UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2010/2011

COURSE	: ELECTRONIC DEVICES AND APPLICATION
COURSE CODE	: BEE 2273 / BEX 21003
PROGRAMME	: BACHELOR OF ELECTRICAL ENGINEERING WITH HONOURS
EXAMINATION DATE	: APRIL / MEI 2010
DURATION	: 3 HOURS
INSTRUCTION	: ANSWER **FIVE (5)** QUESTIONS ONLY.

THIS PAPER CONSISTS OF NINE (9) PAGES

Q1 (a) Explain how the ideal model of operational amplifier is derived from its practical model, finite gain model. Provide a diagram if necessary.

(5 marks)

(b) As the name suggested, operational amplifier is used to perform mathematical operation. **Figure Q1(i)** shows one of the applications of operational-amplifier. The input waveforms of V_1 (CH1) and V_2 (CH2) are shown in **Figure Q1(ii).**

(i) Determine the expression of output, V_O in terms of V_1 and V_2.

(6 marks)

(ii) Based on the answer in part b (i), name the operation performs by this circuit.

(1 marks)

(iii) Based on the inputs given, draw the output waveform generated from this circuit if the resistor, R is equal to 1 kΩ. Show all the steps involved.

(8 marks)

Q2 (a) The circuit in **Figure Q2(a),** is an amplifier utilizing a negative feedback. For this circuit:

(i) State the type of amplifier and negative feedback topology used.

(2 marks)

(ii) Obtain the equation for the feedback network, (ß) and the overall gain, (A_F) of the amplifier.

(8 marks)

(b) A system without feedback has a passband gain of 60 dB, and high cutoff frequency of 75 kHz.

(i) Calculate the midband gain if the system is added with a feedback network with feedback factor, ß = 0.01. Also determine the new cutoff frequency.

(5 marks)

(ii) Sketch the frequency response for both systems and explain how negative feedback can improve the frequency response of an amplifier.

(5 marks)

Q3 (a) An oscillator must fulfilled Barkhausen Criterion in order to sustain the oscillation. Explain the Barkhausen Criterion and how will the oscillator circuit's performance be affected if the loop gain fall below 1, or goes much above 1.

(5 marks)

(b) Two operational amplifiers (Op-Amp) are used in the circuit of **Figure Q3(b)**. Both Op-Amps are powered by ±15V. Based on the figure:

(i) Calculate the frequency of oscillation and find the value of R_F to obtain V_{01} and draw the output waveform obtained at V_{01}.

(10 marks)

(ii) State the name of the second Op-Amp circuit. Draw the output waveform V_{02} and clearly label it.

(5 marks)

Q4 (a) Design a free-running multivibrator using 555 timer IC to produce a 40 kHz square wave with a duty cycle of 80%. Use capacitor of 0.22nF.

(10 marks)

(b) The circuit in **Figure Q4(b)** is used to produce an input pulse train for the 555 timer circuit that you had designed in part (a).

(i) Draw and clearly label the output waveform, V_O of the **Figure Q4(b).**

(5 marks)

(ii) The output, V_O from the circuit in **Figure Q4(b)** is now connected to pin 4 (active low reset pin) of the 555 timer in part (a). With the same time base, illustrate the output waveform of the 555 timer when it receives the input pulse train at pin 4.

(5 marks)

Q5 (a) Describe **TWO (2)** differences between a linear regulator and a switching regulator.

(4 marks)

(b) A power supply circuit using a bridge rectifier and a filter capacitor produces a DC output voltage of 14 V on which 2 V_{p-p} ripples are allowed. This circuit feeds a load of 150 Ω and is fed from a line voltage of 120 V_{rms}, 60 Hz through a transformer. The diodes available have 0.7 V drop when conducting.

(i) Sketch the DC power supply circuit and draw the output waveform across the load.

(6 marks)

(ii) What is the rms voltage across the transformer secondary?

(4 marks)

(iii) What is the value of the filter capacitor?

(4 marks)

(iv) What is the maximum peak inverse voltage (PIV) expected across each diode?

(2marks)

Q6 (a) **Figure Q6(a)** is a Zener follower regulator.

(i) Calculate the output voltage and current across the load R_L.

(5 marks)

(ii) Calculate the transistor power dissipation.

(5 marks)

(b) A circuit illustrated in **Figure Q6(b)** is used as an input to another system. The value of R_1 is 10 kΩ and V_Z is 3.3 V. The input signal V_{in} (t) is sinusoidal waveform with frequency of 1 kHz and 10 V peak-to peak.

(i) Explain the operation of this circuit.

(4 marks)

(ii) Draw the input and output waveforms of this circuit. Please label the diagram.

(6 marks)

Q7 (a) With the help of waveform diagram, explain briefly the differential between Class A, Class B, Class AB, and Class C amplifiers.

(6 marks)

(b) **Figure Q7(b)** is a power amplifier.

(i) Find the voltage (V_B) at the base of each transistor.

(4 marks)

(ii) Calculate average power delivered to the load when a maximum signal is applied without any distortion at the output. Also calculate the power taken from the supply and the efficiency of amplifier. A standard Silicon-based diode and transistors are used.
(10 marks)

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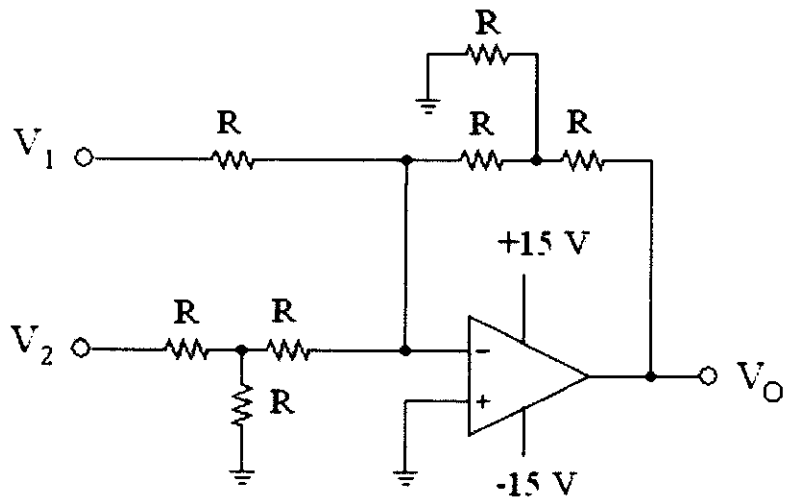

Figure Q1(i)

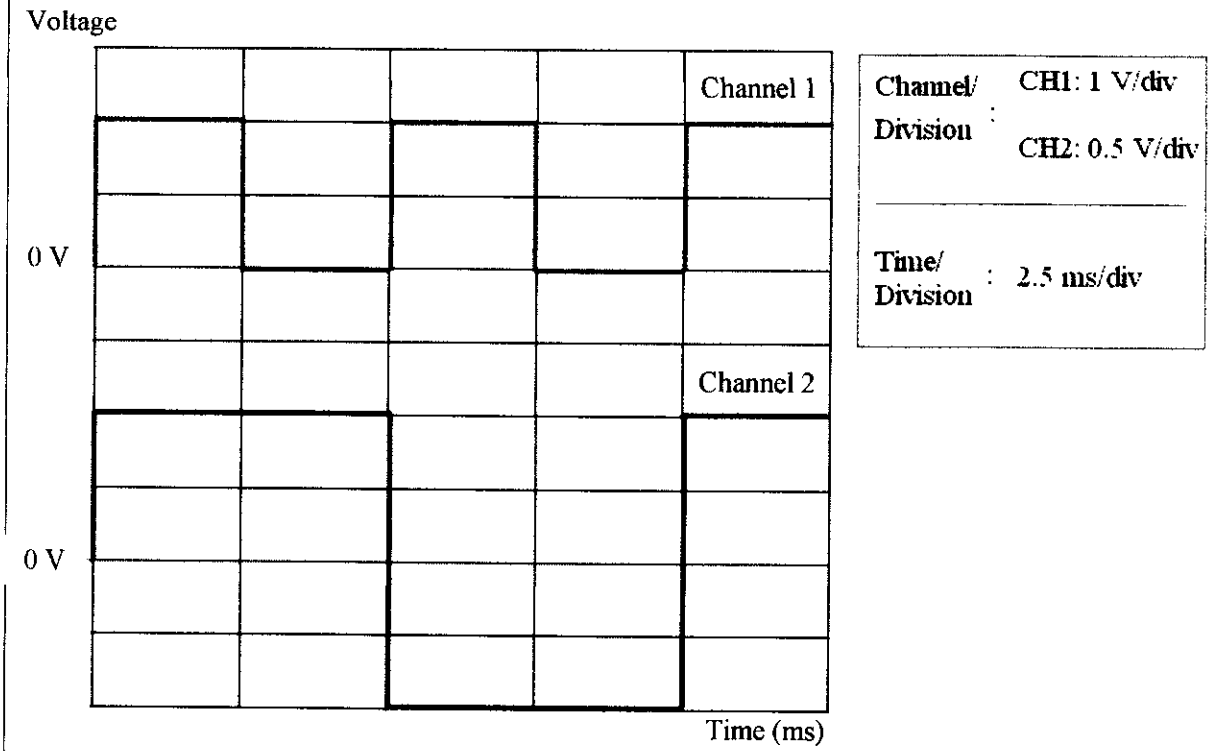

Figure Q1(ii)

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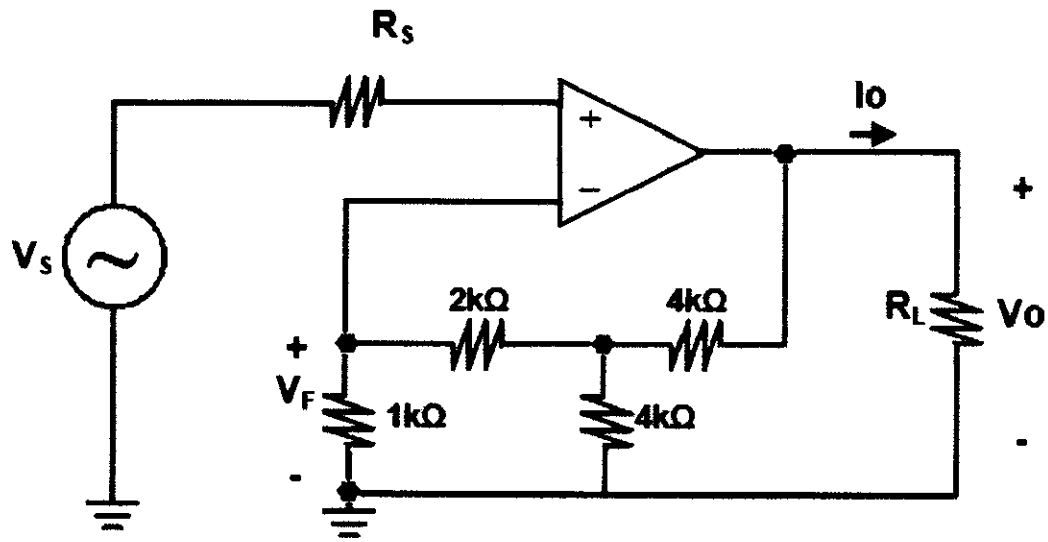

Figure Q2(a)

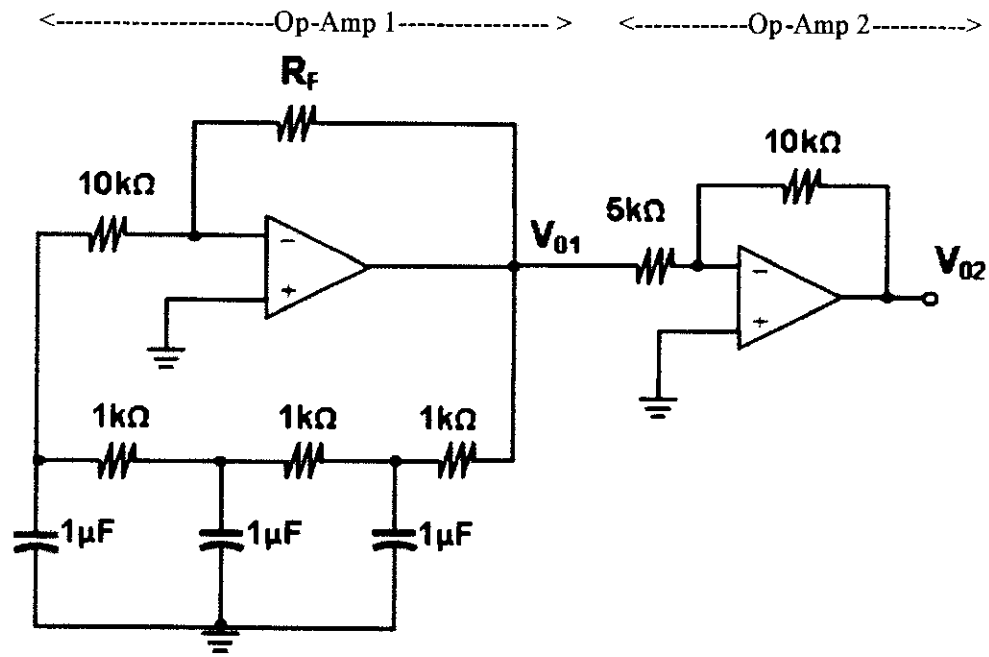

Figure Q3(b)

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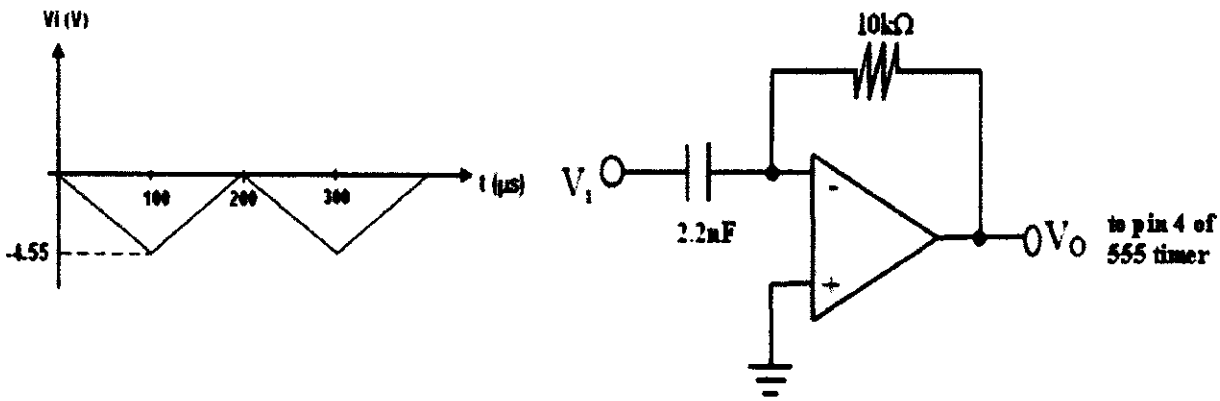

Figure Q4(b)

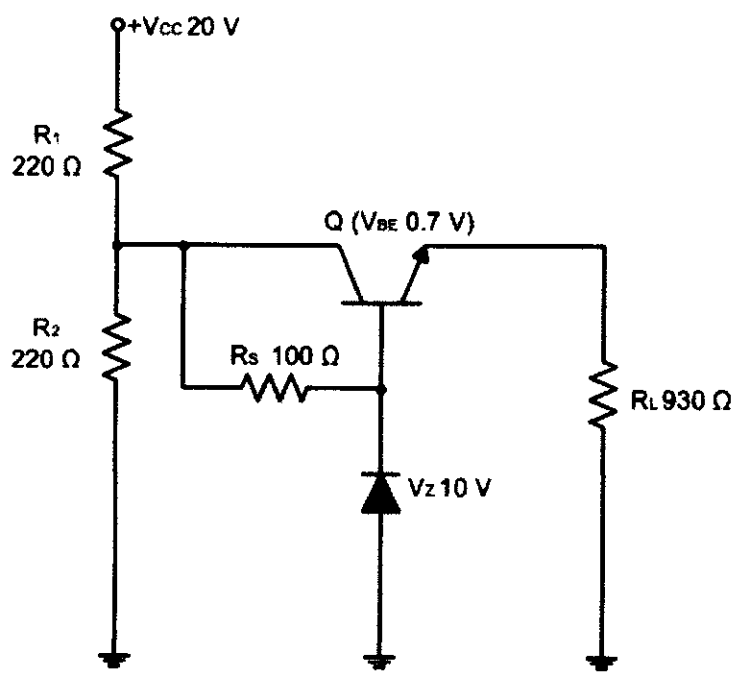

Figure Q6(a)

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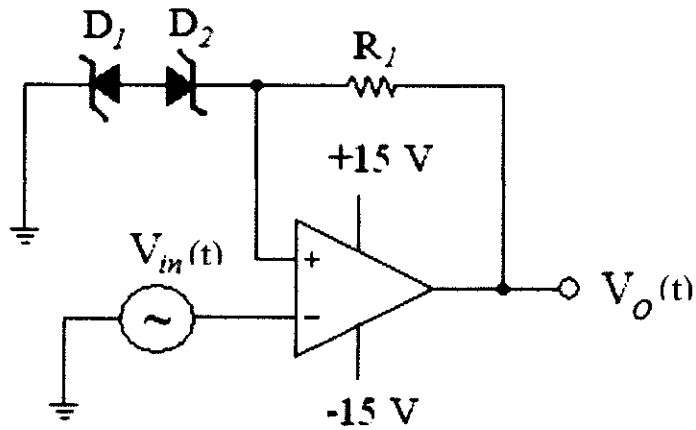

Figure Q6(b)

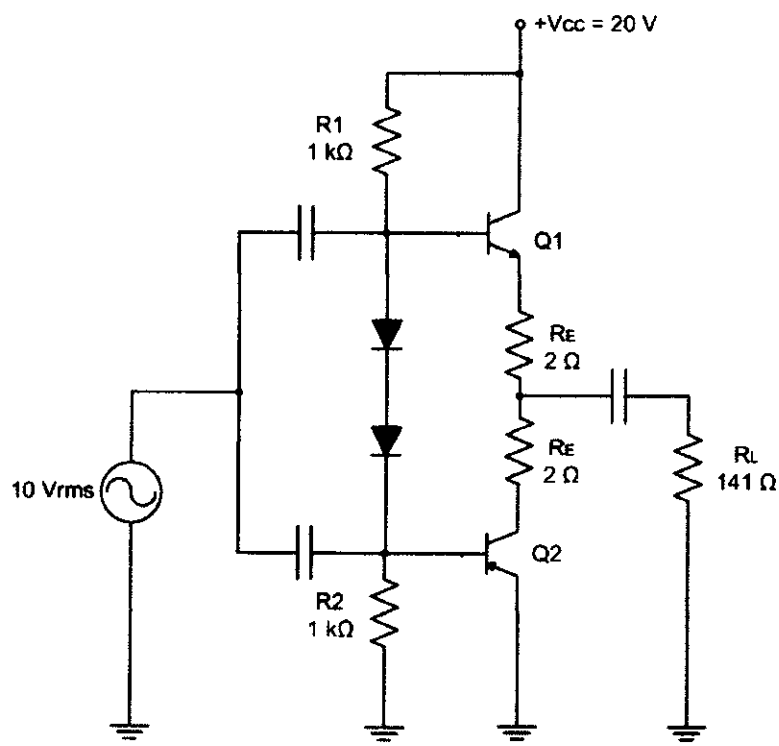

Figure Q7(b)