Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Computer Science and Technology
100 Level 1st Semester Examination – May/July-2017
CST 101-3 Fundamentals of Electronics

Uva Wellassa University

Instructions to candidates
Duration: Three (03) hours
Number of questions: Six (06) Essays
Mark allocation: 200 marks
Answer **all** questions.

Consider the diode voltage (knee voltage) for all diodes as 0.7 V.

1.

a. What are the definitions of a stiff current source and stiff voltage source ?

(06 marks)

b. A current source of 5 mA has an internal resistance of 25 MΩ. Over **what range** of load resistance is the current source stiff ?

(04 marks)

c. Write down "Thevenin's theorem".

(05 marks)

d. Calculate the current through 2 kΩ resistor between point A and point B in Figure 01 given below using **only** Thevenin's theorem.

(15 marks)

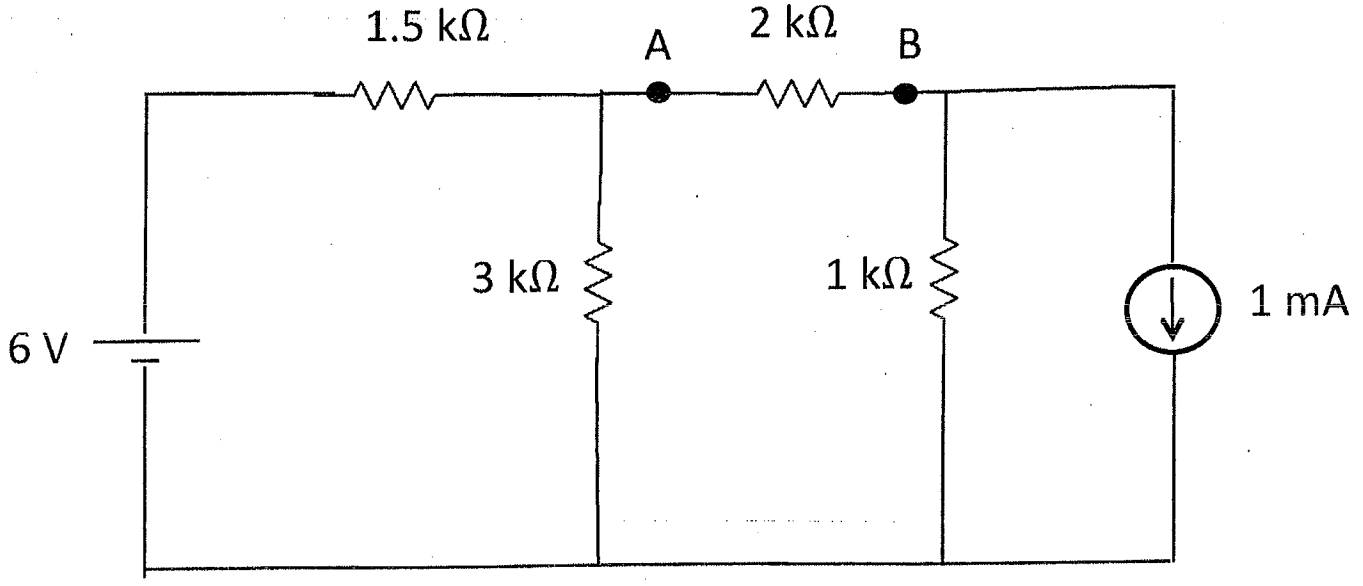

Figure 01

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2.

a. In the circuit shown in Figure 02, identify each section A, B, C and write down the purpose of each section.

(06 marks)

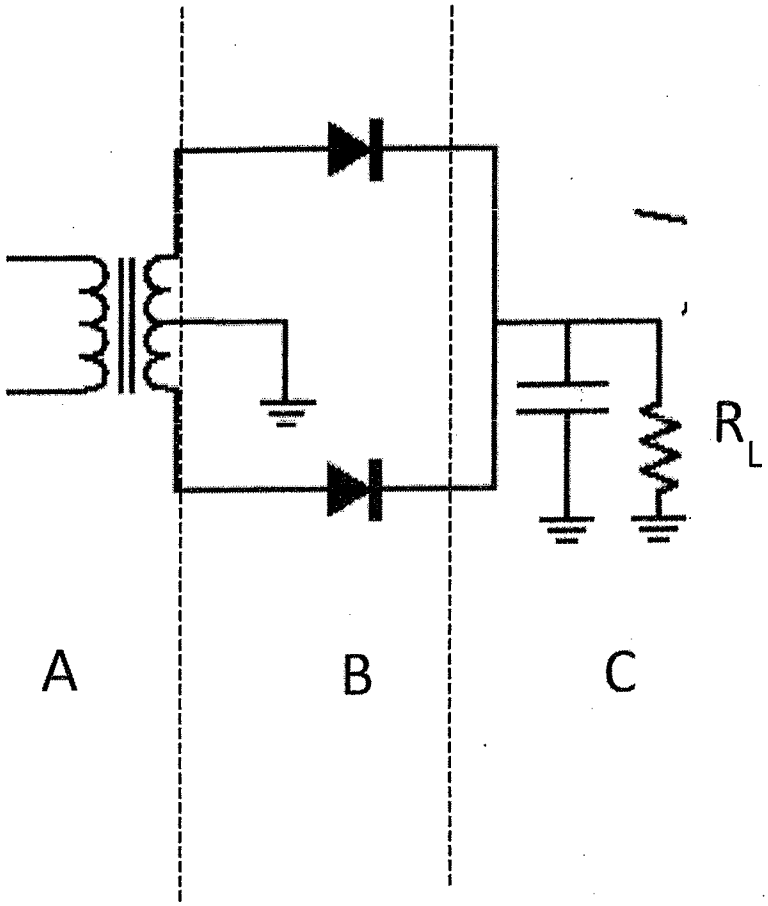

Figure 02

b. The primary *rms* voltage value used as the input for the section A of the circuit is 230 V. The ratio between primary winding and secondary winding is 15 : 1 .

I. What is the peak primary voltage ?

(03 marks)

II. What is the peak secondary voltage ?

(03 marks)

c.

I. What is the peak **output** voltage from the section B of the circuit ? Consider the **second** approximation for the dioodes.

(03 marks)

II. Draw the **input and output** wave forms for the section B of the circuit.

(06 marks)

d.

I. What is the dc voltage through the load resistor R_L ?

(03 marks)

II. Calculate the ripple voltage, if the value of the load resistor R_L is 5 kΩ , the frequency of the input signal coming from section A is 50 Hz and the value of the capacitor is 100 µF.

(06 marks)

III. Draw the waveform through the load resistor.

(05 marks)

3.

a. What is the major characteristic of a zener diode which differs from the characteristics of a normal diode ?

(03 marks)

b. Write down one major application of a Zener diode.

(03 marks)

c. Is the zener diode shown in the Figure 03, operating in the break down region ? Justify your answer.

(12 marks)

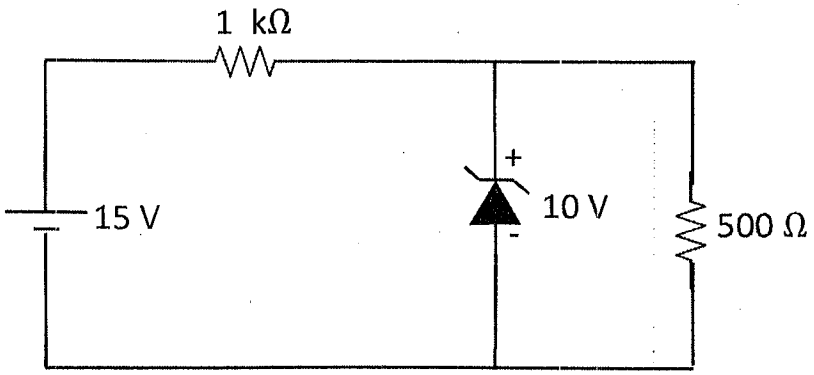

Figure 03

d. Calculate the Zener current in the following circuit shown in Figure 04.

(12 marks)

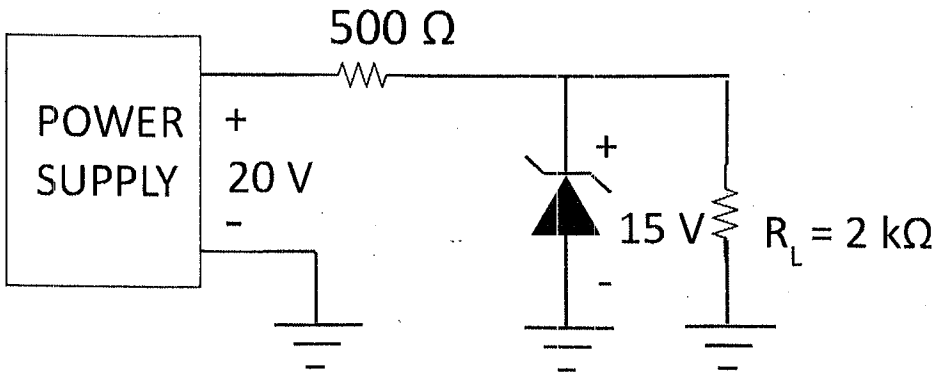

Figure 04

4.

a. Write down two major applications of a transistor.

(05 marks)

b. Which type of circuit (base biased or emitter biased) you use for each application you mentioned in part "a". Justify your answer using the current gain β and operating point Q.

(10 marks)

c. Find the operating point for the following circuit shown in Figure 05 below. Note that the current gain β is 100 for the transistor given in Figure 05. Consider the **second** approximation for diodes.

(20 marks)

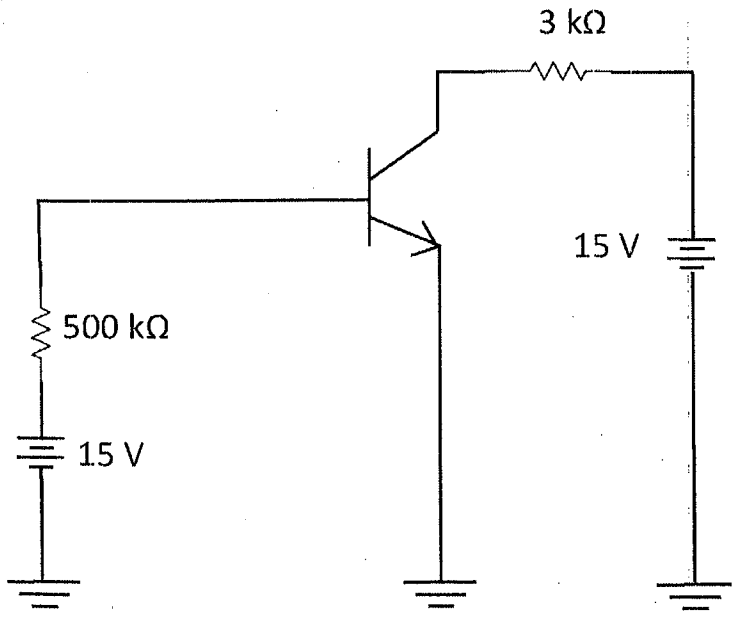

Figure 05

5.

a. Briefly explain why a capacitor is considered as a closed switch for ac signals and an open switch for dc signals.

(06 marks)

b. Identify each section I, II, III in the following circuit shown in Figure 06 and briefly write down the purpose of each section. (Note that the sections are seperated by dash lines)

(09 marks)

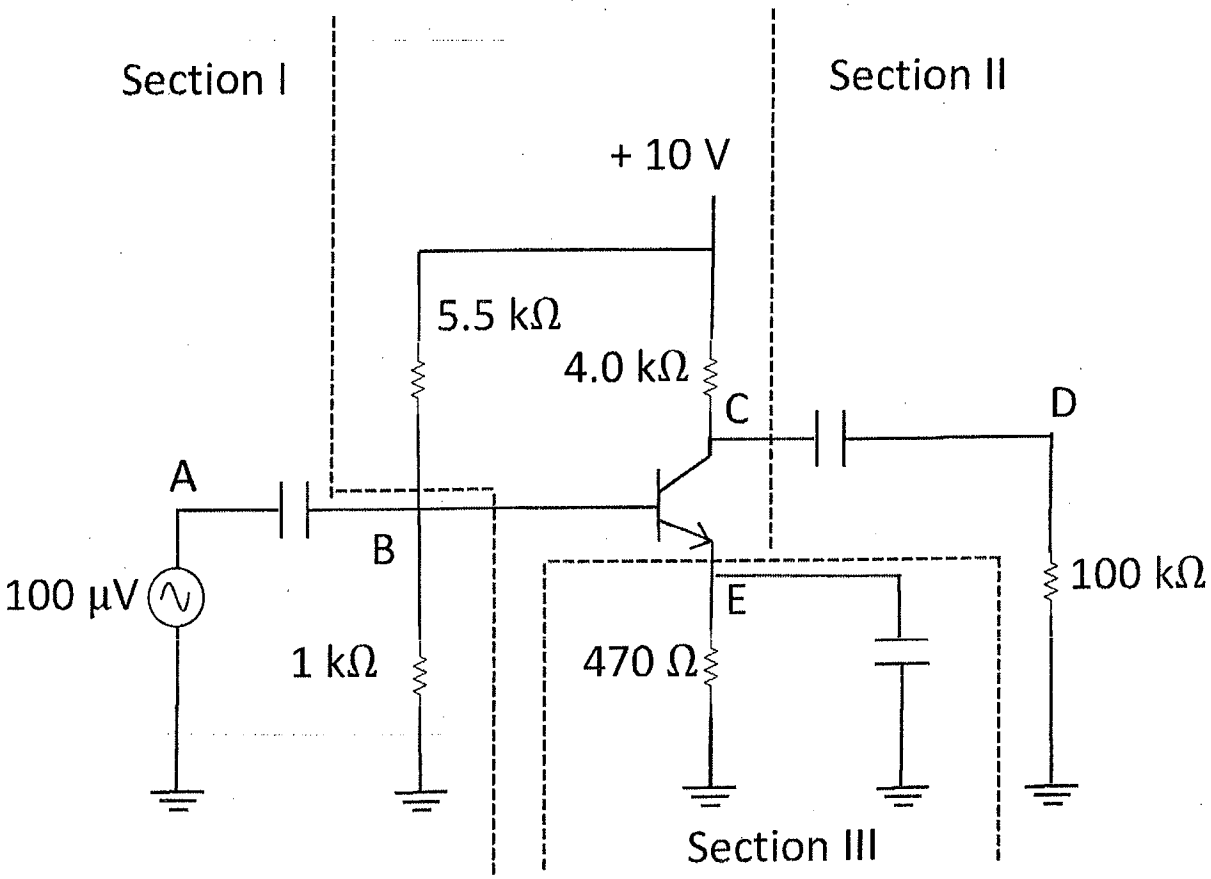

Figure 06

c. Calculate the dc component of the voltage at each point A,B,C,D and E in the above circuit shown in Figure 06 and draw the wave forms at each point showing both ac and dc components of the voltages. Consider the **second** approximation for diodes in the transistor.

(25 marks)

6.

a. What is the major application of an opamp ?

(04 marks)

b. Write down an equation for the common mode rejection ratio (CMRR) of an opamp. Define all the terms in the equation.

(06 marks)

c. A differential amplifier has an open-loop voltage gain of 80 and a common input signal of 6.0 V to both terminals. An output signal of 48 mV results. Calculate the common-mode gain and the CMRR.

(08 marks)

d. For the op amp non inverting amplifier shown in the Figure 07 below, R_i = 8 kΩ and R_f = 20 kΩ. If the input voltage is – 0.8 V, determine

I.The voltage gain

II.The output voltage.

(12 marks)

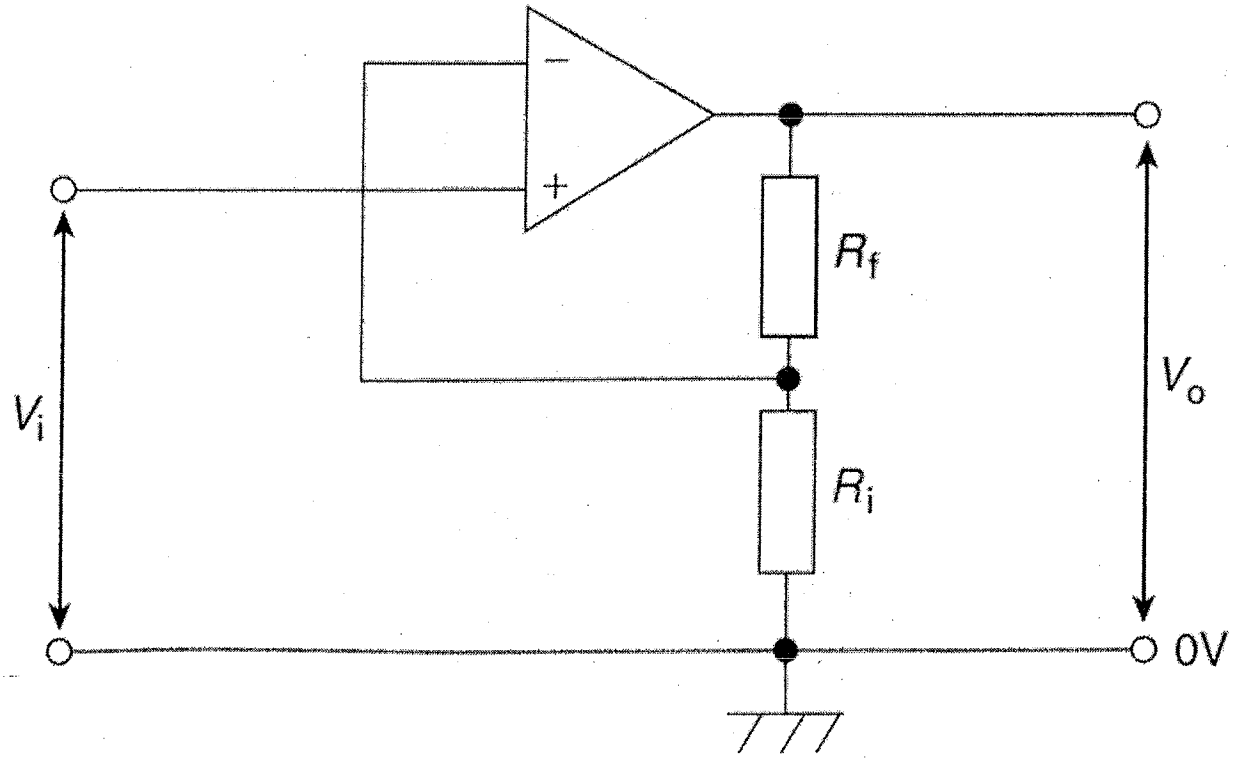

Figure 07