



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2009/2010**

SUBJECT NAME : INDUSTRIAL ELECTRONICS
SUBJECT CODE : DEK3113
COURSE : 3 DEE/DEX
EXAMINATION DATE : NOV 2009
DURATION : 2 ½ HOURS
INSTRUCTION : ANSWERS FOUR (4) QUESTIONS ONLY.

THIS PAPER CONSISTS OF 9 PAGES

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- Q1.** (a) Give similarity between solenoid and relay. (3 marks)
- (b) Based on Figure Q1(b):
- (i) Explain the operation of Figure Q1 (b) during de-energize and energize state. (5 marks)
- (ii) Give function of 15A fuse in the system. (2 marks)
- (c) (i) Give two method for improvement of solenoid construction. (3 marks)
- (ii) Explain one of the method for improvement of solenoid construction which needs graphical diagram to explain. (Appropriate diagram need to be included) (5 marks)
- (d) Figure Q1(d), shows one of the method to prolonged the life time for switch of the relay.
- (i) Explain the operation of Figure Q1(d) when transistor in “on” & “off” condition. (4 marks)
- (ii) What will happen when diode is not exist. (3 marks)
- Q2.** (a) When sensor S1 senses a container, a pneumatic operated valve will open and allows liquid from the tank to flow into it. The valves close automatically after time delay of 5 seconds. After that, container will be transported to another station. Time delay starts when sensor S1 is triggered. The valve is controlled by a rotary actuator which is activated by a single acting solenoid. Please refer Figure Q2(a) for diagram of this process. Draw electric diagram for the process. (7 marks)
- (b) Figure Q2(b) shows the drilling process of an object. Initially, parts are manually placed in a receptacle. When PB is pressed, cylinder A pushes a receptacle under the drilling unit. Then, cylinder B will start to extend. Drilling operation starts once cylinder B at it full extension. Drilling operation operate for 5 seconds. After drilling cylinder A must not return until drill feed unit has reached its start position.

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Cylinder A - Single Acting Cylinder (3/2 way valve normally close):
Solenoid for cylinder A-Y1

Cylinder B - Double Acting Cylinder (5/2 way directional valve):
Solenoid for cylinder B- Y1 and Y2

Assumption:

- (1) Time for cylinder A to move from original position to full extension(or vice versa) is 1 sec.
- (2) Time for cylinder B to move from original position to full extension(or vice versa) is 2 sec.
- (3) Next process will not execute unless previous process been executed.

Based on Figure Q2(b):

- (i) Draw a motion diagram for the application. (4 marks)
- (ii) Draw displacement diagram for Cylinder A and Cylinder B and indicate traveling time in the diagram (4 marks)
- (iii) Draw electric diagram for the process (10 marks)

Q3.

- (a) An alarm buzzer will sound when the sensor S1 at the front door or the sensor S2 at the back door is activate.(When detect movement). The alarm buzzer will stop when the sensor is de-activated (Not detect movement). Draw the PLC ladder diagram (including its addresses) and its mnemonic function for this system. (7 marks)
- (b) Figure Q3(b) show a ladder diagram of a system. Write the mnemonic function of the system. (8 marks)
- (c) Based on Figure Q3(c), Sensor S1 used to detect and count the number of products being carried on an assembly line. When it counts three products, a single acting cylinder will be extended to push a three product into a conveyer for packaging. After 3 seconds, the cylinder will go back to its original position and at the same time, reset the ADDER(emptying the ADDER). Draw ladder diagram for the system.

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Note:

Please use DIFU, ADD, CMP and MOV in your solution.

Need allocate specific address using CQM1H model.

Special relay: 25313(always on), 25505(>), 25506(=), 25507(<)

(10 marks)

Q4.

(a) Consider the integrator circuit in Figure 4(a). The input signal, V_i to the circuit is a 20kHz square wave with 3Vp-p.

(i) Sketch and label the values of the output signal, V_o .

(6 marks)

(ii) Calculate the frequencies where the circuit will stop acting as an integrator.

(4 marks)

(iii) Sketch the output signal, V_o when it is not acting as an integrator and what kind of circuit it is acting now.

(5 marks)

(b) From Figure 4(b), all value R and V are stated as below:

$R_1=2k\Omega$, $R_2=6k\Omega$, $R_3=5k\Omega$, $R_4=4k\Omega$, $R_5=8k\Omega$, $R_6=15k\Omega$,
 $R_7=10k\Omega$

$V_1=1V$, $V_2=2V$

(i) Name types of Op Amp from the circuit.

(4 marks)

(ii) Find the value for V_3 , V_4 and V_5

(6 marks)

Q5.

(a) Elaborate PWM concept in controlling the speed of simple motor.

(6 marks)

(b) In term of duty cycle and average output, explain what is the difference between three diagram in Figure Q5(b). Input signal is 12V.

(9 marks)

(c) With an appropriate diagram explain Full Step One On operation and Full Step Two On operation of Stepper motor.

(10 marks)

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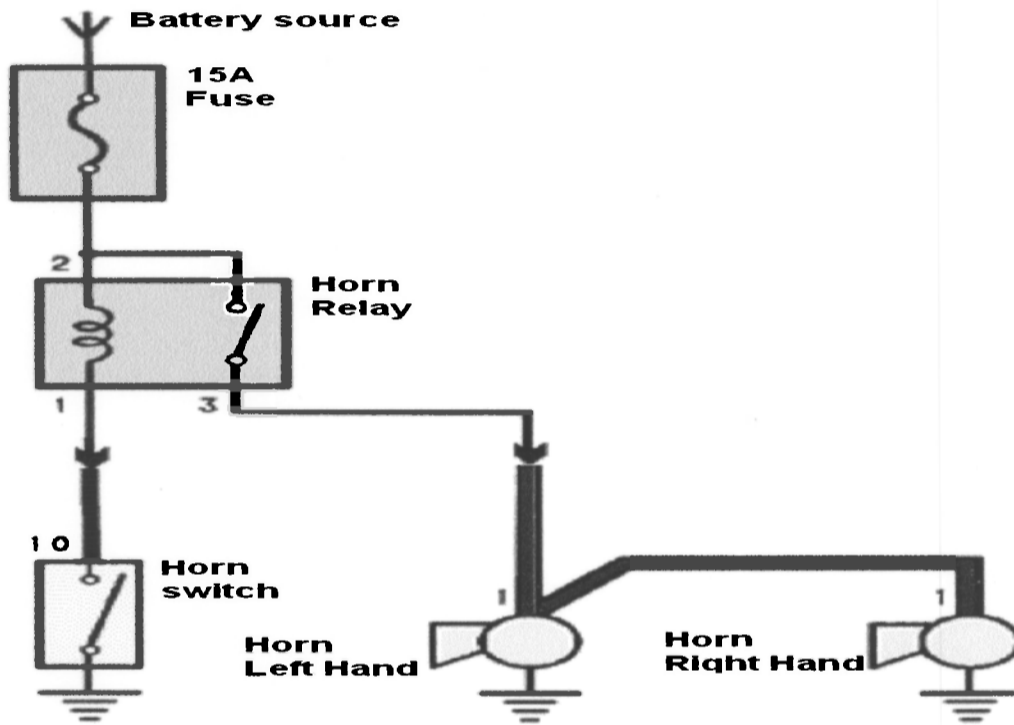


Figure O1(b)

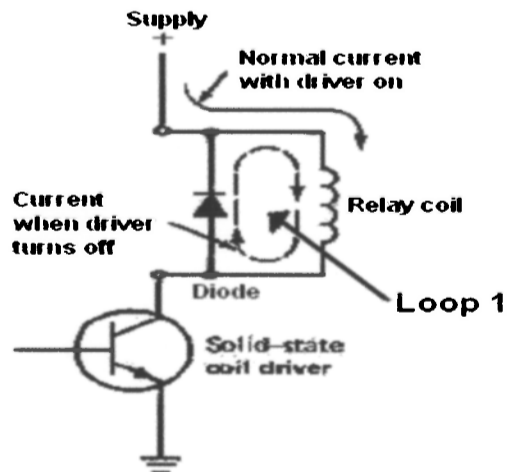


Figure O1(d)

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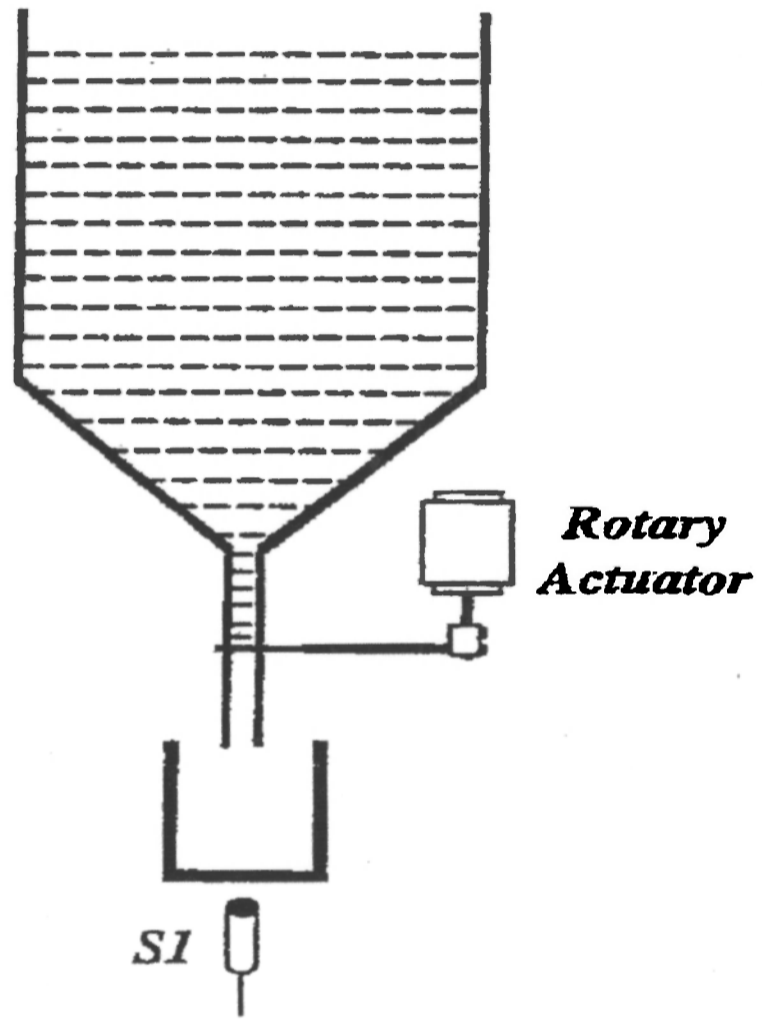


Figure O2(a)

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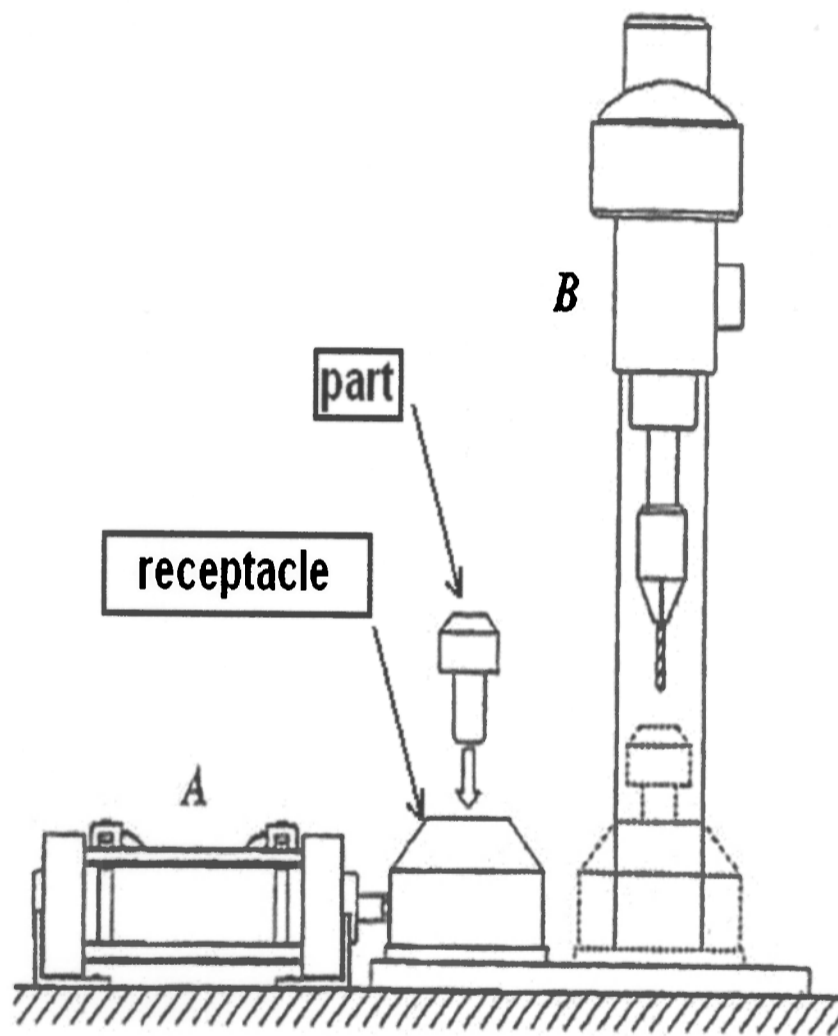


Figure O2(b)

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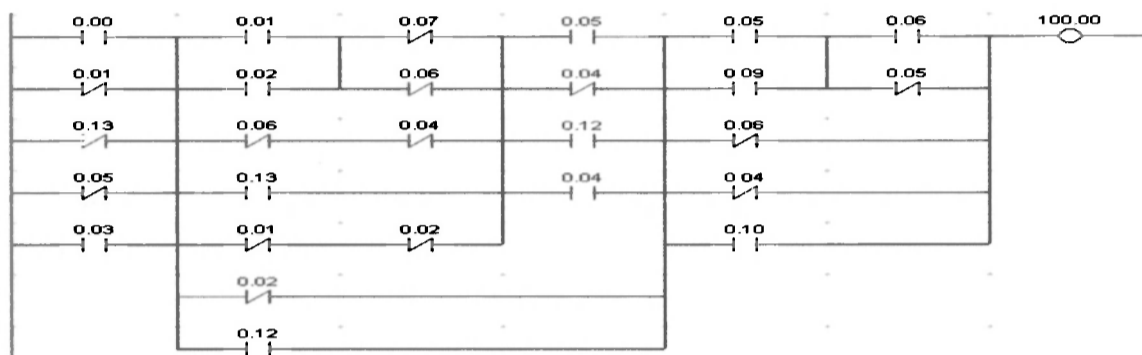


Figure Q3(b)

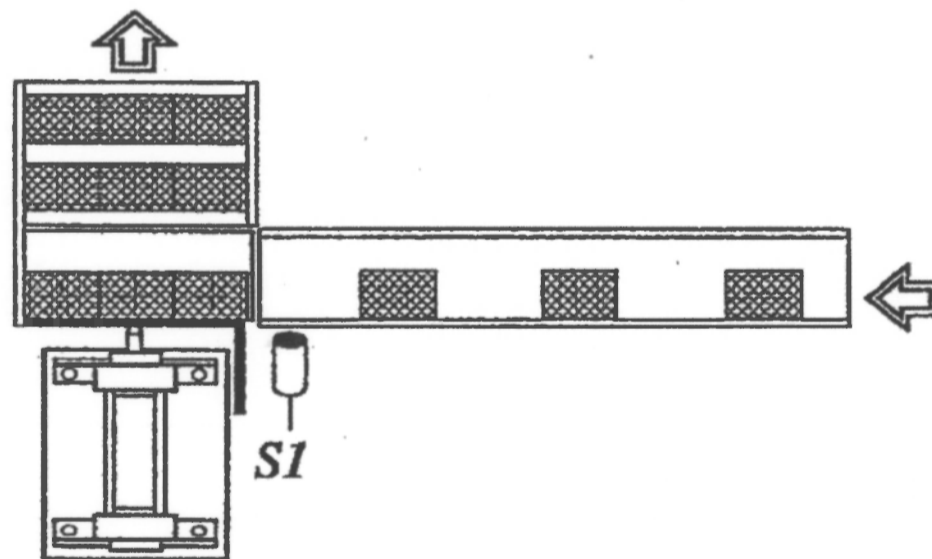


Figure Q3(c)

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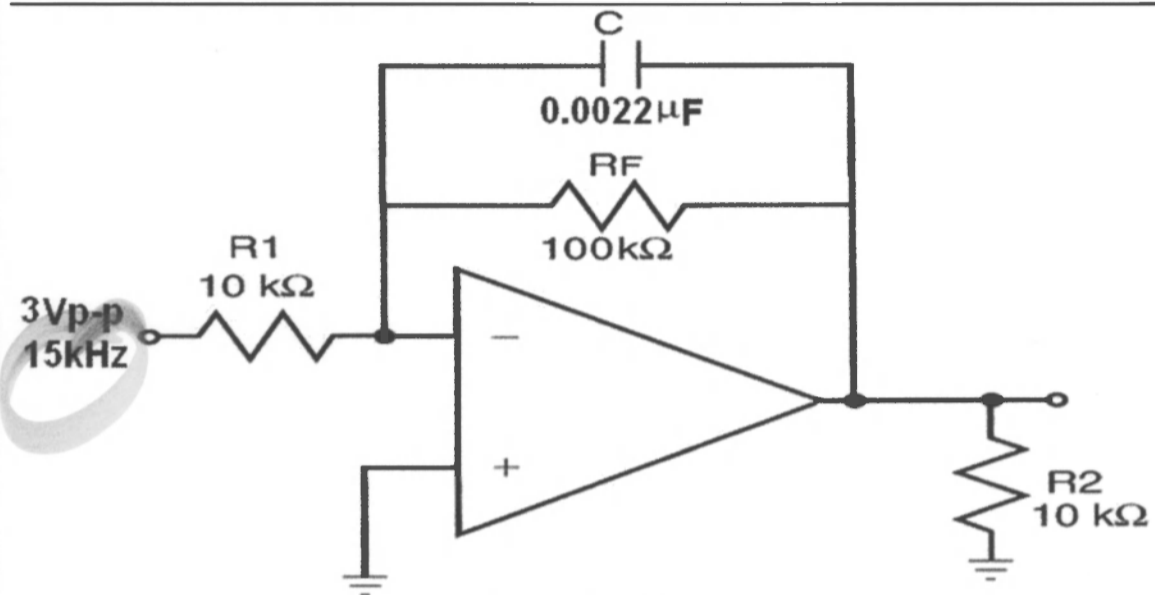


Figure Q4(a)

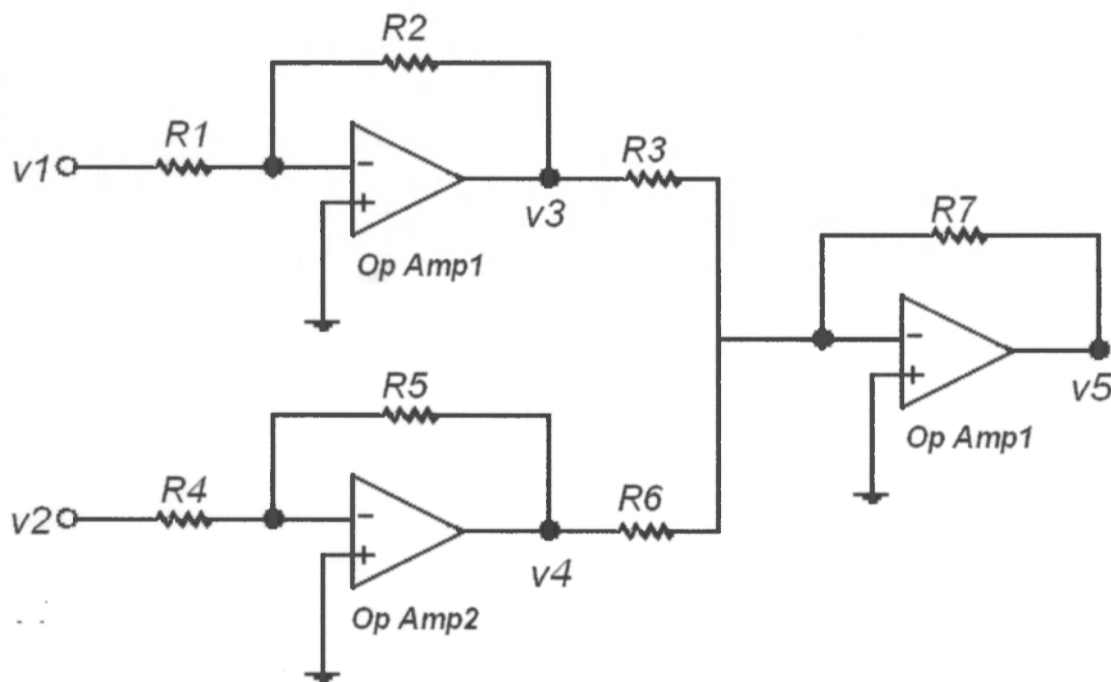


Figure Q4(b)

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1a: 1:1 mark-space ratio (50% duty cycle)



1b: 3:1 mark-space ratio (75% duty cycle)



1c: 1:3 mark-space ratio (25% duty cycle)



Figure 05(b)

707 - 709

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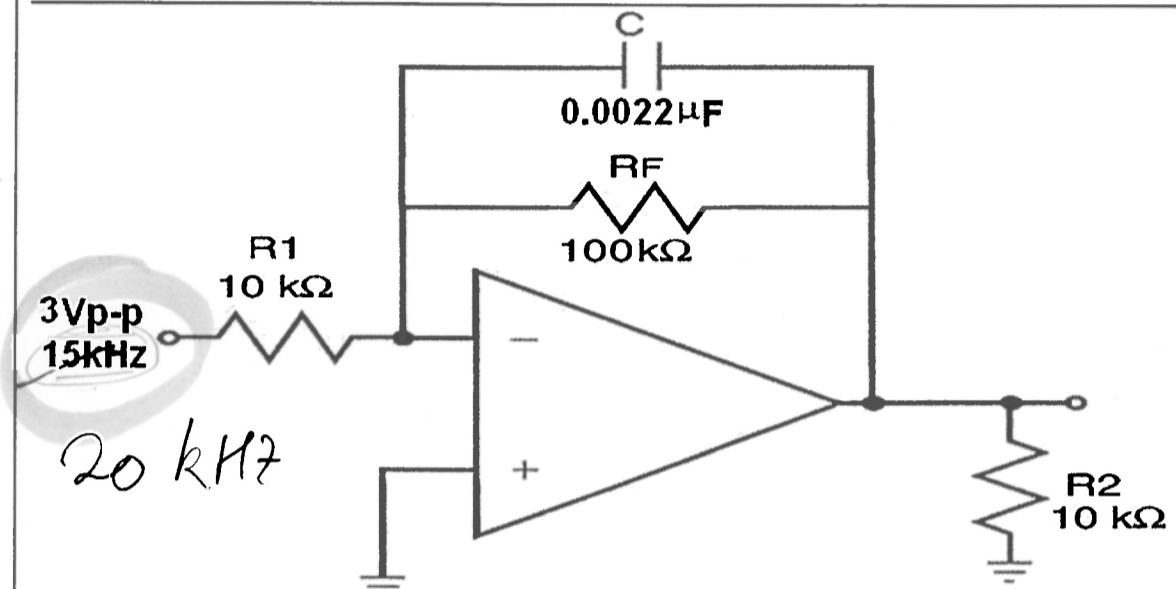


Figure Q4(a)

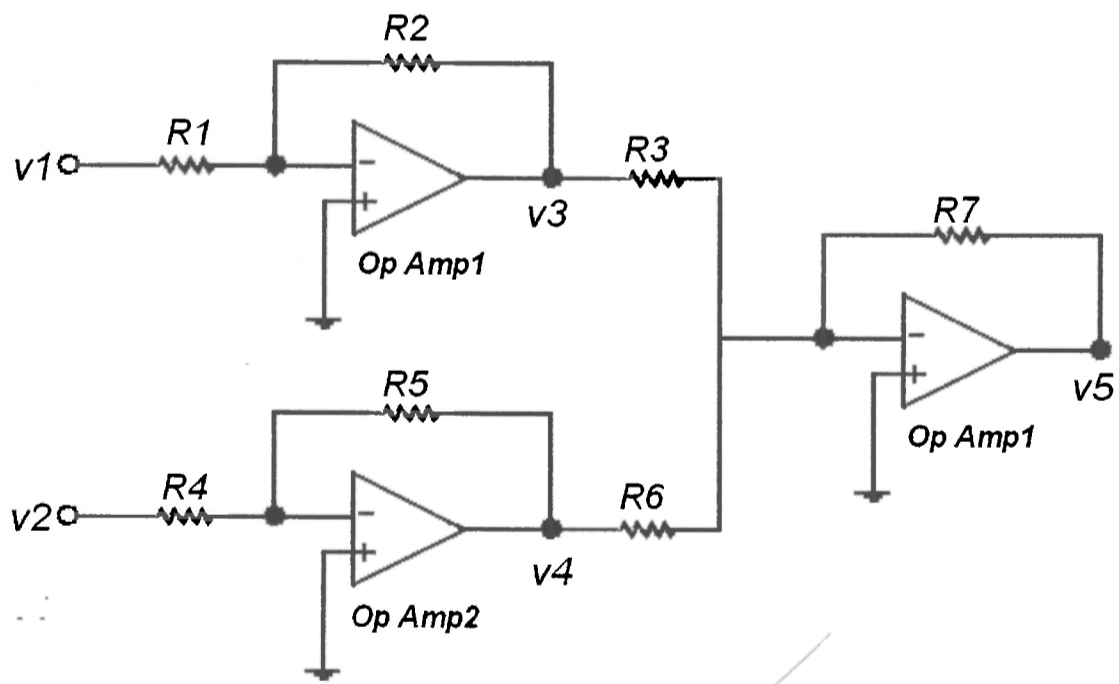


Figure Q4(b)