UNIVERSITI TUN HUSSEIN ONN MALAYSIA

PEPERIKSAAN AKHIR
SEMESTER II
SESI 2008/2009

NAMA MATA PELAJARAN	:	ELEKTRONIK KAWALAN
KOD MATAPELAJARAN	:	BEM 4843
KURSUS	:	4 BEE
TARIKH PEPERIKSAAN	:	APRIL 2009
JANGKAMASA	:	2 JAM 1/2
ARAHAN	:	JAWAB EMPAT (4) SOALAN SAHAJA DARIPADA ENAM (6) SOALAN

KERTAS SOALAN INI MENGANDUNGI SEMBILAN (9) MUKA SURAT

Q1 (a) List three types of circuit control devices?

(2 marks)

(b) How does a relay differ from a solenoid?

(4 marks)

(c) If a solenoid is not operating properly, what items should be checked?

(10 marks)

(d) Explain three reasons why circuit control is needed?

(9 marks)

Q2 Refering to Figure Q2(1) and Figure Q2(2), a circuit that produces a continuous rectangular signal is called an astable (free-running) multivibrator. An astable multivibrator, using a 555 timer chip, is shown in Figure Q2(1). With only two resistors and a capacitor, the 555 IC can produce a highly accurate rectangular signal. Figure Q2(2) is a quick reference chart that provides a way of determining which combination of external resistance and capacitance values generate a desired frequency.

(a) Propose an algorithm, on how to use the chart shown in Figure Q2(2) to determine the required combined values of R_A and R_B for desired frequency.

(9 marks)

(b) Using the formula $f = 1.44/(R_A + 2R_B)C$ and the chart in Figure Q2(2), find the astable multivibrator frequency for each of the R_A , R_B, and C_1 values listed in Table 1. Fill the answer in the blank column (headed frequency calculated and chart values) in the table, and then analysis the result.

(16 marks)

Q3 Figure Q3(1) is the silicon control rectifier (SCR) phase control circuit and Figure Q3(2) is input and output signals for no power to load, half power to load, and full power to load at TP_1, TP_2, TP_3, TP_4, TP_5, and across light-bulb points. Assume that this circuit applies 120 volts RMS to the full wave rectifier and zener diode 15 volts. Sketch the output signal on the Figure Q3(2) and propose the reason for each answer:

(a) At TP_1.

(4 marks)

(b) At TP_2.

(4 marks)

(c) At TP_3.

(4 marks)

(d) At TP_4.

(4 marks)

(e) At TP_5.

(4 marks)

(f) Across light-bulb

(5 marks)

Q4 (a) The op amp current in Figure Q4(a)(1) is capable of comparing the voltage applied to the other input. Fill in the output portion of the table in Figure Q4(a)(2) by applying the voltages listed in the input section, and propose an analysis to this resulted table.

(5 marks)

(b) Figure Q4(b)(1) shows an inverting op amp. Construct the formula to measure the output voltage (V_{OUT}), and fill in the output portion of the table in Figure Q4(b)(2) and Figure Q4(b)(3) by applying the voltages listed in the input section (V_{IN}).

(10 marks)

(c) Figure Q4(c)(1) shows a summing amplifier. Construct the formula to measure the output voltage (V_{OUT}), and fill in the output portion of the table in Figure Q4(c)(2) by applying the voltages listed in the input section (V_1, V_2, V_3).

(10 marks)

Q5 Consider Figure Q5(1) and Figure Q5(2). One type of signal that often used by a digital circuitry is called a monostable (one-shot) multivibrator. Figure Q5(1) shows a circuit of this type that uses a 555 linear IC. Figure Q5(2) is a quick reference chart that provides a way of determining which combination of external resistance and capacitance values generate desired pulse width.

(a) Propose an algorithm how to use the chart shown in Figure Q5(2) to determine the combination of external resistance and capacitance values to generate a desired pulse width.

(9 marks)

(b) Using the formula $T = 1.1RC$ and the chart in Figure Q5(2), find the one-shot time delay for each of the R_A and C_1 values listed in Table 2. Place the answer in the blank columns (headed time delay calculated and chart values) in the table and then analysis the obtained results.

(16 marks)

Q6 Figure Q6 shows a circuit with a single diode and an RL load.

(a) Derive the relevant equation in differential equation form for this circuit for $V_s = E\sin\omega t$.

(10 marks)

(b) Use the Laplace methods and trigonometry laws in Table 3 to solve the differential equation in Q6(a).

(15 marks)

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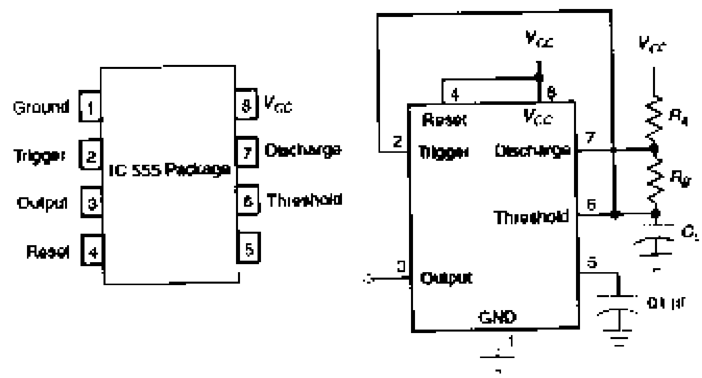

Figure Q2(1)

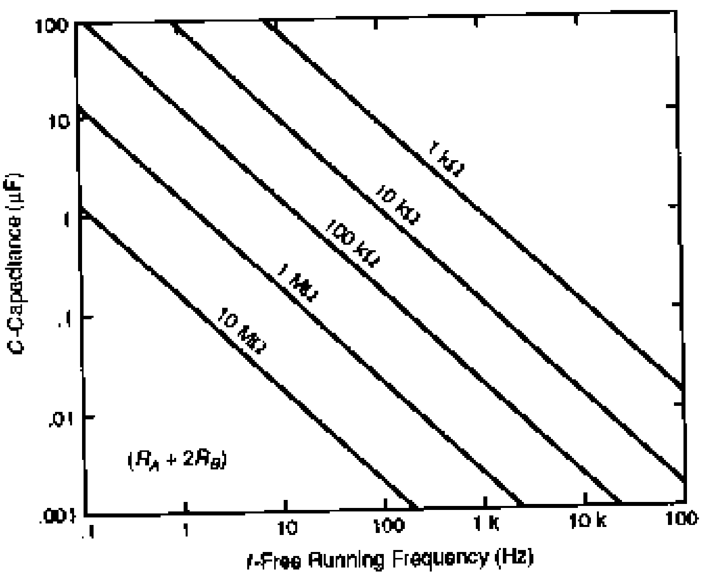

Figure Q2(2)

Table 1

$R_A(\Omega)$	$R_B(\Omega)$	$C_1(\mu F)$	frequency calculated (Hz)	frequency chart values (Hz)
47k	10k	1		
22k	10k	1		
22k	10k	0.1		
22k	2.2k	0.1		
10k	10k	0.01		

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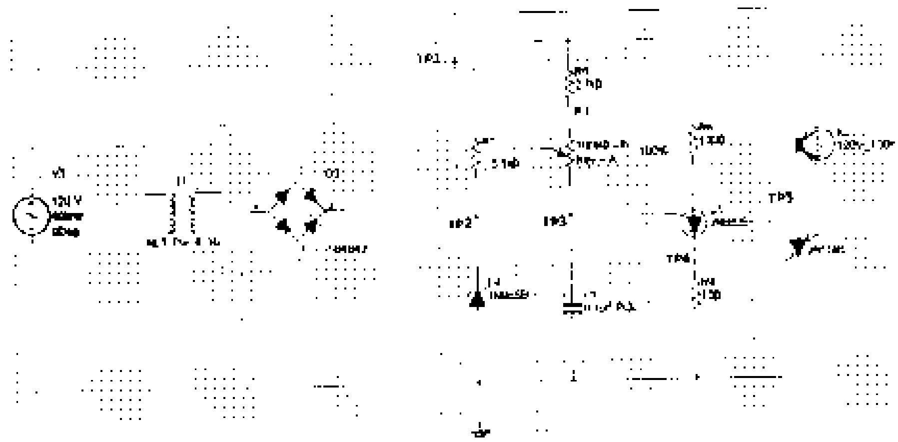

Figure Q3(1)

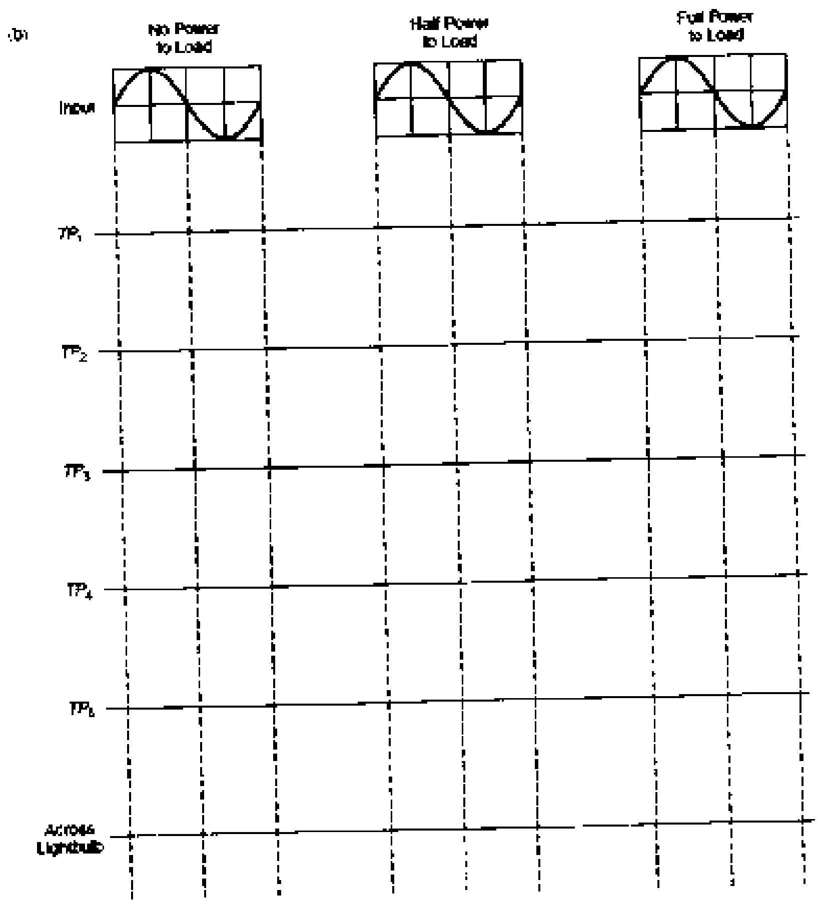

Figure Q3(2)

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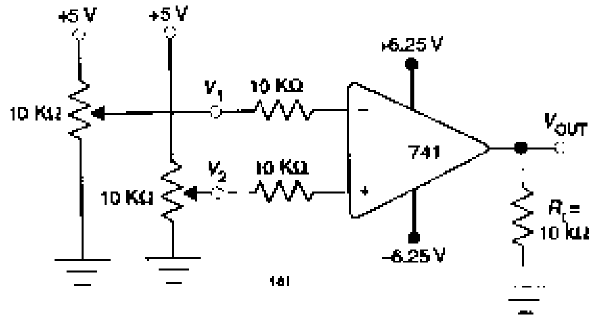

Figure Q4(a)(1)

INPUTS		VOUT (V)
V1	V2	
+4	+1	
+2	+3	
+1	0	
+4	+4	
0	+1	
+3	+2	

(b)

Figure Q4(a)(2)

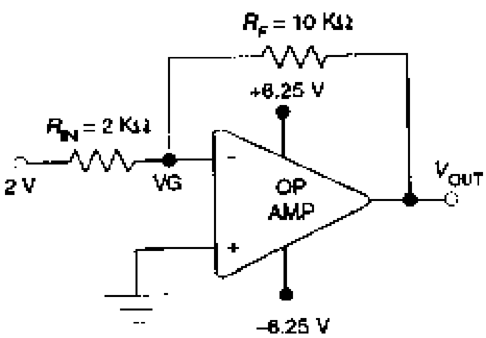

Figure Q4(b)(1)

VIN	VOUT
+0.2v	
-0.4v	
0v	
+0.32v	

(b)

VIN	VOUT
+0.3v	
-0.15v	
-2.0v	
+0.4v	

(c)

Figure Q4(b)(2) Figure Q4(b)(3)

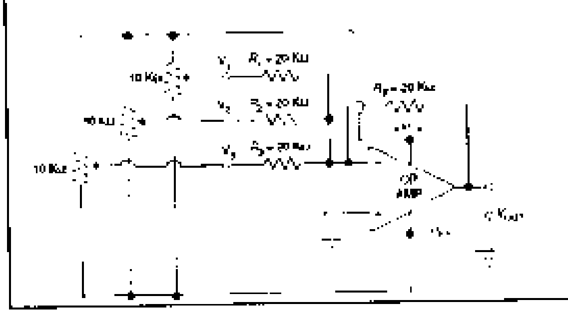

Figure Q4(c)(1)

Input Voltage			Output Voltage (VOUT)
V1	V2	V3	
+1V	+1V	+1V	
+1V	-1V	-1V	
+2V	-1V	-1V	
-3V	-1V	+3V	
+1V	+2V	-1V	

Figure Q4(c)(2)

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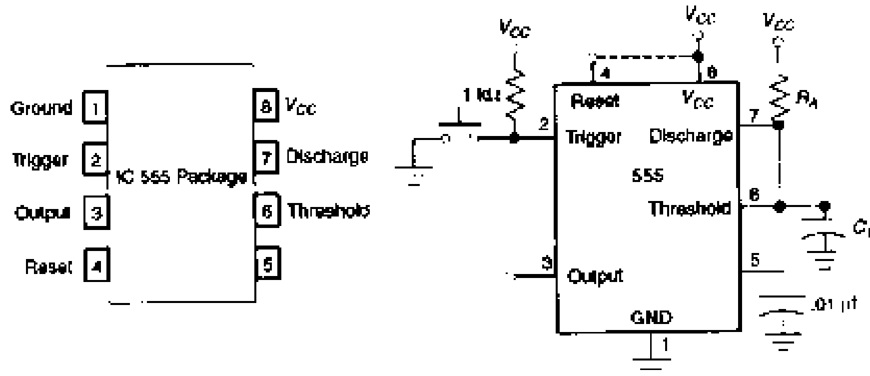

Figure Q5(1)

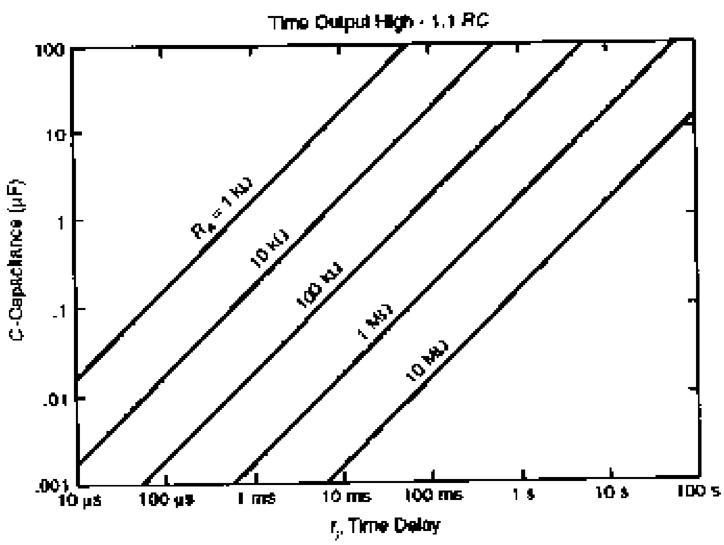

Figure Q5(2)

Table 2

$R_A(\Omega)$	$C_1(\mu F)$	time delay calculated (sec)	time delay chart values (sec)
1M	10		
470k	10		
100k	50		
10k	100		
470k	50		

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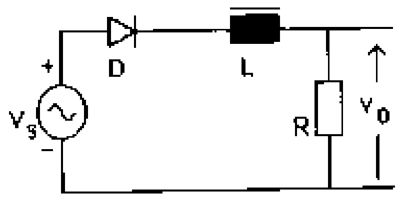

Figure Q6

Table 3

Time Function $f(t)$	Laplace Transform of $f(t)$	
		$\sin(\omega t - \alpha) = \sin\omega t\cos\alpha - \cos\omega t\sin\alpha$
e^{at}	$\frac{1}{s-a}$	$\cos(\omega t - \alpha) = \cos\omega t\cos\alpha + \sin\omega t\sin\alpha$
$\sin\omega t$	$\frac{\omega}{s^2+\omega^2}$	$\tan(\omega L/R) = \frac{\sin(\omega L/R)}{\cos(\omega L/R)}$
$\cos\omega t$	$\frac{s}{s^2+\omega^2}$	$\sin\alpha = \omega L/z$ $\cos\alpha = R/z$