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The Open University of Sri Lanka
Department of Electrical and Computer Engineering
Bachelor of Technology Honors in Engineering – Level 4
ECX 4230 – Fault Diagnosis in Electronic Circuits
Academic Year 2015/2016
FINAL EXAM **Close Book**
Date: 18-11-2016 **Time:9.30AM -12:30 noon**

ANSWER ONLY 05 QUESTIONS

Question 01

(1) Draw the block diagram of the basic television receiver.

(2) Explain the operation/function of the following components you may find in a monochrome television receiver.

(a) Balancing transformer
(b) RF tuner
(c) Video detector

(3) Describe horizontal and vertical scanning processes. Draw the appropriate waveforms to support your answer.

(4) Identify the following raster defects shown in Figure 01 and the causes for each identified defect.

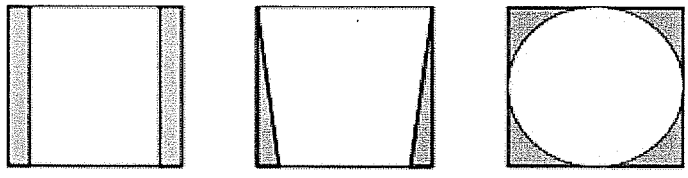

Figure 01

Question 02

(1) List the main components of a color TV receiver.

(2) Define the terms luminance and chrominance.

(3) In colour TV transmission, show that only two signals are enough to send along with luminance signal in order to obtain three primary signals. Provide a detailed discussion along with necessary equations where applicable.

(4) Given the indications on raster, sound and picture, identify the defective stage in a television receiver. Please note that if there are no defect in any of the above indicators '*' symbol is used.

Faulty Situation	Raster	Picture	Sound
(a)	*	Only red color	*
(b)	*	No color	*
(c)	Vertical lines	No picture	*
(d)	No raster output	No picture	No sound

Question 03

(1) Compare RF and AF amplifiers

(2) Explain the operation of an amplitude limiter using the circuit diagram of a typical transistor limiter.

(3) Draw the waveforms you will observe on an oscilloscope for the following faulty conditions based on the circuit shown in Figure 02. For each scenario, clearly indicate the frequency of the observed signals.

(a) when D1 is open
(b) when C is open
(c) when C and D1 are open

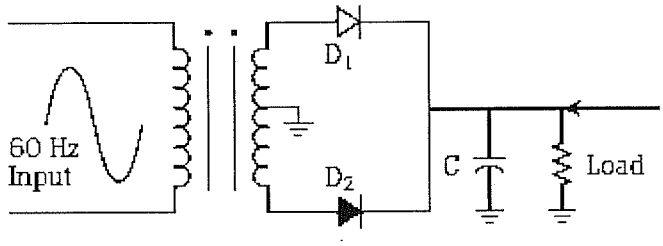

Figure 02

(4) Consider the wave shaping circuit shown in Figure 03. A 10V, 250 Hz square waveform is given as the input. Identify the faults of the circuit for the (a) and (b) waveforms shown in Figure 04 when compared to the expected output waveform.

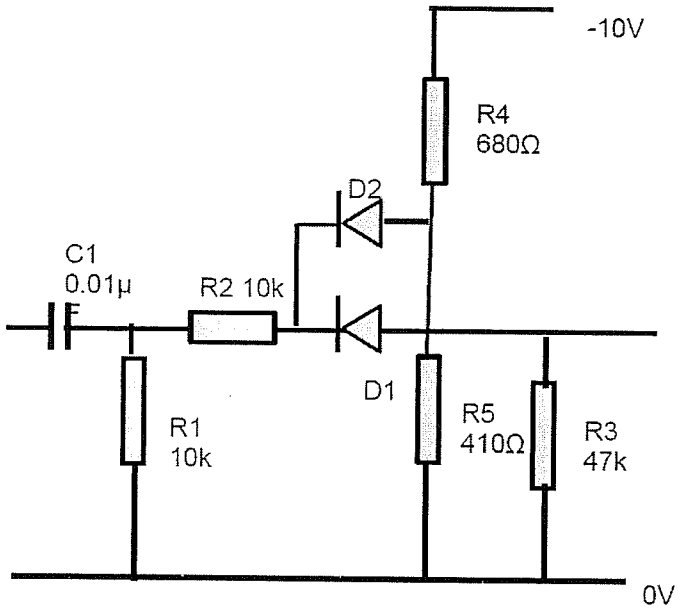

Figure 03

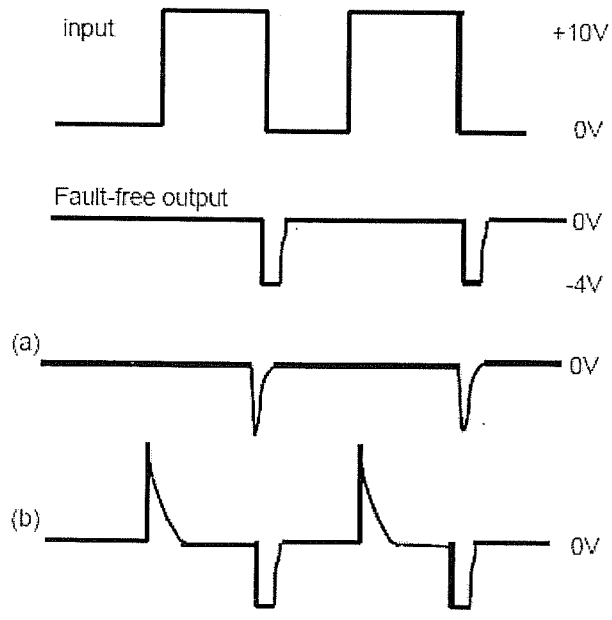

Figure 04

Question 04

(1) Define the term firing angle of a light dimmer circuit.

(2) For a 60Hz sinusoidal input draw the output waveforms when the firing angle is (i) 30^0, (ii) 90^0 and (iii) 150^0.

(3) Identify an appropriate measuring instrument to view the waveforms in (2) and describe the calibration process of the selected instrument.

(4) For the light dimmer circuit shown in Figure 05, compute the RC time constants when the potentiometer is adjusted to (i) 0Ω and (i) 250 kΩ. Describe why the RC time constant is important for the circuit operation.

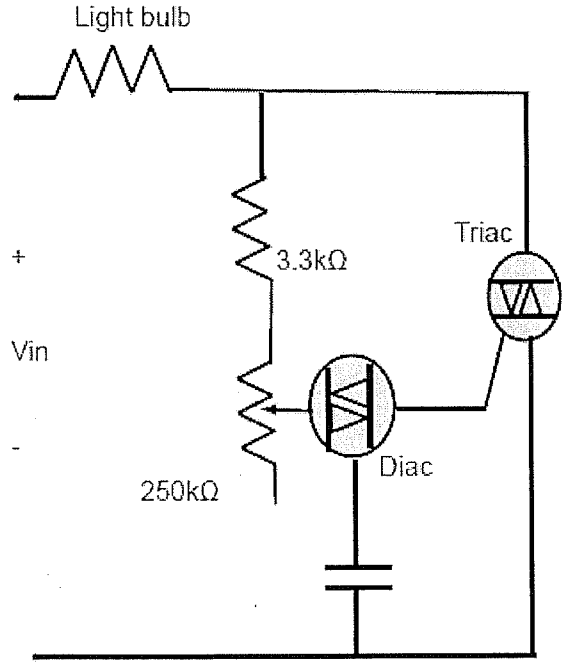

Figure 05

(5) (i) State an appropriate measuring instrument to test a triac.

(ii) Describe how you will test a triac using the above stated measuring instrument. Clearly state the connections and the expected outputs (or readings) corresponding to the tests conducted.

Question 05

(1) Draw the block diagram of a typical oscillator.

(2) Explain the two terms (i) frequency stability and (ii) harmonic distortion of an oscillator.

(3) The following circuit (see Figure 06) is a blocking oscillator sawtooth generator.

(a) Describe its operation with respect to average power dissipation and duty cycle.

(b) Identify the faulty conditions based on the following observed measurements (see Table 01) at different points in the circuit (see Figure 06). Clearly describe how you diagnose each fault.

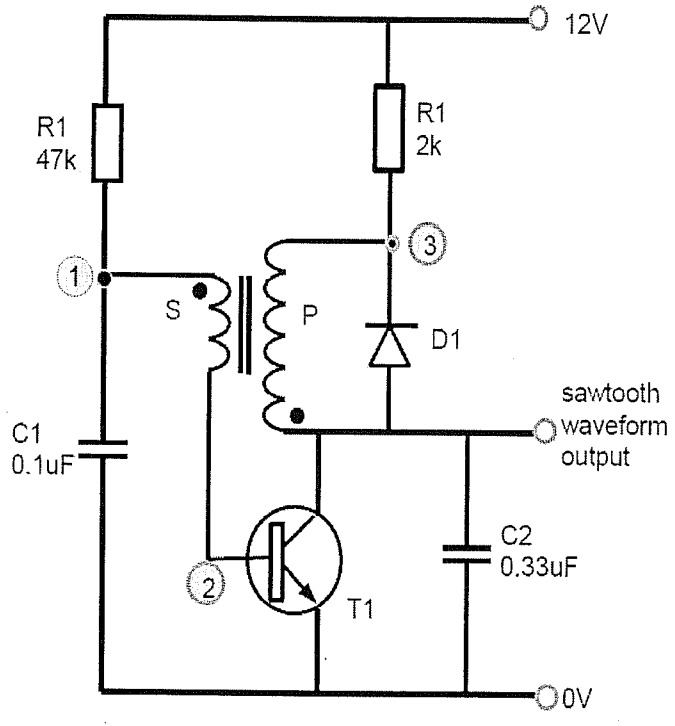

Figure 06

Faulty Condition	1	2	3	4
A	0V	0V	12V	12V
B	0.7V	0.7V	0.1	0.1V
C	1.7V	0V	12V	12V

Table 01

Question 06

(1) Draw the block diagram of a conventional power stabilizer and describe the function of each block.

(2) What are the two types of switch mode stabilizers?

(3) Design a laboratory test set-up for measuring the performance of a power supply unit. Clearly show the input signal, components, devices and the necessary connections used.

(4) Using the test set-up in (3), describe how you would test the load regulation. State any necessary conditions and/or equations applicable during this test.

Question 07

(1) Compare the differences between switched mode power supplies and linear power supplies.

(2) Explain the operation of the following types of switched mode power supplies. Clearly draw the circuit diagrams where necessary.

(i) Self-oscillating flyback converter

(ii) Boost regulator

(iii) Buck regulator

(3) Switched mode power supplies are used in television receivers. There are various faults due to issues of the power supply. State the precautions you should take while diagnosing a power supply fault.

(4) Consider an observed symptom where" the television set is dead: no raster and no sound". State the important steps of the fault diagnosis process.

Question 08

(1) Explain the step-by-step process how you will test a PNP transistor using a digital multimeter using the diode-test function. At each step, clearly state the test lead connections with the appropriate color of the connectors where necessary.

(2) Consider a small signal bipolar junction transistor amplifier circuit shown in the Figure 07.

(i) Assume the circuit is in normal operating condition, compute the voltages you would expect at the three test points 1, 2, and 3.

(ii) When the circuit was tested, at the test points following voltage readings were obtained (see Table 02).

Test point	1	2	3
Measured voltage (V)	2.9	2.9	2.2

Table 02

For these observed readings in Table 02 diagnose the fault in this circuit. Clearly show the necessary calculations.

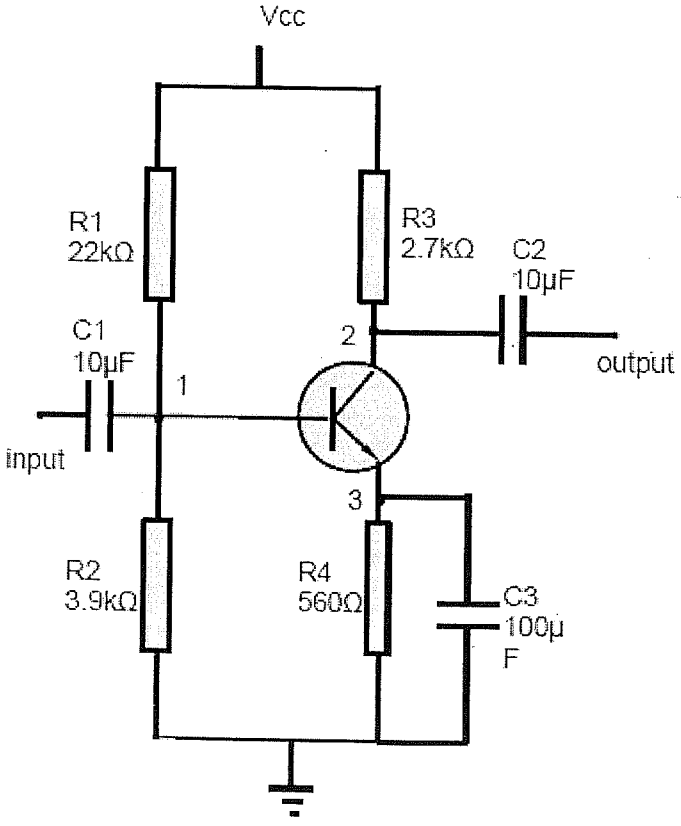

Figure 07

(3) For the following two-stage pre-amplifier shown in Figure 08, identify the faults based on the given observations in Table 03.

Normal Operating Condition					
Test point	1	2	3	4	5
Voltage (V)	0.32	3.5	7.5	2.8	1
Faulty Conditions					

Fault	Test Point Voltages (V)					Output
	1	2	3	4	5	zero output
F1	0.15	5	4.3	4.25	1.6	zero output
F2	0.4	0.2	14	0.2	0.08	zero output
F3	0	0.75	0.1	0	0	zero output
F4	0.2	2.5	9.2	2.3	0.9	12V peak-to-peak

Table 03

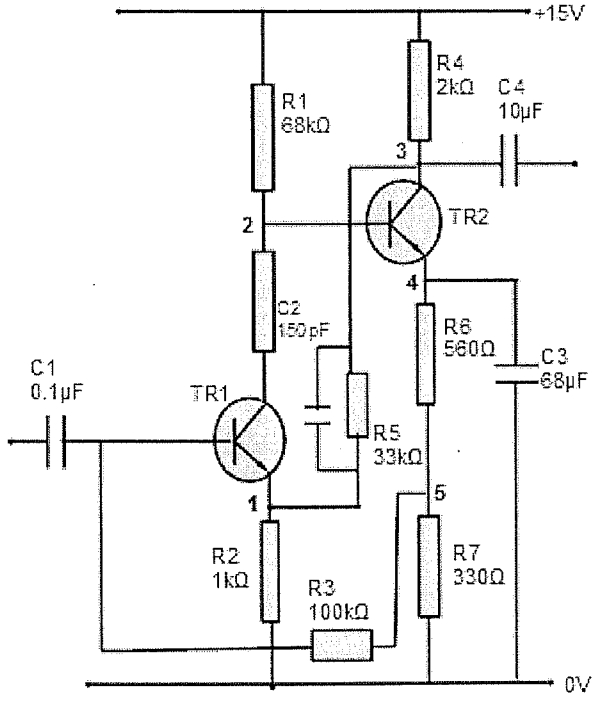

Figure 07