UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2009/2010

SUBJECT NAME	:	ELECTRONIC DEVICES AND APPLICATIONS
SUBJECT CODE	:	BEE 2273
COURSE	:	2 BEE
EXAMINATION DATE	:	NOVEMBER 2009
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY.

THIS PAPER CONSISTS OF **10** PAGES

Q1 (a) The circuit in Figure Q1(a) has been designed to implement a certain relationship between the input and output. Draw the waveform of V_{01}, V_{02} and V_{03} based on the given input, V_i. Assume all Op-Amps are ideal and powered by a +20V and -20V power supply.

(14 marks)

(b) An oscillator circuit in Figure Q1(b) will maintain its oscillation when $A\beta = 1$.

(i) Find R_2 if oscillation frequency, $f_o = 10kHz$.

(3 marks)

(ii) If $\beta = 1/3$, find the relationship between R_a and R_b so that this circuit will continuously oscillates.

(3 marks)

Q2 (a) For the circuit in Figure Q2(a), derive the expressions for the voltage gains, $A_1 = \upsilon_{01} / \upsilon_{in}$ and $A_2 = \upsilon_{02} / \upsilon_{in}$.

(6 marks)

(b) Using Table 1 below, design a filter circuit as in Figure Q2(b), including workable component values that would produce a 4th order Butterworth low pass filter with 4 kHz cutoff frequency. Use the equal components design approach. Choose all capacitors values as 10nF and $R_A = 10k\Omega$.

Table 1: Values for the Butterworth Response

ORDER	ROLL-OFF DB/DECADE	1st STAGE			2nd STAGE			3rd STAGE		
		POLES	DF	R_B/R_A	POLES	DF	R_B/R_A	POLES	DF	R_B/R_A
1	-20	1	Optional							
2	-40	2	1.414	0.586						
3	-60	2	1.00	1	1	1.00	1			
4	-80	2	1.848	0.152	2	0.765	1.235			
5	-100	2	1.00	1	2	1.618	0.382	1	0.618	1.382
6	-120	2	1.932	0.068	2	1.414	0.586	2	0.518	1.482

(14 marks)

Q3 (a) Figure Q3(a) is a block diagram of an amplifier with a negative feedback network has the properties as: input impedance with feedback, $Z_{if} = 1k\Omega$, output impedance with feedback, $Z_{Of} = 200k\Omega$, output impedance without feedback, $Z_O = 10k\Omega$, gain with feedback, $A_f = 20$, $\omega_{Lf} = 10^3$ rad/s and $\omega_{Hf} = 10^6$ rad/s.

(i) State the disadvantage of using negative feedback and discuss how the negative feedback can improve the frequency response of an amplifier.

(3 marks)

(ii) Determine the input impedance without feedback, Z_i, gain without feedback, A, feedback network, β, lower cutoff frequency without feedback, f_L and higher cutoff frequency without feedback, f_H.

(8 marks)

(iii) Sketch the frequency response for both conditions, with and without negative feedback. Compare the bandwidth values.

(5 marks)

(b) (i) Figure Q3(b) shows the oscillator circuit with L_1 = 125mH, L_2 = 0.125mH and C = 0.01F. Determine the feedback gain, β and the amplifier gain, A during the oscillation.

(4 marks)

Q4 (a) Draw a block diagram of a regulated DC power supply, which is to be powered from the 240 volt, 50 Hz mains supply, explain the function of each part of the block diagram, and sketch the waveforms at every stage of the diagram.

(10 marks)

(b) The circuit in Figure Q4(b) will ON the LEDs separately based on the output from the comparator. Assume the voltage drop across each LED is 2V whenever it is ON.

(i) Explain the operation of the circuit.

(6 marks)

(ii) Fill in the table given with ON or OFF conditions for both RED and GREEN LEDs.

(2 marks)

(iii) Determine the current through each of 470Ω resistors when the LED is ON.

(2 marks)

Q5 (a) Refer to Figure Q5(a),

(i) draw and completely label the output V_X, V_{C1}, V_Y and V_{C2}. Show all the calculations. All waveforms must be drawn in their parallel time axes.

(10 marks)

(ii) differentiate between Astable and Monostable Multivibrator.

(2 marks)

(b) Refer to circuit in Figure Q5(b),

(i) find $\beta = V_f / V_o$ and overall gain, V_o / V_s.

(ii) state the type of amplifier and feedback topology used.

(8 marks)

Q6 Design a simple DC power supply circuit consisting of a transformer (N_p: 1), a bridge rectifier and a capacitor as filter with the following specifications:

Output current, I_{dc} – 0.1 A
Average voltage to the load = 15V
Ripple voltage, V_r(p-p) = 0.4 V
Forward diode voltage , V_{diode} = 0.7 V
Mains supply = 110 V, 60 Hz

(a) Draw and label the DC power supply circuit.

(4 marks)

(b) Sketch the output waveforms with values; the peak voltage, V_o(p), the output voltage, V_{dc} and ripple voltage, V_r (p-p).

(4 marks)

(c) Determine:

(i) the required transformer turns ratio.

(5 marks)

(ii) the filter capacitor value.

(3 marks)

(iii) the output of the power supply designed in Q6(a) if a voltage regulator shown in Figure Q6(c) is connected to the output of the DC power supply filter circuit.

(1½ marks)

(iv) briefly explain what will happen if the output of this voltage regulator increases.

(2½ marks)

Q7 Class A Power Amplifier is shown in Figure Q7

(a) Find the Quiscent points (Q-points) of the amplifier. Hence, draw its DC Loadline and AC Loadline.

(16 marks)

(b) Calculate the power delivered to the load R_L and the efficiency.

(4 marks)

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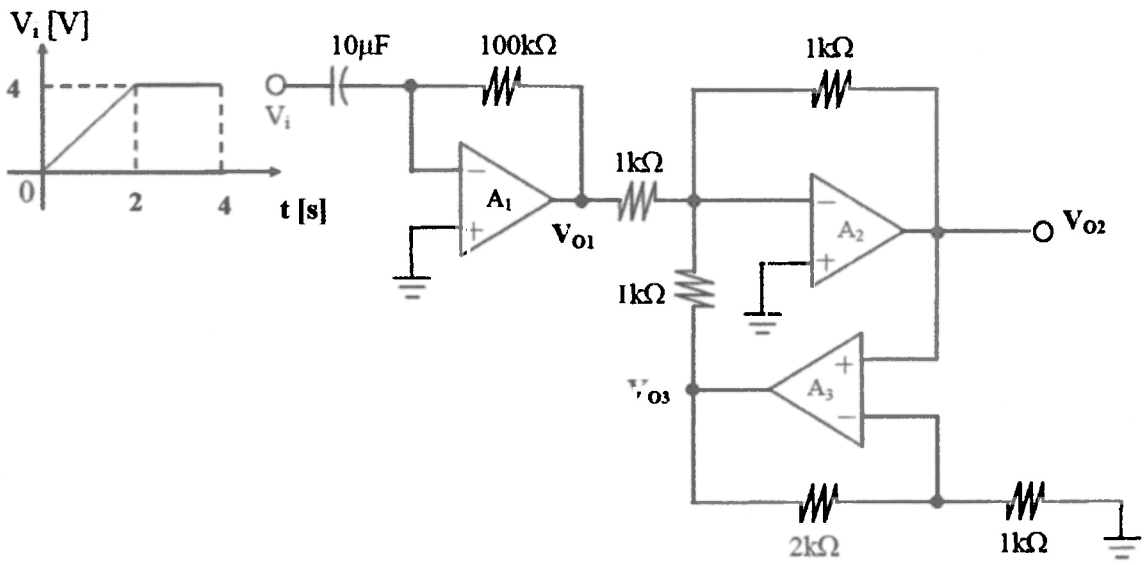

Figure Q1(a)

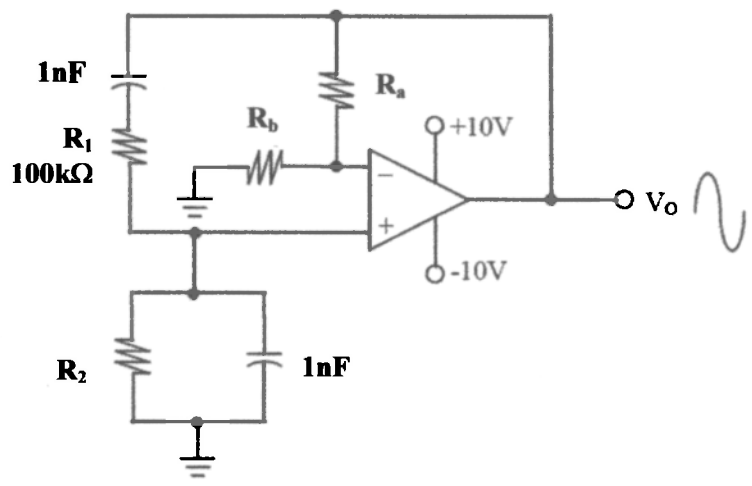

Figure Q1(b)

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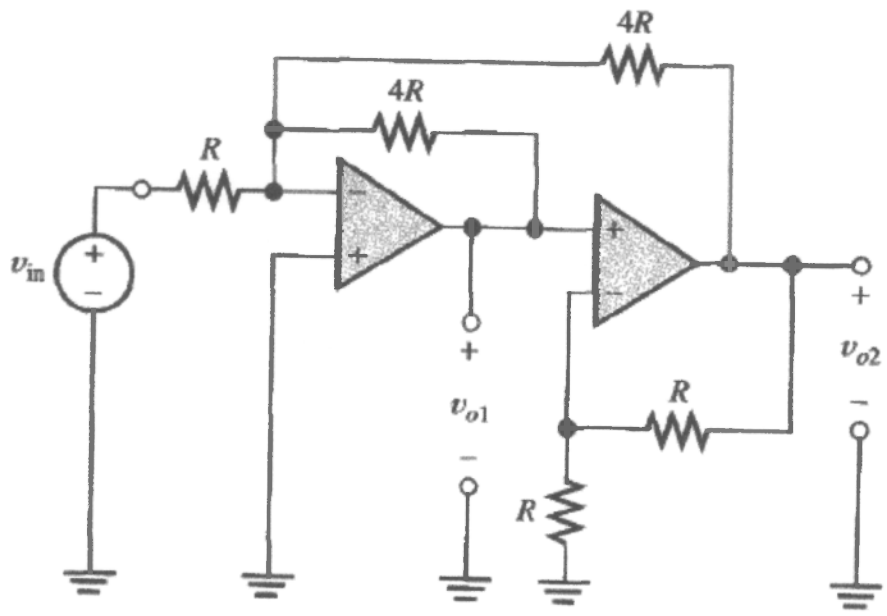

Figure O2(a)

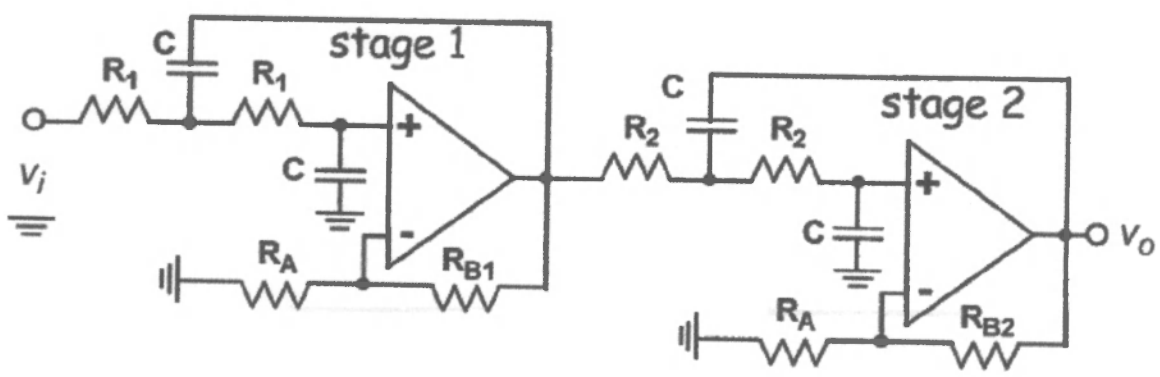

Figure O2(b)

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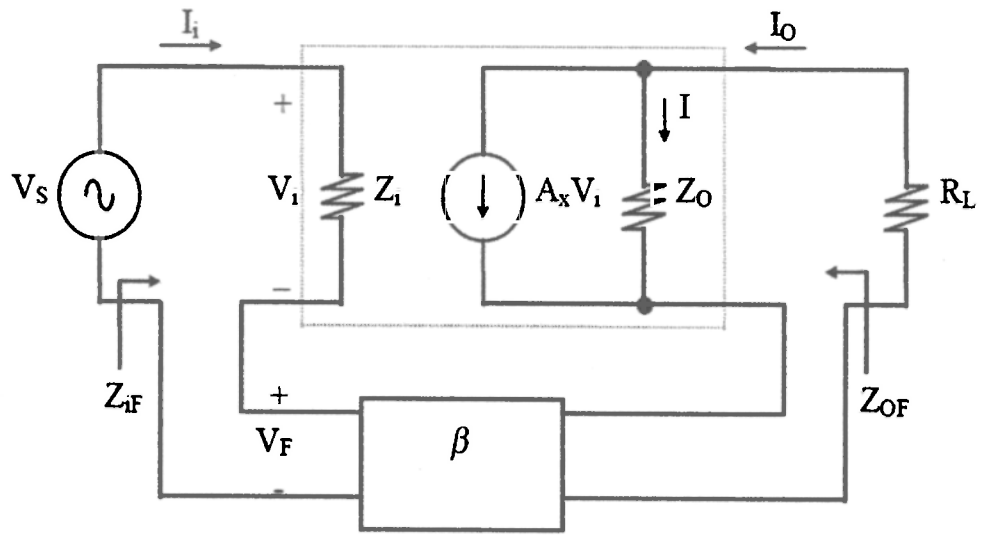

Figure O3(a)

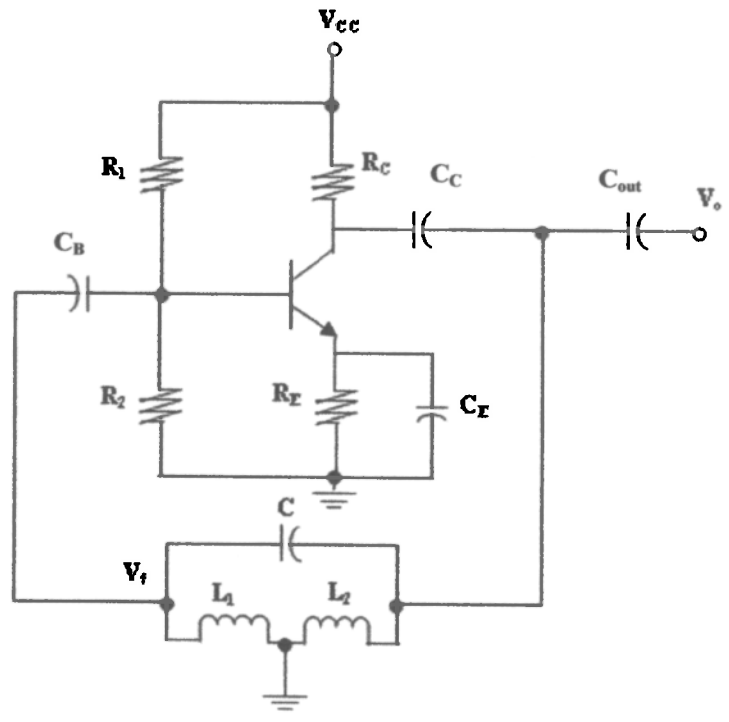

Figure O3(b)

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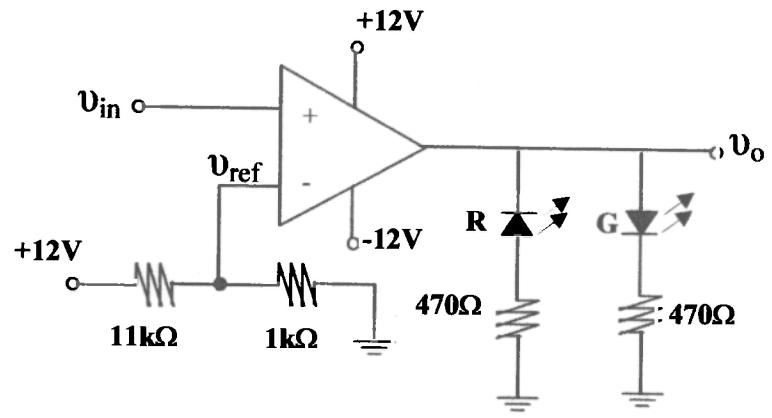

υ_{in}	RED	GREEN
0.5V		
1.5V		

Figure Q4(b)

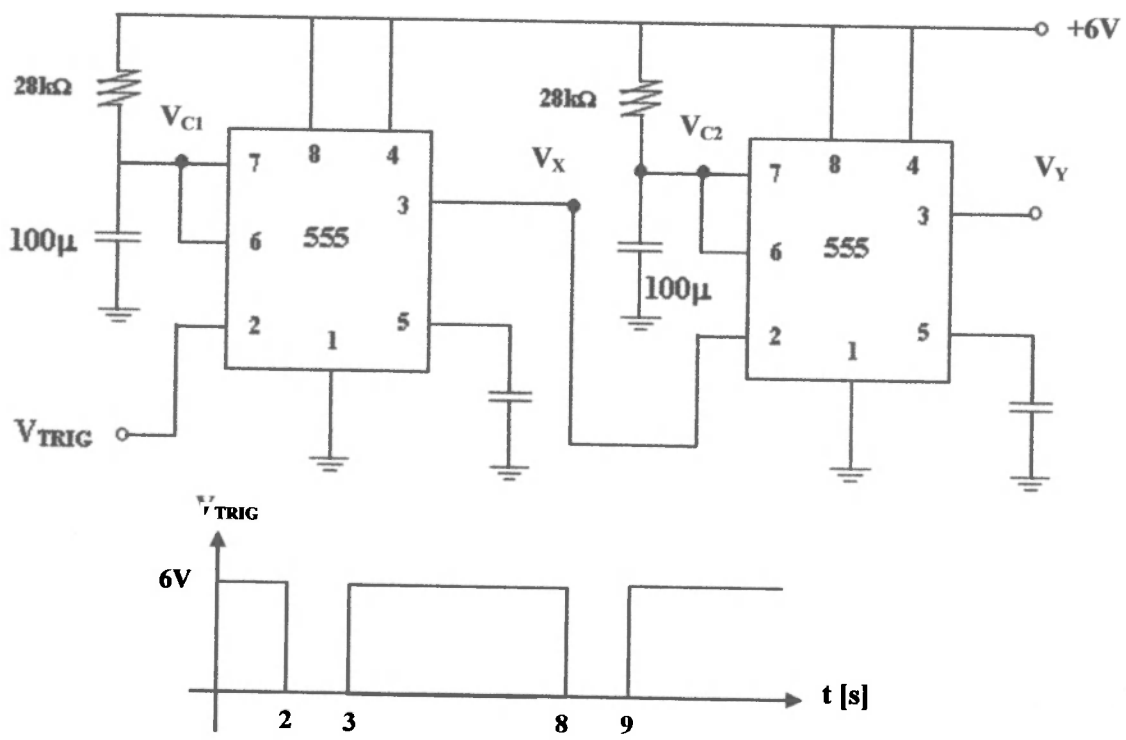

Figure Q5(a)

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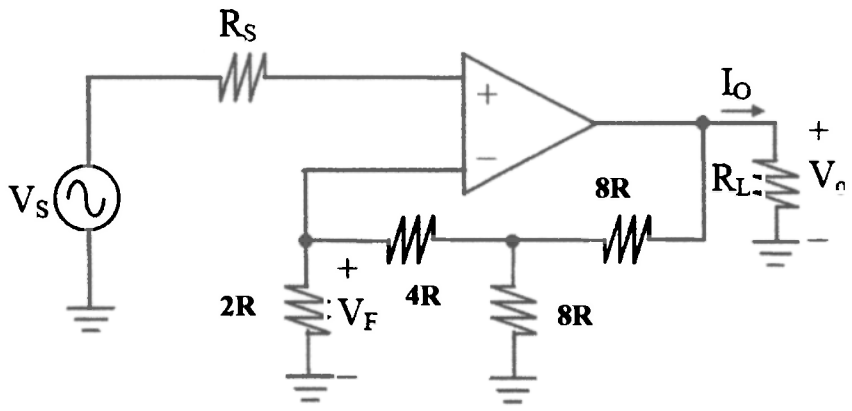

Figure Q5(b)

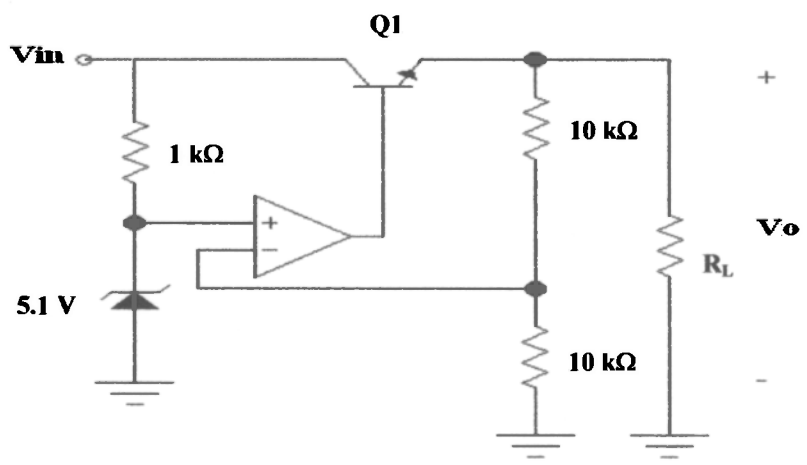

Figure Q6(c)

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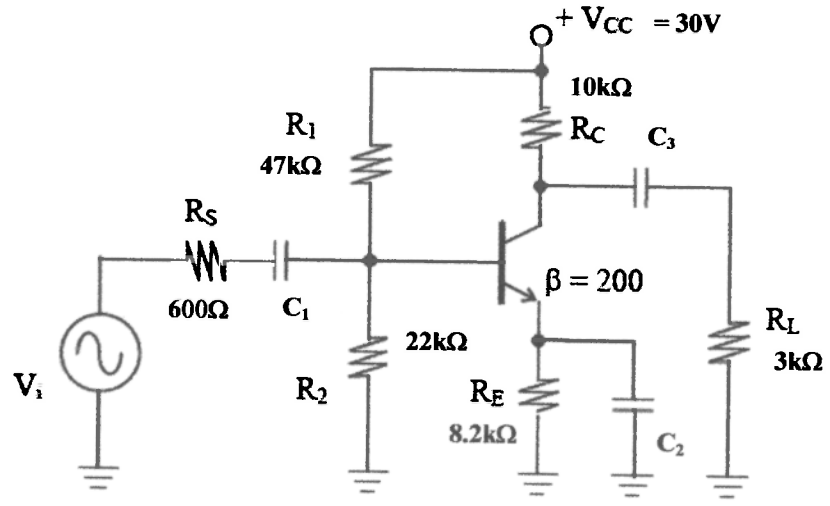

Figure Q7(a)