Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(TAKE-HOME)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	ELECTRONIC CIRCUITS ANALYSIS AND DESIGN
COURSE CODE	:	BEJ 30403
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	JULY 2021
DURATION	:	4 HOURS
INSTRUCTION	:	ANSWERS **ALL** QUESTIONS. **OPEN BOOK EXAMINATION** PLEASE UPLOAD YOUR ANSWER IN PDF FORM TO AUTHOR (UTHM LMS) WITHIN THE SPECIFIED TIME GIVEN.

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Explain **TWO (2)** main characteristics of operational amplifier.

(4 marks)

(b) Calculate the output voltage, V_o for the circuit in **Figure Q1(b)** given that $V_{D1} = 2$ V.

(6 marks)

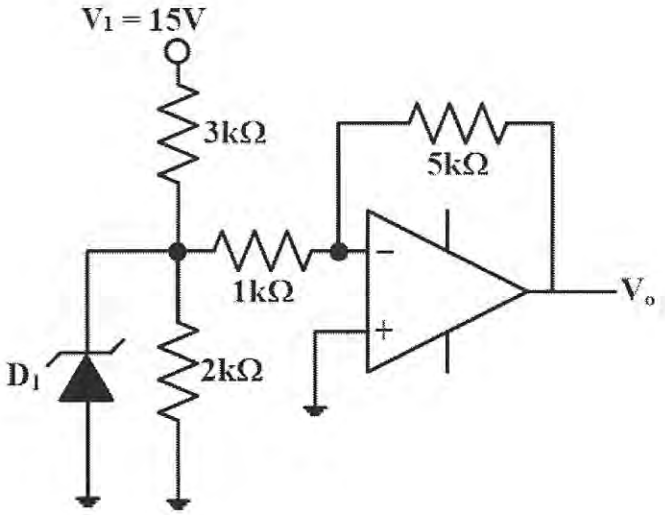

Figure Q1(b)

(c) The values of both V_1 and V_{D1} in **Figure Q1(b)** are changed to $V_1 = 12$ V and $V_{D1} = 4$ V, find the new output voltage, V_o.

(6 marks)

(d) Analyse **TWO (2)** factors that made the comparator is less suitable for system that involves noisy signal.

(4 marks)

Q2 Filter is an important system in most of the electronic applications. It is normally used to eliminate noise and maintain the integrity of transmitted signal.

(a) Differentiate between Butterworth, Chebychev and Bessel response of a filter.

(6 marks)

(b) A differentiator circuit has the values of $R_1 = 5$ kΩ, $R_2 = 10$ kΩ and $C = 0.02$ μF.

(i) Draw the circuit and label accordingly.

(2 marks)

(ii) Derive the transfer function.

(6 marks)

(iii) Prove that the differentiator circuit is actually a high pass filter.

(4 marks)

(iv) Determine the cut off frequency.

(2 marks)

Q3 An amplifier circuit shown in **Figure Q3** has the following characteristic: voltage gain, $A = 100$, input impedance $Z_i = 100$ kΩ, input impedance $Z_o = 1$ kΩ, and gain-bandwidth product $AB = 5000$.

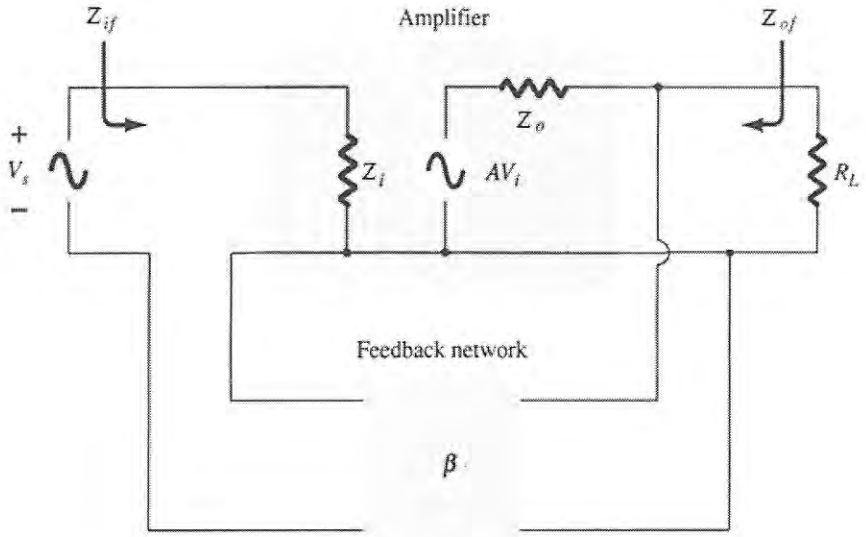

Figure Q3

(a) Explain **THREE (3)** immediate improvements when employing negative feedback in an amplifier circuit.

(6 marks)

(b) Analyse **Figure Q3** to determine the feedback topology and amplifier type of the circuit.

(2 marks)

(c) Given the feedback factor, $\beta = 0.1$, calculate:

(i) the voltage gain with feedback, A_f

(3 marks)

(ii) the input impedance with feedback, Z_{if}

(3 marks)

(iii) the output impedance, Z_{of}

(3 marks)

(iv) the gain-bandwidth product with feedback, A_fB_f

(3 marks)

Q4 (a) By assuming all the diodes in **Figure Q4(a)** are ideal,

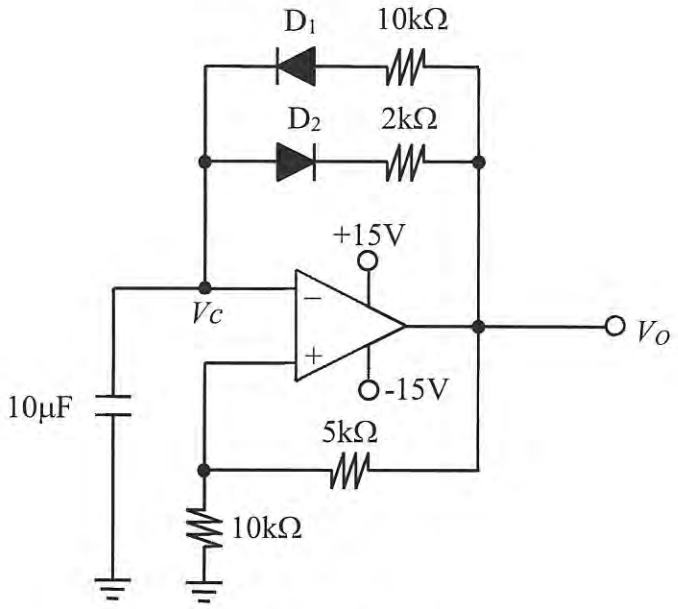

Figure Q4(a)

(i) Analyse the frequency of the output waveform, V_O.

(7 marks)

(ii) Illustrate the output waveform, V_O and the voltage of the capacitor, V_C. Draw both waveforms parallel at x-axis and show clearly the relationship between these two waveforms. Also clearly label the waveforms.

(6 marks)

(b) Design a circuit using 555 timer that will produce an output as shown in **Figure Q4(b)**. Show the complete circuitry with labels. Use a capacitor value of 0.01μF.

(7 marks)

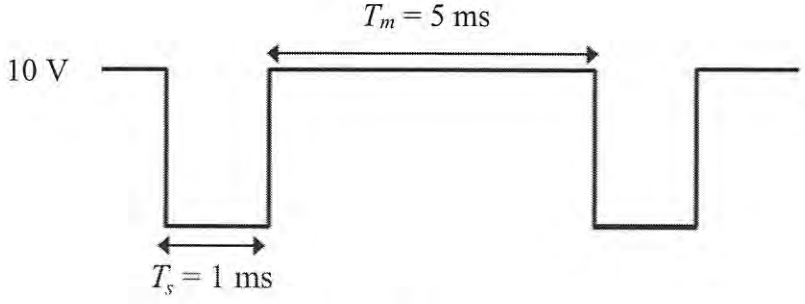

Figure Q4(b)

Q5 (a) Examine the voltage regulator circuit in **Figure Q5** to find the value for the resistors R_S and R_1, such that the regulated output voltage is at 20 V and I_{Lmax} = 50 mA. Also determine the power rating for the transistor to be used in the circuit. For the Zener diode, V_Z = 5 V and I_Z = 10 mA when V_i = 50 V.

(8 marks)

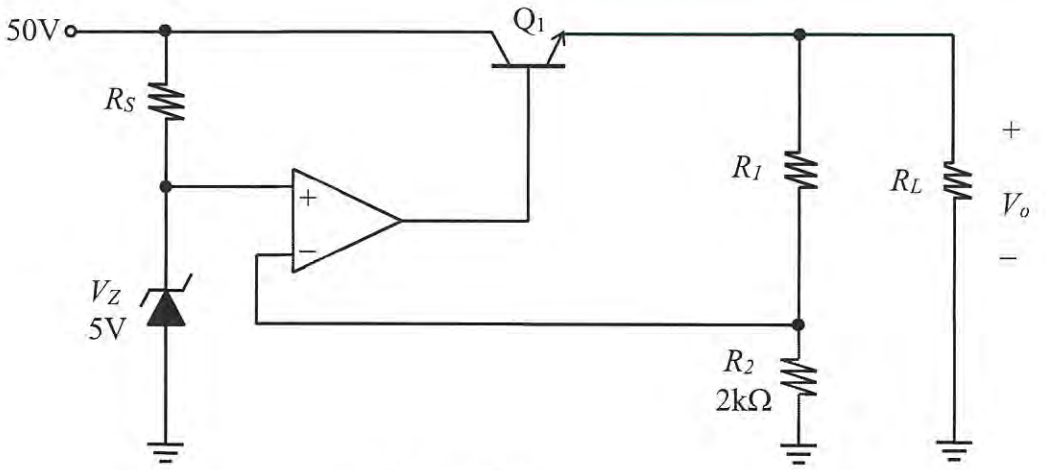

Figure Q5

(b) Calculate the minimum value of the load resistance (R_L) in **Figure Q5**. Explain what will happen if a load with a resistance value less than the $R_{L(min)}$ is used in the circuit.

(4 marks)

(c) Relate how the circuit in **Figure Q5** works as a voltage regulator if the output voltage is slightly dropped below the regulated output value.

(4 marks)

(d) Modify the circuit in **Figure Q5**, such that it will have a current limiter to protect the circuit in case of a short circuit and describe how the new circuit works.

(4 marks)

- END OF QUESTIONS -