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The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical & Computer Engineering

Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: EEX3350/ ECX3150 - Electronics I**
Academic Year	: 2017/18
Date	:16th January 2019
Time	: 0930-1230hrs
Duration	: **3 hours**

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Eight (8)** questions in **Eight (8)** pages.
3. Answer any **Five (5)** questions only. All questions carry equal marks.
4. Answer for each question should commence from a new page.
5. This is a Closed Book Test (CBT).
6. Answers should be in clear hand writing.
7. Do not use Red colour pen.

Q1.

a. Name three special diodes and briefly explain their operation with an application in each case. [05 Marks]

b. A Zener diode application and a characteristic curve of a Zener diode are shown in Figure Q1.

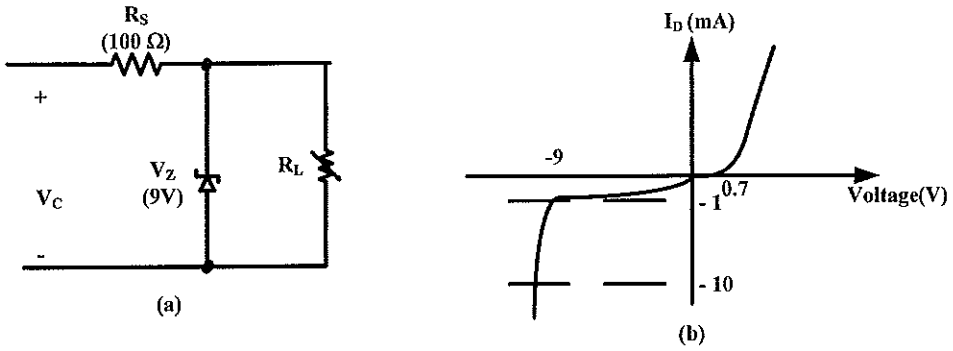


Figure Q1

Variable DC voltage supply that can be changed between 0 to 20V is connected as the input and variable load which has the maximum power dissipation of 0.5W is connected as the output load.

i. What is the output voltage of Figure Q1 (a)? [02 Marks]

ii. Calculate input voltage that can drive the maximum current to the load. [08 Marks]

iii. Calculate the power dissipation of Rs, which can withstand the maximum output current of the load. [02 Marks]

iv. A bulb rating 9V/0.5W is connected to the output replacing the variable load. What is the required minimum current to light the bulb using the calculated input voltage in part b. ii.? [03 Marks]

Q2. An amplifier circuit is shown in Figure Q2. Transistor specifications are given in Table Q2.

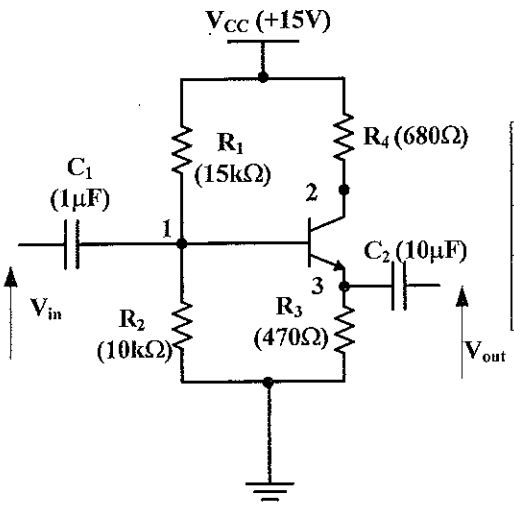


Figure Q2

Table Q2: Specification of transistor

Transistor specifications		Min	Max
Current gain	50		
V_{CE} (V)		0.2	5
Collector current (I_C)(mA)		0.1	1000

a. State the transistor configuration of the circuit shown in the Figure Q2. [02 Marks]

b. Calculate the voltages at the test points marked as 1, 2 and 3 in the Figure Q2. [09 M arks]

c. Sketch the DC load line and mark the Q point for the amplifier. [05 Marks]

d. Comment on the stability of the circuit. [04 Marks]

Q3.

a. Write the four characteristics of an ideal operational amplifier. [04 Marks]

b. An application of operational amplifier is shown in figure Q3.

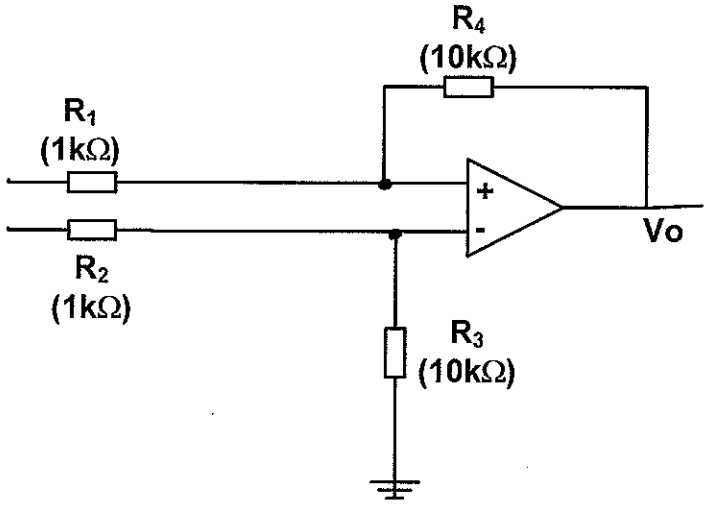


Figure Q3

i. Write the kirchoff's current law to two selected nodes of the circuit shown in Figure Q3. [04 Marks]

ii. Hence, derive the transfer function. [03 Marks]

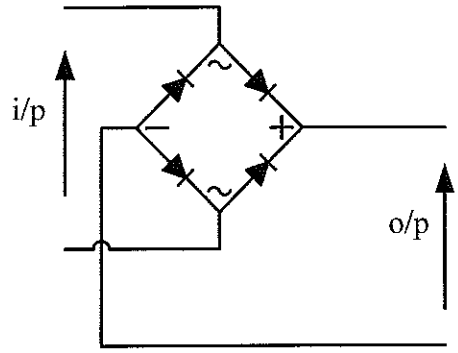
iii. Calculate the output voltage, if the V1 = 5sin1000t and V2 = 10sin1000t and sketch the output signal in a graph. [06 Marks]

iv. Identify the function of the circuit. [03 Marks]

Q4.

a. Name the four sections of a linear power supply. [04 Marks]

b. You have given the following blocks to build a linear power supply; you are required to build a 15V DC power supply using the AC signal of 230V/50Hz as the input. The supply needs to operate a variable load of 100Ω to1KΩ. Select the components and draw the circuit diagram of a linear power supply. Mark the voltages at outputs of each block that you have selected. [8 Marks]



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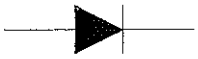

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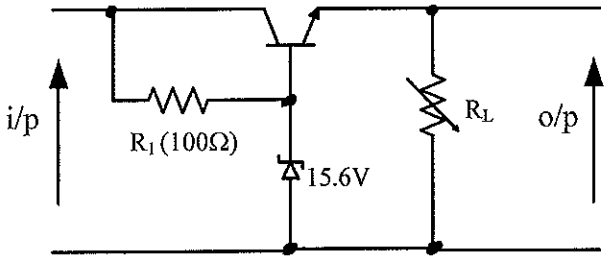

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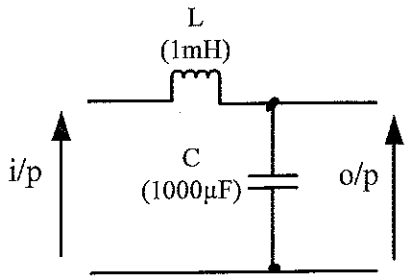

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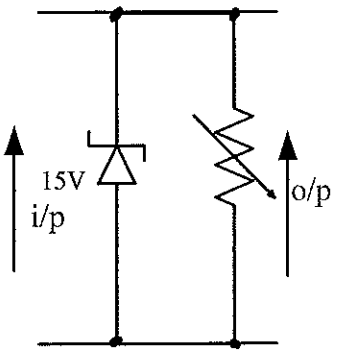

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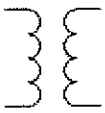

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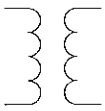

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c. Sketch the output waveform of the each section with reference to the input AC signal. (Note: Mark the necessary voltages and time periods in your sketch)

[8 Marks]

Q5. A circuit built by a student shown in Figure Q5.

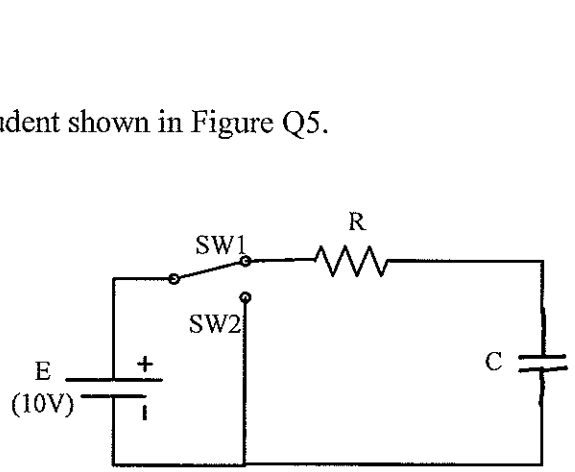

Figure Q5.1

a. The student switches on the SW2 switch and observed the voltmeter reading across the capacitor. It was 0V. Then he switched off the SW2 switch and switch on the SW1 switch. Then he saw that the voltmeter reading started to increase. Then he observed the voltmeter reading in every 10 second intervals. The observations were marked in Table Q5.

Table Q5: Voltmeter readings across capacitor in different time intervals

Time interval (s)	10	20	30	40	50	60	70	80	90	100
Voltage (V)	1.9	3.4	4.7	5.2	6.5	7.2	7.7	7.7	8.5	8.8

i. Draw the graph using the data in the Table Q5. [04 Marks]

ii. Calculate the time constant of the circuit shown in Figure Q5.1. [05 Marks]

b. The 10mH inductor is replaced with the capacitor as shown in Figure Q5.2.

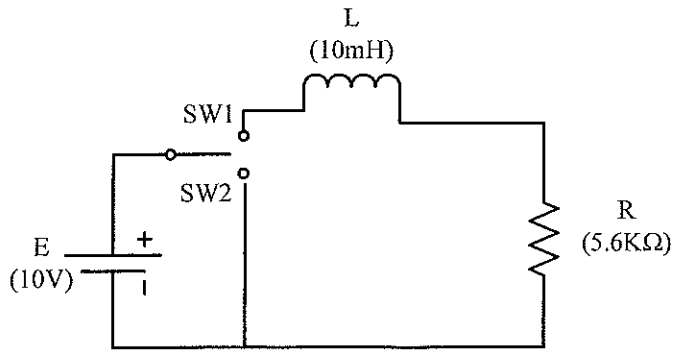

Figure Q5.2

i. Write an expression for the rate of current when the switch (SW1) is closed. [02 Marks]

ii. When the switch (SW1) is closed. Calculate the
    1. Time constant
    2. Initial current
    3. Maximum possible current in the circuit [05 Marks]

ii. Now the SW1 is open and the SW2 is closed. Draw the current variation in the circuit. (Mark the time period and the current in the diagram.) [04 Marks]

Q6. An amplifier circuit is shown in figure Q6. I_{DSS} is 10mA and pinched off voltage is -6V.

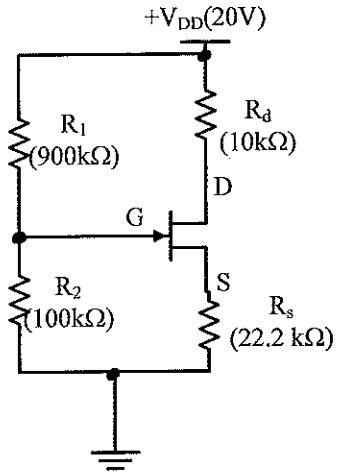

Figure Q6

a. Write an equation to obtain source voltage (Vs). [03 Marks]
b. Calculate the drain current through the channel. [12 Marks]
c. Hence, determine the gate source voltage to drive the amplifier. [05 Marks]

Q7.

a. Digital logic gate is represented by the Figure Q7.

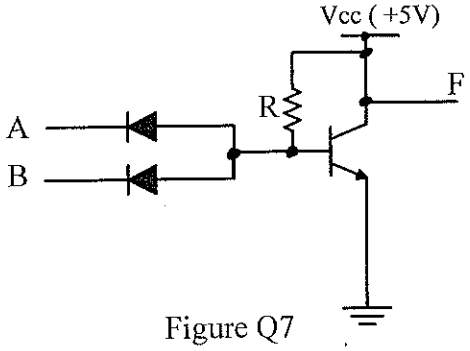

Figure Q7

i. Write the truth table for this circuit. [04 Marks]

ii. Hence write the Boolean expression. [03 Marks]

iii. Identify the logic gate. [02 Marks]

b.

i. Construct a half adder using logic gates. [04 Marks]

ii. Construct a full adder using half adders and draw the truth table for full adder. [05Marks]

iii. Explain why full adders are necessary? [02 Marks]

Q8.

a. Convert octal number 32.643 to hexadecimal [02 Marks]

b. Draw Combinational logic circuit for $\overline{\bar{A}B\bar{C} + \overline{ABC} + \bar{A}\bar{B}C}$ [03 Marks]

c. Draw the truth table for the function. $Y(A,B,C,D) = \sum(2,3,6,7,10,12,14,15)$ [04 Marks]

d. Simplify the output functions of (c) using a Karnaugh map. [06 Marks]

e. Write the simplified output functions using sum of product (SOP) terms. [05 Marks]