) Draw the small-signal equivalent circuit of the circuit. Given $r_d = 50\text{k}\Omega$. (2 marks)
- (iii) Calculate the transconductance, g_m . (1 mark)
- (iv) Calculate the input impedance, Z_{in} and the output impedance, Z_{out} . (for both with and without r_d) (7 marks)
- (v) Calculate the voltage gain, A_V . (for both with and without r_d) (2 marks)

Q4 (a) Figure Q4(a) is an amplifier circuit that only amplifies the signals of specified frequencies. Assume that the BJT transistor has an infinite value of AC collector resistance, r_o (or r_c) with $r_e = 28.48 \Omega$ and $A_v = -72.91$,

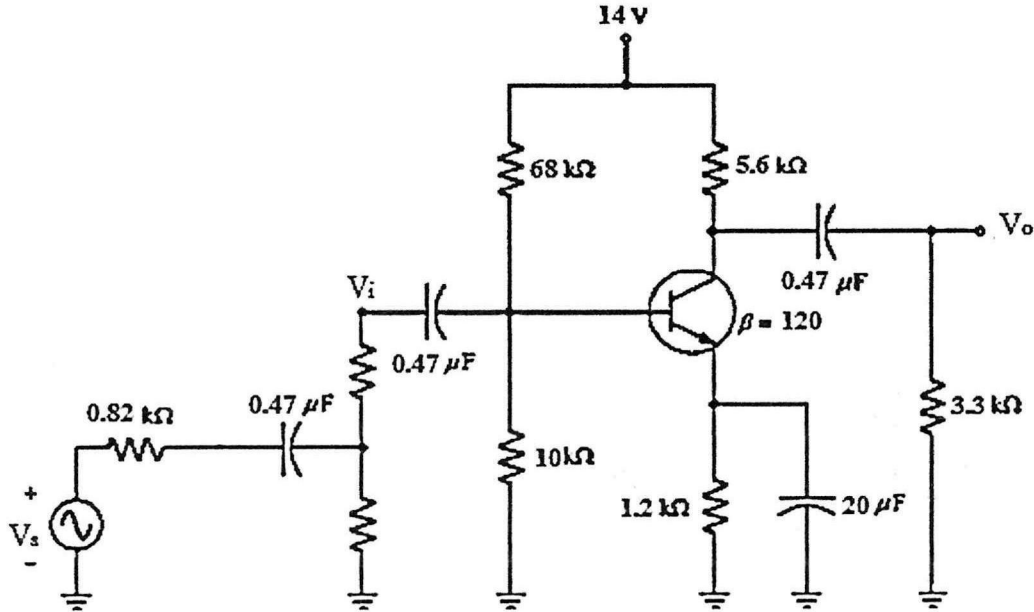


Figure Q4(a)

- (i) determine the low cut-off frequencies f_{LC} , f_{LS} and f_{LE} . (12 marks)
 - (ii) state the dominant low cut-off frequency, f_L . (1 mark)
 - (iii) sketch the frequency response. (3 marks)
- (b) Power amplifier is the part of audio electronics. A power amplifier circuit is used to drive the loads like speakers with minimum output impedance.
- (i) Draw the basic block diagram of a practical power amplifier. (4 marks)
 - (ii) Differentiate between voltage amplifier and power amplifier. (2 marks)
 - (iii) Determine the input power, output power and circuit efficiency of a class B amplifier providing a 20 V peak signal to a 16Ω load and a power supply of $V_{cc} = 30 \text{ V}$. (10 marks)

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- (iv) A crossover distortion occurs in Class B power amplifier when the signal changes or “crosses-over” from one transistor to the other at the zero voltage point. Suggest the modifications of the Class B power amplifier circuit to overcome crossover distortion.

(3 marks)

- END OF QUESTIONS -

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