UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2009/2010

SUBJECT NAME	:	CONTROL ELECTRONIC
SUBJECT CODE	:	BEM 4843
COURSE	:	4 BEE
DATE	:	NOVEMBER 2009
TIME	:	2 ½ HOURS
INSTRUCTION	:	ANSWER FOUR (4) QUESTIONS ONLY

THIS PAPER CONSIST OF 9 PAGES

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

(3 marks)

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

(4 marks)

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

(10 marks)

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

(8 marks)

Q2 D/A converters are available in IC form. One popular type, shown in Figure Q2, is the 8-bit DAC0808. An inverting op amp is externally connected to the D/A IC package. The maximum current level of 2 mA at the output of the op amp is dictated by the 10 volt supply and 5 KΩ resistor connected to pin 14.When the digital input is 0000 0000, the minimum current of 0 mA flows through pin 4.When the digital input is 1111 1111, the maximum current of 2 mA flows through pin 4. Using a 5 KΩ feedback resistor (R_F), the analog output voltage at the op amp output is on the range of 0 volts to 10 volts. If a different voltage range is desired, the V_{REF} voltage applied to pin 14 can be changed, the resistor at pin 14 can be changed, or the R_F resistor value can be used to change the gain.

(a) How many different analog voltages are produced at the output D/A converter if only four inputs are used?

(3 marks)

(b) How many different analog voltage levels can be produced by the DAC0808 IC?

(3 marks)

(c) List three ways in which the voltage range of the DAC0808 IC can be varied.

(9 marks)

(d) How many voltage levels are produced with an open at the LSB input? Explain your answer.

(10 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) at TP_1, TP_2, TP_3, TP_4, TP_5 and across light-bulb. Give the reason for each answer.

(25 marks)

Q4 The 8-bit ADCs in IC form require only eight clock pulses using a register that performs a function called successive approximation. Figure Q4 shows the schematic diagram of the ADC0804 analog-to-digital converter IC. It uses an internal successive approximation register (SAR).The circuit is capable of converting an analog voltage into a proportional 8-bit digital output. The voltage range to be converted is determined by applying the maximum desired voltage to V_{DC} at pin 20.The analog input is applied across $V_{IN}(+)$ and $V_{IN}(-)$.

(a) How many clock pulses are required by the ADC0804 IC to complete one analog-to-digital conversion?

(3 marks)

(b) How many percents is the resolution of the ADC0804 IC?

(6 marks)

(c) Apply the analog voltage listed on the top line of the input section of Table Q4.

(16 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 Q5. Place the answer in the blank columns (headed time delay calculated and chart values) in the table and then analyze the obtained results.

(16 marks)

Q6 Figure Q6 shows a circuit with a single diode and an R-L load.

(a) Derive the relevant equation in differential equation form for this circuit for $V_s = E\sin\omega t$. (5 marks)

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

(20 marks)

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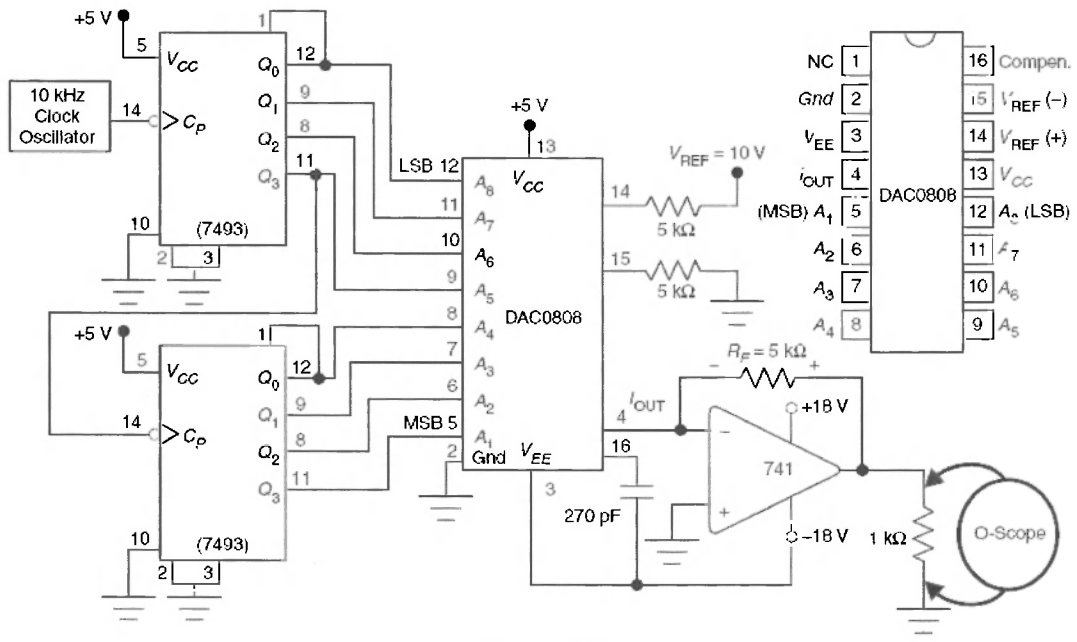

Figure Q2

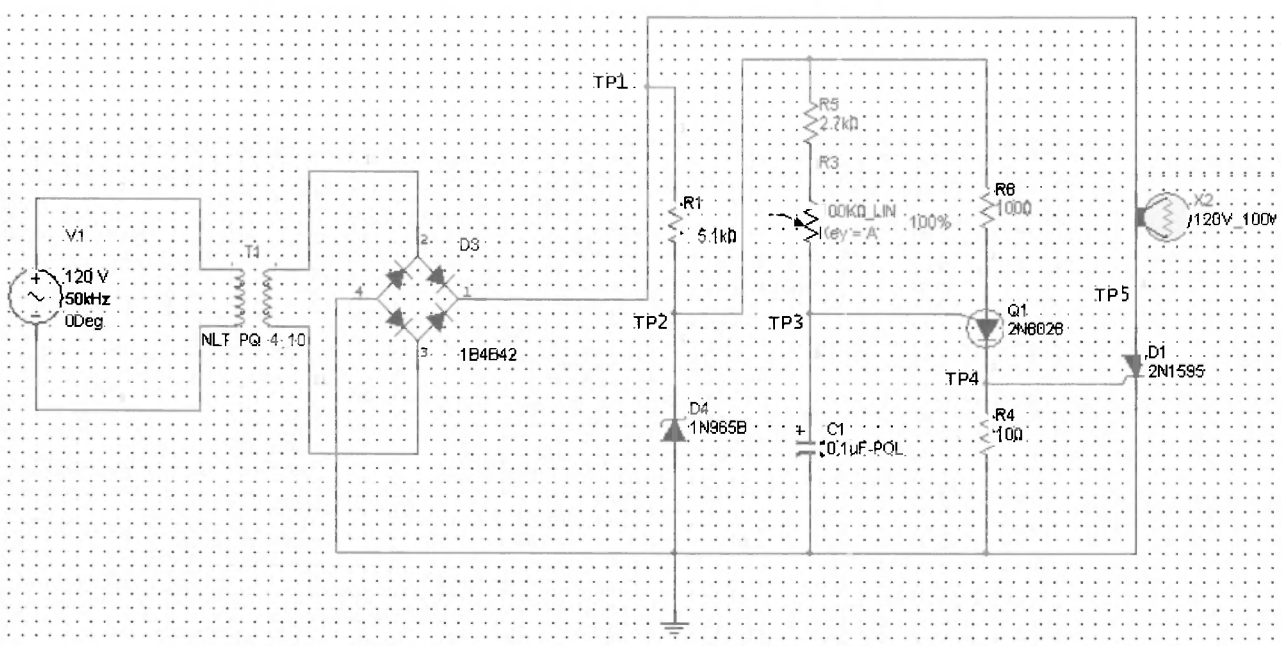

Figure Q3(1)

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(b)

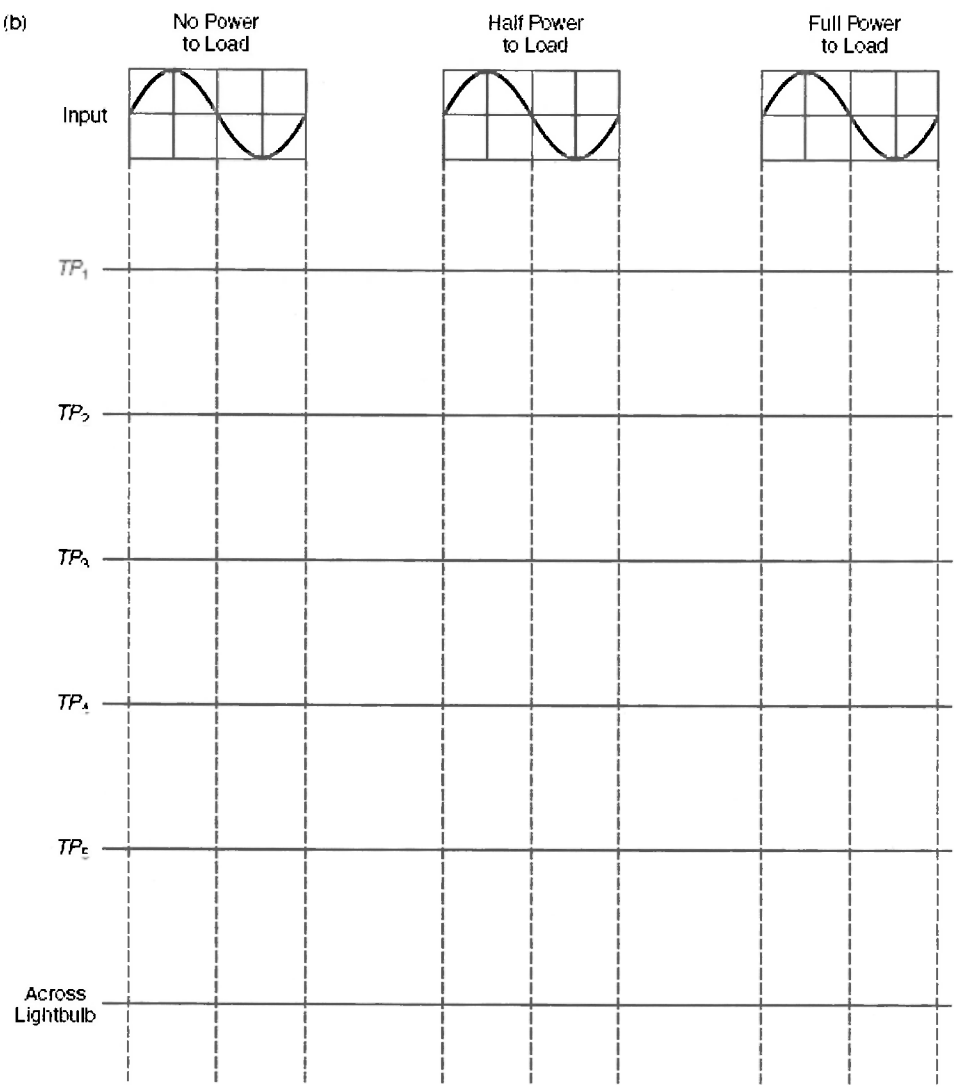

Figure Q3(2)

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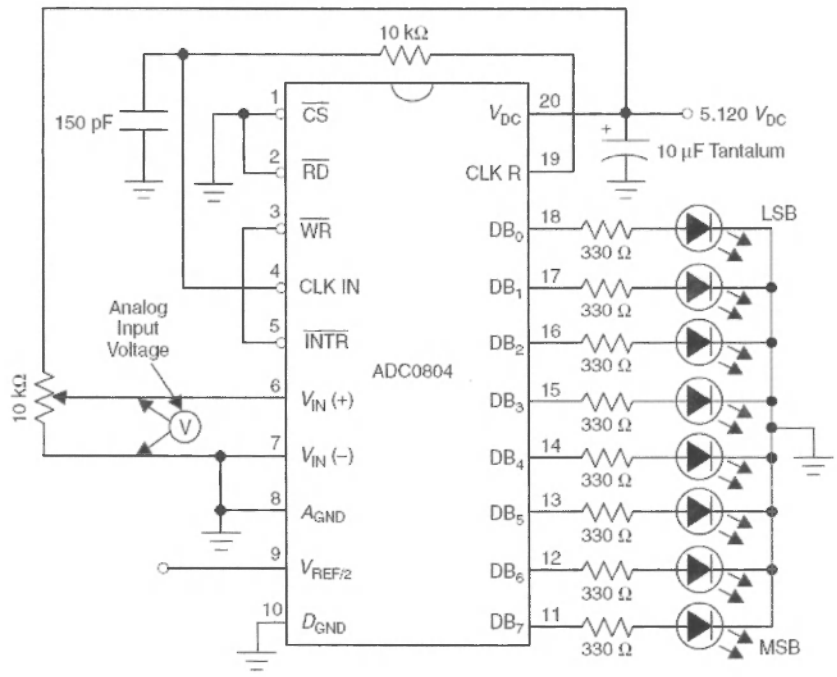

Figure Q4

Table Q4

Input	Output								
Measured Analog Voltage	Resolution Values								Resolution Total
	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
	2.56V	1.28V	0.64V	0.32V	0.16V	0.08V	0.04V	0.02V	
0V									
0.4V									
1.0V									
1.6V									
2.3V									
3.5V									
4.6V									
5.12V									

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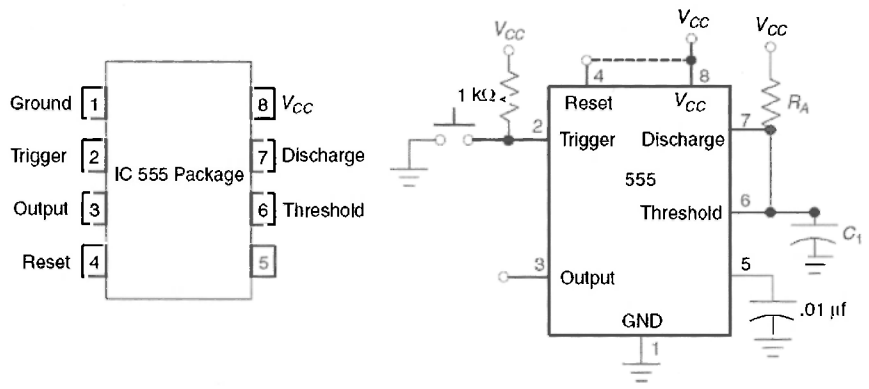

Figure Q5(1)

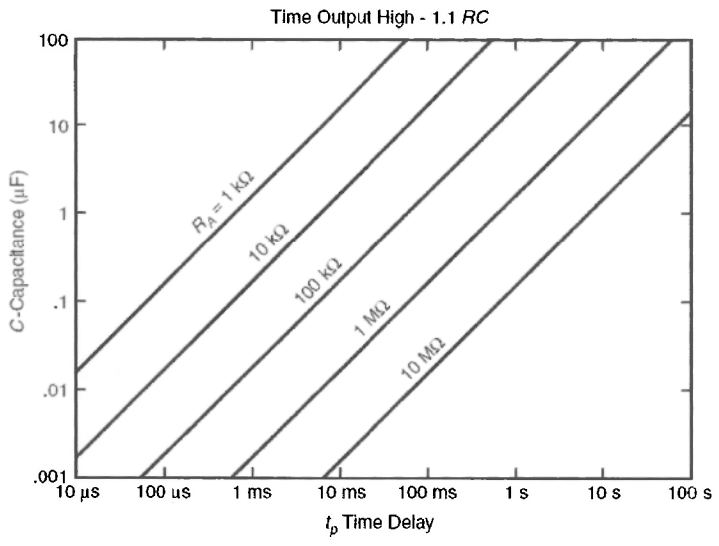

Figure Q5(2)

Table Q5

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

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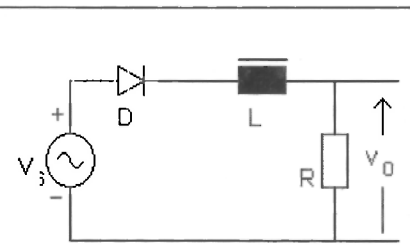

Figure Q6

Table Q6

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