

I B.Tech. Regular Examinations, June -2005

ELECTRONIC DEVICES & 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

1. Compare the motion and trajectories of electron when placed
 - (a) Only in electric fields
 - (b) Only in magnetic fields
 - (c) Combined electric & Magnetic fields.
2. (a) Compare the characteristics of a p-n junction diode, zener diode and tunnel diode.
(b) How do you determine whether a given semiconductor is p-type or n-type? Explain the principle with necessary equations.
3. A full wave rectifier has a center tap transformer of 100-0-100V and each one of the diodes is related at $I_{max} = 400\text{mA}$ and $I_{av} = 150\text{mA}$. Neglecting the voltage drop across the diodes.
 - (a) The value of load resistor that gives the largest d.c. power output.
 - (b) D.C. load voltage
 - (c) D.C. load current
 - (d) PIV of each diode.
4. (a) Draw the input and output characteristics of transistor in CE configuration with regions of operation and explain. Show how h-parameters can be determined graphically.
(b) Derive the relation between α and β .
5. (a) Draw the structure of photo transistor and give its working principle?
(b) What are the advantages of phototransistor over photo diode?
(c) Draw the characteristics of phototransistor.
6. (a) Draw the circuit diagram of a collector to base bias circuit of CE amplifier and derive expression for S.

- (b) Determine the quiescent currents and the collector to emitter voltage for a germanium transistor with $\beta=50$ in self biasing arrangement. Draw the circuit with a given component value $V_{CC} = 20V$, $R_C = 2K$, $R_e = 100\Omega$ $R_1 = 100K\Omega$ $R_2 = 5K$. Also find out stability factor.
7. (a) Derive the expressions for A_v , Z_i , Z_o and A_I of voltage shunt feedback.
 (b) Identify topology, with justification for the circuit shown in (figure1). below. Transistors used are identical and have parameters $h_{ie} = 2K$, $h_{fe}=50$ and $h_{re}=h_{oe}= 0$. Determine A_{vf} .

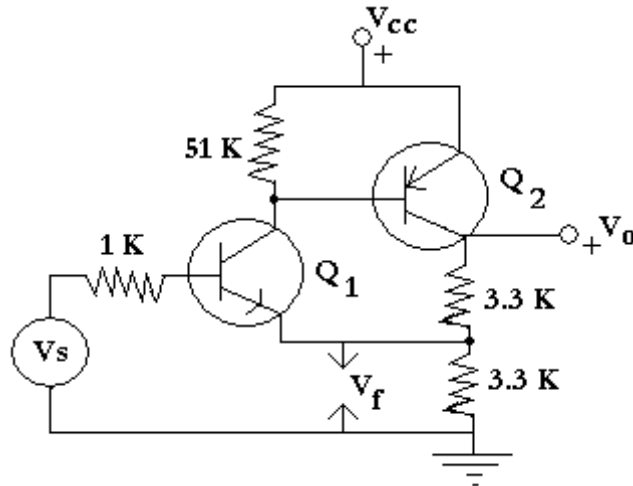


Figure 1:

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 $20\mu H$ while the frequency is to be changed from $950KHZ$ to $2050KHZ$. Calculate the range over which the capacitor is to be varied.

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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
2. (a) Explain why p-n junction contact potential cannot be measured by placing a voltmeter across the diode terminal.
(b) With reference to the P-N junction diode.
 - i. Distinguish between drift current and diffusion current.
 - ii. Distinguish between diffusion capacitance and transition capacitance.
3. (a) Compare half wave, Full wave and Bridge rectifier.
(b) What is the necessity of having filter in power supply? Obtain the ripple factor of a full wave rectifier with shunt capacitor filter.
4. (a) Explain the input and output characteristics of CE configuration of a transistor and indicate various regions.
(b) Prove that for a CE transistor in active region $I_C = \beta I_B + (1 + \beta) I_{co}$.
5. (a) Compare JFET and MOSFET with respect to various features.
(b) Draw the biasing circuit suitable for JFET and if the JFET is replaced by a MOSFET for what mode of operation it is valid and explain about the function of each component used in the circuit.
6. (a) What are the compensation techniques used for V_{BE} and I_{CO} . Explain with the help of suitable circuits.
(b) Draw the h-Parameters equivalent circuit of CC,CE configuration and what are the typical values of h-Parameters for a transistor in CE and CB configuration.
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 500Ω 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.
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.

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1. Compare the motion and trajectories of electron when placed
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2. (a) Explain the term reverse saturation current in the case of a p-n junction diode.
(b) Derive the expression for I_o in a p-n junction diode.
3. (a) Discuss a full wave rectifier with π filter.
(b) Compare the performance of inductive, L-section and π section filters.
4. (a) Why transistor is considered as current control device. Explain.
(b) In a transistor if emitter junction is forward biased and collector is reverse bias explain its operation.
(c) Explain why $\alpha < 1$ and $\beta > 1$ for a given transistor.
5. (a) Give the UJT symbol and simplified equivalent circuit with external resistors included.
(b) Draw UJT emitter characteristics and mention various region.
(c) If $V_E < V_p$ and $V_E > V_p$ for these condition how UJT works.
(d) If $\eta=0.8$ $V_{BB} = 15V$ and $V_D = 0.7V$. Find the value of V_p .
6. (a) Draw the circuit diagram of a collector to base bias circuit of CE amplifier and derive expression for S.
(b) Determine the quiescent currents and the collector to emitter voltage for a germanium transistor with $\beta=50$ in self biasing arrangement. Draw the circuit with a given component value $V_{CC} = 20V$, $R_C = 2K$, $R_e = 100\Omega$ $R_1 = 100K\Omega$ $R_2 = 5K$. Also find out stability factor.
7. (a) State and explain Barkhausen criterion. What are the four topologies of feedback amplifier. Explain taking sampling and mixing signals to each topology.

- (b) State transfer gain of each configuration and define feedback factor.
- 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.
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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 $3 \times 10^5 \text{ms}^{-1}$ enters an electric field of 910v/m making an angle of 60° 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.
2. (a) What are general specifications of PN junction diode.
(b) The voltage across a silicon diode at room temperature (300°k) is 0.7 volts when 2mA current flows through it. If the voltage increases to 0.75V calculate the diode current (assume $V_T = 26\text{mA}$).
3. (a) A 15-0-15 Volts (rms) ideal transformer is used with a full wave rectifier circuit with diodes having forward drop of 1volt. The load is a resistance of 100ohm and a capacitor of $10,000\mu\text{f}$ 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 Π -section followed by L-section filter and explain its operation.
4. (a) Draw the circuit and explain the output characteristics of CB transistor Configuration?
(b) Derive the expression for the collector current without neglecting the leakage current.
5. (a) Briefly discuss about the following opto electric devices.
 - i. Photo diode
 - ii. Photo transistor
(b) List out different types of MOSFETS and compare their salient features.
6. (a) What is meant by thermal runaway briefly explain?
(b) What is the condition for thermal stability?

- (c) An n-p-n transistor if $\beta=50$ is used in common emitter circuit with $V_{CC}=10V$ and $R_C=2K$. The bias is obtained by connecting 100K resistance from collector to base.
Find the quiescent point and stability factor S.
7. (a) Classify the amplifiers based as feedback topology and give their block diagram. How the input and output impedance are effected in each case.
(b) Draw the circuit diagram of a current feed back circuit and derive Expressions for Voltage gain and output resistance, and input resistance.
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 $20\mu H$ while the frequency is to be changed from 950KHZ to 2050KHZ. Calculate the range over which the capacitor is to be varied.
