Code No: RR221401 **Set No.1**

II B.Tech. II Semester Regular Examinations, April/May -2005
ELECTRONIC DEVICES AND CIRCUITS
(Mechatronics)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Differentiate between Avalanche breakdown and Zener break down phenomena in Semiconductor Diodes under reverse bias conditions.
   (b) Draw the equivalent circuit of a varactor diode mentioning its applications
   (c) Draw the reverse characteristic of a semiconductor diode and explain the method of obtaining the curve.

2. (a) With suitable sketches, discuss about the principle of operation of bridge rectifier circuit. Mention the advantages and disadvantages of the circuit when compared to other full wave rectifier circuit.
   (b) Derive the expressions for ripple factor and efficiency of bridge rectifier circuit.

3. (a) Draw the circuit diagram to obtain the UJT characteristics between the Emitter voltage 'V_E' and the Emitter current 'I_E' for a fixed value of 'V_{BB}'.
   (b) What is the reason for getting the negative resistance region in UJT characteristics? Explain.
   (c) Determine the peak-point Emitter voltage 'V_P' required for UJT to switch into on state, if the Supply voltage 'V_{BB}' is 20 Volts, Intrinsic stand-off ratio 'η'= 0.75 and 'V_D'= 0.5.
   (d) Mention some applications of UJT with suitable explanation

4. (a) Why biasing is necessary for a Transistor circuit in a given configuration. Mention the three different types of biasing a Bipolar Junction Transistor.
   (b) Draw the Transistor biasing circuit using fixed bias arrangement and explain its principle with suitable analysis.
   (c) Mention the DC load line equation for CE Transistor fixed bias circuit and describe the method of drawing the DC load line on the CE Transistor output characteristics.

5. (a) Draw the practical circuit of a single stage Common Base Transistor Amplifier with potential divider biasing.
   (b) Assuming sinusoidal input signal to the above CB Transistor amplifier, explain the working of the amplifier with necessary waveforms.
   (c) Draw the A C equivalent circuit of the CB Transistor amplifier and explain the concept of amplification and mention some practical applications of it.

6. (a) Draw the FET amplifier circuit with potential divider biasing with tabilization of bias. ssume sinusoidal input to the amplifier. Explain the operation of the amplifier showing the signal waveforms on the output characteristics of the device and the load line.

   (b) Discuss the concept of amplification from the small signal low frequency equivalent circuit of FET amplifier with necessary derivation for voltage amplification.

7. (a) Discuss with mathematical expressions, how the negative feedback in amplifiers increases amplifier bandwidth and reduces distortion in amplifiers

   (b) Calculate

      i. voltage gain A_{Vf}
      ii. input impedance R_{inf}
      iii. output impedance R_{0f} and
      iv. Bandwidth for voltage series feedback amplifier with parameters of the internal amplifier as $A_V = -200$; $R_{in} = 5K\Omega$; $R_0 = 20K\Omega$; Bandwidth = 50KHz and having feedback factor β = - 0.02.

8. (a) Draw the weinbridge oscillator circuit and explain its working.

   (b) Calculate the value of 'C' used in the weinbridge circuit that determines the oscillator frequency of 10 KHZ. Assume R=50 KΩ in the weinbridge circuit.

   (c) Derive the expression for feedback factor in the weinbridge circuit.

⋆ ⋆ ⋆ ⋆ ⋆

Code No: RR221401 **Set No.2**

II B.Tech. II Semester Regular Examinations, April/May -2005
ELECTRONIC DEVICES AND CIRCUITS
(Mechatronics)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Discuss the significance of Forbidden Band Gap energy in Energy-Band Diagrams with reference to the difference in cut-in voltages for Silicon and Germanium diode working under forward Bias conditions.
   (b) Mention the reason for Silicon devices to work at higher temperatures when compared to Germanium devices with necessary Energy Band diagrams.
   (c) Calculate the magnitude of barrier voltage at 300^0K for P-N junction with N_A=10^{18}/cm^3 on P-side and N_D= 10^{15}/cm^3 on N-side of a Germanium semiconductor diode. Intrinsic carrier concentration n_i= 1.5x10^6/cm^3 and. V_T=25 mv at 300^0K.

2. (a) What is the significance of the term "ripple factor" in rectifier circuits.
   (b) Draw the circuit diagram of Bridge rectifier using semiconductor diodes.
   (c) Explain the working of Bridge Rectifier Circuit.
   (d) Compare the performance factors of Bridge Rectifier with Full Wave Rectifier circuit using center tapped transformer.

3. (a) Draw the circuit diagram to obtain the UJT characteristics between the Emitter voltage 'V_E' and the Emitter current 'I_E' for a fixed value of 'V_{BB}'.
   (b) What is the reason for getting the negative resistance region in UJT characteristics? Explain.
   (c) Determine the peak-point Emitter voltage 'V_P' required for UJT to switch into on state, if the Supply voltage 'V_{BB}' is 20 Volts, Intrinsic stand-off ratio 'η'= 0.75 and 'V_D'= 0.5.
   (d) Mention some applications of UJT with suitable explanation

4. (a) Discuss the need for stabilizing the quiescent operating point of Transistor amplifiers
   (b) Define the hybrid parameters of a BJT in Common Emitter configuration considering the Transistor as a four terminal network. Mention typical values for the h-parameters
   (c) In Transistor fixed bias circuit V_{CC} = 12.7 volts, V_{BE} = 0.7 volts, R_B = 120 KΩ and R_C = 1.27KΩ and β = 50, Calculate I_{CQ} and V_{CEQ}.

5. (a) Draw the practical circuit of a single stage Common Base Transistor Amplifier with potential divider biasing.

(b) Assuming sinusoidal input signal to the above CB Transistor amplifier, explain the working of the amplifier with necessary waveforms.

(c) Draw the A C equivalent circuit of the CB Transistor amplifier and explain the concept of amplification and mention some practical applications of it.

6. (a) Draw the potential divider bias circuit for P-Channel JFET and explain the function of each component in the circuit.

(b) Derive the expression for voltage gain of JFET model for self bias configuration.

7. (a) Draw the block diagram of voltage series negative feedback amplifier and derive the expressions for

i. input resistance and

ii. output resistance of feedback amplifier.

(b) For a voltage series feedback amplifier, Midband voltage gain A_V = -1000; β = - 0.1 and input signal V_S = 0.1V. Calculate the

i. Voltage gain A_{Vf} of the feedback amplifier;

ii. Output voltage V_0;

iii. feedback voltage V_f and

iv. effective input voltage parameters of the negative feedback amplifier.

8. (a) Draw the basic circuit of transistor Colpitts oscillator and explain the functioning of various components in the circuit.

(b) Derive the expression for frequency of oscillations f_0 of Colpitts oscillator circuit

(c) In a transistor Colpitts oscillator circuit, L = 10 μ H. $C_=$ 0.01μ f and C_2 = 0.1μ f. Calculate the

i. operating frequency and

ii. feedback fraction 'β'

⋆ ⋆ ⋆ ⋆ ⋆

II B.Tech. II Semester Regular Examinations, April/May -2005
ELECTRONIC DEVICES AND CIRCUITS
(Mechatronics)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Discuss the significance of Forbidden Band Gap energy in Energy-Band Diagrams with reference to the difference in cut-in voltages for Silicon and Germanium diode working under forward Bias conditions.
   (b) Mention the reason for Silicon devices to work at higher temperatures when compared to Germanium devices with necessary Energy Band diagrams.
   (c) Calculate the magnitude of barrier voltage at 300^0K for P-N junction with N_A=10^{18}/cm^3 on P-side and N_D= 10^{15}/cm^3 on N-side of a Germanium semiconductor diode. Intrinsic carrier concentration n_i= 1.5x10^6/cm^3 and. V_T=25 mv at 300^0K.

2. (a) What is the significance of the term "ripple factor" in rectifier circuits.
   (b) Draw the circuit diagram of Bridge rectifier using semiconductor diodes.
   (c) Explain the working of Bridge Rectifier Circuit.
   (d) Compare the performance factors of Bridge Rectifier with Full Wave Rectifier circuit using center tapped transformer.

3. (a) Draw a diagram showing the structural details of N-Channel MOSFET device.
   (b) Draw a circuit diagram with biasing voltages to obtain the Drain characteristics and the Transfer characteristics of N-Channel Enhancement MOSFET device.
   (c) Draw the Drain characteristics of Enhancement MOSFET and discuss the method of obtaining the output characteristics of the MOSFET device
   (d) Explain the operation of N-Channel Enhancement MOSFET device.

4. (a) Draw the circuit diagrams showing the three configurations of Transistor amplifiers.
   (b) Draw the Transistor biasing circuit using Collector-to-base bias arrangement. Explain the concept of providing proper bias for the Transistor to act as amplifying device
   (c) Mention the DC load line equation for CE Transistor Collector to base bias circuit and describe the method of drawing the DC load line on the CE Transistor output characteristics.

5. (a) Draw the hybrid-π model of a CE amplifier and determine the circuit components using h-parameters. Mention typical values for the hybrid-π parameters.

(b) A transistor used in a CE amplifier has f_T = 60 MHZ ; h_{fe} = 100 ; r_{bb}' = 100Ω ;
$r_{b'e}$=1KΩ ; g_m = 100 m mhos; R_S = 900 Ω and R_L = 1 KΩ .Calculate the mid-frequency voltage gain and upper cut-off frequency fβ.

6. (a) Draw the Source follower circuit and explain the operation of the circuit with it's emphasis on discussion of the name source follower circuit for the Common Drain FET amplifier circuit.

(b) The Source follower circuit has R_1= 2MΩ; R_2= 2MΩ; R_S= 2KΩ; R_L= 25KΩ and g_m = 5000 μ s. Calculate the input impedance, output impedance and voltage gain of the amplifier circuit.

7. (a) Enumerate the various reasons for changes in gains of electronic amplifiers.

(b) Derive the expression for the reduction of relative change in gain in negative feedback amplifier compared to that without feedback.

(c) If an amplifier with a gain A_V of 1000 and feedback factor β = -0.2 has again change of 25% due to changes in temperature. Calculate the change in gain of the feedback amplifier.

(d) With suitable expressions for voltage gain, describe the role of by-pass capacitor in a conventional CE amplifier using BJT. Also mention the type of feedback.

8. (a) Draw the electrical equivalent circuit of a crystal and draw the frequency versus reactance curve and show the two resonant frequencies f_S and f_P on the graph.

(b) Discuss the importance of resonating the crystal at f_{Series} or $f_{Parallel}$ and illustrate the the locations of the crystal in two crystal oscillator circuits for the two cases of the crystal resonated at f_S and f_P.

⋆ ⋆ ⋆ ⋆ ⋆

Code No: RR221401 **Set No.4**

II B.Tech. II Semester Regular Examinations, April/May -2005
ELECTRONIC DEVICES AND CIRCUITS
(Mechatronics)

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Discuss the various factors that are responsible for the 'Transition Capacitance' C_T of a Semiconductor diode with necessary details.
   (b) The reverse saturation current I_S at T=300^0K of a PN junction germanium diode is 50 micro amps. Calculate the forward bias voltage V_f to be applied across the junction to obtain a forward current I_f of 50 ma ?
   (c) Mention the various factors that are to be considered for selecting Zener diodes in voltage regulator circuits?
   (d) Draw the forward and reverse characteristic of a Zener diode

2. (a) Mention the parameters that cause for fluctuations in the output voltage of a regulated power supply circuit.
   (b) Draw the equivalent circuit of a Tunnel Diode.
   (c) Explain the significance of the ratio of peak current to valley currents on the Tunnel Diode characteristic and its relation to the Figure of merit of Tunnel Diodes. Explain its significance as the device to operate as a high speed switch.

3. (a) Discuss the merits and demerits of BJT and JFET devices
   (b) Draw a diagram showing the structural details of N-Channel Field Effect Transistor.
   (c) Draw a circuit diagram with biasing voltages to obtain the Output characteristics and the Transfer characteristics of a Junction Field Effect Transistor
   (d) Derive an expression for the drain current in terms of pinch- of and gate to source voltages.

4. (a) Explain the method of determining the Transistor h-parameters from the Transistor characteristics with definitions for the h-parameters.
   (b) Draw a stabilization circuit using self-bias arrangement and Diode compensation techniques for a Transistor and explain the working of the circuit.
   (c) Explain the importance of stability factor.

5. (a) Draw the practical circuit of a single stage Common Emitter Transistor Amplifier with self-biasing method.
   (b) Assuming sinusoidal input signal to the above CE Transistor amplifier, explain the function of each component in the circuit in the process of signal amplification.

(c) Explain the phase reversal of output signal of CE Transistor amplifier.

6. (a) Draw the circuit of P-Channel FET amplifier with voltage divider biasing scheme and explain the working of the circuit.

   (b) Define the amplifier Bandwidth using the frequency response characteristic. Explain why f_L and f_H are known as half-power points.

7. (a) Discuss the merits and demerits of negative and positive feedback amplifiers

   (b) It is required to have an amplifier with a closed loop gain A_{Vf} = -100 and a gain which should not vary by more than 1%, when the non-feedback amplifier gain varies by 20%. Compute the values of

      i. A_V and

      ii. β

8. (a) Draw the circuit of R-C phase shift oscillator circuit using JFET as the active device and discuss the nature of feed back used in the feedback path.

   (b) In the R-C phase shift oscillator circuit, discuss the passive of part of the circuit that is responsible to get the 180^0 phase shift.

   (c) Calculate the value of 'C' in the frequency-determining network of a FET RC phase shift oscillator circuit having R = 2.5 KΩ ; assuming frequency of oscillation f = 1.625 KHZ.

   (d) Repeat (c) if it is a BJT RC phase shift oscillator with R_C = 4kΩ

⋆ ⋆ ⋆ ⋆ ⋆