Code No: 07A41401 **R07** **Set No. 2**

II B.Tech II Semester Examinations,December 2010
SEMICONDUCTOR DEVICES AND CIRCUITS
Mechatronics

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain how n-type and p-type semi-conductors are formed? Explain the concept of hole.
   (b) The leakage current in pn junction Germanium diode is 10 μA at room temperature 300^0K. Calculate the change in temperature required so that the leakage current may rise to 40 μA. [8+8]

2. (a) Explain the following regions of JFET.
      i. Ohmic region
      ii. Cutoff region
      iii. Pinchoff region
   (b) Show that for small values of V_{GS} compared with V_P, the drain current is given approximately by $I_D = I_{DSS} + g_m V_{GS}$. [9+7]

3. (a) Define the following:
      i. Kinetic Energy
      ii. Electron volt
      iii. Electric Intensity
      iv. Current density of conductor
   (b) Explain about anode system used in a Cathode Ray Tube with a neat diagram. [10+6]

4. (a) Draw the equivalent circuit of current amplifier with current shunt feedback and derive the expression for the
      i. input resistance
      ii. output resistance
   (b) An amplifier has an open loop gain of 1000 and a feed back ratio 0.04. If the open loop gain changes by 10% due to temperature, find the percentage change in gain of the amplifier with feedback . [4+12]

5. (a) A colpitts oscillator is designed with $C_2 = 100$pf and $C_1 = 7500$pf. The inductance is variable. Determine apparent range of inductance value if apparent frequency of oscillation is to vary between 950 and 2050 KHz.
   (b) Draw the circuit diagram of FET colpitts oscillator and explain its working. Derive the expression for frequency of oscillator and condition for starting of oscillator. [8+8]

6. (a) Write a short note on base spreading resistance ?
   (b) Explain the analysis of a CE transistor amplifier circuit using simplified hybrid parameters. [6+10]

7. (a) Draw the circuit diagram of CLC filter and explain its operation.
   (b) Prove that the ripple factor of LC filter is
   $r = \frac{1}{6\sqrt{2}\omega^2 LC}$ [8+8]

8. (a) Discuss the advantages and disadvantages of R-C coupled transistor amplifers. What is the role of coupling capacitor in determining the frequency response.
   (b) Derive the expression for gain-bandwidth product of the amplifer and show that the gain-bandwidth product is constant. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A41401 **R07** **Set No. 4**

II B.Tech II Semester Examinations,December 2010
SEMICONDUCTOR DEVICES AND CIRCUITS
Mechatronics

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Draw the circuit diagram of center tapped Full Wave Rectifier and explain its operation with input, output waveforms.
   (b) Derive the following center tapped Full Wave Rectifier parameters.
      i. DC Voltage
      ii. RMS Voltage
      iii. Ripple factor
      iv. Efficiency. [8+8]
2. (a) Explain the input and output characteristics of a transistor in common emitter configuration
   (b) Define current amplification factors α and γ. Prove that the relation between α and γ is $\gamma = \frac{1}{1-\alpha}$ [8+8]
3. (a) Explain the following terms:
      i. Doping
      ii. Donor
      iii. Acceptor
      iv. Concentration
   (b) What are semiconductors? Differentiate intrinsic and extrinsic semiconductors. [8+8]
4. (a) Explain the function of the following in CRO:
      i. Horizontal Amplifier
      ii. Vertical Amplifier
   (b) Explain about deflection system used in a Cathode Ray Tube with a neat diagram. Also explain about the screen of CRO. [8+8]
5. (a) Assume that a silicon transistor with β=10 $V_{BE} = 0.6$V, $V_{CC} = 22.5$V and $R_C = 5.6$K is used in figure 5. It is desired to establish a Q point at V_{CE}=12V, $I_C = 1.5$mA and a stability factor S ≤ 3. Find R_e, R_1, and R_2.
   (b) Explain diode bias compensation method. [12+4]

Code No: 07A41401 **R07** **Set No. 4**

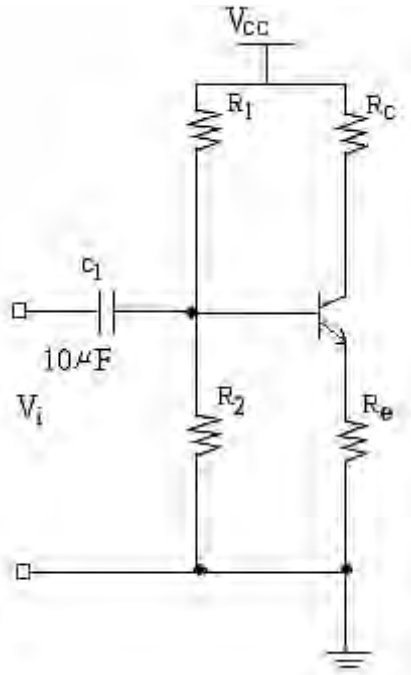

Figure 5

6. (a) Describe the construction of phase shift oscillator and explain its working.
   (b) An Hartley oscillator is design with L_1=20μ H L_2 = 2mH and a variable capacitance. Determine the range of capacitance value if the frequency is varied between 1050KHz and 2150 KHz. [8+8]

7. (a) Draw the small signal equivalent circuit of common Drain amplifier and derive the expression for voltage gain.
   (b) Draw the circuit of RC-coupled amplifier using transistor and draw the frequency response characteristic. [10+6]

8. (a) Explain the concept of feedback as applied to electronic amplifier circuits. What are the advantages and disadvantages of positive and negative feedback?
   (b) With the help of a general block diagram explain the term feed back.
   (c) Define the following terms in connection with feedback.
      i. Closed loop voltage gain
      ii. Open loop voltage gain [8+4+4]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A41401 **R07** **Set No. 1**

II B.Tech II Semester Examinations,December 2010
SEMICONDUCTOR DEVICES AND CIRCUITS
Mechatronics

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Foa a Germanium diode, the reverse saturation current at room temperature 300^0 is 2 μA. Calculate
   i. Forward dynamic resistance at forward voltage of 0.25 volts
   ii. Reverse dynamic resistance at a reverse voltage of 0.25 volts
   (b) Calculate the ratio of current for forward bias voltage of 0.05 V to the current for the same magnitude of the reverse bias. Assume the pn junctiion diode is Si. [8+8]
2. (a) Compare CE, CB and CC configurations
   (b) Explain the merits and de-merits of FET'S over BJT'S. [8+8]
3. (a) Draw the circuit of Half wave rectifier with resistance load and explain the working of it. Show that the ripple factor for the above circuit is 1.21.
   (b) Discuss the need of filters in rectifier circuits. [10+6]
4. (a) Define the term potential and derive the relation between electric field intensity and potential for
   i. Uniform electric field
   ii. Non uniform electric field
   (b) Explain the motion of electrons in
   i. Electric fields
   ii. magnetic fields. [6+10]
5. (a) What is the effect of employing negative feedback on voltage and current gains of practical voltage amplifier?
   (b) For the given circuit (figure 5b), calculate R_m, A_{vf} and R_{if}. The transistor h-parameters are h_{ie}=2KΩ, h_{fe} = 100. Neglect h_{oe} and h_{re}. [4+12]

Code No: 07A41401 **R07** **Set No. 1**

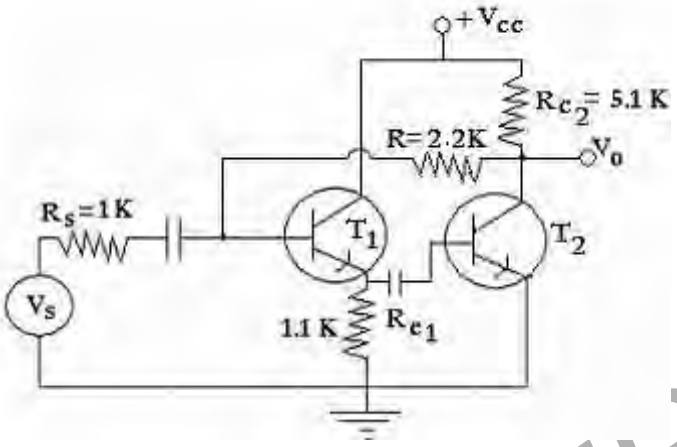

Figure 5b

6. (a) Draw the circuit of a common drain amplifier. Draw its high frequency small signal equivalent circuit.

   (b) Derive expressions for the high frequency voltage gain, input admittance, input capacitance and output admittance. [6+10]

7. (a) Draw the circuit of R-C phase shift oscillator circuit using JFET as the active device and discuss the nature of feed back used in the feedback path.

   (b) In the R-C phase shift oscillator, discuss the passive part of the circuit that is responsible to get the 180^0 phase shift.

   (c) Calculate the value of 'C' in the frequency-determining network of a FET RC phase shift oscillator having R = 2.5 KΩ; assuming frequency of oscillation f = 1.625 KHZ. [6+5+5]

8. (a) Explain the need and significance of biasing of transistor (BJT) circuits. Discuss different types of bias arrangements used in Transistor amplifier circuits.

   (b) Define the stability factors, S' and S''. [10+6]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A41401 **R07** **Set No. 3**

II B.Tech II Semester Examinations,December 2010
SEMICONDUCTOR DEVICES AND CIRCUITS
Mechatronics

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Draw the circuit diagram of Half Wave Rectifier and explain its operation with input, output waveforms.
   (b) Derive the following Half Wave Rectifier parameters.
      i. DC Voltage
      ii. RMS Voltage
      iii. Ripple factor
      iv. Efficiency. [8+8]

2. Determine Conductivity and Resistivity of following intrinsic semiconductors at room temperature 300^0K.
   (a) Germanium:
   Intrinsic concentration $(n_i) = 2.5 \times 10^{13} cm^{-3}$.
   Electron mobility $(\mu_n) = 3800 cm^2/v - sec$
   Hole mobility $(\mu_p) = 1800 cm^2$/v-sec
   (b) Silicon:
   Intrinsic concentration $(n_i) = 1.5 \times 10^{10} cm^{-3}$.
   Electron mobility $(\mu_n) = 1300 cm^2/v - sec$
   Hole mobility $(\mu_p) = 500 cm^2/v - sec$ [8+8]

3. (a) An electron is emitted from a thermionic cathode with a negligible initial velocity and is accelerated by a potential of 1000 Volts. Calculate final velocity of the particle.
   (b) Repeat the above problem for the case of a charged particle having mass equal to 500 times of an electron and a charge same as of an electron that has been introduced into the electric field with an initial velocity of 10^5 m/sec. [8+8]

4. (a) Draw the equivalent circuit for one stage RC coupled CE amplifier valid for low frequency range.
   (b) Derive expression for current gain A_{IL} and Voltage gain A_{VL} valid for low frequency range. [6+10]

5. (a) Compare n channel JFET with p channel JFET.
   (b) Draw the n channel depletion MOSFET construction and explain its operation. [6+10]

6. (a) State three fundamental assumptions which are made in order that the expression $A_f = A/(1 + A\beta)$ be satisfed exactly.

   (b) An Amplifier has a value of $R_{in} = 4.2K\Omega$, $A_V = 220$ and β=0.01. Determine the value of input resistance of the feedback amplifier.

   (c) The amplifer in part (a) had cut-off frequencies f_1=1.5KHZ and f_2=501.5 KHZ before the feedback path was added. What are the new cut-off frequencies for the circuit? [6+4+6]

7. (a) Draw the circuit diagram of a general oscillator and obtain the maintenance condition and the frequency of an oscillator

   (b) An Hartley oscillator is design with $L_1 = 20\mu$H $L_2 = 2$mH and a variable capacitance. Determine the range of capacitance value if the frequency is varied between 950KHz and 2050 KHz. [8+8]

8. (a) Define stability factor and derive an expression for the stability factor for collector to base bias.

   (b) A germanium transistor is used in the self-biasing arrangement of figure 8b with V_{cc}=16V and R_c= 1.5K Ω. The quiescent point is chosen to be V_{CE} = 8V and I_c = 4mA. A stability factor S=12 is desired. If β=50 find R_1, R_2 and R_e.

   [6+10]

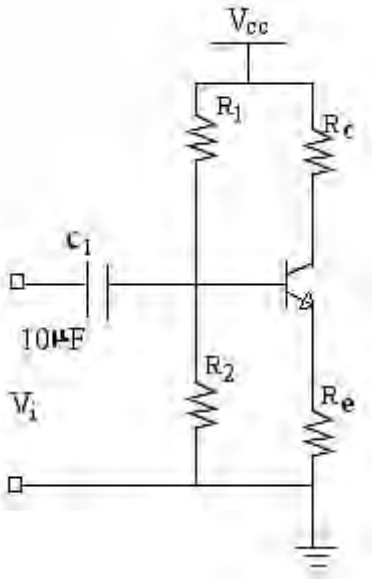

Figure 8b

⋆ ⋆ ⋆ ⋆ ⋆