The Open University of Sri Lanka
Department of Electrical and Computer Engineering
Final Examination - 2010
ECX3230 – Electronics

00193

Closed Book Test

Date: 04.03.2010 Time: 09.30 – 12.30

01 NOV 2011

Answer any **FIVE** Questions

1)

a) Briefly describe the behavior of the PN junction in biased and unbiased situations (with the help of graphs) [4]

b) Name and draw symbols of 3 special purpose diodes and write an application of each diode. [3]

c) A voltage stabilizer circuit is shown in figure 1. Maximum power dissipation of the zener diode is ¼ W.

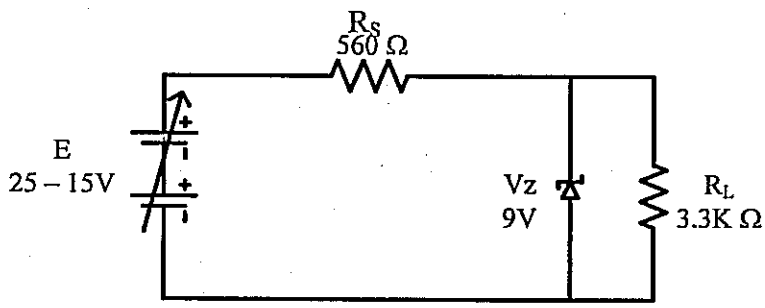


Figure 3

i) The battery is set to 15V,Calculate the current through the load and the zener current. [2]

ii) Recalculate the i) when the battery is set to 25V. [1]

iii) Calculate the load resistance when the zener diode is operating in maximum dissipation.[4]

iv) Explain a modification that you suggest to operate a load that consumes about 1A .

[Hint: Do not change the specifications of the given circuit. You may add an active device for the modification] [6]

2) An amplifier circuit is shown in figure 2. A Si transistor and a transformer of ratio 1:5 used. Assume the maximum swing of the signal.

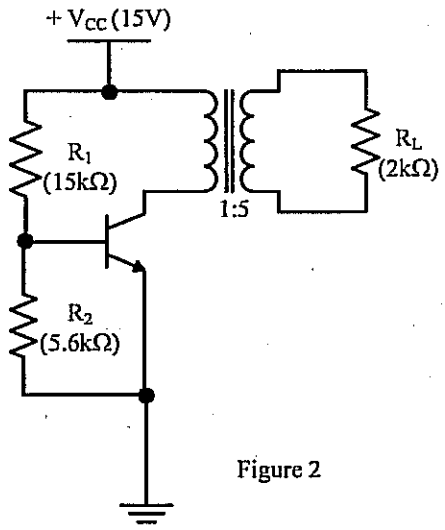


Figure 2

a)
- i) Write the configuration of the circuit. [1]
- ii) Calculate the voltages at the three terminals of the transistor. [5]
- iii) Draw the DC load line and mark the Q point. [6]

b) The transistor current gain is 30.
- i) What is the biasing method used in the circuit given in figure 2?[1]
- ii) Derive an expression for the stability factor for the circuit in figure 2. [3]
- iii) Calculate stability factor and comment on the stability of the circuit. [4]

3)

a) Simplify the following using Boolean algebra.
- i) $f1 = \overline{P}QR + P\overline{Q}R + PQ\overline{R} + \overline{PQ}R + P\overline{QR}$ [4]
- ii) $f2 = P\overline{Q} + \overline{R}Q + PQR$ [3]

b) Simplify the following using a Karnaugh map.

F(A,B,C,D) = (1, 3, 5, 7, 8, 9, 11, 12, 13) [3]

c) An Operational amplifier circuit is given in figure 3.
- i) Derive the transfer function of the amplifier. [5]
- ii) Calculate the output voltage, if the Vin is a 2V sinusoidal signal. [2]
- iii) Draw the output waveform with reference to the input. [2]
- iv) Write the function of the figure 3. [1]

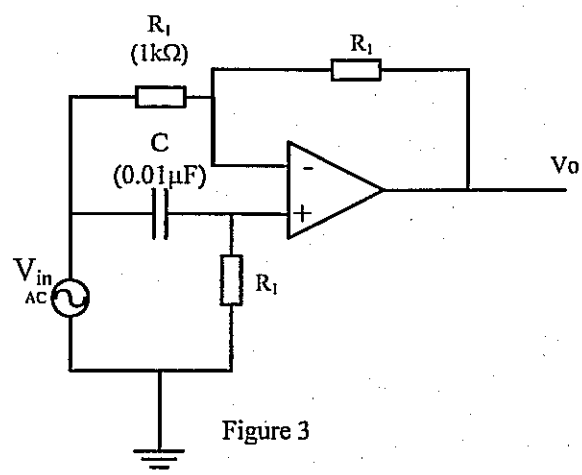


Figure 3

4)

a) Compare and contrast the bipolar and unipolar transistors.[5]

b) Write two applications of JFET and the operating region of these two applications.[2]

c) The JFET amplifier is shown in figure 4 and the Input characteristics are given in figure 4.1.

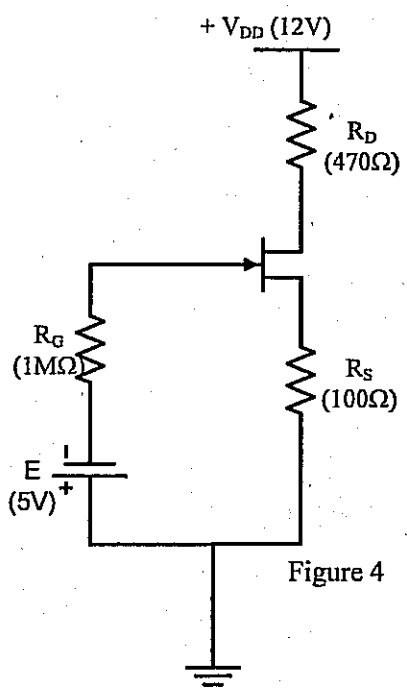


Figure 4

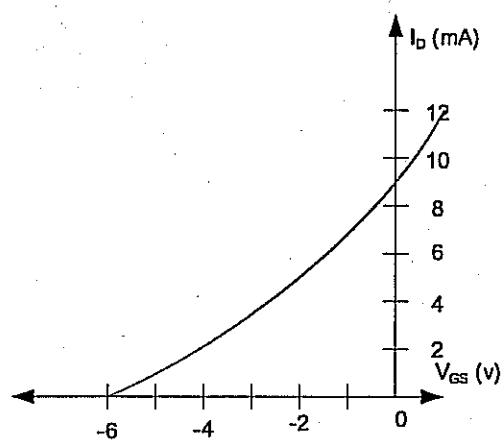


Figure 4.1

i) Write the relevant equation to calculate currents and voltages of the circuit given in figure 4.[2]

ii) Calculate drain current and the gate source voltage. [4]

iii) Draw the AC equivalent circuit for the given circuit in figure 4. [4]

iv) Derive an expression voltage gain.[3]

5)

a) Write two methods of full wave rectification and give two differences between those methods. [4]

b) Name the basic three parts of a stabilized power supply and write the function of each part. [3]

c)

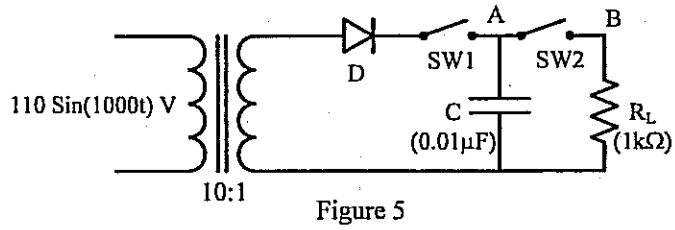


Figure 5

i) Write the rectification method of the circuit shown in figure 5. [1]
ii) Draw the wave form at point A related to the input, when the switch1 (SW1) is on and switch2 (SW2) is off. [3]
iii) Draw the wave form at point B related to the input, when both switches are on. [3][(Assume that initially no charge in the capacitor)

d)

i) Derive an equation for the ripple factor for the circuit given in figure 5. [3]
ii) Calculate the ripple factor. [1]
iii) Give a suggestion to minimize the effect of the ripple factor. [2]

6) A small signal amplifier circuit is shown in figure 6. Forward current gain and the input impedance are 50 and 1kΩ respectively and neglect the effect of the h_{oe} and h_{re} of the h parameter model.

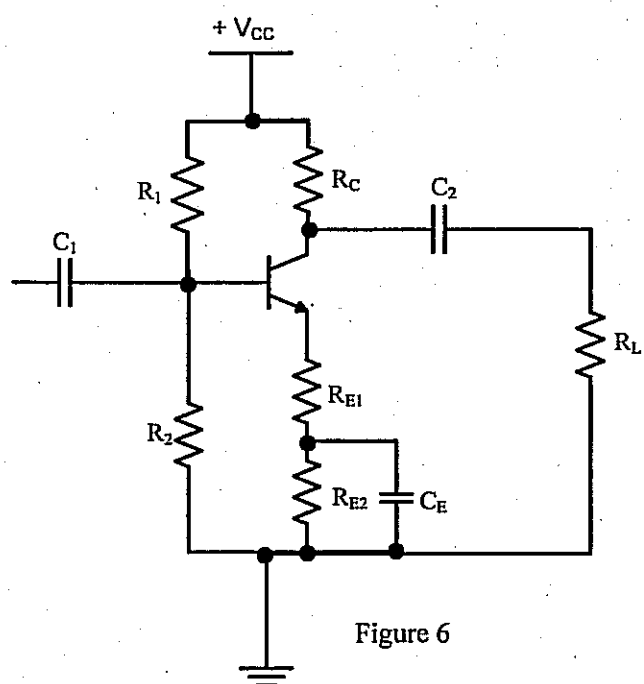


Figure 6

a) Draw the AC h parameter equivalent circuit for the amplifier. [5]
b) Using above parameters derive the expressions for the amplifier in figure 6.
i) Current gain [3]
ii) Voltage gain [3]
iii) Power gain [3]
iv) Input impedance [3]
v) Output impedance [3]

7)

a) What are the types of multivibrators? [3]

A signal is generated using the circuit shown in figure 7.1.

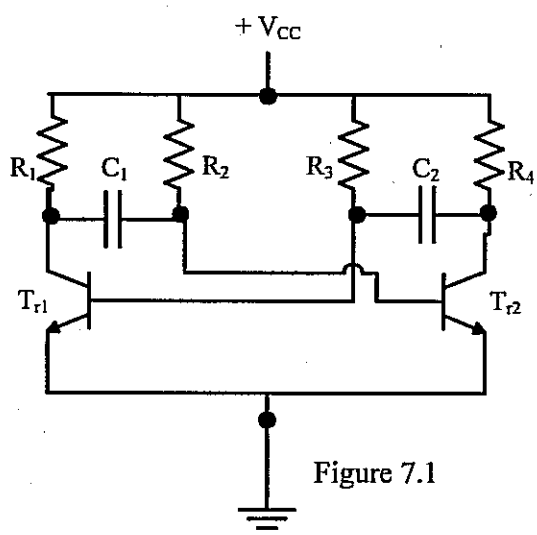


Figure 7.1

b)

i) Explain the operation of the circuit shown in figure 7.1. (Initially T_{r1} is saturated and T_{r2} is in cutoff states.) [5]

ii) Derive an expression for the frequency oscillation of the figure 7.1 [4]

iii) Draw the output wave form and the wave form at the base of T_{r2}. [3]

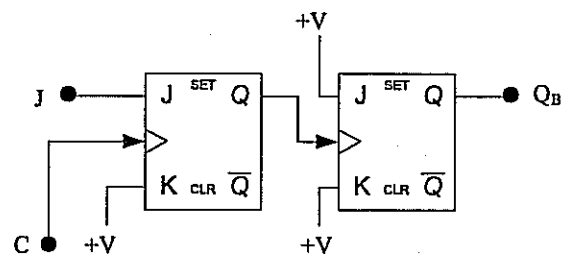
c) Design a small circuit to generate a sawtooth signal using the above circuit in figure 7.1. [5]

8)

a) What is the main difference between combinational logic and sequential logic? [2]

b) Ten complimentary flip flops are connected in series to the form an electronic counter. Calculate the maximum number that the counter can memories. [2]

c) Draw the output(Q_B) related to input signal shown in figure 8.1 [8]



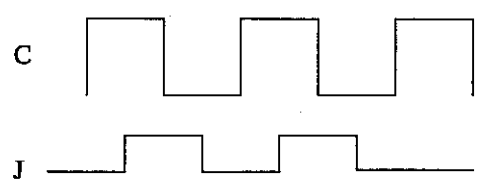


Figure 8.1