Code No: R05010204 **Set No. 1**

I B.Tech Supplimentary Examinations, Aug/Sep 2008
ELECTRONIC DEVICES AND CIRCUITS
(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Computer Science & Systems Engineering, Electronics & Telematics, Electronics & Computer Engineering and Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) An electron is moving perpendicular to magnetic field 'B'. Derive the expression for radius 'R' of the trajectory and period of rotation T.
   (b) Derive the expression for the electro magnetic deflection sensitivity in the case of the CRT. [8+8]

2. (a) Sketch the energy band diagram of an open-circuited pn-junction. Explain the terms: 'depletion region', 'potential barrier', and 'barrier energy'.
   (b) The voltage across a si diode at room temperature of 300^0k is 0.71V when 2.5 mA current flows through it. If the voltage increases to 0.8V, calculate the new diode current. [16]

3. (a) Compare various filter circuits in terms of their circuits, ripple factor and a voltage waveforms.
   (b) Determine the ripple factor of an L-type choke imput filter comprising a 10H choke and 8μF capacitor. Used with a FWR. Compare with a simple 8μF capacitor input filter at a load current of 50 mA and also 150 mA. Assuming the d.c. voltage of 50V. [16]

4. (a) For the transistor switching circuit shown in figure 4a, determine the following:

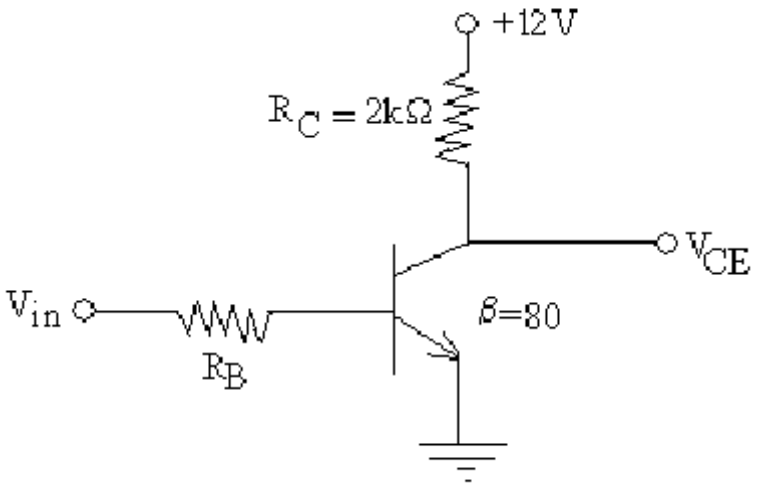

Figure 4a

i. What is V_{CE} when there is no input voltage, V_{in}

ii. What minimum value of I_B is required to saturate the transistor?

iii. Calculate the maximum value of R_B to keep the transistor under saturation when V_{in}=6V.

(b) Use proper diagrams to explain the structure of enhancement only type MOSFETs. Why are the devices so named? Can they be operated in the depletion mode? [10+6]

5. (a) Explain in detail about thermal runaway and thermal resistance.

(b) For the circuit shown figure 5b, determine I_E, $V_C$and V_{CE} . Assume V_{BE}=0.7V [8+8]

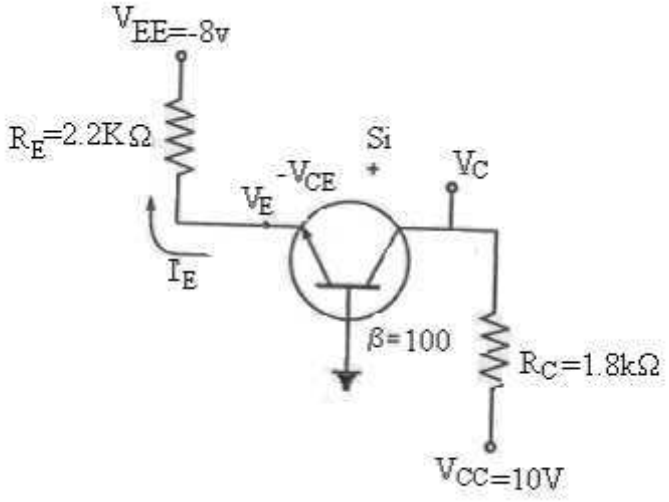

Figure 5b

6. (a) Draw a low frequency equivalent circuit for a CC amplifier and derive the the

relations for the current gain, voltage gain and input resistance in terms of h-parameters. [2+6]

(b) In the common collector circuit (figure6b), the transistor parameters are h_{ic}=1.2K and h_{fc}= -101. Calculate input and output resistances, voltage gain and current gain. [8]

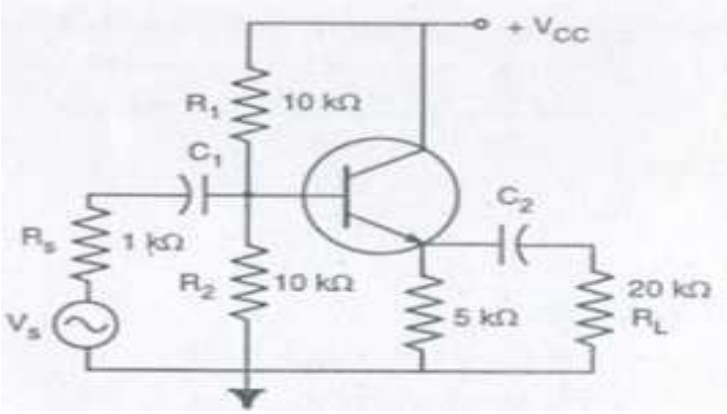

Figure 6b

7. (a) What do you understand by feedback in amplifiers? Explain the terms feedback factor and open loop gain. [4+2+2]

   (b) Calculate the gain, input impedance, output impedance of voltage series feedback amplifier having A=300, R_i=1.5K,R_O=50K and β=1/12. [8]

8. (a) Draw the circuit diagram of a RC phases shift oscillator using BJT. Derive the expression for frequency of oscillators.

   (b) Classify different type of oscillators based on frequency range.

   (c) Why RC oscillators are not suitable for high frequency applications. [8+4+4]

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) An electron is moving perpendicular to magnetic field 'B'. Derive the expression for radius 'R' of the trajectory and period of rotation T.
   (b) Derive the expression for the electro magnetic deflection sensitivity in the case of the CRT. [8+8]

2. (a) Sketch the energy band diagram of an open-circuited pn-junction. Explain the terms: 'depletion region', 'potential barrier', and 'barrier energy'.
   (b) The voltage across a si diode at room temperature of 300^0k is 0.71V when 2.5 mA current flows through it. If the voltage increases to 0.8V, calculate the new diode current. [16]

3. (a) Explain why a bridge rectifier is preferred over a centre-tap rectifier.
   (b) Explain the necessity of a bleeder resistor.
   (c) A diode has an internal resistance of 20Ω and 1000Ω load from a 110V rms source of supply. Calculate
      i. the efficiency of rectification
      ii. the percentage regulation from no load to full load. [4+4+8]

4. (a) Describe a UJT. Draw its equivalent circuit and hence define the intrinsic standoff ratio. Draw its characteristic curve and explain the various parameters.
   (b) Calculate the values of I_E, β_{dc} and α_{dc} for a transistor with I_C=12.427μA, I_B=200mA, I_{CBO}=7μA. Also determine the new level of I_C which will result from reducing I_B to 150μA. [10+6]

5. (a) Draw the collector to base bias circuit and derive the expression for the stability factor S. [3+5]
   (b) Calculate the value of thermal resistance θ for the transistor circuit shown (figure 5b) in order to make the circuit thermally stable. Assume I_{C0} = 1nA at 25^0C. [8]

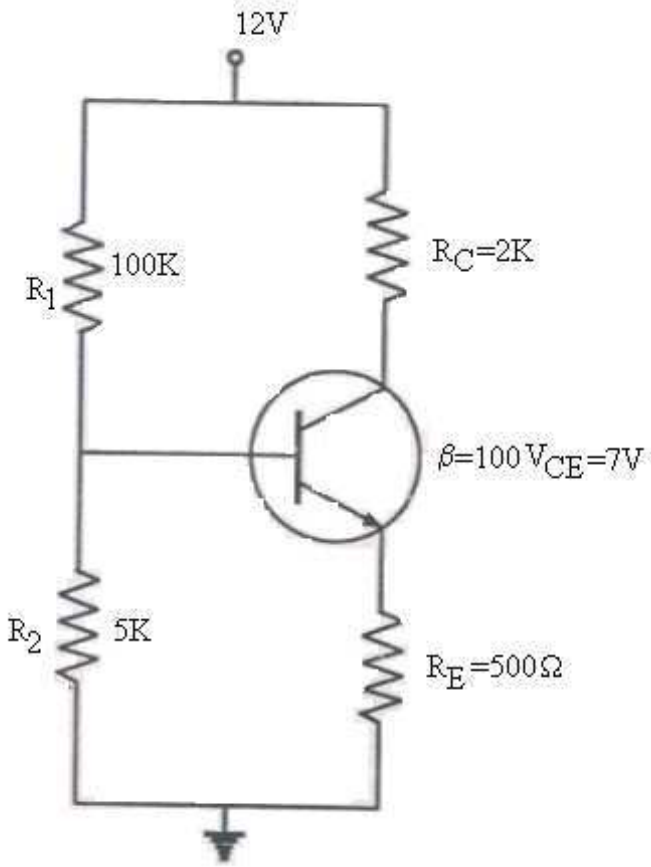

Figure 5b

6. (a) Draw the low frequency small signal model of a transistor in CB and CE configurations and explain significance of each model. [2+2+2+2]

   (b) The amplifier circuit shown in figure 6b uses a transistor with h_{fe}=100, h_{ie}=3.37K. Calculate A_I, A_V, R_I. [3+3+2]

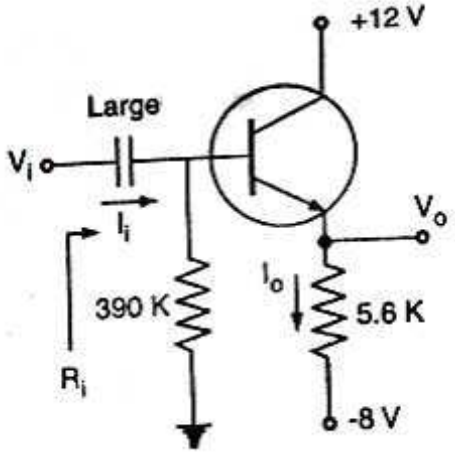

Figure 6b

7. (a) Draw the circuit diagram of voltage shunt feedback amplifier and derive expressions for voltage gain and feedback factor.

(b) An amplifier has midband gain of 125 and a bandwidth of 250KHz.

i. If 4% negative feedback is introduced, find the new bandwidth and gain

ii. If bandwidth is restricted to 1MHz, find the feed back ratio. [4+4]

8. (a) Draw the circuit diagram of a RC phases shift oscillator using BJT. Derive the expression for frequency of oscillators.

(b) Classify different type of oscillators based on frequency range.

(c) Why RC oscillators are not suitable for high frequency applications. [8+4+4]

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Code No: R05010204 **Set No. 3**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Derive the expression for transit time τ (tow) and final velocity V in the case of an electron traversing in uniform electric field E.
   (b) An electron with a velocity of $3 \times 10^5 ms^{-1}$ enters an electric field of 910 v/m making an angle of 60^0 with the positive direction. The direction of the electric field is in the positive Y direction. Calculate the time required to reach its maximum height. [8+8]

2. (a) State and prove mass action law. Define volt equivalent of temperature. How are mobility and diffusion constant related?
   (b) The junction on a step - graded pn-junction diode is doped with N_A corresponding to 1 acception atom per 10^6 si atoms. Calculate the contact difference of potential V_0 at room temperature. Assume $N_A = N_D$, $n_i = 1.45 \times 10^{10}/cm^3$ and silicon has 5×10^{28} atoms/m. [16]

3. (a) Show that the maximum redification efficiency of HWR is 40.6% and that of FWR is 81.2%.
   (b) A bridge rectifier with capacifilter is fed from 220V to 40V step down transformer. If average d.c current in load is 1A and capacitor filter of 800 μF. Calculate load regulation and ripple factor. Assume power line frequency of 50Hz. Neglect diode forward resistance and d.c. resistance of secondary of transformer. [16]

4. (a) Draw the two transistor version of an SCR and explain its firing characteristics with this circuit.
   (b) Explain the working principle of UJT with its characteristics. [8+8]

5. (a) Explain bias compensation using sensistors.
   (b) In the circuit shown, if I_C=2mA and V_{CE}=3V. Calculate R_1 and R_3. (figure 5b) [6+10]

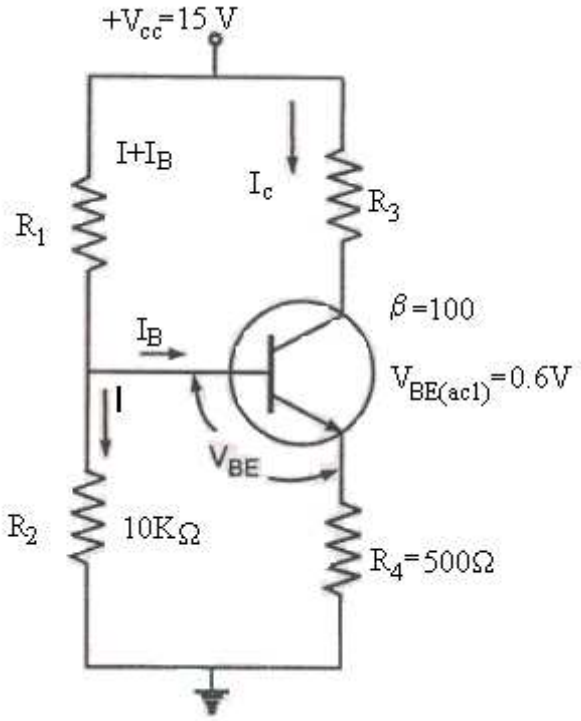

Figure 5b

6. (a) Define f_α, f_β, and f_τ. State the relation between f_β and f_τ .

   (b) Determine A_V, A_I, R_I and R_O for a CE amplifier using a transistor with h_{ie}=1.2K, h_{fe}=36, h_{oe}= 2 × 10^{-4}mho, h_{re}= 0. Use R_L = 2.5k and source resistance R_S = 500Ω. Neglect the effect of the biasing circuit. (figure 6b) [8+8]

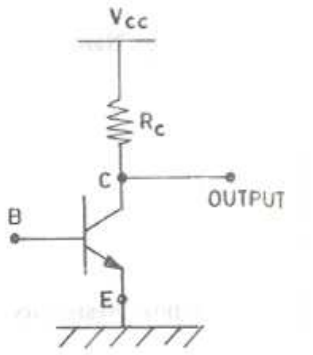

Figure 6b

7. (a) Define Desensitivity. [3]

   (b) For large values of D, what is A_f? What is the significance of this result? [5]

   (c) An Amplifier has a mid-frequency gain of 100 and a bandwidth of 200KHz. [8]

   i. What will be the new bandwidth and gain if 5% negative feedback is introduced?

ii. What should be the amount of negative feedback if the bandwidth is to be restricted to 1MHz?

8. (a) Show that the gain of Wien bridge oscillator using BJT amplifier must be at least 3 for the oscillations to occur.

   (b) In a transistorized Hartley oscillator the two inductances are 2mH and 20μH while the frequency is to be changed from 950KHZ to 2050KHZ. Calculate the range over which the capacitor is to be vaired. [10+6]

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) List out the advantages and disadvantages of both electrostatic and electromagnetic deflection system ?
   (b) Explain the terms [8+8]
      i. Potential
      ii. Electron Volt
      iii. Charge density
      iv. Current density.

2. (a) Define mobility, conductivity and diffusion and obtain the Einstein's relation.
   (b) In a typical n-type semiconductor, the Fermi level lies 0.5 ev below the conduction band at 300^0K. Find its new position when temperature in increased to 600^0 K. [16]

3. (a) Draw the circuit of shunt type voltage regulator and explain its working. [16]
   (b) Design a series regulated power supply to provide a normal O/P voltage of 25V and $I_L \leq 1A$ The unregulated power supply has the following specifications $V_i = 50 \pm 5V$, and fuse wire resistance $V_0 = 10\Omega$.

4. (a) Compare different types of transistor configuration with necessary circuit diagrams using transistor.
   (b) Explain giving illustrative diagrams how the pinch-off condition occurs ina MOSFET. [8+8]

5. (a) Explain the reasons for keeping the operating point of a transistor as fixed.
   (b) For the circuit shown (figure5b), calculate V_E, I_E, I_C and V_C. Assume V_{BE}=0.7V. [8+8]

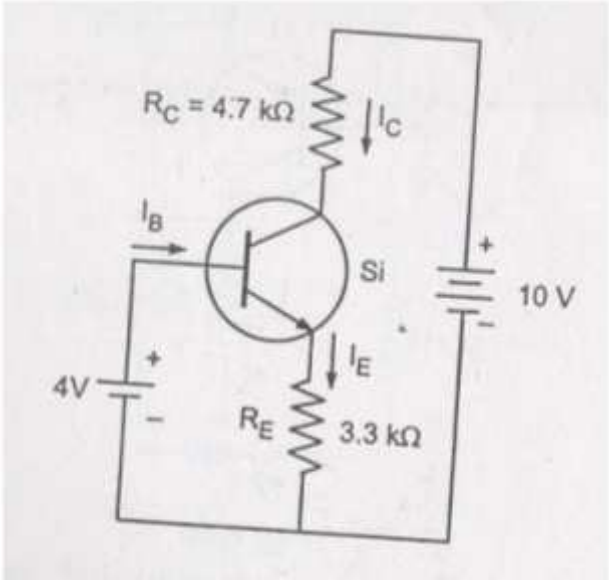

Figure 5b

6. (a) Draw the circuit diagram of common source amplifier and derive expressions for voltage gain and output resistance. [2+3+3]

   (b) For the circuit shown in figure 6b, determine A_I, A_V, R_I and R_0 using reasonable approximations. The h-parameters for the transistor are given as h_{ie}=2K, h_{fe}=100, h_{oe}= 10^{-5}mhos, h_{re} is negligible. [2+2+2+2]

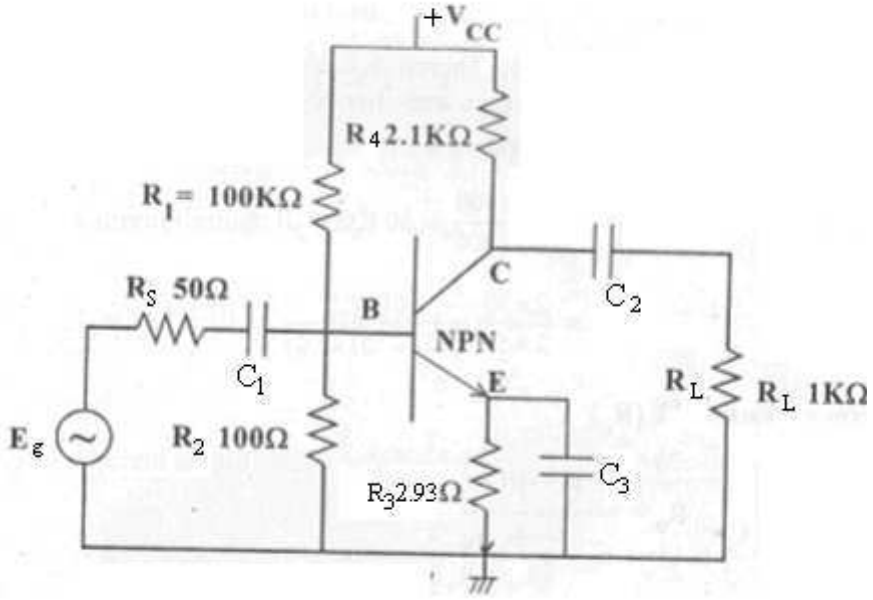

Figure 6b

7. (a) Explain with circuit diagram a negative feedback amplifier and obtain expressions for its closed loop gain. [4+4]

   (b) The gain of an amplifier is decreased to 1000 with negative feedback from its gain of 5000. Calculate the feedback factor and the amount of negative feedback in dB. [8]

8. (a) Show that the gain of Wien bridge oscillator using BJT amplifier must be at least 3 for the oscillations to occur.

   (b) In a transistorized Hartley oscillator the two inductances are 2mH and 20μH while the frequency is to be changed from 950KHZ to 2050KHZ. Calculate the range over which the capacitor is to be vaired. [10+6]

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