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Code No: R05010204 **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) 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) What do you understand by depetion region at p-n junction? What is the effect of forward and reverse biasing of p-n junction on the depletion region? Explain with necessary diagrams.
   (b) Explain the concept of tunneling with energy band diagrams. [8+8]

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 magnitude 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) With neat diagram explain the various current components in an pnp transistor.
   (b) Explain the input and output characteristics of a transistor in CB configuration. [8+8]

5. (a) List the three sources of instability of collector current and define three stability factors. [4+4]
   (b) For the circuit shown (figure 5), calculate I_B, V_C and V_{CE}. [8]

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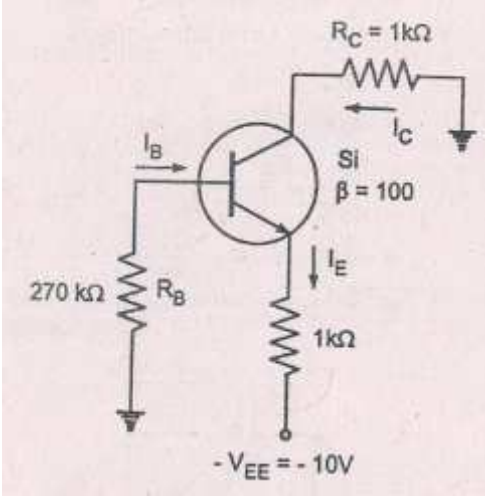

Figure 5

6. (a) Draw the low frequency hybrid π model and explain the meaning of each component of the model. [3+5]

   (b) For the circuit shown in figure 6, calculate A_I, A_V, R_I and R_0. Given h_{ie} = 4K and h_{fe} = 200. [2+2+2+2]

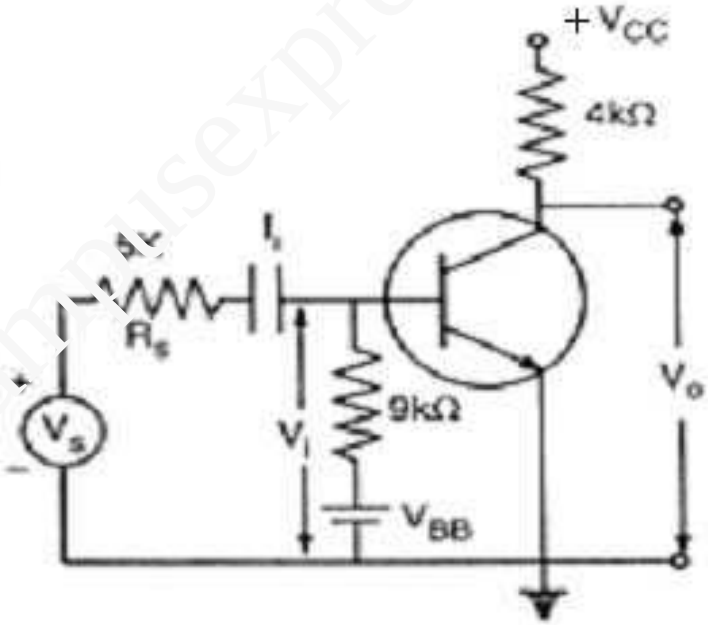

Figure 6

7. (a) Discuss briefly about various characteristics of an amplifier which are modified by negative feedback. [8]

   (b) An RC coupled amplifier has a voltage gain of 1000. f_1=50Hz, f2=200KHz and a distortion of 5% without feedback. Find the amplifier voltage gain, f_1^1 , f_2^1 and distortion when a negative feedback is applied with feedback ratio of 0.01. [5+3]

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8. (a) Derive the expression for frequency of oscillations in RC-phase shift oscillator using BJT.

   (b) A crystal has L=0.1H, C=0.01PF, R=10kΩ and C_M=1PF. Find the series resonance and Q-factor. [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) What is varactor diode? Explain the operation of varactor diode with its equivalent circuit. What are its applications.
   (b) The conductivity of intrinsic Si is 3 $\mho$/m at room temperature and the electron and hole mobilities in it are 0.4 m^2/V.Sec and 0.2 m^2/V.Sec. respectively. Calculate the number of electrons and holes per m^3 participating in the conduction process. [16]

3. (a) Explain about the regulation characteristics of Zener diode with a circuit and waveforms.
   (b) A full wave rectifier circuit uses two silicon diodes with a forward resistance of 20Ω each. A d.c. voltmeter connected across the load of 1kΩ reads 55.4 volts. Calculate
      i. I_{RMS}
      ii. Average voltage across each diode
      iii. ripple factor
      iv. Transformer secondary voltage rating. [8+8]

4. (a) Obtain the expression for the collector current of a transistor in CE configuration.
   (b) Define α_{dc} and β_{dc} of a transistor, for a transistor the base current in 100μA and collector current in 2.9μA. Find α_{dc} and β_{dc}. [10+6]

5. (a) Explain thermal instability. What are the factors affecting the stability factor. [4+4]
   (b) For the CE amplifier circuit shown below, find the percentage change in collector current if the transistor with h_{fe}=50 is replaced by another transistor with h_{fe}=150. Assume V_{BE}=0.6V (figure 5) [8]

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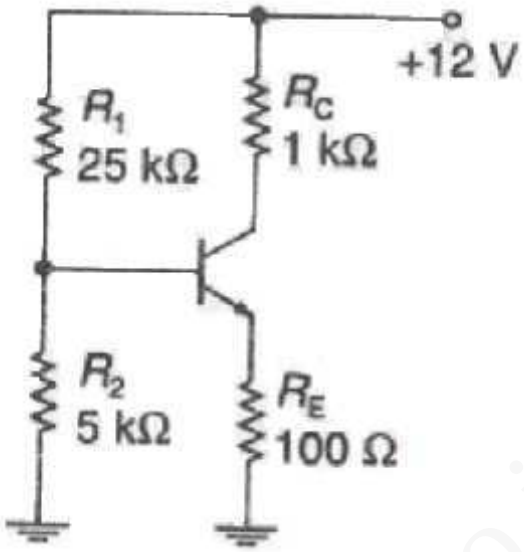

Figure 5

6. (a) Draw the emitter follower circuit and derive the expressions for voltage gain and current gain. [3+5]

   (b) Find the voltage gain for the source follower as shown in figure 6. Also find the output resistance if the input voltage is 2mV. Assume g_m=5500μS [8]

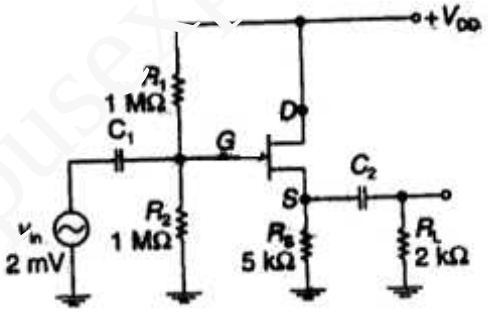

Figure 6

7. (a) How does negative feedback reduce distortion in an amplifier. [8]

   (b) An Amplifier has a voltage gain of 400, f_1=50Hz, f_2=200KHz and a distortion of 10% without feedback. Determine the voltage gain, f_{1f}, f_{2f} and D_f when a negative feedback is applied with feedback ratio of 0.001. [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

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1. (a) Explain the term current density. Obtain the expression for current density 'J' in terms of dimensions of the conductor, velocity and carrier concentration of charge carrier.
   (b) The distance between the plats of a plane parallel capacitor is 1 cm. An electron starts at rest at the negative plate. If a direct voltage of 1000 volts is applied, how will it take the electron to reach the positive plate? [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) Compare the performance of HWR uses capacitor filter, inductor filter and L-section filter. What is the need of bleeder resistance in FWR choke filter?
   (b) A FWR circuit is fed from a transformer with a center tap. The rms voltage from end of secondary to center tap is 30V. If the diode forward resistance is 2Ω and that of the half secondary is 8Ω, Calculate the following for a 1kΩ load:
      i. Power delivered to load
      ii. Percentage regulation at full load
      iii. Efficiency of rectification
      iv. TUF secondary. [16]

4. (a) Obtain the expression for the collector current of a transistor in CE configuration.
   (b) List the important characterisitcs of FET and compare FET with BJT.[10+6]

5. (a) What are the biasing schemes available to achieve the required bias in a junction
   field effect transistor. Explain any one of the biasing schemes.

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(b) For the circuit shown figure 5b, Find the values of V_{DS} and V_{GS}. Given I_D=5mA,
V_{DD}=10V, R_D=1KΩ, R_S=500Ω. [8+8]

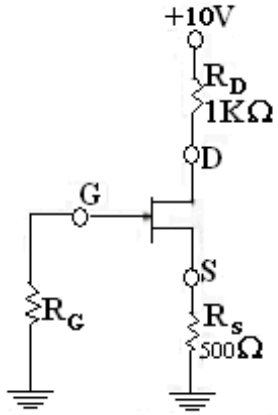

Figure 5b

6. (a) Draw the circuit diagram of common source amplifier with unbypassed Rs and derive voltage gain and output resistance [2+3+3]

(b) Determine the overall voltage gain of the cascode amplifier shown in figure 6 with R_{B1}=7.5K, R_{B2}=6.8K, R_{L3}=3.3K, R_E=1.3K, R_C=2.2K. For the two transistors $\beta_1 = \beta_2$=120 and supply voltage V_{CC}=18V. [8]

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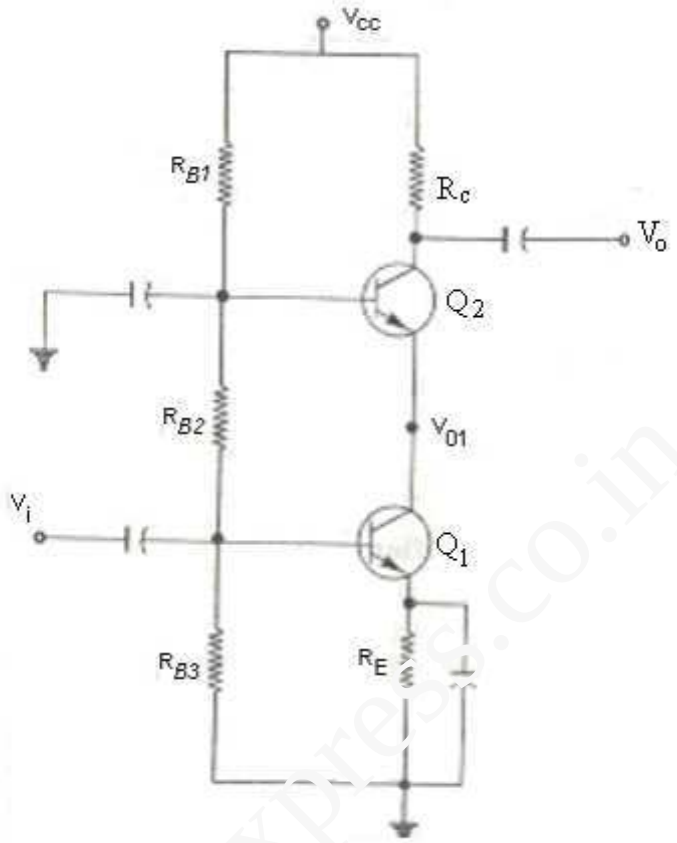

Figure 6

7. (a) Discuss briefly about various characteristics of an amplifier which are modified by negative feedback. [8]

   (b) An RC coupled amplifier has a voltage gain of 1000. f_1=50Hz, f2=200KHz and a distortion of 5% without feedback. Find the amplifier voltage gain, f_1^1 , f_2^1 and distortion when a negative feedback is applied with feedback ratio of 0.01. [5+3]

8. (a) Draw the circuit diagram of a RC phases shift oscillator using BJT. Derive the expression for frequency of oscillators.

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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) An electron is moving perpendicular to magnetic field 'B'. Derive the expression for radius 'R' of the trajectory and period of rotation T.
   (b) Derive the expression for the electro magnetic deflection sensitivity in the case of the CRT. [8+8]

2. (a) What do you understand by depetion region at p-n junction? What is the effect of forward and reverse biasing of p-n junction on the depletion region? Explain with necessary diagrams.
   (b) Explain the concept of tunneling with energy band diagrams. [8+8]

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) For the transistor switching circuit shown in figure 4(a)iii, determine the following:
      i. What is V_{CE} when V_{in}=OV?
      ii. What minimum value of I_B in required to saturate the transistor?
      iii. Calculate the maximum value of R_B to keep the transistor under saturation when V_{in}=5V.

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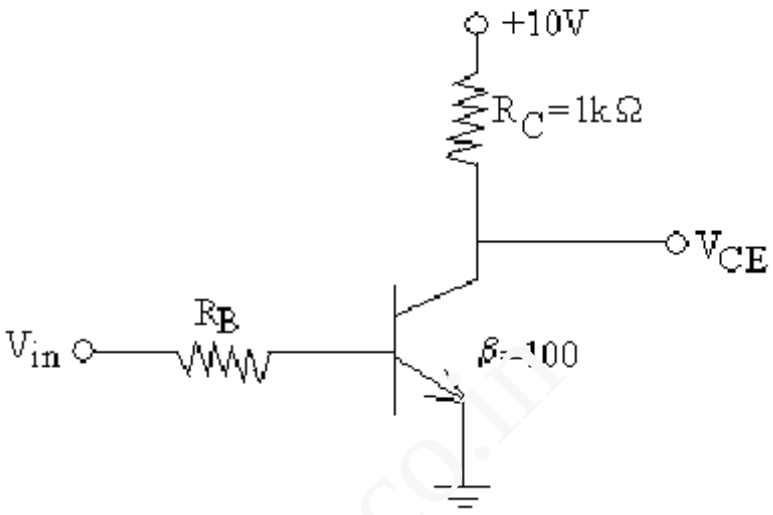

Figure 4(a)iii

(b) How should the gate-source junction of a JFET be biased? Explain how the potential applied to this junction controls the drain current. [10+6]

5. (a) Explain bias compensation using resistors.

(b) In the circuit shown, if I_C=2mA and V_{CE}=3V. Calculate R_1 and R_3. (figure 5) [6+10]

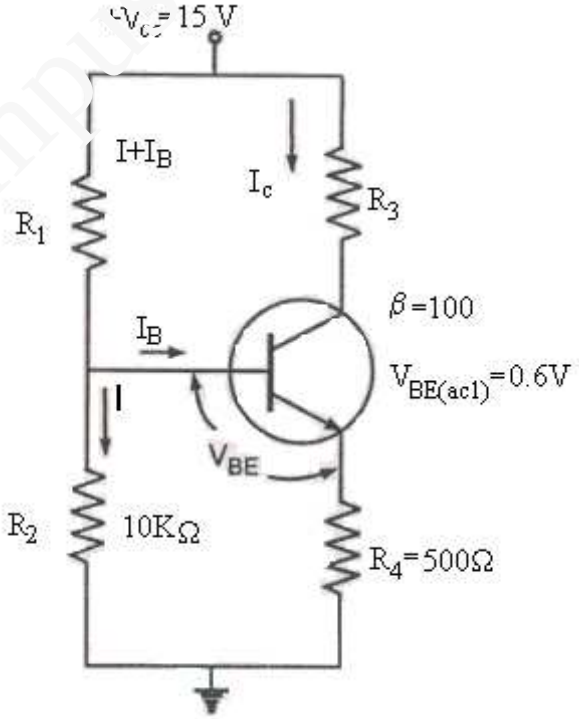

Figure 5

6. (a) Draw the emitter follower circuit and derive the expressions for voltage gain

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and current gain. [3+5]

(b) Find the voltage gain for the source follower as shown in figure 6. Also find the output resistance if the input voltage is 2mV. Assume g_m=5500μS [8]

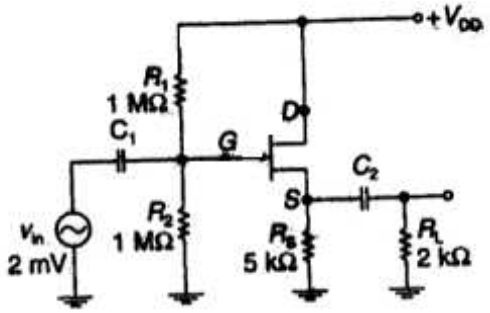

Figure 6

7. (a) Explain the concept of feedback as applied to electronic amplifier circuit. What are the advantages and disadvantages of positive and negative feedback? [4+3+3]

(b) An Amplifier has a voltage gain of 1000. With negative feedback, the voltage gain reduces to 10. Calculate the fraction of the output that is fedback to the input. [6]

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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