UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2010/2011

COURSE	:	CONTROL ELECTRONICS
COURSE CODE	:	BEM 4843
PROGRAMME	:	4 BEE
EXAMINATION DATE	:	NOVEMBER/DECEMBER 2010
DURATION	:	2 HOUR 30 MINUTES
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTION ONLY

THIS PAPER CONSISTS OF EIGHT (8) PAGES

Q1 A pressurized tank must maintain a gas at 325 psi. A pressure sensor is used to measure the condition of the controlled variable. As the gas cools, the pressure in the tank decreases. When it drops to 300 psi, a valve is opened, which allows steam to flow to a heat exchanger inside the tank. The additional steam heats the gas and causes pressure to rise. Determine the following:

(a) Controlled variable in this process

(2 marks)

(b) Manipulated variable in this process

(2 marks)

(c) Set point

(2 marks)

(d) Measured variable

(2 marks)

(e) Draw the open-loop block diagram that shows elements, input/output signals, and signal direction.

(7 marks)

(f) Draw the closed-loop block diagram that shows elements, input/output signals, and signal direction

(10 marks)

Q2 (a) The op-amp as shown in Figure Q2(a) is capable of comparing the voltage applied to one input to the voltage applied to the other input. Calculate the output voltage (V_{out}) in Table Q2(a).

(7 marks)

(b) Figure Q2(b) shows an inverting op-amp. Calculate the output voltage (V_{out}) in Table Q2(b) by applying the listed input voltages (V_{in}).

(8 marks)

(c) Figure Q2(c) shows a summing amplifier with the ability of adding the algebraic sum of all the input voltages. Calculate the output voltage (V_{out}) in Table Q2(c) by applying the listed input voltages (V_1, V_2 and V_3).

(10 marks)

Q3 (a) The silicon controlled rectifier (SCR) is a semiconductor device with four PN layers is shown in Figure Q3 which has three terminals, labeled anode (A), cathode (K) and gate (G). Set the switches as shown in the diagram and then apply power to the circuit. Calculate the anode and gate voltages and hence state the condition of SCR as shown in Table Q3(a).

(10 marks)

(b) Calculate the anode to cathode voltage (V_{AK}) before SCR firing.

(5 marks)

(c) When the SCR is ON, calculate the voltage from anode to the cathode (V_{AK}).

(5 marks)

(d) Calculate the value of V_{AK} when the current flowing through the SCR is drops.

(5 marks)

Q4 (a) List four (4) control modes used by the controller section.

(4 marks)

(b) Describe the operation of each type of mode control function.

(4 marks)

(c) List and define eight (8) terms associated with control modes for closed-loop systems.

(8 marks)

(d) List two (2) factors that cause the controlled variable deviate from the set point in an on-off system.

(4 marks)

(e) Calculate the differential gap percentage if a full temperature controls range is 120 degrees and the differential gap is 8 degrees.

(5 marks)

Q5 (a) List and define two (2) characteristics used in the motor selection process.

(5 marks)

(b) No-load speed of a motor is 2200 RPM (revolution per minute) and when the rated load is connected to the shaft, the speed drops to 2020 RPM. Calculate the speed regulation of a motor in percent.

(5 marks)

(c) Calculate the torque of a motor that has a tangential force of 660 pounds at the surface of 6 inches diameter pulley. (Give answer in SI unit.)

(5 marks)

(d) Determine the kilowatt rating of 23. 45 HP motor.

(5 marks)

(e) If the wattage consumed by a motor is 34.5 kW and produces an output of 45.6 HP, calculate the efficiency of a motor.

(5 marks)

Q6 (a) List and define three (3) factors to determine the speed of an AC motor.

(6 marks)

(b) Find the speed of a 8-pole motor when 50 Hz frequency is applied.

(5 marks)

(c) Calculate the percent slip of a two-phase motor that has a synchronous speed of 3550 RPM and a rotor speed of 2750 RPM.

(5 marks)

(d) Calculate the speed of stepper motor in RPM that operates at a step angle of 8 degrees with the stepping rate of 320 degrees.

(5 marks)

(e) List two (2) advantages of DC drives over AC drives

(4 marks)

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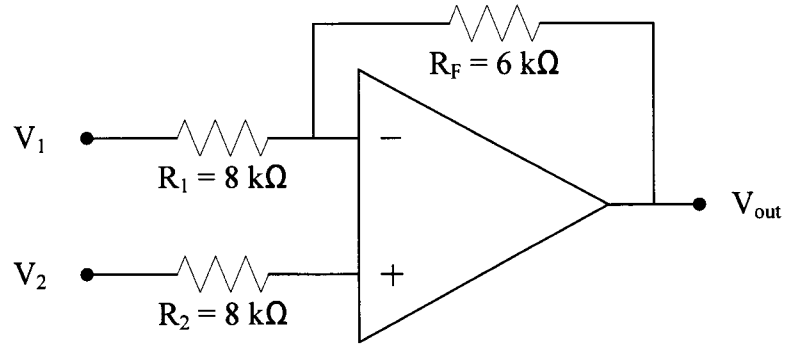

Figure Q2(a)

Table Q2(a)

No.	Input Voltage (V_{in})		Output Voltage (V_{out})
	V_1	V_2	
(i)	+ 1	+ 2	
(ii)	+ 3	+ 4	
(iii)	- 4	- 4	
(iv)	+ 3	- 4	
(v)	0	- 3	
(vi)	- 3	+ 2	

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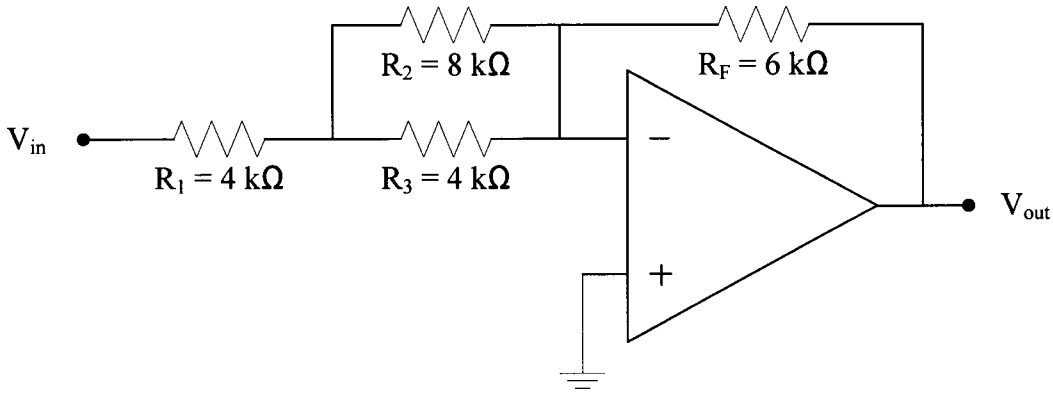

Figure Q2(b)

Table Q2(b)

No.	Input Voltage (V_{in})	Output Voltage (V_{out})
(i)	+ 6.25	
(ii)	- 0.20	
(iii)	- 2.45	
(iv)	+ 0.45	
(v)	+ 3.30	
(vi)	- 5.00	

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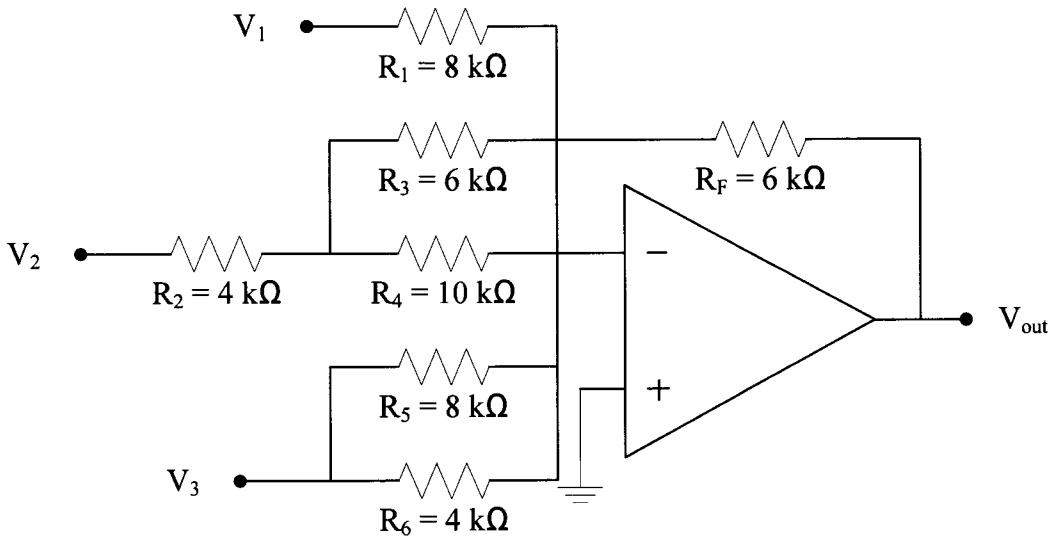

Figure Q2(c)

Table Q2(c)

No.	Input Voltage (V_{in})			Output Voltage (V_{out})
	V_1	V_2	V_3	
(i)	+ 1	+ 1	+ 1	
(ii)	+ 1	- 1	- 1	
(iii)	+ 2	- 1	- 1	
(iv)	- 3	+ 1	+ 3	
(v)	+ 1	+ 2	- 1	
(vi)	+ 1	- 2	- 3	

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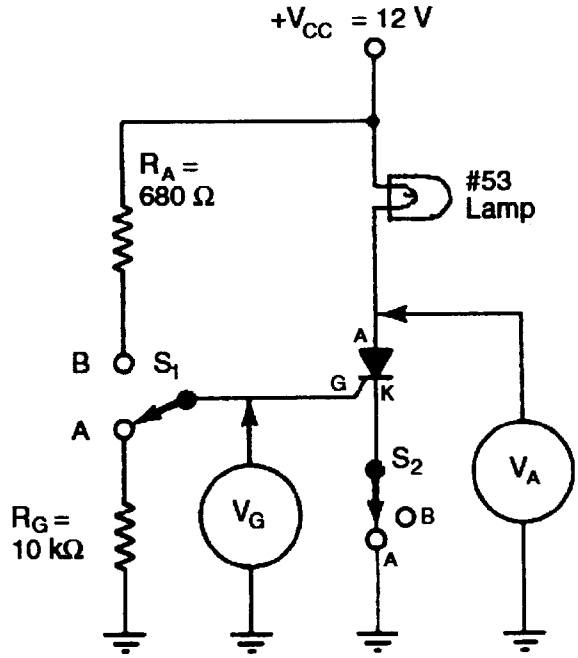

Figure Q3

Table Q3(a)

S_1 Condition	S_2 Condition	Gate Voltage (V_G)	Anode Voltage (V_A)	Condition of SCR (ON or OFF)
A	A			
B	A			
A	A			
A	B			
A	A			