

I B.Tech Supplementary Examinations, Aug/Sep 2008
BASIC ELECTRONIC DEVICES AND CIRCUITS
(Electrical & Electronic Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

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) Explain the following terms:
 - i. Potential
 - ii. Electron Volt
 - iii. Charge density
 - iv. Current density. [8+8]
2. (a) Explain the concept of Transition capacitance C_T of an p-n junction diode.
(b) Derive the expression for transition capacitance C_T of a diode. [4+12]
3. (a) Discuss the operation of HW rectifier with and without capacitor filter.
(b) Draw the Half wave rectifier circuit using a step down Transformer with $V_s = 46 \sin(100\pi t)$ and a semiconductor diode. Calculate the turns ratio of the Transformer windings when the primary voltage of the Transformer is 230 volts. [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. For the biasing arrangement of the figure 5 and assuming that the reverse saturation currents of the diode and transistor are equal, prove that

$$S = 1,$$

$$S' = -\frac{\beta}{R_1} \quad [16]$$

$$S'' = \frac{I_{C1} - I_{C01}}{\beta_1}$$

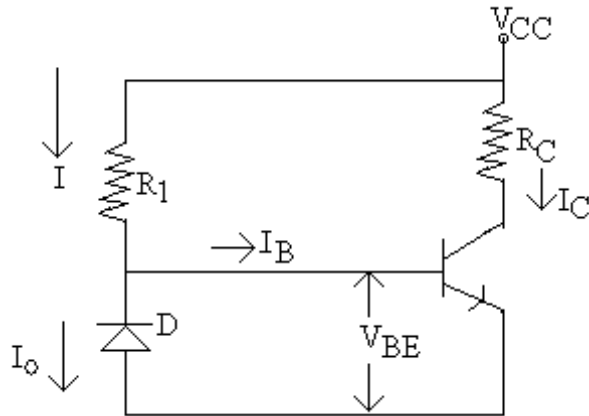


Figure 5

6. (a) The h-parameters of a transistor used as an amplifier in the CE configuration are $h_{ie}=800\Omega$, $h_{fe}=50$, $h_{oe}=80 \times 10^{-6}\Omega^{-1}$ and $h_{re}=5.4 \times 10^{-4}$. If the load resistance is $5\text{ K}\Omega$, determine the current gain, input impedance, output impedance, voltage gain and power gain.
- (b) Draw the small signal model for a common-source FET amplifier. [10+6]
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 unbypassed emitter resistor. [8+8]
8. (a) Explain why in every practical oscillator the loop gain is slightly larger than unity?
- (b) The RC network of a Wien-bridge oscillator consists of resistors of values $R_1=R_2=220\text{K}\Omega$ and capacitors of values $C_1=C_2=250\text{pF}$. Calculate the frequency of oscillation. [8+8]

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1. (a) Derive an expression for magnetic deflection sensitivity of a C.R.O.
(b) An electron having a speed $V_0 = 10^7$ m/sec is injected in the XY plane at an angle of 30° to the X axis. A uniform magnetic field parallel to the Y-axis and with flux density $B = 5.10$ mwb/m² exists in the region. Find the position of the electron in the region. Find the position of the electron in space at $t=5$ m sec after entering the magnetic field. [8+8]
2. (a) Explain qualitatively the V-I characteristics of a tunnel diode.
(b) Calculate the dynamic forward and reverse resistance of a p-n junction diode when the applied voltage is 0.24 V. Assume Germanium diode. $I_0 = 2\mu A$ and $T = 300^\circ K$. [8+8]
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) 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) Define the three stability factors?
(b) Calculate the values of the resistors in a fixed bias circuit using the following specifications. $I_{CQ}=9.2mA$, $V_{ceQ}=4.4V$, $h_{fe}=1115$, $V_{be}=0.7V$ and $V_{cc}=9v$. [6+10]

6. (a) For a CE configuration, what is the maximum value of R_S for which R_0 differs by no more than 10 percent of its value for $R_S = 0$? Transistor parameters are $h_{ie}=1.1K\Omega$, $h_{re} = 2.5 \times 10^{-4}$, $h_{fe}=50$ and $h_{oe}=24 \mu A/V$.
(b) Sketch the circuit of a source follower. Derive the expression for the voltage gain at low frequencies and what is the maximum value of voltage gain. [8+8]
7. (a) List the steps required to carry out the analysis of a feedback amplifier.
(b) Calculate voltage gain, input impedance and output impedance of a CE amplifier with voltage-shunt negative feedback. [6+10]
8. (a) Prove that the amplitude of the oscillations is limited by the onset of nonlinearity.
(b) Design a phase-shift oscillator to operate at a frequency of 5kHz. Use a MOS-FET with $\mu=55$ and $r_d=5.5K$. The phase shift network is not to load down the amplifier. Find the minimum value of the drain circuit resistance R_d for which the circuit will oscillate. [8+8]

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1. (a) Explain with a block diagram the major parts of CRT.
(b) An electron having a speed $V_0 = 10^7$ m/sec is injected in the XY plane at an angle of 30° to the X axis. A uniform magnetic field parallel to the Y-axis and with flux density $B = 5.10$ mwb/m² exists in the region. Find the position of the electron in the region. Find the position of the electron in space at $t=5$ m sec after entering the magnetic field. [8+8]
2. (a) What are general specifications of p-n junction diode?
(b) The voltage across a silicon diode at room temperature of 300°K is 0.7 volts when 2mA current flows through it. If the voltage increases to 0.75V, calculate the diode current (assume $V_T = 26\text{mV}$). [16]
3. (a) Derive the expression for Average value of current, R.M.S value of current and Average voltage across the load for a half wave rectifier.
(b) Compare the performance of series inductor, L-section and π -section filters. [8+8]
4. (a) Explain the input and output characteristics of BJT in CB configuration.
(b) Compare important characteristics of BJT and FET. [10+6]
5. (a) Define the three stability factors?
(b) Calculate the values of the resistors in a fixed bias circuit using the following specifications. $I_{CQ}=9.2\text{mA}$, $V_{ceQ}=4.4\text{V}$, $h_{fe}=1115$, $V_{be}=0.7\text{V}$ and $V_{cc}=9\text{V}$. [6+10]
6. (a) Draw the h-parameter equivalent circuit of a transistor in the CB configuration and explain the significance of each term in circuit.
(b) A FET amplifier in the common-source configuration uses a load resistance of $300\text{K}\Omega$. The ac drain resistance of the device is $100\text{K}\Omega$ and the transconductance is 0.5mA/V . Find the voltage gain of the amplifier? [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 unbypassed emitter resistor. [8+8]
8. For the feedback network shown in figure 8 find the transfer function and the input impedance. If this network is used in a phase shift oscillator, find the frequency of

oscillation and the minimum amplifier voltage gain. Assume that the network does not load down the amplifier. [16]

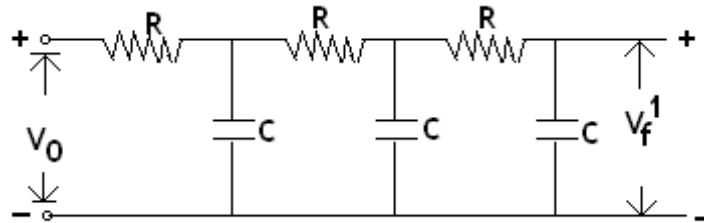


Figure 8

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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/m² 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) Explain qualitatively the V-I characteristics of a tunnel diode.
(b) Calculate the dynamic forward and reverse resistance of a p-n junction diode when the applied voltage is 0.24 V. Assume Germanium diode. $I_0 = 2\mu A$ and $T = 300^\circ K$. [8+8]
3. (a) Define the terms as referred to FWR circuit:
 - i. PIV
 - ii. average d.c. voltage
 - iii. RMS current
 - iv. ripple factor.(b) A full wave rectifier (FWR) supplies a load requiring 300V at 200mA. Calculate the transformer secondary voltage for:
 - i. a capacitor input filter using a capacitor of 10 μF .
 - ii. a choke input filter using a choke of 10 H and a capacitance of 10 μF . Neglect the resistance of choke. [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. What is the need for biasing? Explain the types of biasing with neat circuit diagrams? [16]
6. (a) The h-parameters of a transistor used as an amplifier in the CE configuration are $h_{ie}=800\Omega$, $h_{fe}=50$, $h_{oe}=80 \times 10^{-6}\Omega^{-1}$ and $h_{re}=5.4 \times 10^{-4}$. If the load resistance is 5 K Ω , determine the current gain, input impedance, output impedance, voltage gain and power gain.
(b) Draw the small signal model for a common-source FET amplifier. [10+6]

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) 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]
