Code No: Y0221/R07 **Set No. 1**

I B.Tech Supplementary Examinations, January 2014
BASIC ELECTRONIC DEVICES AND CIRCUITS
(Electrical & Electronics Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive an expression for magnetic deflection sensitivity of C.R.O.
   (b) An electron is injected with an initial velocity V_{ox} of 4×10^6 m/sec halfway between two large parallel plates 0.5 cm apart. The XZ plane is parallel to the plates. There is a voltage of 200V impressed between the plates, and a magnetic field of 10 mwb/m^2 perpendicular to the plates, directed from the positive to the negative plate. Where does the electron strike the positive plate and with what velocity? [8+8]

2. (a) Determine the resistivity of Germanium:
      i. in intrinsic condition at 300 ^{0}K
      ii. with donor impurity of 1 in 10^7
      iii. with acceptor impurity of 1 in 10^8
      Given for germanium at room temperature. $n_i = 2.5 \times 10^{13}/cm^3$; $\mu_p = 1800$ cm^2/V-sec, $\mu_n = 3800$ cm^2/V-sec and number of Germanium atoms/$cm^3 = 4.4 \times 10^{22}$.
   (b) Compare Avalanche and Zener breakdown. [10+6]

3. (a) A 15-0-15 Volts (rms) ideal transformer is used with a full wave rectifier circuit with diodes having forward drop of 1 volt. 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 L-section filter and explain its operation. [8+8]

4. (a) Why CE circuit is preferred to a CB circuit. Describe the operation of PNP grounded emitter transistor amplifier.
   (b) Draw the basic structure of a SCR and explain its characteristics. [8+8]

5. (a) Differentiate bias stabilization and compensation techniques.
   (b) Design a voltage divider bias network using a supply of 24V, β=110 and I_{CQ}=4μA, V_{ceQ}=8V choose V_e=V_{cc}/8. [7+9]

6. (a) Derive the expressions for the performance quantities of a CE transistor amplifier using h-parameters.
   (b) Draw the small signal model for a common- drain FET amplifier. [10+6]

7. (a) Explain the effect of negative feedback on the input and output impedance of an amplifier.

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(b) An amplifier has a voltage gain of -100. The feedback ratio is -0.04. Determine the voltage gain with feedback, the output voltage of the feedback amplifier for an input voltage of 40mv, the feedback factor and the feedback voltage. [8+8]

8. (a) State the Nyquist criterion for stability.

(b) Explain the principle of operation of a wien-bridge oscillator with the help of a neat diagram. Obtain an expression for its frequency of oscillation. [6+10]

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Code No: Y0221/R07 **Set No. 2**

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

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1. (a) With the help of necessary equations show that the trajectory of an electron is cycloid when it is placed in perpendicular electric and magnetic fields.
   (b) Determine the velocity and kinetic energy of an electron accelerated through potential of 3 KV. [8+8]
2. (a) Explain the working principle of an LED with necessary diagrams. Draw the V-I characteristics and explain.
   (b) List out the applications of an LCD. [10+6]
3. (a) Derive the expression for ripple factor in a full wave rectifier using an inductor filter.
   (b) In a full wave rectifier using an LC-filter L=10 H, C=100μ F and R_L=500Ω. Calculate I_{dc}, V_{dc} for an input V=30sin (100πt). [8+8]
4. (a) Draw the circuit and explain the drain and gate characteristics of a JFET in C.S. configuration.
   (b) Give the parameter values and specifications of a JFET. [10+6]
5. (a) Differentiate bias stabilization and compensation techniques.
   (b) Design a voltage divider bias network using a supply of 24V, β=110 and I_{CQ}=4μA, V_{ceQ}=8V choose V_e=V_{cc}/8. [7+9]
6. (a) Draw and explain the approximate model of a CB amplifier.
   (b) Find the voltage gain and current gain of a CE amplifier whose h_{ie}=1KΩ, h_{fe}=100, h_{re}= 0.003, h_{oe}= 50μA/V. Consider the source resistance of 50 Ω and load resistance of 1KΩ. [8+8]
7. (a) An amplifier has a gain of -100 and a distortion of 8%. What is the effect of introducing negative feedback with feedback factor of 0.05?
   (b) Find A_f for a CE stage with an un bypassed emitter resistor. [8+8]
8. (a) Find V_i/V_f' for the network shown in figure 8a.

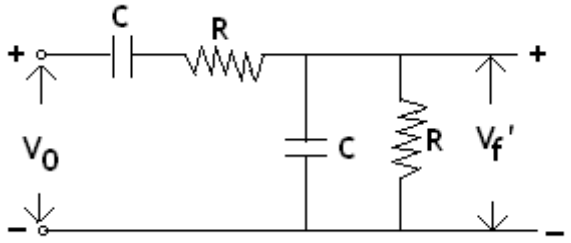

Figure 8a

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(b) Sketch the circuit of a phase shift oscillator using feedback network shown in figure 8b.

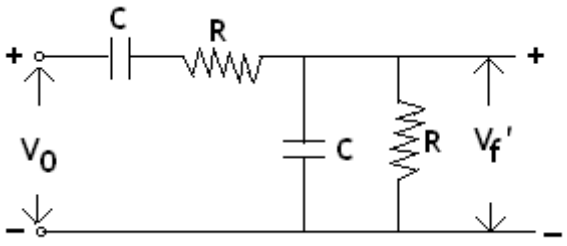

Figure 8b

(c) Find the expression for the frequency of oscillation, assuming that the network does not load down the amplifier of question (b).

(d) Find the minimum gain required for oscillations of the circuit of question (b). [16]

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Code No: Y0221/R07 **Set No. 3**

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1. (a) Draw the schematic diagram of a CRT and explain about the various sections and the materials used.
   (b) In a CRT, the electrons emitted are accelerated by a potential of 500V. The length of the deflecting plates is 1.3 cm. Distance between the deflecting plates is 0.5 cm. The distance between the centre of the deflecting plates and the screen is 20 cm. Determine the value of electrostatic deflection sensitivity. [8+8]

2. (a) Distinguish between zener and Avalanche breakdown mechanisms.
   (b) Describe the action of PN junction diode and explain how it acts as a switch.
   (c) Explain the V-I characteristics of a varactor diode. [6+5+5]

3. (a) Draw the circuit diagram of a Half wave rectifier. Explain the operation of the circuit with relevant waveforms.
   (b) A bridge rectifier uses four identical diodes having forward resistance of 5Ω each. Transformer secondary resistance is 5 ohms and the secondary voltage is 30 V (rms). Determine the dc output voltage for I_{dc} = 200 mA and value of the output ripple voltage. [8+8]

4. (a) Compare CB, CE, CC configurations with respect to current gain, voltage gain, input resistance and output resistance.
   (b) Explain what is meant by early effect in the case of tyransistor and what is its consequences. [10+6]

5. (a) Compare the advantages and disadvantages of biasing schemes.
   (b) Calculate the quiescent current and voltage of collector to base bias arrangement using the following data:
   V_{cc} =10V, R_b=100KΩ, R_c=2KΩ, β=50 and also specify a value of R_b so that V_{ce}=7V. [8+8]

6. (a) Consider an emitter follower and show that as $R_e \to \infty$ then $1 - A_v \cong \frac{h_{ie}h_{oe}}{1+h_{fe}}$
   (b) Draw the small signal model of common drain MOSFET amplifier and define all parameters. [8+8]

7. (a) An amplifier has a gain of -100 and a distortion of 8%. What is the effect of introducing negative feedback with feedback factor of 0.05?
   (b) Find A_f for a CE stage with an un bypassed emitter resistor. [8+8]

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8. (a) Consider the two section RC network shown in figure 8a. Find the V_i/V_f' function, and verify that it is not possible to obtain 180^0phase shift with a finite attenuation.

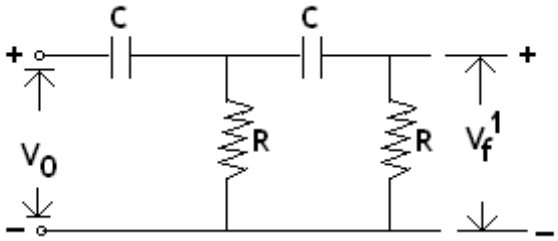

Figure 8a

(b) State the similarities and differences between series and parallel resonance crystal oscillator circuits. [10+6]

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Code No: Y0221/R07 **Set No. 4**

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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 an expression for magnetic deflection sensitivity of C.R.O.
   (b) An electron is injected with an initial velocity V_{ox} of 4×10^6 m/sec halfway between two large parallel plates 0.5 cm apart. The XZ plane is parallel to the plates. There is a voltage of 200V impressed between the plates, and a magnetic field of 10 mwb/m^2 perpendicular to the plates, directed from the positive to the negative plate. Where does the electron strike the positive plate and with what velocity? [8+8]

2. (a) Derive diode equation and discuss about various parameters involved in the equation.
   (b) Determine the values of forward current in the case of a p-n junction diode, with I_0=10 micro amperes. $V_F = 0.8$V at T = 300 ^{0}k. Assume silicon diode. [10+6]

3. (a) Define the following terms of a half wave rectifier with resistive load:
      i. Ripple factor
      ii. Peak inverse voltage
      iii. Rectification efficiency.
   (b) A 230 V, 60Hz voltage is applied to the primary of a 5 : 1 step down, center tapped transformer used in a full wave rectifier having a load of 900Ω. If the diode resistance and the secondary coil resistance together has a resistance of 100Ω, determine:
      i. dc voltage across the load
      ii. dc current flowing through the load
      iii. dc power delivered to the load
      iv. PIV across each diode.
      v. Ripple voltage and its frequency. [6+10]

4. (a) Compare BJT, JFET and MOSFET in all respects.
   (b) Draw the static characteristics of SCR for different gate currents and explain briefly. [8+8]

5. Explain how to minimize the percentage variations in I_C due to variations in I_{CO}, V_{BE} and β with suitable circuit diagrams. [16]

6. (a) Explain the method of evaluating h parameters for a transistor in CB configuration.

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(b) A CC amplifier is driven by a voltage source of internal resistance R_s=1kΩ. The load impedance if R_L=1KΩ. The transistor parameters are h_{ic}= 1.1KΩ, h_{fc} = -51, h_{rc}=1, h_{oc}= 25μA/V. Compute input and output impedance of the amplifier. [8+8]

7. (a) Draw the circuit of a feedback pair with Voltage shunt topology and find the voltage gain?

   (b) The open-loop gain of an amplifier changes by 20% due to changes in the parameters of the active amplifying device. If a change of gain by 2% is allowed, find the minimum value of feedback ratio and open-loop gain, if the amplifier gain with feedback is 10. [8+8]

8. (a) What is condition of unity loop gain to sustain oscillations? Prove it.

   (b) Prove that the ratio of the parallel to series resonant frequencies of a crystal is 1+1/2(C/C'). [8+8]

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