

**I B.Tech Supplementary Examinations, Aug/Sep 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) 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) Explain the following terms
  - i. Storage time
  - ii. Transitive time
  - iii. junction capacitance.
 (b) Calculate the dynamic forward and reverse resistance of a p-n junction diode when the applied voltage is 0.25V at T=300K Given  $I_o = 2\mu A$ . [8+8]
  
3. (a) What is the cause of surge in rectifier circuits using capacitor filter. How is the current limited?  
 (b) In a full wave rectifier the required dc voltage is 9V and the diode drop is 0.8V calculate ac rms input voltage required in case of bridge rectifier circuit and center tapped full wave rectifier circuit.  
 (c) Derive the expression for the ripple factor of half wave rectifier and full wave rectifier. [4+6+6]
  
4. (a) Explain active region, saturation region and cut-off region in transistor characteristics.  
 (b) Differentiate between NPN and PNP transistors.  
 (c) Explain the input and output characteristics of the transistor in CC configuration with diagrams. What is the inference from these characteristics? [6+4+6]
  
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) 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  $h_{ic} = 1500$   $h_{fe} = -80$   
 $h_{oc} = 2 \times 10^{-5} \text{ mho}$   $h_{rc} = 1$  Calculate input impedance  $Z_i$ , Voltage gain AV  
 and output impedance  $R_O$ . [4+4+4+4]
7. (a) Prove that introducing feedback improves the frequency response of the amplifier. [8+8]
- (b) For the given circuit below (figure 7b),  $h_{fe} = 100$ ,  $h_{ie} = 1.1 \text{ K}$ ,  $h_{re} = h_{oe} = 0$ . Determine  $A_{vf}$ ,  $R_{if}$  and  $R_{of}$ .

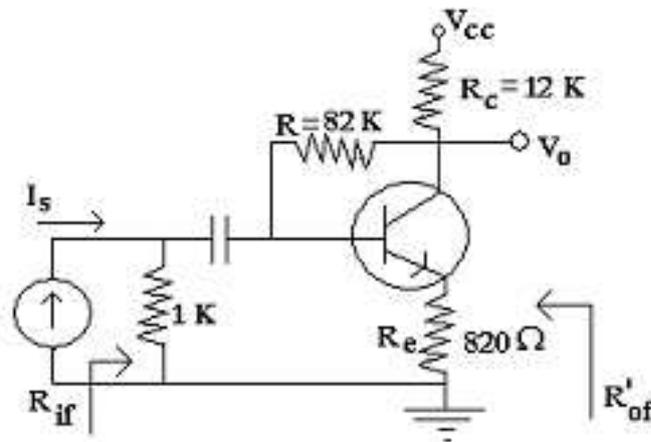


Figure 7b

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  $2 \text{ mH}$  and  $20 \mu\text{H}$  while the frequency is to be changed from  $950 \text{ KHz}$  to  $2050 \text{ KHz}$ . Calculate the range over which the capacitor is to be varied. [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) 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) Explain the circuit diagram of a single phase full-wave bridge rectifier and sketch the input, output waveforms.
- (b) Define percentage regulation and prove that the regulation of both half wave and full wave rectifier is given by percentage regulation is equal to  $\frac{R_f}{R_L} \times 100\%$  [8+8]
4. (a) Define the following terms and explain.
  - i. Emitter efficiency
  - ii. Transport factor.
  - iii. Large signal current gain.
- (b) The reverse leakage current of the transistor when connected in CB configuration is  $0.2\mu A$  while it is  $18\mu A$  when the same transistor is connected in CE configuration. Calculate  $\alpha_{dc}$  and  $\beta_{dc}$  of the transistor.
- (c) If  $\alpha_{dc} = 0.99$  and  $I_{CBO} = 50\mu A$ , find Emitter current. [6+6+4]
5. (a) What are the hybrid or h parameters?. Why are they so called?
- (b) Draw the hybrid parameter equivalent circuit for an n-p-n common emitter transistor and briefly explain. [8+8]

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  $Z_i$ , Voltage gain AV  
and output impedance  $R_O$ . [4+4+4+4]
7. (a) Briefly discuss about the effect of feedback on amplifier Bandwidth.  
(b) Draw the frequency response of an amplifier with and without feedback and  
show the bandwidth for each case and how these two curves are related to  
gain bandwidth product.  
(c) We have an amplifier of 60db gain. It has an output impedance  $Z_o = 10k\Omega$ .  
it is required to modify its output impedance to  $500\Omega$  by applying negative  
feedback. Calculate the value of the feedback factor Also find the percentage  
change in the over all gain, for 10% change in the gain of the internal amplifiers.  
[4+6+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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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 is meant by the minority carrier storage time of a diode.  
(b) A Zener voltage regulator circuit is to maintain constant voltage at 60V, over a current range from 5 to 50mA. The input supply voltage is 200V. Determine the value of resistance R to be connected in the circuit, for voltage regulation from load current  $I_L = 0mA$  to  $I_L$  max, the maximum possible value of  $I_L$ . What is the value of  $I_L$  max? [6+10]
3. (a) Derive the expression for ripple factor in a full wave rectifier using an inductor filter.  
(b) Compare the performance of series inductor, L-Section and  $\pi$  - Section filters.  
(c) In a full wave rectifier using an LC - filter  $L=10$  H,  $C=100\mu$  F and  $R_L= 500\Omega$ . Calculate  $I_{dc}$ ,  $V_{dc}$ , for an input  $v_i = 30\sin(100\pi t)$ . [6+6+4]
4. (a) What are the different configurations of BJT?  
(b) Derive the relation between  $\alpha$  and  $\beta$ .  
(c) Calculate the collector current and emitter current for a transistor with  $\alpha_{dc} = 0.99$  and  $I_{CBO} = 50 \mu$  A when the base current is  $20\mu$  A. [6+6+4]
5. (a) Explain how BJT can be used as an amplifier?  
(b) What is meant by bias?. Explain the importance of bias?  
(c) Draw the low frequency equivalent circuit of a BJT? [8+4+4]
6. (a) For the given circuit (as shown in figure6a) find  $R_S, R_1$  and  $R_2$  for the given data  $\beta=50$ ,  $V_{BE} =0,6V$   $V_{CC}=22.5V, R_C=5.6K$  and it is desired to establish a Q point at  $V_{CE}=12V$ ,  $I_C=12.5mA$  and stability factor  $S \leq 3$ .

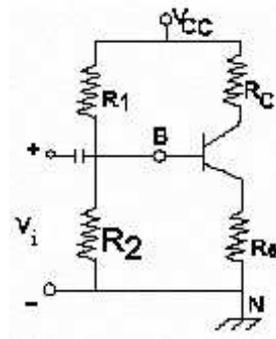


Figure 6a

- (b) What is the role of  $R_e$  in the self bias circuit? [10+6]
7. (a) Draw the circuit diagram of a voltage shunt feedback 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 impedance, output impedance of voltage series, feedback. Amplifier having  $A = -300$ ,  $R_i = 1.5K$ ,  $R_o = 50K$  and  $\beta = \frac{-1}{20}$  [6+4+6]
8. (a) Derive an expression for frequency of oscillation of transistorized Colpitts oscillator.  
 (b) A quartz crystal has the following constants.  $L = 50mH$ ,  $C_1 = 0.02PF$ ,  $R = 500\Omega$  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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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) Derive the expression for Hall voltage  $V_H$ .  
(b) What are the applications for Hall voltage?  
(c) What is modified Hall coefficient? Explain? [10+2+4]
3. (a) Draw the circuit diagram of a bridge rectifier circuit with shunt capacitance filter? Sketch the input and output wave forms and explain its operation with the aid of output wave form.  
(b) What are the advantages and disadvantages of shunt capacitance filter.  
(c) What is the difference between rectifier, unregulated power supply and regulated power supply? [8+4+4]
4. (a) With the help of a neat diagram show different current components in a transistor.  
(b) Why is CE configuration is most widely used?  
(c) Calculate the values of  $I_c$  and  $I_B$  for a transistor with  $\alpha_{dc} = 0.99$  and  $I_{CBO} = 5\mu A$ ,  $I_B$  is measured as  $20\mu A$ . [6+5+5]
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  $\mu$ .  
(b) From the definition of  $g_m$  obtain expression for  $g_m$ .  
(c) For an n-channel silicon FET with  $a = 3 \times 10^{-4} \text{cm}$  and  $N_D = 10^{15} \text{electrons/cm}^3$ . Find the pinch off voltage.
6. (a) Draw the circuit diagram of small signal CE amplifier circuit and give its equivalent hybrid model. What is the role of  $C_c$  and  $C_e$ .

- (b) Obtain frequency response of CE amplifier circuit and find out its band width. What is the impact of  $C_C$  and  $C_S$  on the band width? [8+8]
7. (a) Show that for voltage series feedback amplifier input resistance and gain are decreased by  $(1+\beta A_V)$  with feed back.
- (b) For the given circuit(in figure7b) , calculate  $A_{vf}$ ,  $R_{if}$  and  $R_{of}$ . Given  $h_{ie}=1100 \text{ K}$ ,  $h_{fe} = 200$ .  $h_{re}= h_{oe}= 0$ . [8+8]

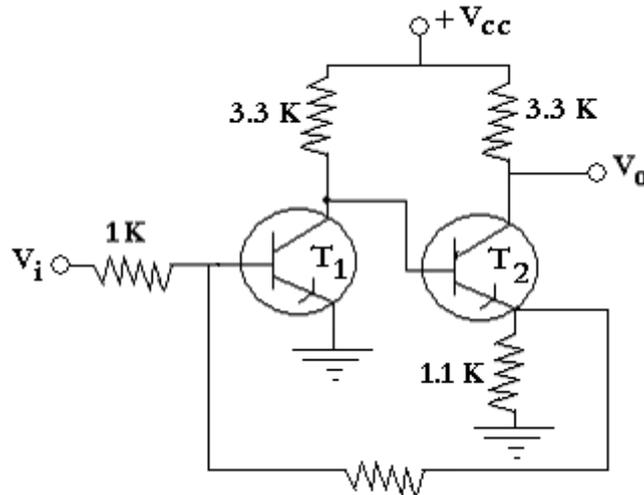


Figure 7b

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