Code No: R05010204 **Set No. 1**

I B.Tech Semester Supplimentary Examinations, June 2009
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) What is the purpose of Time Base Circuits in CRO?
   (b) What are graticules? What are the different types? [8+8]
2. (a) Compare the performance characteristics of Si and Ge diodes.
   (b) For a Si diode with reverse saturation current of 5 nA, calculate the dynamic forward and reverse resistance at a voltage of 0.4V and -0.4V respectively, applied across the diode. Assume room temperature of 27^0 C. [16]
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 magnetude 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) 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) Explain how a FET is used as a voltage variable resistor.
   (b) A self biased p-channel JFET has a pinch off voltage V_P=5V and I_{DSS}=12mA. The supply voltage available is 12V. Determine the values of R_D and R_S so that I_D=5mA and V_{DS}=6V. [8+8]
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]

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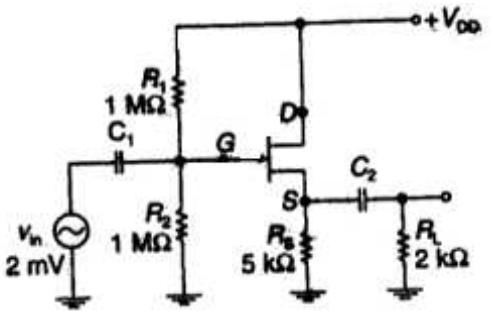

Figure 6

7. (a) State three fundamental assumptions which are made in order that the expression A_f =A/(1+$A\beta$) be satisfied exactly. [8]

   (b) An Amplifier has a value of R_{in}=4.2K, A_V=220 and β=0.01. Determine the value of input resistance of the feedback amplifier. [4]

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

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

Answer any FIVE Questions
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1. (a) Derive the expression for transit time τ (tow) and final velocity V in the case of an electron traversing in uniform electric field E.
   (b) An electron with a velocity of $3 \times 10^5 ms^{-1}$ enters an electric field of 910 v/m making an angle of 60^0 with the positive direction. The direction of the electric field is in the positive Y direction. Calculate the time required to reach its maximum height. [8+8]

2. (a) Explain the nature of V-I characteristics of a diode from its current equation and write a short notes on temperature dependence of diode characteristics.
   (b) A pn-junction diode has, at a temperature of 125^0 C, a reverse saturation current of 30μA. At a temperature of 125^0 C find the dynamic resistance for 0.2V bias is forward and reverse direction. [16]

3. (a) Derive an expression for ripple factor of an L-section filter. What is the effect of increasing the number of L-section in filter on the performance of the rectifier.
   (b) A bridge rectifier has an input voltage of $V_s = 200$ Sin 314t. It supplies power to a load of $R_L = 100\Omega$. Calculate
      i. D.C.Output voltage
      ii. Rectifier efficiency.

   Assume ideal diodes. [16]

4. (a) With the help of block diagrams, explain the structure of NPN and PNP transistors. How must the two PN junctions in a BJT be biased for proper transistor operation.
   (b) Describe the construction of an LED and explain its operational mechanism. [10+6]

5. (a) Explain how a FET is used as a voltage variable resistor.
   (b) A self biased p-channel JFET has a pinch off voltage V_P=5V and I_{DSS}=12mA. The supply voltage available is 12V. Determine the values of R_D and R_S so that I_D=5mA and V_{DS}=6V. [8+8]

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6. (a) Discuss the effect of coupling capacitor (C_c) on low frequency response of CE amplifier. [6]

   (b) For a CB transistor amplifier driven by a voltage source of internal resistance R_s = 1.2k the load impedance is resistor R_L = 1k. The h-parameters are h_{ib}=22Ω., h_{fb}= - 0.98, h_{ob}= 0.5 μA/V, h_{rb}= 3×10^{-4} . Calculate A_V, A_I,and R_I. [$3^{1}/2 + 3^{1}/2 + 3$]

7. (a) Define the following terms in connection with feedback [3+3+3]

   i. Return difference,f_b

   ii. Closed loop gain

   iii. Open loop gain

   (b) Referring to the figure 7 shown below, it has R_S=600Ω, h_{ie}=2KΩ, h_{fe}=80 and h_{ie}=5KΩ, R_B=40KΩ Calculate A_{vf}, A_v, R_{if},R_{of}. [7]

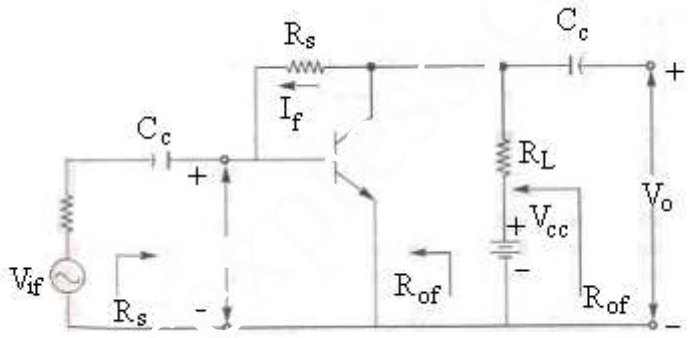

Figure 7

8. (a) What type of feedback is employed in oscillators? And what are the advantages. Discuss the conditions for sustained oscillations.

   (b) Find the capacitor C and h_{fe} for the transistor to provide a resonating frequency of 10KHZ of a phase-shift oscillator. Assume R_1=25kΩ, R_2=60kΩ, R_c=40kΩ, R=7.1kΩ and h_{ie}=1.8kΩ. [10+6]

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

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1. (a) When an electron is placed in a magnetic field with a period of rotation $T = \frac{35.5}{B} \times 10^{-12}$ sec so that the trajectory of an electron is a circle.
   (b) What is the radius described by an electron placed in a magnetic field, perpendicular to its motion , when the accelerating potential is 900v, and $B - 0.01wb/m^2$. What is the time period of rotation? [8+8]

2. (a) Give the equivalent circuit of an ideal and practical zener diode under reverse-biased condition and explain the function of the model. How do you define temperature coefficient of a zener diode?
   (b) Calculate forward current in Ge diode at 20^0 C when forward voltage is0.3V. Compare this value with that after a temperature rise of 50^0 C. Assume that reverse saturation current doubles for every 10^0 C rise in temperature. [16]

3. (a) Compare various filter circuits in terms of their circuits, ripple factor and a voltage waveforms.
   (b) Determine the ripple factor of an L-type choke imput filter comprising a 10H choke and 8μF capacitor. Used with a FWR. Compare with a simple 8μF capacitor input filter at a load current of 50 mA and also 150 mA. Assuming the d.c. voltage of 50V. [16]

4. (a) Define the following JFET parameters
      i. Transconductance
      ii. Drain resistance
      iii. Amplification factor and give the relation between them.
   (b) With the help of block diagrams, explain the structure of NPN and PNP transistors. How must the two PN junctions in a BJT be biased for proper transistor operation. [10+6]

5. (a) Draw a BJT fixed bias circuit and derive the expression for the stability factor 'S'. [3+5]
   (b) An NPN transistor with $\beta = 50$ is used in a common emitter circuit with V_{CC}= 10V,R_C = 2k. The bias is obtained by connecting a 100K resistance from collector to base. Assume V_{BE} = 0.7 V. Find

i. the quiescent point and
ii. the stability factor, S. [4+4]

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_{B3}=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]

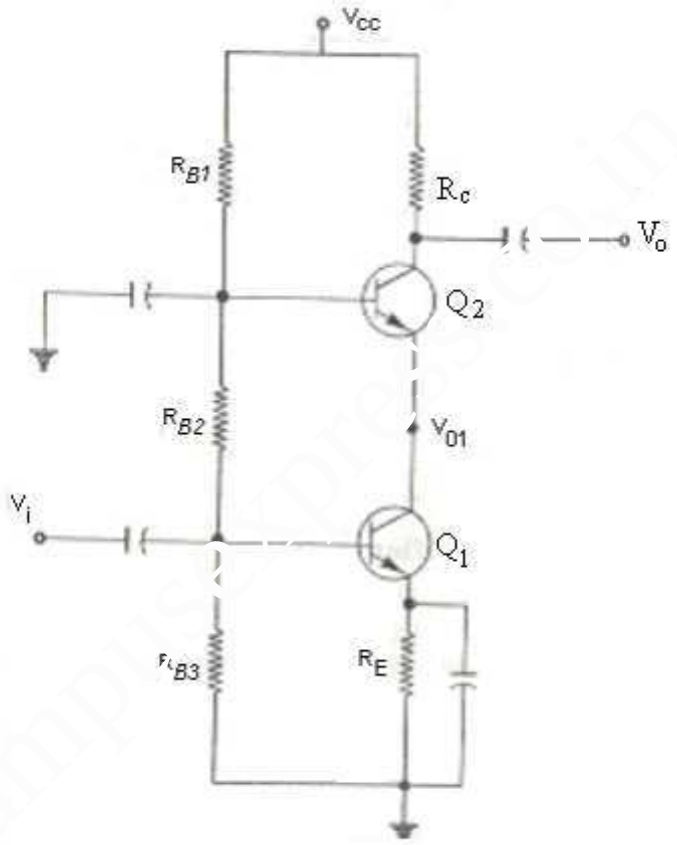

Figure 6

7. (a) Explain negative feedback with the help of the emitter follower as an example. Why is the emitter follower so called? [8]
   (b) The gain of an amplifier is decreased to 10,000 with negative feedback from its gain of 60,000. Calculate the feedback factor. Express the amount of negative feedback in dB. [8]

8. (a) Why the LC oscillators are not suitable for low frequency applications. Explain the principle of working of basic LC oscillators.
   (b) Find C and h_{fe} of a transistor to provide f_o of 50KHZ of a RC phase shift oscillator. Given $R_1 = 22k\Omega$, $R_2 = 68k\Omega$, $R_c = 20k\Omega$, R=6.8kΩ and $h_{ie} = 2k\Omega$. [10+6]

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1. (a) Derive the expressions for acceleration, Velocity and displacement of a charged particle placed in an electric field E.
   (b) Two parallel plates of a capacitor are separated by 4cms. An electron is at rest initially at the bottom plate. Voltage is applied between the plates, which increases linearly from 0v to 8v in 0.1 m.sec. If the top plate is +ve, determine [8+8]
      i. The speed of electron in 40.n sec
      ii. The distance traversed by the electron in 40.n.sec.

2. (a) Sketch the energy band diagram of an open-circuited pn-junction. Explain the terms: 'depletion region', 'potential barrier', and 'barrier energy'.
   (b) The voltage across a si diode at room temperature of 300^0k is 0.71V when 2.5 mA current flows through it. If the voltage increases to 0.8V, calculate the new diode current. [16]

3. (a) What is a rectifier? List the important charcteristics of a rectifier circuit. What are the various types of rectifiers? How do you obtain almost D.C. from the rectifier circuit?
   (b) A diode whose internal resistance is 15Ω is to supply power to a 900Ω load from 115V(rms) source to supply. Calculate:
      i. d.c.load current
      ii. peak load current
      iii. a.c load current
      iv. the percentage regulation from no-load to the given load. [16]

4. (a) Sketch the circuit symbols for
      i. n-channel JFET
      ii. p-channel JFET
      iii. n-channel enhancement type MOSFET
      iv. p-channel enhancement type MOSFET

v. n-channel depletion type MOSFET and
vi. p-chanel depletion type MOSFET.
And compare JFET and MOSFETs.

(b) Why FET in called unipolar device and in called as voltage operated dice. What are the important characteristics of FET. [10+6]

5. (a) Draw two biasing circuits for an enhancement type MOSFET and explain.
(b) The data sheet for an enhanced MOSFET gives I_D=4.5mA at V_{GS}=12V and $V_{GS(th)}$=6V. Determine the value of I_D for V_{GS}=10V. [8+8]

6. (a) Draw the circuit for darlington pair and derive the expressions for A_I, A_V, R_I and R_0. [3+5]
(b) The figure 6shows a CE amplifier with collector to base bias. Calculate A_I, A_V, R_I . The transistor parameters are h_{ie}=1.1K, h_{fe}=50, h_{oe}=25$\times$ 10^{-6}A/V, h_{re}=2.5 $\times$ 10^{-4}. [8]

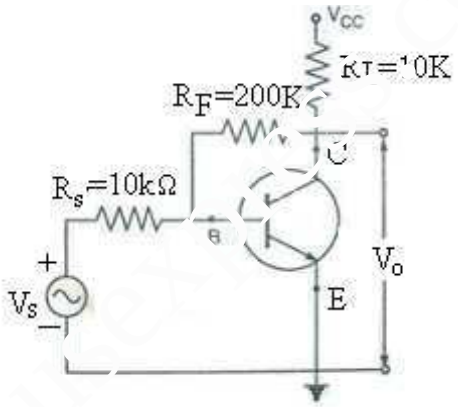

Figure 6

7. (a) Define the following terms in connection with feedback [3+3+3]
i. Return difference,f_b
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(b) Referring to the figure 7 shown below, it has R_S=600Ω, R_L=2KΩ, h_{fe}=80 and h_{ie}=5KΩ, R_B=40KΩ Calculate A_{vf}, A_v, R_{if},R_{of}. [7]

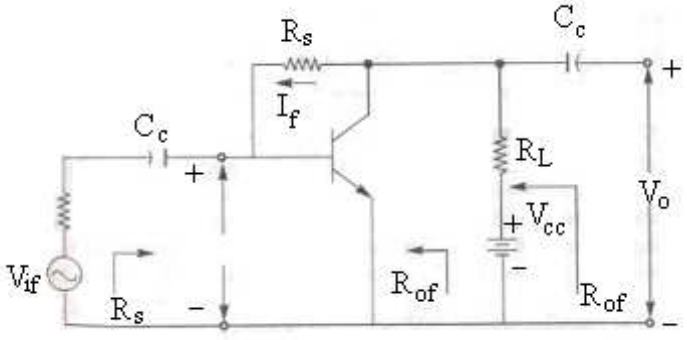

Figure 7

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8. (a) Show that the gain of Wien bridge oscillator using BJT amplifier must be at least 3 for the oscillations to occur.

   (b) In a transistorized Hartley oscillator the two inductances are 2mH and 20μH while the frequency is to be changed from 950KHZ to 2050KHZ. Calculate the range over which the capacitor is to be vaired. [10+6]

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