UNIVERSITI TUN HUSSEIN ONN MALAYSIA

PEPERIKSAAN AKHIR
SEMESTER II
SESI 2008/2009

NAMA MATA PELAJARAN	:	PERANTI ELEKTRONIK DAN APLIKASI
KOD MATA PELAJARAN	:	BEE 2273
KURSUS	:	2 BET/BEP/BEM/BER
TARIKH PEPERIKSAAN	:	APRIL 2009
JANGKA MASA	:	3 JAM
ARAHAN	:	JAWAB **LIMA (5)** SOALAN SAHAJA DARIPADA TUJUH (7) SOALAN.

KERTAS SOALAN INI MENGANDUNGI 8 MUKA SURAT

Q1 (a) The circuit in Figure Q1(a) has been designed to implement a certain relationship between the input and output.

(i) Name the three op-amp circuits shown.
(ii) Find the expression for V_o.
(iii) Develop an alternate design using only one op-amp. Use feedback resistor of 100 kΩ.

(12 marks)

(b) The mid-frequency gain and low cutoff frequency of a circuit without feedback are 100 and 500 Hz respectively. If the gain bandwidth product is 300 MHz,

(i) Find the new mid-frequency gain and the high cutoff frequency for the circuit with negative feedback and feedback factor, $\beta = 0.19$.
(ii) Draw the frequency response for both conditions, with and without feedback on the same graph.

(8 marks)

Q2 For the circuit in Figure Q2,

(a) Sketch the frequency response of the circuit. Label the gain (in dB) and cutoff frequency.

(6 marks)

(b) If the input signal, V_i to the circuit is a 10 kHz square wave with a peak voltage of 1 V, sketch and label both the input, V_i and output signal, V_o.

(8 marks)

(c) If V_i is a sinusoid of amplitude 2 V and frequency 1 kHz, sketch and label both the input, V_i and output signal, V_o.

(6 marks)

Q3 (a) The circuit in Figure Q3 (a) is a block diagram of an amplifier with a negative feedback network. Given $A_x = 2000$ and $\beta = 0.01$.

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

(1 mark)

(ii) Derive the equation for the overall gain of the amplifier with feedback network (A_{xf}) and determine the value.

(5 marks)

(iii) Determine the output impedance with feedback (Z_{of}) if the output impedance without feedback, Z_o is 5kΩ.

(2 marks)

(iv) If the low cutoff frequency of the amplifier with feedback network (f_{Lf}) is 500Hz, calculate the low cutoff frequency (f_L) if the amplifier does not have the feedback network.

(2 marks)

(b) (i) What is an oscillator? State the purpose of the feedback circuit for an oscillator circuit.

(2 marks)

(ii) Figure Q3(b)(ii) is a Colpitts oscillator. Determine the value of the components (L and R_F) for it to oscillate at 50 kHz.

(8 marks)

Q4 (a) (i) State the Barkhausen criterions for oscillation and describe how the Wein-Bridge Oscillator meets the conditions for oscillation.

(4 marks)

(ii) Design a Wein-Bridge Oscillator to oscillates at 1 kHz using 0.02μF capacitors . The value of feedback resistor in the amplifier circuit is 10 kΩ. Draw the circuit and determine the required component values.

(6 marks)

(b) The circuit in Figure Q4(b) is able to generate both a triangular wave as well as a square wave.

(i) Derive the expression for V_A in terms of V_B.

(ii) Assuming that Op-amp 301 has saturation voltages of ±13 V, draw the waveforms for V_A and V_B on the same graph (same time base) and label all the values.

(10 marks)

Q5 The timer in Figure Q5 is designed to produce a duty cycle of less than 50%. R_2 is a series combination of R_{2A} and R_{2B}.

(a) (i) Find suitable values for the resistors if the minimum frequency f_{min} = 76.39 kHz and minimum duty cycle, $\%D_{min}$ = 19%.

(6 marks)

(ii) Calculate the maximum range of duty cycle.

(8 marks)

(iii) Sketch the output voltages during minimum period, T_{min} and maximum period, T_{max}.

(4 marks)

(b) Give two (2) applications for the circuit designed in Q5(a).

(2 marks)

Q6 Design a simple DC power supply consisting of a centre-tapped transformer (12V-0-12V), a 2-diode rectifier and a capacitor as filter with the following specifications:

Output current, $I_o(max) = 0.1$ A
Ripple voltage, $V_r(p\text{-}p) = 0.5$ V
Forward diode voltage , $V_{diode} = 0.7$ V
Mains supply = 240 V, 50 Hz

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

(4 marks)

(b) Sketch the output waveform and label (with values) the output voltage, V_{dc} and ripple voltage, V_r.

(5 marks)

(c) Determine:

(i) the required transformer turns ratio
(ii) the filter capacitor value
(iii) the output range of this simple power supply if an adjustable output voltage regulator shown in Figure Q6(c) is connected to the output of the filter circuit. The value of R_2 can be varied from 0 to 1 kΩ. Assume that $I_{adj} = 7$ mA and R_1=10kΩ.

(11 marks)

Q7 (a) The transistor in the power amplifier shown in Figure Q7(a)(i) has the AC load line as shown in Figure Q7(a)(ii). The transformer has turns ratio of 14.6 : 8 . Assume that the transformer has zero resistance.

(i) Determine the centre Q (quiescent) point values for collector current, I_{CQ} and collector voltage, V_{CEQ} .
(ii) What is the maximum peak-to-peak collector voltage and current?
(iii) Find the average power delivered to the load under the maximum signal conditions of (ii).
(iv) Find the power dissipated in the transistor under no signal conditions (standby).
(v) Find the maximum efficiency.

(11 marks)

(b) (i) The circuit in Figure Q7(b) operates on a ±15 V supply. The impedance of the speaker is 4 Ω. What is the maximum current through the speaker and the power dissipated in it?
(ii) The circuit in Figure Q7(b) will have crossover distortion in its output waveform. Draw the output waveform to illustrate crossover distortion and explain how this happen.
(iii) Modify the circuit in Figure Q7(b) so that crossover distortion could be eliminated. Draw the modified circuit and explain briefly how it is eliminated.

(9 marks)

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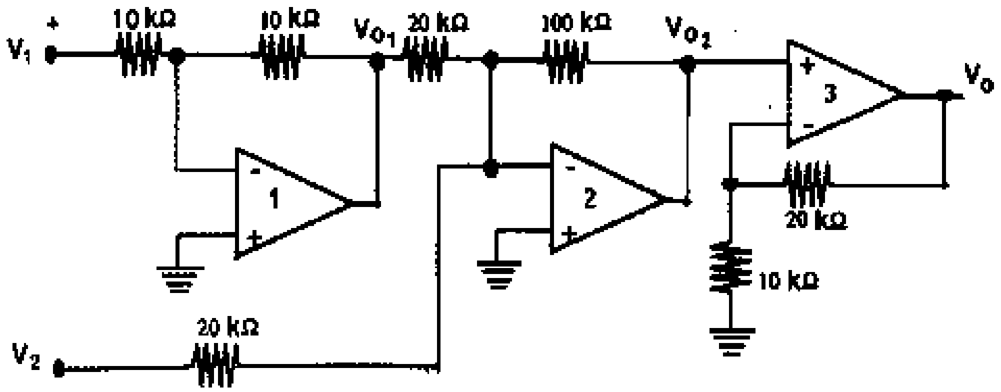

Figure Q1(a)

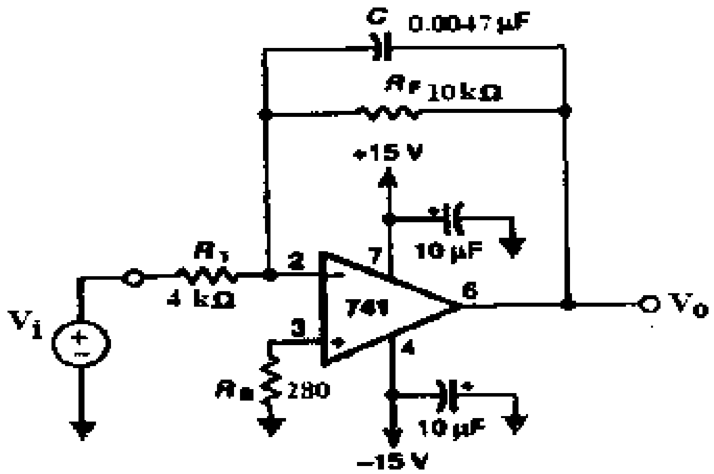

Figure Q2

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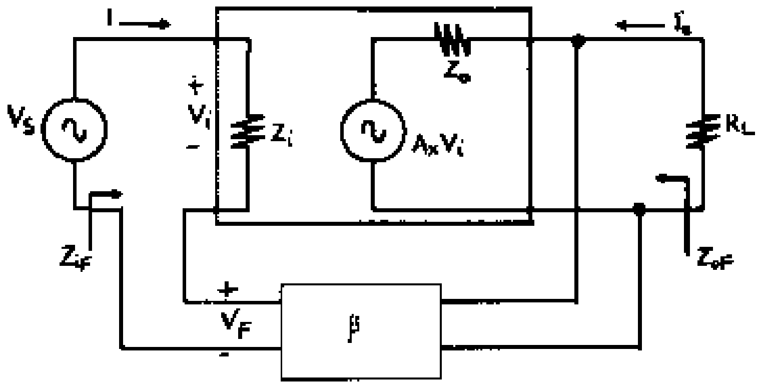
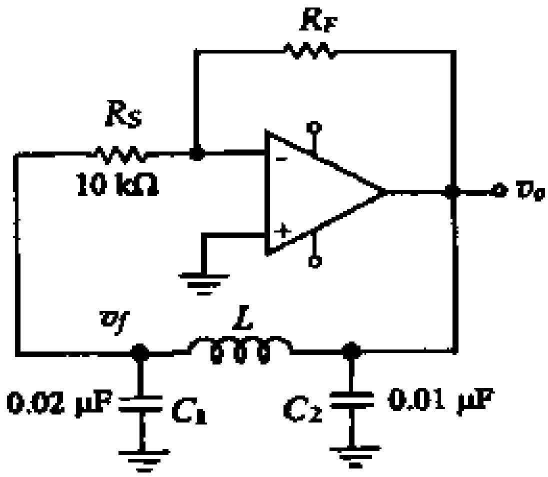


Figure Q3 (a)



Q3(b)(ii)

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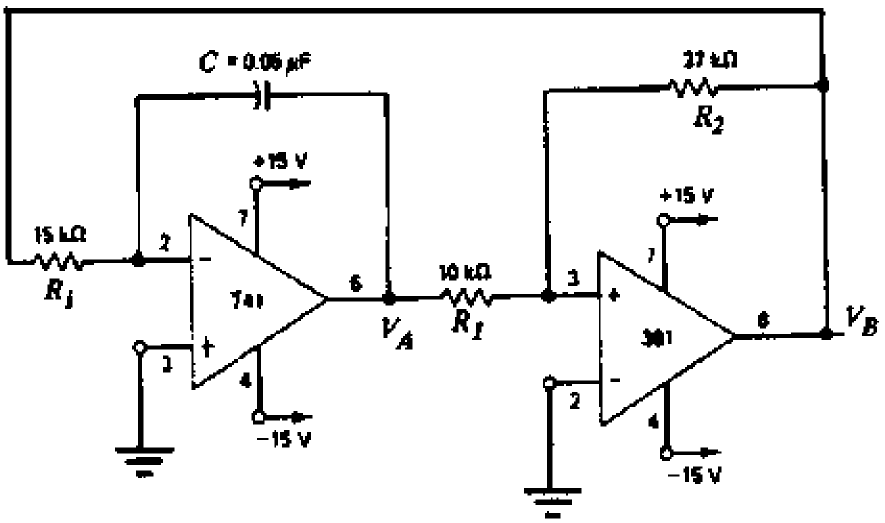

Figure Q4(b)

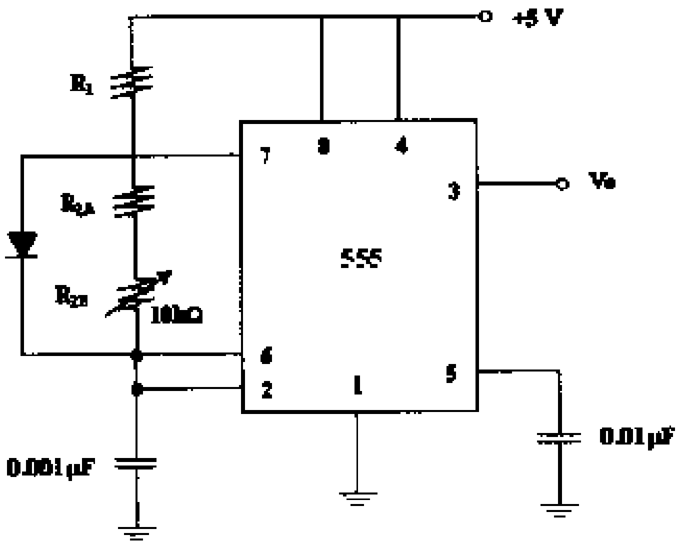

Figure Q5

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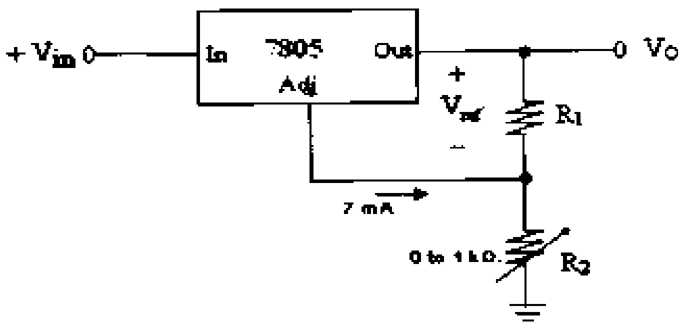

Figure Q6(c)

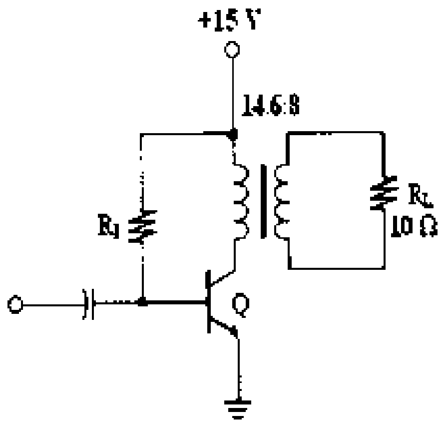

Figure Q7(a)(i)

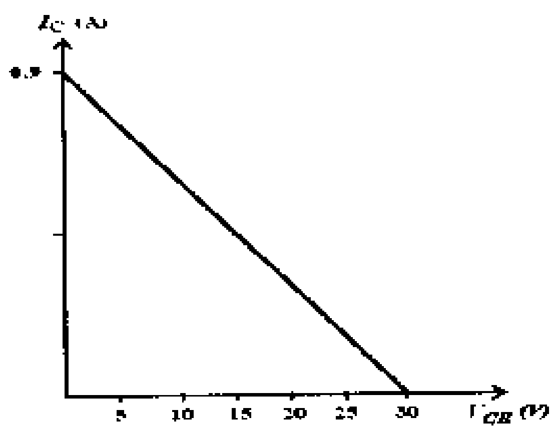

Figure Q7(a)(ii)

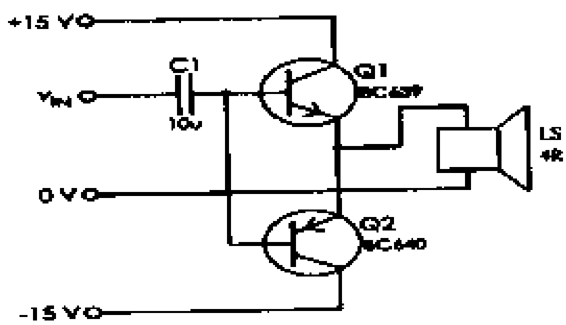

Figure Q7(b)