2ND SEMESTER EXAMINATION, APRIL – 2005

BASIC ELECTRONICS

Full Marks – 70

Time : 3 Hours

The figures in the right hand margin indicate full marks for the questions.

Question No. 1 is compulsory and answer any ***five*** *from the rest.*

Assume suitable data if not mentioned. Symbols carry their usual meaning.

1. Answer the following briefly : 2×10

(a) Do the following number conversions :

(i) $A3E89_{16}$ to octal

(ii) $82B_{8}$ to hexadecimal.

(b) Subtract the following binary numbers :

(i) 1100 – 1001

(ii) 11010 – 10111.

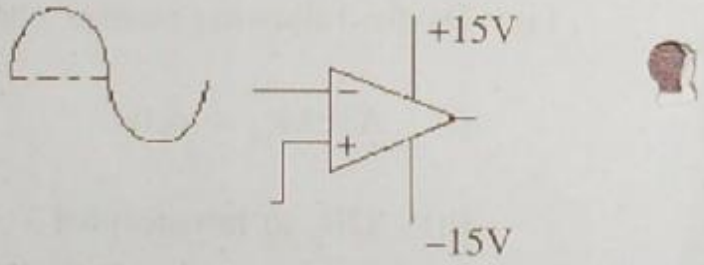
(c) Express –85 in 8-bit sign-magnitude 1's and 2's complement form.

(d) Add 56 and –27 using 2's complement.

(e) The resistance of a semiconductor material decreases with an increase in temperature – Justify this statement.

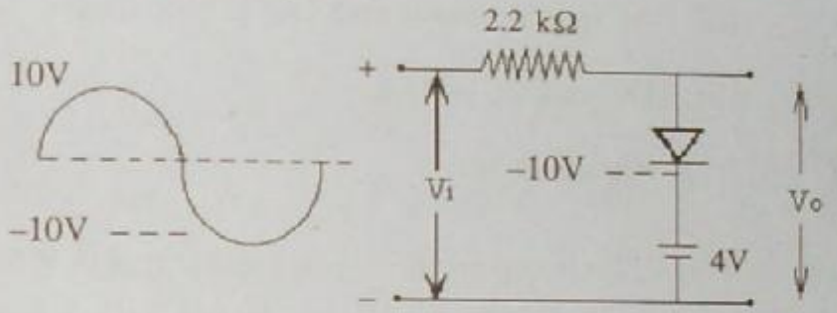
(f) Distinguish between Zener breakdown and Avalanche breakdown. Which of these can be used in high voltage applications ?

(g) Draw the output waveform for the following circuit :



(h) Bring out the differences between BJT & FET ?

(i) Draw and scale the output waveform for the following circuit :



(j) If $\sqrt{41}_b = 5_b$, find the value of b.

2. Radiation falls on a semiconductor specimen that is uniformly illuminated, and a steady state is reached. At t = 0, the light source is switched off. Sketch the minority carrier concentration as a function of time for $t \geq 0$. Define all the symbols in your equation describing the sketch. 10

3. A crystal diode having an internal resistance $r_f = 20\Omega$ is used for half-wave rectification. If the applied voltage is $v = 50 \sin\omega t$ and the load

resistance is $R_L = 800\Omega$, determine the following : 10

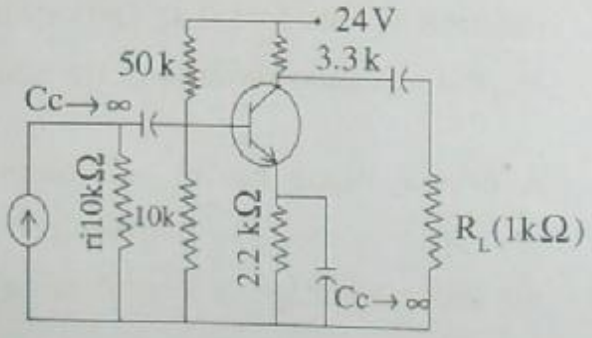
(i) I_m, I_{dc} and I_{rms}.

(ii) AC power input and DC power output.

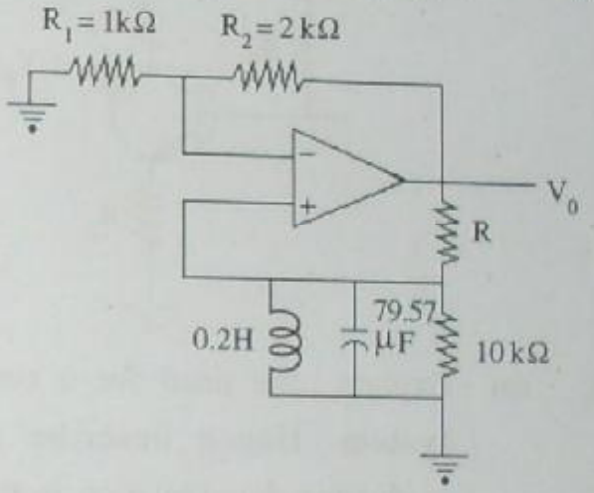
(iii) DC output voltage.

(iv) Ripple factor.

4. The BJT shown in the figure below has $\beta = 50$. All bypass and coupling capacitors are assumed to have zero reactance at the signal frequency. Find the quiscent conditions (V_{CEQ}, I_{CQ}), the small signal equivalent circuit the current, gain and input impedance seen by the current source i_c. 10



5. Consider the op-amp to be ideal. What is the value of R for which oscillations will be sustanied ? What is the frequency of oscillation ? 10



6. (i) Convert the following expression to canonical SOP form : 5

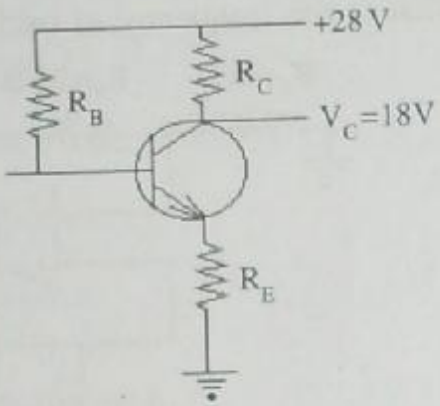
$(\overline{A} + C).(A.B + A.B + A.C)$

(ii) Convert the following expression to canonical POS form : 5

$A + A.B + \overline{A}.C$

7. For the emitter bias configuration of Figure below with the specifications : $I_{C_Q} = (1/2)\, I_{Csat}$, $I_{Csat} \doteq 8$ mA,

V_C = 18V and β = 110, determine the value of R_C, R_E and R_B. 10



8. (a) Explain the need for a communication system. Hence describe the role of modulaton demodulation in it. 5

(b) What is the input impedance of an ideal voltmeter ? Why ? Explain the CRO as a voltmeter ? 5