The Open University of Sri Lanka
Department of Electrical and Computer Engineering
Final Examination -2012
ECX4230 – Fault Diagnosis in Electronic Circuits

Date:17.08.2013 Time: 0930 -1230 hrs

Answer any five questions. All questions caring equal marks.

1.

a. Write the common faults appear in the following components. [3 marks]
   i. Capacitor
   ii. Resistor
   iii. Transistor

b. A unity current gain amplifier is shown in figure 1.

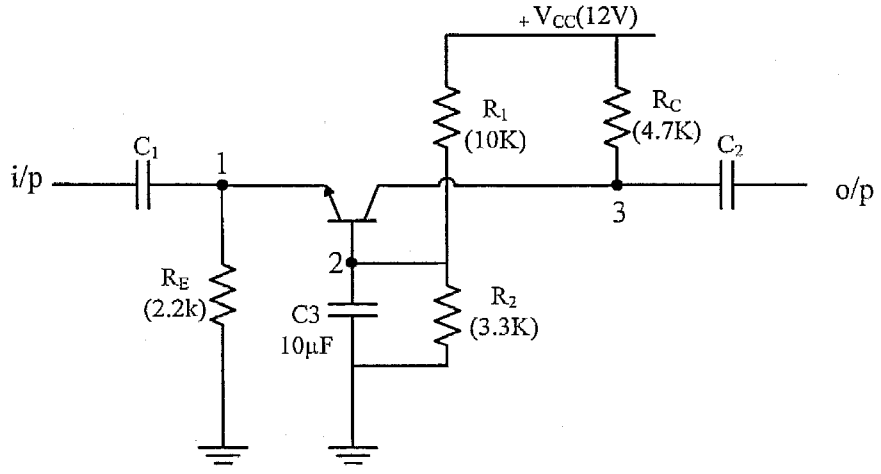

Figure 1

i. Test point voltages of figure 1 are measured with a 20k/V multimeter which have three ranges (0 – 10V, 0 – 20V, 0 – 50V). Use the correct range and calculate the test point voltages in figure 1. [9 marks]

ii. The table given below shows the voltages at the test points under fault conditions. Find the faulty component(s) and the type of fault giving reasons.

Case	1	2	3	
A	0	2.97 V	12 V	No output
B	2.37 V	2.97 V	0.03 V	No output
C	2.37 V	2.97 V	0 V	No output
D	8.72 V	9.32 V	3.18 V	Positive clips

[8 marks]

2.

a. Draw a block diagram of a switch mode power supply (SMPS) and give the function of each block. [5 marks]

b. What do you understand of duty cycle of the SMPS? [3 marks]

c. Differentiate between a linear mode power supply and a switch mode power supply. [3 marks]

d. A conventional stabilizer circuit is shown in figure 2.

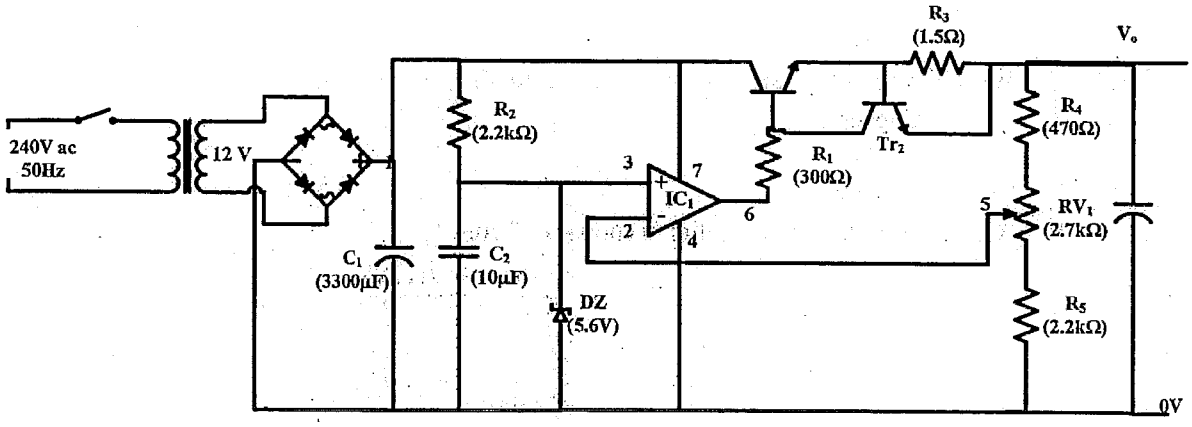

Figure 2

Find the faulty component(s) and the type of fault giving reasons for the following faults.

Case	2	3	7	6	V_o
A	0	+5.7 V	0	0	0
B	+5.7 V	+5.7 V	+16.2V	+11V	+10.4V
C	+0.2V	+5.7 V	+16.2V	+6.4V	+5.7V

[9 marks]

3. Free running sawtooth oscillator is shown in figure 3.

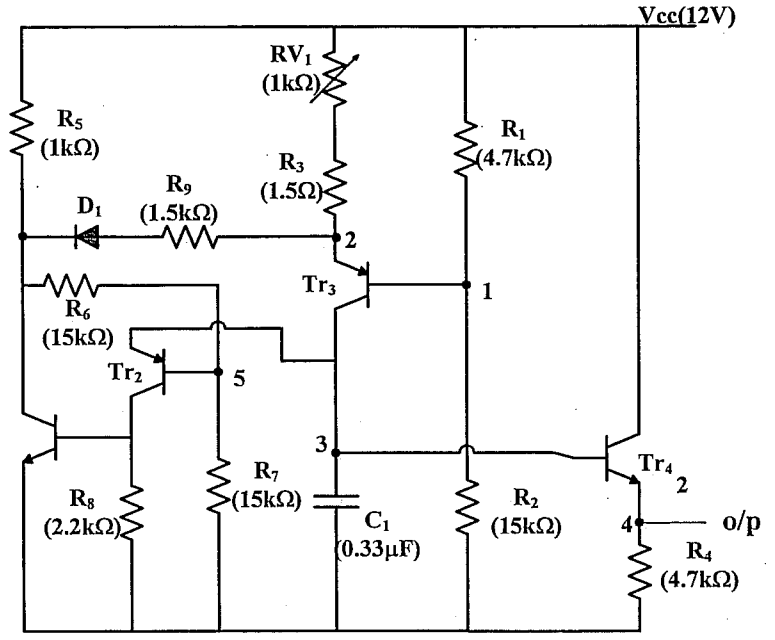

Figure 3

a. Explain the operation of this circuit. [3 marks]

b. Calculate the available range of the output signal. [2 marks]

c. Sketch the waveforms at test points 6, 3, 2 and 4 at a common scale showing the time and voltage values. Assume RV1 is set to the highest value [6 marks].

d. Write the purpose of the following components. [3 marks]

   i. Tr3

   ii. Tr1 and Tr2

   iii. Tr4

e. Following table shows the test point voltages under faulty conditions. State the faulty components with reasons. Assume RV1 is set to the highest value. [6 marks]

Case	1	2	3	4	5	6	symptoms
A	11.48V	6.32 V	0	12V	12V	0	No output
B	11.48V	6.32 V	8.12 V	10.12V	9.52V	7.52V	No output
C	0.2 V	0.11 V	0.71V	10.12V	9.52V	0.11V	No output

4. A D.C amplifier circuit is shown is shown in figure 4.

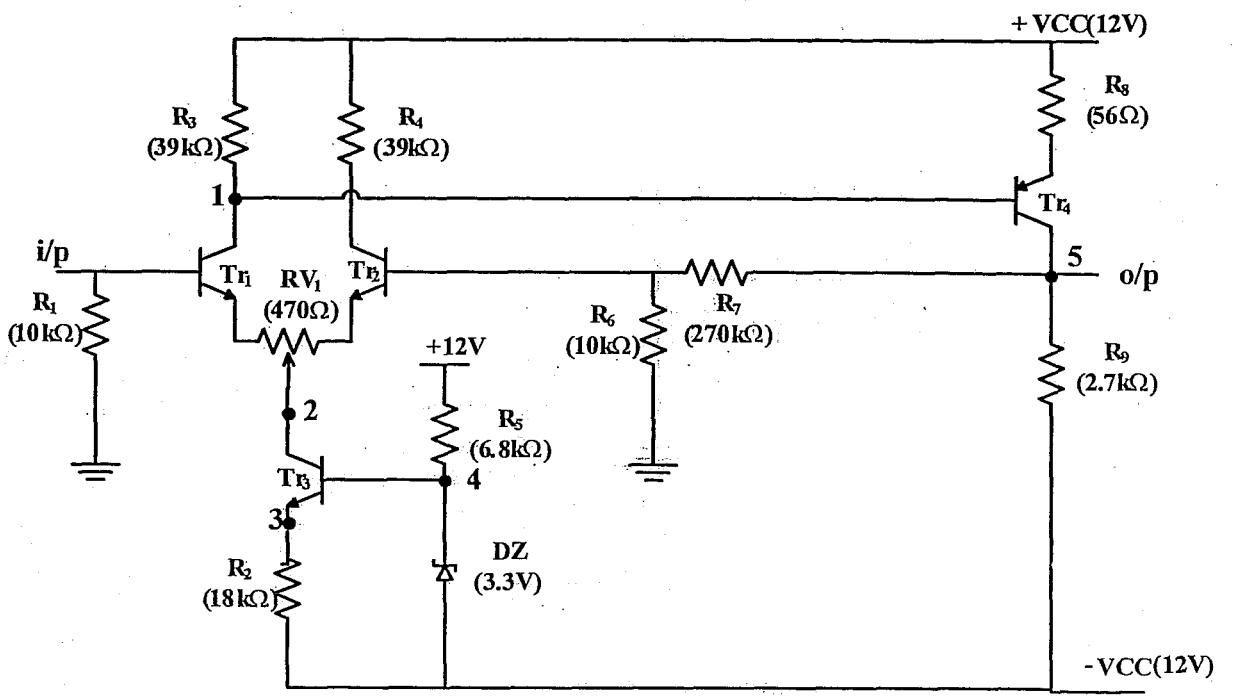

Figure 4

a. Write the type of the feedback used in this amplifier circuit and give the path of the feedback. [2 marks]

b. Calculate the test point voltages at no signal.(assume Tr_1 and TR_2 are matched pair of transistors) [8 marks]

c. Calculate the voltage gain for this circuit [2marks]

d. Find the faulty component/s **giving reasons** [8 marks]

Fault	DC Test Point(V)				
	1	2	3	4	5
P	11.9	-0.9	-9.3	-8.7	-12.0
Q	12.0	5.9	5.8	6.4	-12.0
R	11.8	-0.9	-9.3	-8.7	-12.0
S	11.4	-0.9	-9.3	-8.7	-12.0

5. The circuit shown in figure 5 is a monostable circuit.

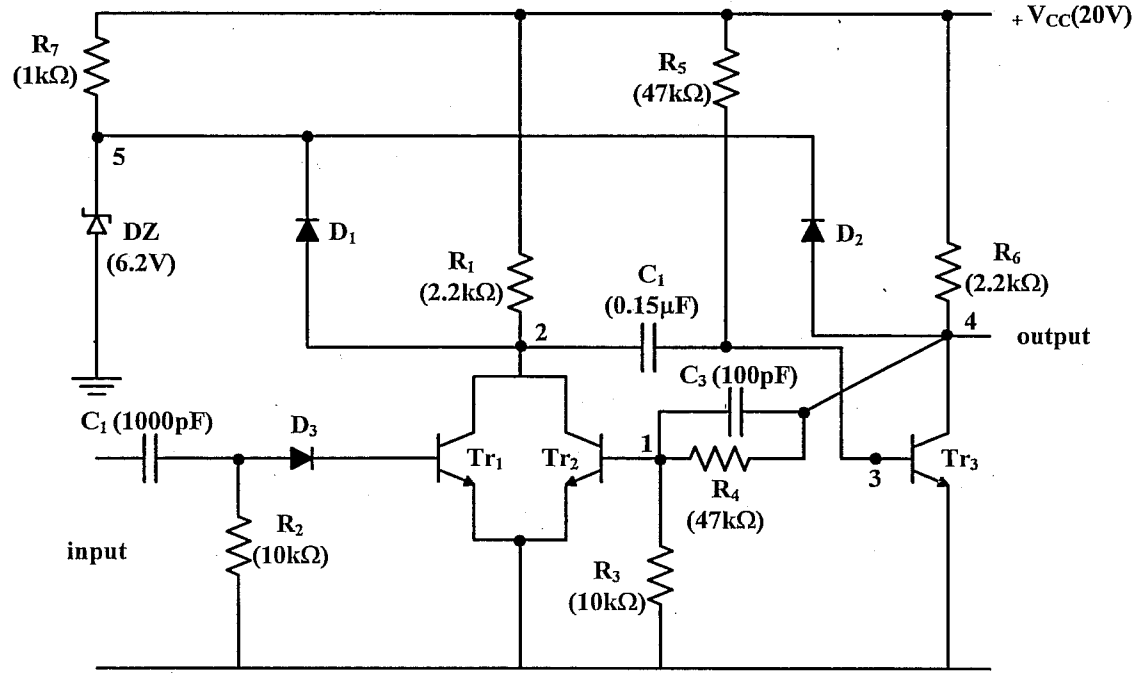

Figure 5

a. Which two components determine the width of the output pulse? [3 marks]

b. What is the purpose of C_3? [2 marks]

c. In each of the following cases the monostable fails to produce an output when the correct input is applied. State which component (or components) is at fault with reasons. (+ve means "just positive".) [10 marks]

Fault	1	2	3	4	5
A	+ve	0	0.7	0.1	6.2
B	+ve	7.0	0.7	0.1	6.2
C	0	7.0	0.7	0.1	6.2
D	+ve	0.7	0.7	0.1	0
E	0.7	0.13	0	7.0	6.2

d. How could the circuit be modified to produce negative going output pulses? [5 marks]

5. Logic circuit is shown in figure 6.

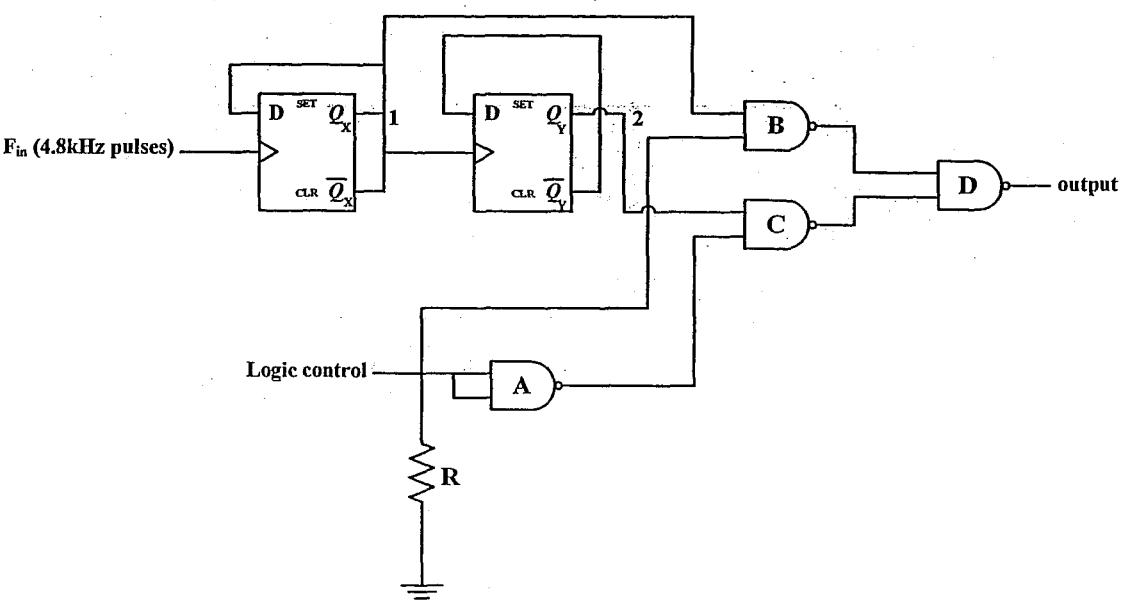

Figure 6

a. Draw the output waveform with respect to the input when the
   i. Logic control is set to logic 1
   ii. Logic control is set to logic 0
   (You may use TP1 and TP2 waveforms as well) [8 marks]

b. State the portion of the circuit that is at fault and the type of fault for the following symptoms. [6 marks]

	Control logic	Output
A	1	2.4KHz square wave
	0	0
B	1	1
	0	0

c. Describe the symptoms for the following faults. [6 marks]
   i. Gate B output " stuck at 0"
   ii. An open circuit track to the clock input of the second D flip flop.

7. The lamp dimming circuit is shown in figure 7.

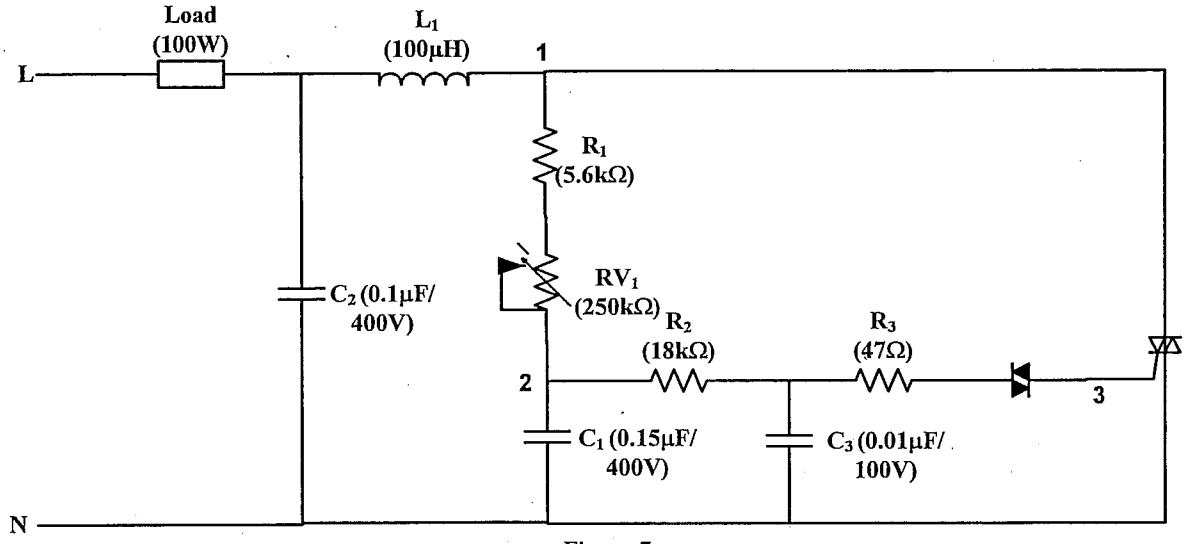

Figure 7

a. Write the triggering modes of the triac. [2 marks]
b. What are the advantages of triac over thyrister? [2 marks]
c. State the purpose of L1 and C1? [2 marks]
d. Draw the waveform for the followings
   i. Diac gate currernt
   ii. Load voltage [6 marks]
e. Calculate the conduction angle when the RV1 is set to its maximum [4 marks]
f. The a.c. voltages with minimum RV1 set are as follows. State the component failure with the reason. [4 marks]

T.P	1	2	3	Symptoms
	235 V	227 V	0	No output

8.

a. What is used to match the input impedance of the RF amplifier of a TV to that of an antenna? [2 marks]
b. Show in a block diagram how the TV signal is processed after extracting sound in a color receiver. [3 marks]
c. What are the signals used to ensure the lines and the frames in their proper places? [2 marks]
d. Explain how the detected Y and colour component signals are used to recover the colour signals R,G and B in a PAL receiver. [6marks]
e. How does the receiver colour decoder carrier signal is kept in phase with the transmitter colour encoder carrier signal? [3 marks]
f. In a defective TV receiver, sound signal and the raster is received without the picture. What could be the faulty sections? Explain how you are going to locate the fault using an oscilloscope. [4 marks]