THE OPEN UNIVERSITY OF SRI LANKA
B. SC. DEGREE PROGRAMME 2010/2011
FINAL EXAMINATION – 2011
PYU2262- ELECTRONICS
DURATION: THREE HOURS (3 HRS)

ANSWER 06 QUESTION ONLY INCLUDING QUESTION NO 01 (Question No 01 is compulsory).

Date : 11-07-2011 Time : from 1.30 pm to 4.30 pm

1. (a) Figure 1 shows the transformer having a turn ratio of $N_1 : N_2 = 20:1$, $V_{rms} = 240$ V , 50 Hz .

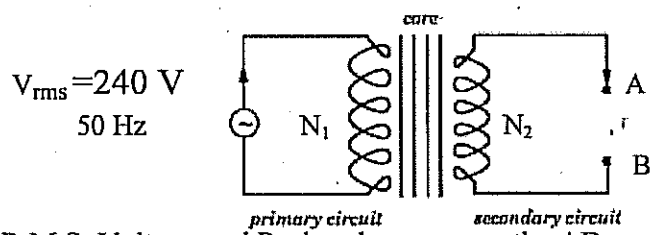


Figure 1

(i) Find the R.M.S. Voltage and Peak voltage across the AB
(ii) Draw the wave form across AB
(iii) Using the above transformer you are going to construct a low voltage power supply. Sketch the circuit diagram for full wave rectification using four (04) rectification diode.
(iv) Draw the output wave pattern after connecting the four (04) rectifier diode and Find DC voltage of the output.
(v) Now you are given a capacitor C= 0.2 μF and a Load Resistor R_L= 1 kΩ. Rearrange the circuit diagram drawn in Question (iii).
(vi) Find the ripple factor of the output wave form
(vii) Finally if you are given a zener diode with $V_Z = 9.0$ V, connect this zener diode to the circuit drawn in Question (v)

(b)

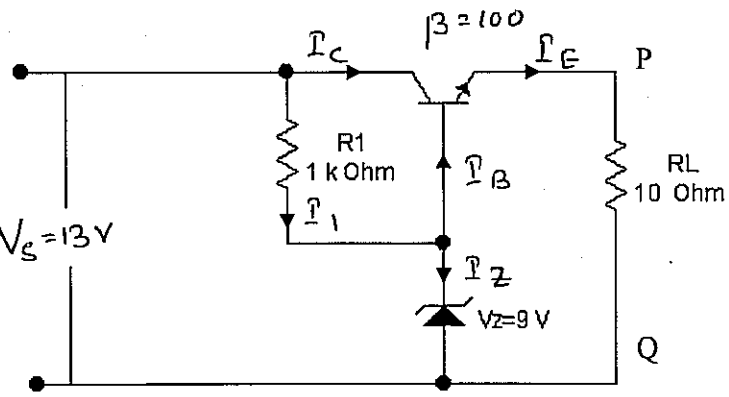


Figure 2

(i) Explain the function of the voltage regulator in figure 2
(ii) Find the voltage across PQ (V_L)
(iii) Calculate the currents I_1, I_B , and I_Z in the above circuit
(iv) Find the power dissipation of the Zener diode and the transistor

(20 Marks)

2. (a)

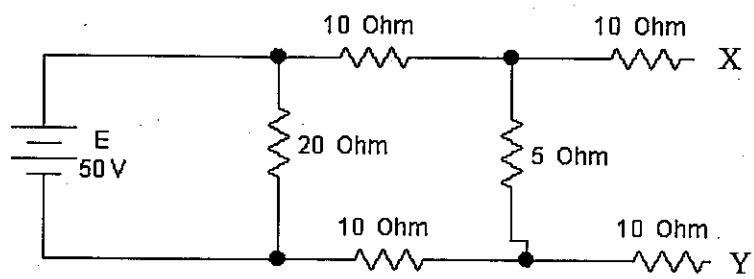


Figure 3

(i) Write down the procedure for applying the Thevenin's theorem

(ii) Find the current through the 5Ω (Ohm) Resistor

(iii) Hence calculate the open circuit voltage across XY

(iv) Find the closed loop resistance R_O

(v) Draw the reduced circuit diagram

(vi) Calculate the power dissipation of the 10 Ω resistor which would be connected across XY in the network shown in figure 3

(b) In the circuit shown in figure 4, the operating point is chosen such that $I_c = 2$ mA, $V_{CE} = 3$ V. If $R_C = 2.2$ kΩ, $V_{CC} = 9$ V and $\beta = 50$, Determine the values of R_1, R_2 and R_E . Consider $V_{BE} = 0.7$ V and $I_1 = 10\ I_B$.

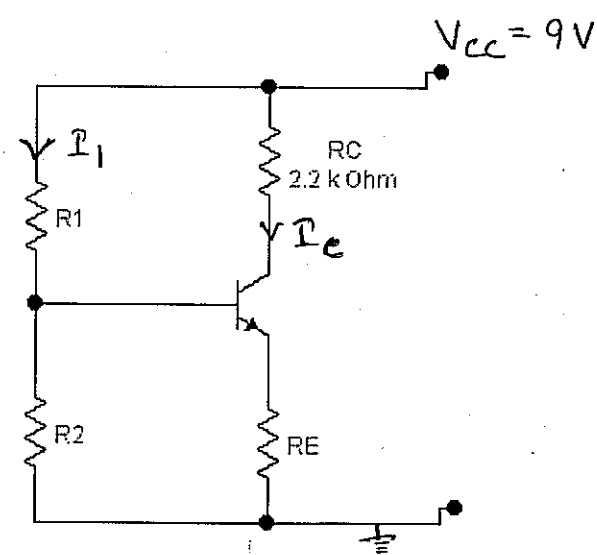


Figure 4

(16 Marks)

3. (a)

(i) What do you understand by a semi-conductor? Discuss some important properties of semiconductors.
(ii) Give the energy band description of semiconductors.
(iii) Discuss the effect of temperature on semiconductors.
(iv) What do you understand by intrinsic and extrinsic semiconductors?
(v) Explain the formation of potential barrier in a *pn* junction.
(vi) Draw and explain the V-I characteristics of a *pn* junction.
(vii) What is the importance of Peak Inverse Voltage?

(b) Calculate the current through 48 Ω resistor in the circuit shown in figure (5). Assume the diode to be of silicon and forward resistance of each diode is 1 Ω.

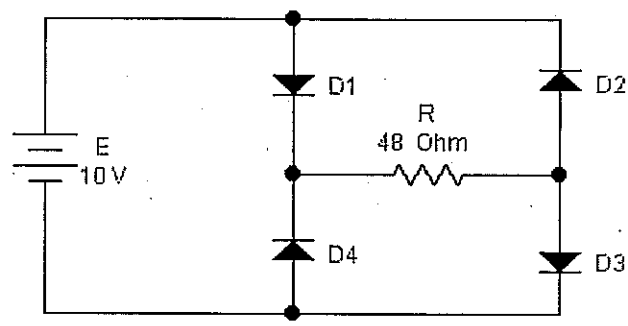


Figure 5

(c) For the circuit shown in figure (6) . Find the maximum and minimum values of current through Zener diode.

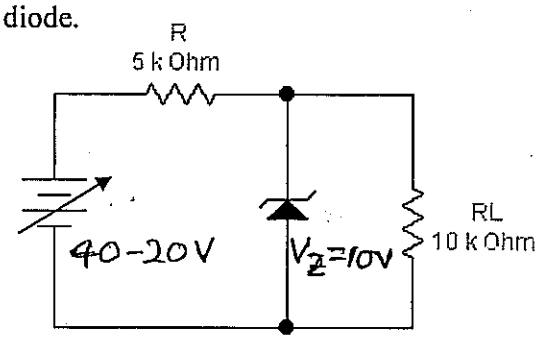


Figure 6

(16 Marks)

4. (a) Discuss the biasing and the stability of a Transistor in the following biasing methods

(i) fixed biased circuit
(ii) collector to base biased circuit
(iii) emitter biased circuit

(b) In the small-signal amplifier of figure 7, $h_{fe} = 100$, $h_{ie} = 560\ \Omega$, $R_C = 2\ k\Omega$, $R_E = 1\ k\Omega$, $R_B = 600\ k\Omega$ and h_{re} and h_{oe} are negligible.

(i) Draw the h- parameter equivalent circuit for the amplifier shown in figure 7.
(ii) Calculate the input and the output impedances and voltage gain of the amplifier

(iii) Sketch the DC load line and mark the Q point for the circuit given in figure 7.

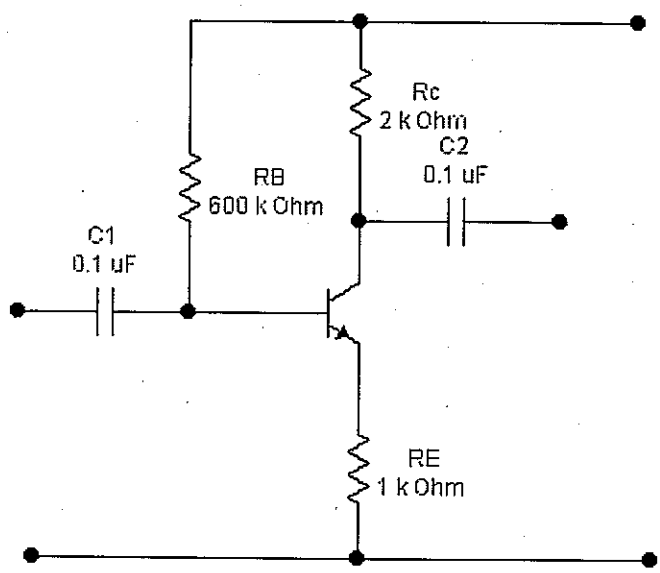


Figure 7

(16 Marks)

5.

(a)

(i) Discuss advantages and disadvantages between class A amplifier and class B amplifier with the wave form diagram

(ii) If the output wave form of an amplifier is given in the following form.

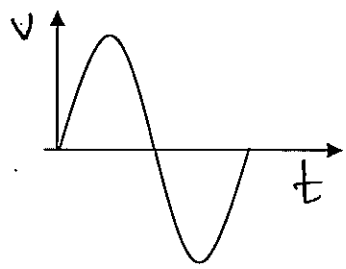


Figure 8

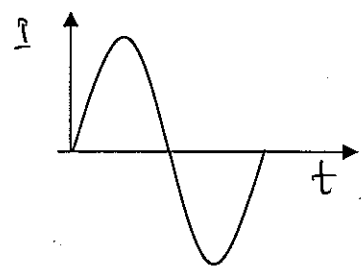


figure 9

Find the following parameters

1. Average power output
2. Average dc current
3. Average input power. Hence find the efficiency of the amplifier

(b) Explain the operation of a Wien-bridge oscillator using a circuit diagram. Find an expression for the frequency of oscillation.

(c) Discuss the amplitude stability of the Wien-bridge oscillator.

(*16 Marks*)

6.

(i) Discuss the term negative feedback and positive feedback using circuit diagrams

(ii) What do you mean by connecting the feedback network either in shunt with the output or in series with the output

(iii) After introducing the negative feedback comment on the following modifications of amplifier characteristics

(a) Stability of gain

(b) Decrease in distortions

(c) Effect on input and output impedances

(iv) Figure 10 shows a current feedback block diagram with current and resistances

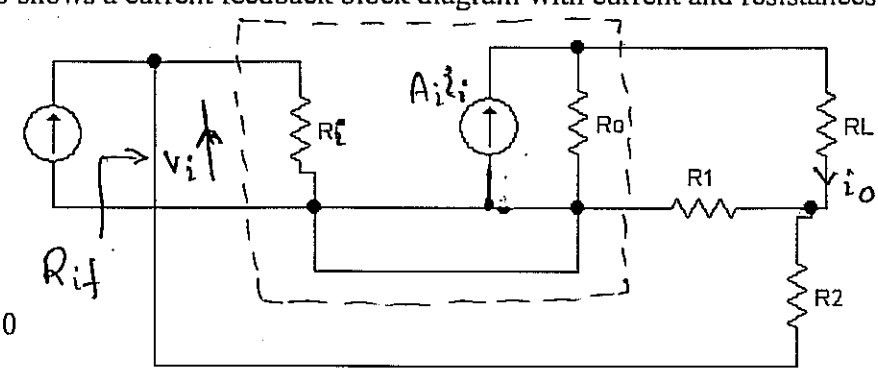


Figure 10

(a) Prove that the feedback current can be written as $i_f = \beta\, i_0$

Where $\beta = \dfrac{R_1}{R_1+R_2+R_i}$

(b) Hence prove that current gain with feedback is

$$A_{if} = \frac{A_i}{1-\beta A_i}$$

Where A_i current gain without feedback

(c) Find the input impedance R_{if} of the amplifier.

(*16 Marks*)

7.

(i) Draw the following gates using only NAND gates
   (a) NOT
   (b) AND
   (c) OR

(ii) Write down the advantages and disadvantages of Digital Electronics

(iii) Verify the following Boolean identities

   (a) $AB + \bar{A}C + BC = AB + \bar{A}C$
   (b) $ABC + A\bar{B}C + AB\bar{C} = AC + AB\bar{C}$
   (c) $A + \bar{A}B = A + B$
   (d) $AB + AC + B\bar{C} = AC + B\bar{C}$

(iv) A pump is to operate (P), when water level of any two or all three reservoirs X, Y and Z goes below a certain mark. A level detector fitted with each reservoir produces a high voltage signal whenever the water level in the reservoir falls below the desired mark. If a high voltage switches on the pump, design a logic circuit to operate the pump

(v) Prove that using any map method, it can be simplified to P = XY +YZ +ZX.

(*16 Marks*)

8. (a) Convert 99_{10} to (i) standard binary (ii) hexadecimal (iii) BCD binary

(b) What is multiplexer? Explain the operation of 4 - to - 1 multiplexer

(c) Implement the Boolean function given by the equation $f(P,Q,R) = \sum 2,4,7$ using 4–to-1 multiplexer with two selection lines.

(*16 Marks*)

9. (a)

(i) How can a flip flop be categorized as a memory element?

(ii) The S R latch initially is in the set state. If inputs are changed such that S = 1 and R = 1, what happens to the next state of the flip-flop?

(iii) Why is a D-type flip flop called as a delay flip flop?

(b) Consider the circuit below which uses D-type flip flops

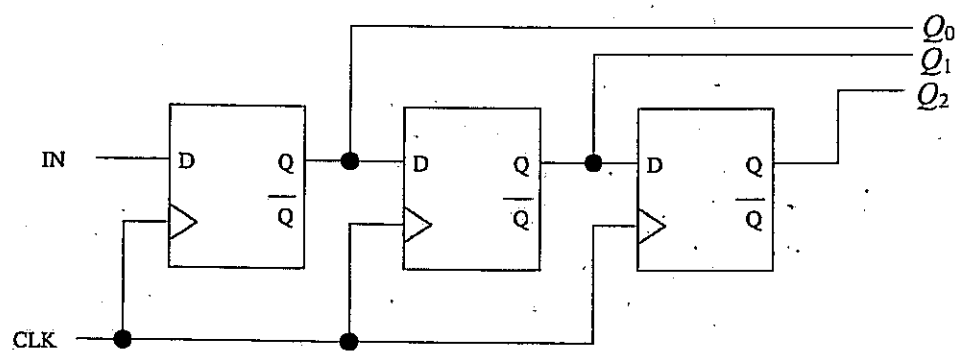
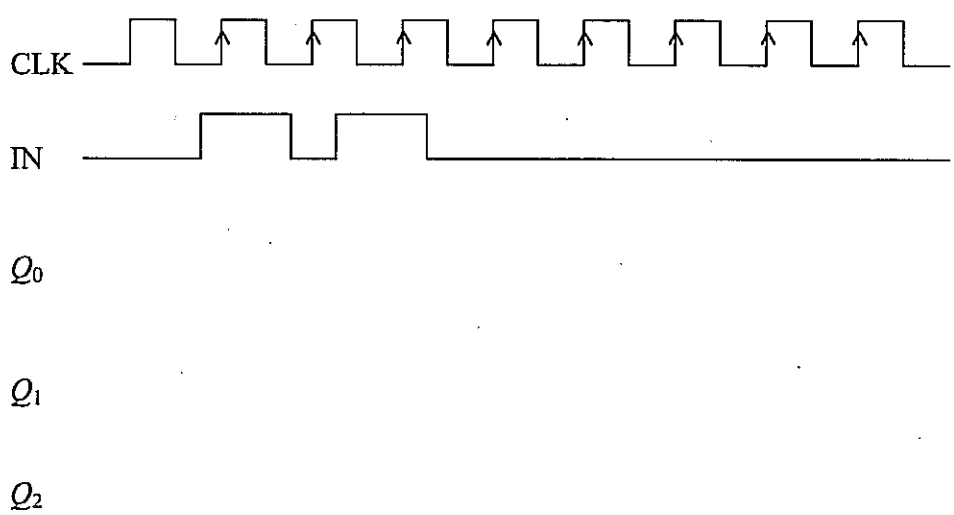


Figure 11

Complete the timing diagram by including the signals Q_0, Q_1 and Q_2. (Assume that they are all initially LOW, as indicated.)



(16 Marks)

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