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

I B.Tech Supplimentary Examinations, Aug/Sep 2007
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) 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) Show that in the n-type semiconductor, the Fermi level lies below the bottom of to conduction band.
   (b) The resistivities of the two sides of a step-graded Si junction are 5 Ω - cm (p.side) and 2.5 Ω - cm (n side). Calculate the height of the potential barrier V_0. Take μ_p = 475 cm^2/V.sec and μ_n =1500 cm^2/V.sec at the room temperature of 300°k, and $n_i = 1.45 \times 10^{10}$ atoms/cm^3 . [16]

3. (a) Explain the principle of operation of HWR with and without capacitor input filter and draw the waveforms.
   (b) A FWR circuit is fed from a transformer having a center-tapped secondary winding. the rms voltage from either end of secondary to center tap is 30V. If the diode forward resistance is 5Ω and that of the secondary is 10Ω for a load of 900Ω, Calculate:
      i. Power delived to load
      ii. % regulation at full load
      iii. efficiency at full load
      iv. TUF of secondary. [16]

4. (a) Draw the drain characteristics of depletion type MOSFET. Explain clearly different operating regions in characteristics with proper reasoning.
   (b) Describe the construction of a light-emitting diode and explain its operational mechanism. [10+6]

5. (a) Explain bias compensation using sensistors. [6]

(b) In the circuit shown, if I_C=2mA and V_{CE}=3V. Calculate R_1 and R_3. (figure 5) [10]

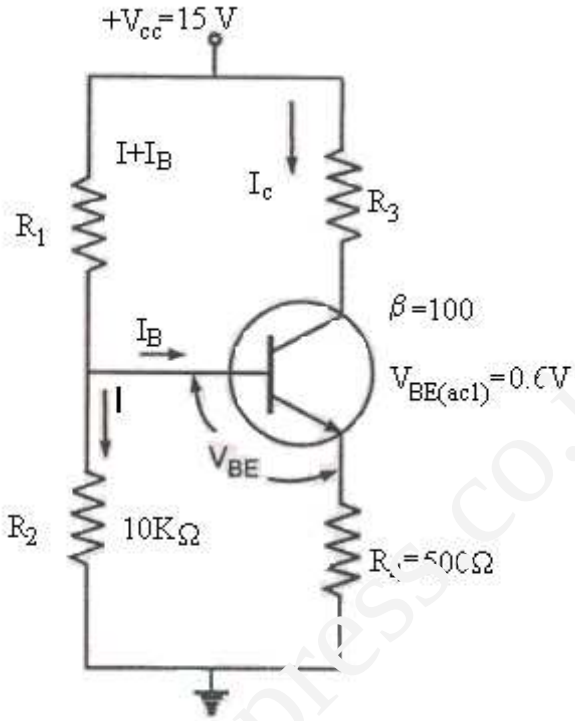

Figure 5

6. (a) Draw the circuit for darlington pair and derive the expressions for A_I, A_V, R_I and R_0. [3+5]

(b) The figure 6shows a CE amplifier with collector to base bias. Calculate A_I, A_V, R_I . The transistor parameters are h_{ie}=1.1K, h_{fe}=50, h_{oe}=25$\times$ 10^{-6}A/V, h_{re}=2.5 $\times$ 10^{-4}. [8]

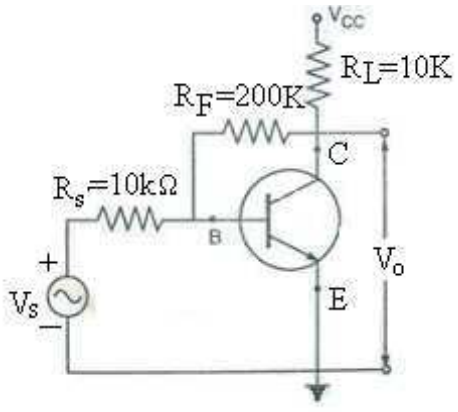

Figure 6

7. (a) Explain negative feedback with the help of the emitter follower as an example. Why is the emitter follower so called? [8]

(b) The gain of an amplifier is decreased to 10,000 with negative feedback from its gain of 60,000. Calculate the feedback factor. Express the amount of negative

feedback in dB. [8]

8. (a) What are the factors that affect the frequency stability of an oscillator? How frequency stability can be improved in oscillators?

   (b) Derive an expression for frequency of oscillation of Hartley oscillator using BJT. [8+8]

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the expression for trajectory of an electron placed in combined electric(E) and magnetic fields(B). Both the fields are perpendicular to each other and the initial velocity is zero.
   (b) The magnetic flux density $B = 0.02\omega b/m^2$ and electric field strength $E = 10^5 v/m$ are uniform fields, perpendicular to each other.A pure source of an electron is placed in a field. Determine the minimum distance from the source at which an electron with 0v will again have 0v in its trajectory under the influence of combined Electric and magnetic field. [8+8]

2. (a) Explain the formation of depletion region in an open-circuited pn-junction with neat sketches. [8]
   (b) A pn-junction diode has a reverse saturation current of 30 μA at a temperature of 125^0C. At the same temperature find the dynamic resistance for 0.2V bias in forward and reverse direction. [8]

3. (a) What are the important characteristics of a rectifer circuit? Explain them briefly.
   (b) A diode whose internal resistance is 20Ω is to supply power to a 100Ω load from 110V (rms) source of supply. Calculate:
      i. Peak load current
      ii. d.c load current
      iii. a.c load current
      iv. the percentage regulation from no load to the given load. [16]

4. (a) Summarise the sailent features of the characteristics of BJT operatives in CE, CB and CC configurations,
   (b) Calculate the values of I_E, β_{dc} and α_{dc} for a transistor with I_C=13μA, I_B=200mA, I_{CBO}=6μA. Also determine the new level of I_C which will result from reducing I_B to 100mA. [10+6]

5. (a) Draw a BJT fixed bias circuit and derive the expression for the stability factor 'S'. [3+5]

(b) An NPN transistor with $\beta = 50$ is used in a common emitter circuit with V_{CC}= 10V,R_C = 2k. The bias is obtained by connecting a 100K resistance from collector to base. Assume V_{BE} = 0.7 V. Find

i. the quiescent point and

ii. the stability factor, S. [4+4]

6. (a) Draw the CE amplifier with unbypassed R_E and derive the expressions for voltage gain and current gain. [3+5]

(b) The figure 6 is swamped FET amplifier. Determine the voltage gain when R_L=100KΩ. Neglect the FET output resistance (r_d) Take g_m = 4 mS. [8]

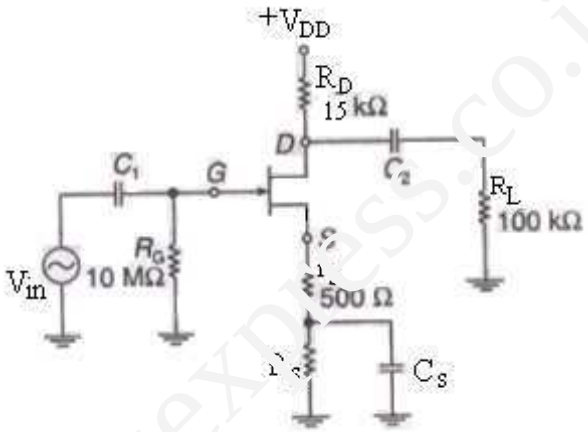

Figure 6

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
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

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) Explain the terms avalanche breakdown and 'zener breakdown'. What do you mean by voltage and zener current? How does zener diode regulate the d.c. voltage.
   (b) A certain pn-junction diode has a leakage current of 10^{-14} A at room temperature of 27^0 C and 10^{-9}A at 125^0 C. The diode is forward biased with a constant current source of 1mA at room temperature. If current is assumed to remain constant. Calculate the junction barrier voltage at room temperature and at 125^0 C. [10+6]

3. (a) Derive the expression for ripple factor for FWR with L-Section filter. Explain the necessity of a bleeder resistor.
   (b) A 3KΩ resistive load is to be supplied with a d.c.voltage of 300V from a.c.voltage of adequate magnetude and 50Hz frequency by wave rectification. The LC filter is used along the rectifier. Design the bleeder resistance, turns ratio of transformer, VA rating of transformer PIV rating of diodes. [16]

4. (a) Sketch the circuit symbols for
      i. n-channel JFET
      ii. p-channel JFET
      iii. n-channel enhancement type MOSFET
      iv. p-channel enhancement type MOSFET
      v. n-channel depletion type MOSFET and
      vi. p-chanel depletion type MOSFET.
      And compare JFET and MOSFETs.

(b) Why FET in called unipolar device and in called as voltage operated dice. What are the important characteristics of FET. [10+6]

5. (a) Compare BJT, JFET and MOSFET in all respects.

(b) For the JFET circuit with voltage divider bias as shown below, calculate V_G, V_S, V_D and V_{DS}. if V_{GS}= -2V. (figure 5)

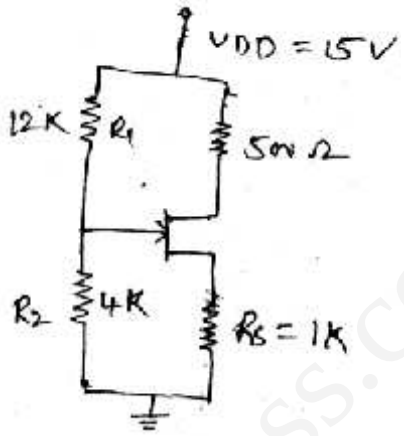

Figure 5

6. (a) Draw the circuit for darlington pair and derive the expressions for A_I, A_V, R_I and R_0. [3+5]

(b) The figure 6shows a CE amplifier with collector to base bias. Calculate A_I, A_V, R_I . The transistor parameters are h_{ie}=1.1K, h_{fe}=50, h_{oe}=25$\times$ 10^{-6}A/V, h_{re}=2.5 $\times$ 10^{-4}. [8]

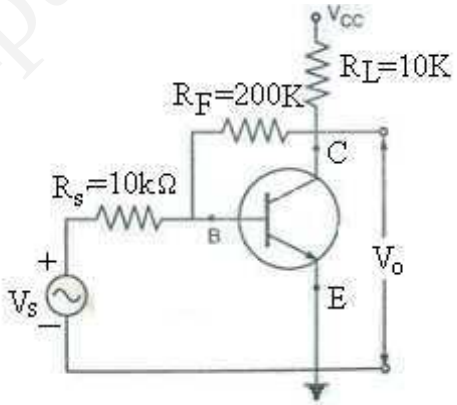

Figure 6

7. (a) Define the following terms in connection with feedback [3+3+3]

i. Return difference,f_b

ii. Closed loop gain

iii. Open loop gain

(b) Referring to the figure 7 shown below, it has R_S=600Ω, R_L=2KΩ, h_{fe}=80 and h_{ie}=5KΩ, R_B=40KΩ Calculate A_{vf}, A_v, R_{if},R_{of}. [7]

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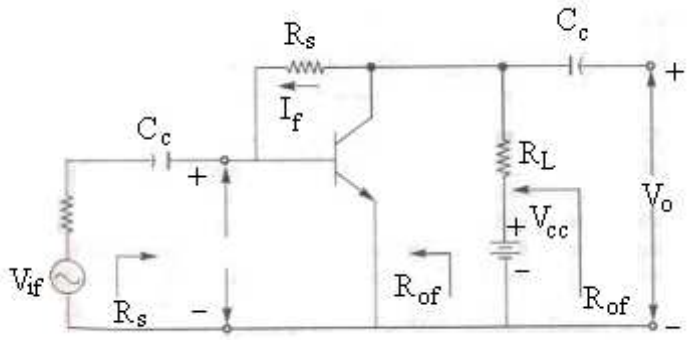

Figure 7

8. (a) Discuss and explain the basic circuit of an LC oscillator and derive the condition for the oscillations?

   (b) A crystal has L=2H, C=0.01PF and R=2kΩ. Its mounting capacitance is 2PF. Calculate its series and parallel resonating frequency. [10+6]

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

Answer any FIVE Questions
All Questions carry equal marks

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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) What is a tunnel diode? Draw the V-I characteristics of such a diode and explain the occurrence of the negative differential resistance.
   (b) A Ge diode has a saturation current of 1 nA at 20^0 C. Find it current when it is forward biased by 0.4v. Find the current in the same diode when the temperature rises 11^0 C. [16]

3. (a) Draw and explain the circuit diagram of FWR with L-section filter. What is its ripple factor?
   (b) A HWR circuit has filter capacitor of 1200 μF and is connected to a load of 400 Ω. The rectifier is connected to a 50 Hz, 120 V_{rms} Source. It takes 2 m sec for the capacitor to rechandge during each cycle. Calculate the minimum value of the repetitive surge current for which the diode should be rated. [16]

4. (a) Summarise the sailent features of the characteristics of BJT operatives in CE, CB and CC configurations,
   (b) Calculate the values of I_E, β_{dc} and α_{dc} for a transistor with I_C=13μA, I_B=200mA, I_{CBO}=6μA. Also determine the new level of I_C which will result from reducing I_B to 100mA. [10+6]

5. (a) Explain how do you set a Q point in a self biased JFET. [4+4]
   (b) For the FET self biased circuit shown (figure 5), calculate the values of R_D and R_S to obtain the bias condition. The maximum drain current is 10mA and V_{GS}= -2.2V at I_D=5mA. [4+4]

Code No: R05010204 **Set No. 4**

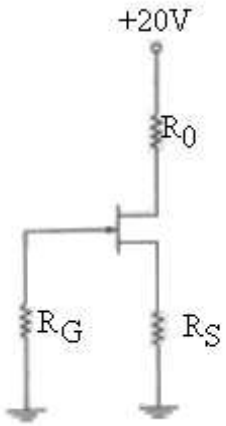

Figure 5

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 6 uses a transistor with h_{fe}=100, h_{ie}=3.37K. Calculate A_I, A_V, R_I. [3+3+2]

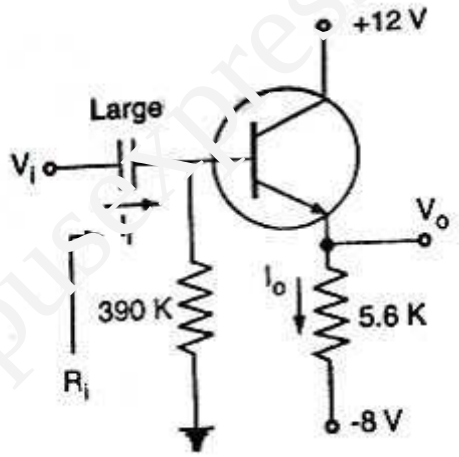

Figure 6

7. (a) Explain the concept of feedback with block diagram. [4+4]

   (b) An Amplifier with negative feedback gives an output of 12.5V with an input of 1.5V. When feedback is removed, it requires 0.25V input for the same output. Find

      i. value of voltage gain without feedback

      ii. value of β, if the input and output are in phase and β is real. [3+5]

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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