Code No: RR10205 **Set No. 1**

I B.Tech Supplimentary Examinations, February 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) 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 are the various applications of p-n junction diode? Explain.
   (b) Draw the symbol and explain the V-I characteristics of the p-n junction diode. [8+8]

3. (a) Define the following terms with respect to rectifiers.
      i. Percentage regulation
      ii. Peak inverse Voltage
      iii. The efficiency of rectification
      iv. Transformer utilization factor.
   (b) A diode whose internal resistance is 20Ω is to supply power to a 1000Ω load from 110V rms source calculate [8+8]
      i. Peak load current
      ii. Dc load current
      iii. Ac load current
      iv. Percentage regulation from no load to the given load.

4. (a) A Germanium transistor with $\alpha = 0.98$ gives a reverse saturation current I_{CO} = 12mA when used in CB configuration. Calculate the collector current in CE mode for a base current of 0.2mA.
   (b) Sketch the profiles of majority and minority carrier currents in the base of an NPN transistor. Explain the transistor action with the help of these profiles. [6+10]

5. (a) Give the constructional features of DIAC and give its working principle?
   (b) How DIAC is different from TRIAC in application point of view?

6. (a) What are the compensation techniques used for V_{BE} and I_{CO}. Explain with the help of suitable circuits.
   (b) Draw the h-Parameters equivalent circuit of CC,CE configuration and what are the typical values of h-Parameters for a transistor in CE and CB configuration. [8+8]

7. (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 general block diagram explain the term feedback.
   (c) Define the following terms in connection with feedback. [6+4+6]
      i. Return difference feedback.
      ii. Closed loop voltage gain.
      iii. Open loop voltage gain.

8. (a) Classify various oscillators based on O/P waveforms, circuit components, operating frequencies and feedback used.
   (b) A phase shift oscillator is to be designed with FET having $g_m = 5000\mu s$, rd=4kΩ while the resistance in the feedback circuit is 9.7kΩ. Select the proper value of C and R_D to have the frequency of oscillations as 5KHZ. [10+6]

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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 the electro static deflection sensitivity in the case of CRT.
   (b) Compare electro static and electro-magnetic deflection sensitivity in all respects. [8+8]

2. (a) Compare the characteristics of a p-n junction diode, zener diode and tunnel diode.
   (b) How do you determine whether a given semiconductor is p-type or n-type? Explain the principle with necessary equations. [8+8]

3. (a) In a full wave single phase bridge rectifier circuit can the transformer and load be interchanged? If so or not justify your statement.
   (b) Show that for a full wave rectifier $\eta = \left(\frac{81.2}{1+\frac{R_f}{R_L}}\right)\%$.
   (c) Define the following terms [4+6+6]
      i. Ripple factor
      ii. Form factor
      iii. PIV

4. (a) A transistor operating in CB configuration has $I_c = 2.98$ mA, $I_E = 3.00$mA and $I_{CO} = 0.01$ mA what current will flow in the collector circuit of this transistor when connected in CE configuration with a base current of $30\mu A$.
   (b) The reverse saturation current in a transistor is $8\mu A$. If the transistor common base current gain is 0.979, calculate the collector and emitter current for $40\mu A$ base current. [8+8]

5. (a) Draw the circuit diagram of a saw tooth wave form generator using UJT and explain its operation.
   (b) What is meant by Pinch off voltage pinch of locus of JFET? Mark Pinch of locus form drain characteristic.

6. (a) Define the stability factors, S', S'' and what is the need of this in BJT circuits.

(b) Draw the circuit diagram of a self bias BJT circuit and explain how to determine the values of R_1 and R_2. [6+10]

7. (a) Discuss the step-by-step procedure for identifying feedback topology.

   (b) An amplifier with open loop voltage gain of 1000 delivers low of power output at 10% second harmonic distortion when input is 10 mv. If 40 db negative feedback is applied and out put power is to remain at 10 w, determine required input signal and second harmonic distortion with feedback. [8+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) 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) Give the relation between voltage and current for a p-n junction diode.
   (b) If two similar germanium diodes are connected back to back and the voltage V is impressed upon. Calculate the voltage across each diode and current through each diode. Assume similar value of $Io = 1\mu a$ for both the diodes and η=1.
   (c) Explain about diffusion capacitance of p-n junction diode. [6+6+4]

3. (a) A 15-0-15 Volts (rms) ideal transformer is used with a full wave rectifier circuit with diodes having forward drop of 1volt. The load is a resistance of 100ohm and a capacitor of 10,000μf is used as a filter across the load resistance. Calculate the dc load current and voltage.
   (b) Draw the circuit diagram of a bridge rectifier circuit with Π-section followed by L-section filter and explain its operation. [6+10]

4. (a) Explain the operation of NPN and PNP transistors.
   (b) Explain the early effect and its consequences.
   (c) Derive the relation between α and β. [6+4+6]

5. (a) Sketch the cross section of an NMOS enhancement transistor and briefly explain.
   (b) What is the significance of the threshold voltage V_T in

i. enhancement mode
ii. depletion mode MOSFETS.

(c) Define R_d, g_m and μ of JFET. [6+4+6]

6. (a) Discuss the phenomena of thermal runaway .
(b) What is meant by bias stabilization?
(c) Derive the expression for stability factors S.
(d) For the CC amplifier the transistor parameters are $h_{ic} = 1500$ $h_{fe} = -80$ $h_{oc} = 2 \times 10^{-5} mho$ $h_{rc} = 1$ Calculate input impedance Zi, ,Voltage gain AV and output impedance R_O. [4+4+4+4]

7. (a) Show that for voltage shunt feedback amplifier transresistance gain, R_i and R_o are decreased by a factor (1+Aβ) with feedback.
(b) For the given circuit(as shown in figure7b), h_{fe}=110, h_{ie}=1100Ω, h_{re}=h_{oe}=0. Determine with R_e= 1 K. [8+8]

i. $R_f = \frac{V_o}{I_s}$ *where* $I_s = \frac{V_s}{R_s}$
ii. $A_{vf} = \frac{V_o}{V_s}$,
iii. $R_{if.}$
iv. R'_{of}

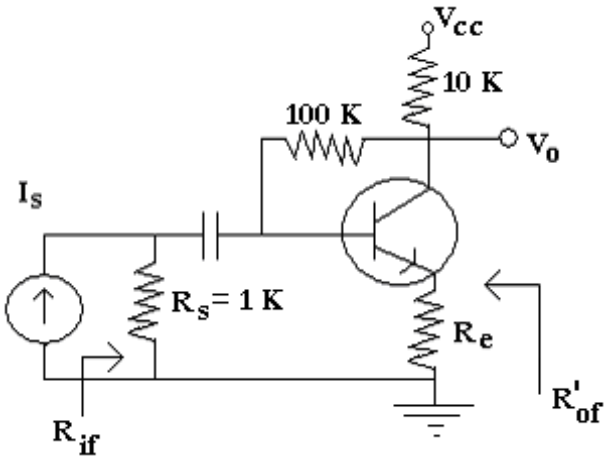

Figure 7b

8. (a) Derive an expression for frequency of oscillation of transistorized Colpitts oscillator.
(b) A quartz crystal has the following constants. L=50mH, C_1=0.02PF, R=500Ω and C_2=12PF. Find the values of series and parallel resonant frequencies. If the external capacitance across the crystal changes from 5PF to 6PF, find the change in frequency of oscillations. [8+8]

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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 the electro static deflection sensitivity in the case of CRT.
   (b) Compare electro static and electro-magnetic deflection sensitivity in all respects. [8+8]

2. (a) Explain why p-n junction contant potential cannot be measured by placing a voltmeter across the diode terminal.
   (b) With reference to the P-N junction diode. [4+12]
      i. Distinguish between drift current and diffusion current.
      ii. Distinguish between diffusion capacitance and transition capacitance.

3. (a) Derive the expression for ripple in a pi-section filter when used with a half wave rectifier.
   (b) A full-wave single phase rectifier employs a Π-section filter consisting of two $4\mu F$ capacitances and a 20H choke. The transformer voltage to the center tap is 300V rms. The load current is 500mA. Calculate the dc output voltage and the ripple voltage. The resistance of the choke is 200Ω. [8+8]

4. (a) Given that $\alpha_{dc} = 0.987$, determine the corresponding value of β_{dc}
   (b) Given $\beta_{dc} = 120$, determine the corresponding value of α.
   (c) Given that $\beta_{dc} = 180$ and $I_c = 2.0$ mA find I_E and I_B.
   (d) Given that $\beta_{dc} = 160$ and find γ. [4+4+4+4]

5. (a) For a small signal JFET $i_D = f(V_{GS}, V_{DS})$. Obtain expressions for i_d and hence define g_m, r_d and μ.
   (b) From the definition of g_m obtain expression for g_m.
   (c) For an n-channel silicon FET with $a = 3{\times}10^{-4}$cm and $N_D = 10^{15} electrons/cm^3$. Find the pinch off voltage.

6. (a) Draw the circuit diagram of a collector to base bias circuit of CE amplifier and derive expression for S.

(b) Determine the quiescent currents and the collector to emitter voltage for a germanium transistor with β=50 in self biasing arrangement. Draw the circuit with a given component value $V_{CC} = 20V$, $R_C = 2K$, $R_e = 100\Omega$ $R_1 = 100K\Omega$ $R_2 = 5K$. Also find out stability factor. [8+8]

7. (a) Draw the circuit diagram of a voltage shunt feed back using BJT and derive expression for voltage gain with feedback.

   (b) What are the advantages and disadvantages of negative feedback?

   (c) Calculate the gain, input impendence, output impendence of voltage series, feedback. Amplifier having A= -300 Ri = 1.5K $R_o = 50$ K and $\beta = \frac{-1}{20}$ [6+4+6]

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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