

The Open University of Sri Lanka
 Department of Electrical and Computer Engineering
 ECX3150 – Electronics I
 Final Examinations – 2014/15 (Closed Book)



Date: 07.08.2015

Time: 09.30 – 12.30

Answer any five questions.

1. Figure 1 shows a resistor network circuit.

- Name the theory/method you can use to calculate the output voltage (V_{out}) in figure 1. [2 marks]
- Calculate the voltage across the load (R_2), using the method you mentioned in (1.a.) [3 marks]

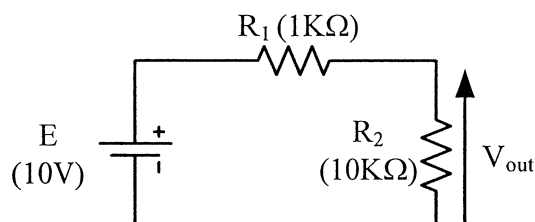


Figure 1

- A student needs to maintain a constant voltage of 9V across the load R_2 , what are the modifications that you suggest for the circuit shown in figure 1 using discrete component? [4 marks]
- Re draw the circuit using the suggested component in (1.c). [3 marks]
- Calculate the current through the R_2 . [8 marks]
- Calculate the voltage/ power ratings for the components that you suggest in part (1.c.). [3 marks]

2.

a. Simplify the following functions using Boolean algebra

i. $F_1 = \overline{A}B\overline{C} + \overline{A}B\overline{C} + A\overline{B}\overline{C} + ABC$ [3 marks]

ii. $F_2 = \overline{A}B\overline{C}D + \overline{A}B\overline{C}D + \overline{A}B\overline{C}D + \overline{A}B\overline{C}D + A\overline{B}\overline{C}D + ABCD$ [4 marks]

b. Convert the following

- 26.3_{10} to binary [2 marks]
 - 18.6_{10} to octal [2 marks]
 - 20.745_{10} to hexadecimal [3 marks]
 - -31 to two's complement [2 marks]
- c. Add two binary numbers, $0110 + 0011$ [2 marks]

- d. Divide 100011_2 by 101_2 [2 marks]
- 3.
- Write the truth table for NAND, NOR and XOR gates. [3 marks]
 - Simplify the following logic function using Karnaugh map.
 - $f(A, B, C, D) = (1, 5, 9, 10, 11, 13, 14, 15)$ [4 marks]
 - $f(A, B, C, D) = (0, 1, 2, 5, 6, 7, 8, 9)$ [4 marks]
 - Implement the Simplified logic function obtained in
 - (3.a.i.) using two input NAND gates. [5 marks]
 - (3.a.ii) using basic gates. [4 marks]
4. Sections of stabilized power supply unit are given in figure 4. All the diodes have 0.7 V forward voltages. Transistor base emitter voltage is 0.7V and current gain is 50. Zener diode voltage and the max. power dissipation are 5.7V and 0.25mW respectively.

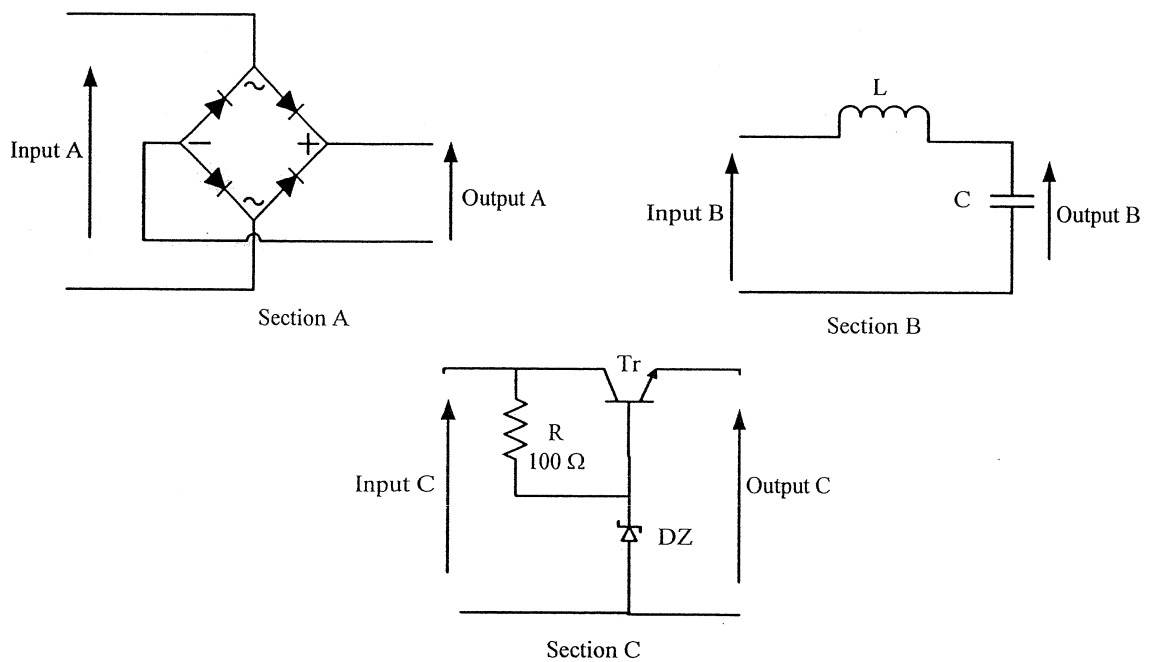
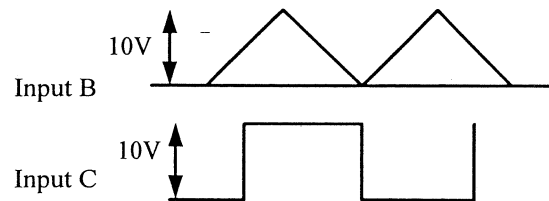
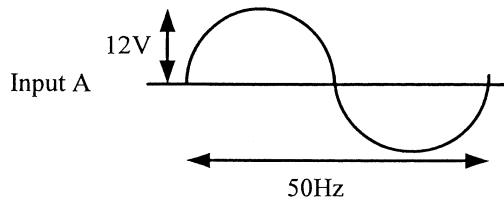
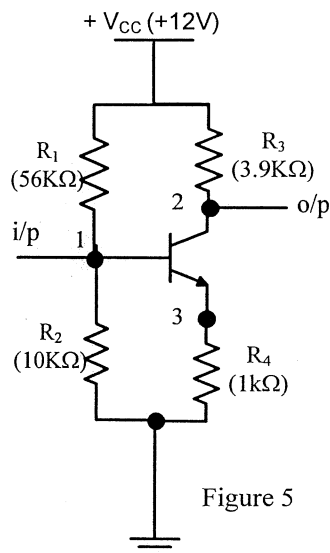


Figure 4

- Name each section and write the operation of each section. [6 marks]
- Different inputs are feed to each section. Draw the output with reference to the input signal. [6 marks]



- c. Design a linear power supply unit using the given sections given in figure 4. [2 marks]
- d. Calculate ,
- output voltage of the linear power supply unit. [2 marks]
 - maximum output current for this linear power supply unit. [4 marks]
5. A single stage transistor amplifier is given in figure 5. Si Transistor has a high current gain.



- Name the configuration of the circuit shown in figure 5. [2marks]
 - Calculate the test point voltages 1, 2, 3. [5marks]
 - Draw the D.C load line of the amplifier. Clearly state necessary calculations. [8 marks]
 - According to your knowledge state the best Q point position and any modification to the amplifier design to achieve the best Q point. [5 marks]
- 6.
- Write four characteristics of an operational amplifier. [4 marks]
 - An operation amplifier circuit shown in figure 6.

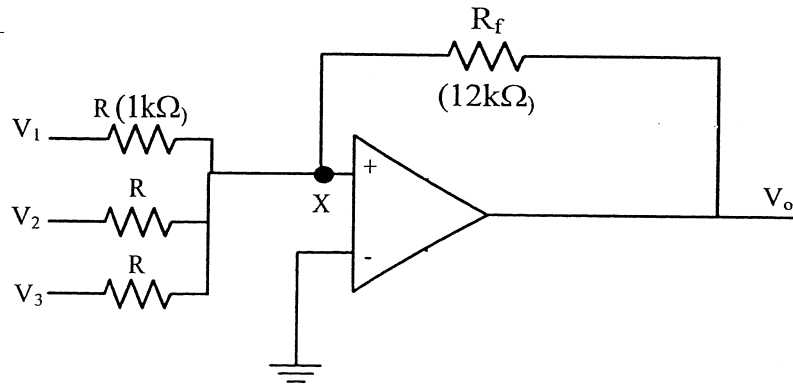


Figure 6

- i. Derive a function with an input output relation. [6 marks]
- ii. Name the operation of the design in figure 6, using the derived function in 6.b.i [3 marks]
- iii. Calculate the output signal, if the following signals are given to the input. $V_1 = 2\text{ V}$, $V_2 = 5\text{ V}$, $V_3 = 1\text{ V}$ signal. [3 marks]
- iv. Draw the output signal indicating necessary parameters of the signal. [4 marks]

7. An experiment is set up to observe the transient response of a capacitor. The circuit is shown in figure 7.

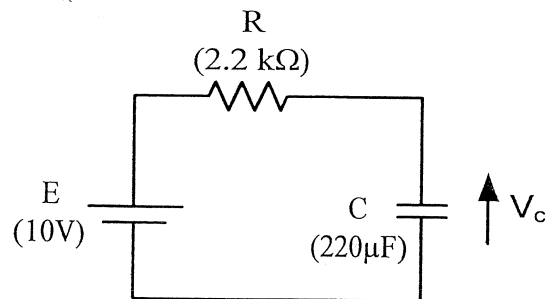


Figure 7

- a. Derive an expression for V_c of the circuit shown in figure 7. [5 marks]
- b. Calculate the voltage of the capacitor at $t = 0.5\text{ s}$ [3 marks]
- c. After 4 s battery was replaced with a switch. Explain the behavior of the capacitor when the switch is on. [4 marks]
- d. If the switch is replaced by a sinusoidal voltage source with 10V peak voltage,
 - i. Explain the voltage variation of the capacitor. [4 marks]
 - ii. Draw the output signal (voltage across capacitor) with reference to the input signal. [4 marks]

8.

- a. Write down the advantages of Field effect transistors over bipolar transistors. [04 marks]
- b. Consider the circuit shown in figure 7. I_{DSS} and pinch off voltage of the JFET is 12mA and -3V respectively.

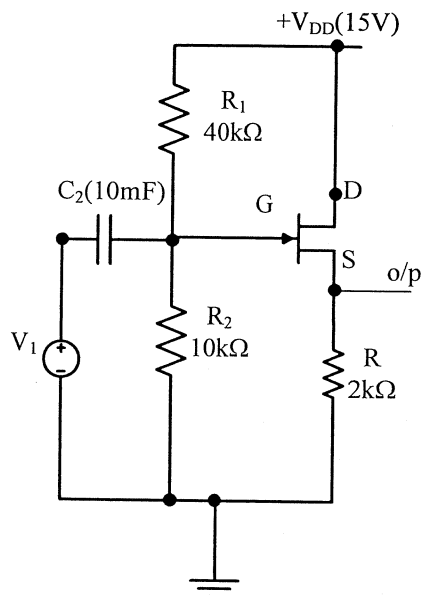


Figure 7

- i. What is the amplifier configuration used in this circuit? [02 marks]
- ii. Find the gate source voltage, when no input signal is applied. [10 marks]
- iii. Hence find the Drain current of the channel. [04 marks]