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06EE56

Fifth Semester B.E. Degree Examination, May/June 2010
Linear ICs and Applications

Time: 3 hrs. Max. Marks:100

Note:1. ***Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Use of resistor and capacitor standard value lists is permitted.

PART – A

1 a. With a neat circuit diagram, explain the operation of a high input impedance capacitor coupled non inverting amplifier. Develop the expression for input impedance of the circuit. **(08 Marks)**

b. Sketch the circuit of a high input impedance capacitor coupled voltage follower, using a single polarity power supply. Briefly explain its operation. Also draw the input waveform, output waveform before and after the output coupling capacitor. **(06 Marks)**

c. Design a high zin capacitor coupled voltage follower, using a 741 op-amp. The lower cutoff frequency for the circuit is to be 50 Hz and the load resistance is $R_L = 3.9$ kΩ. Also determine the minimum theoretical input impedance of the circuit. [For 741 op-amp, input bias current $I_{B(max)} = 500$ nA. Minimum open loop voltage gain $M_{min} = 50000$] **(06 Marks)**

2 a. Sketch the circuit of a lag compensation network. Explain its operation and show how it affects the frequency response of an operational amplifier. **(06 Marks)**

b. Define slew rate of an operational amplifier. Show how the slew rate of an op-amp can produce distortion in a sinusoidal output wave form. Also explain how the slew rate can limit the amplitude of the distortion free sine wave output for a given op-amp cutoff frequency. **(06 Marks)**

c. List the precautions that should be observed for operational amplifier circuit stability. **(08 Marks)**

3 a. Show how a dead zone circuit can be combined with a summing circuit to produce precision limiting on the positive half cycle of the output waveform. Draw the voltage waveforms throughout the circuit and explain its operation. **(10 Marks)**

b. Using a 741 op-amp with $V_{CC} = \pm 18V$, design a two output precision half wave rectifier to give peak outputs of 2 V when the applied input has a 2V peak amplitude. Specify the diodes to suit a maximum signal frequency of 100 kHz. **(05 Marks)**

c. With a neat circuit diagram, explain the working of a voltage follower type peak detector. **(05 Marks)**

4 a. With a neat circuit diagram and waveforms, explain the operation of non-inverting Schmitt trigger circuit with different LTP and UTP. **(06 Marks)**

b. Draw the circuit of an op-amp monostable multivibrator. Show the voltage waveforms throughout the circuit and explain its operation. **(10 Marks)**

c. Using a 741 op-amp, design a voltage level detector circuit to switch its output between approximately -17V and +17V, when the input exceeds 1 V. **(04 Marks)**

PART – B

5 a. With a neat circuit diagram and relevant waveforms, explain the operation of a triangular/rectangular waveform generator which has frequency and duty cycle controls. **(10 Marks)**

b. Using a BIFET op-amp with a ±9V power supply, design a R-C phase shift oscillator to have an output frequency of 10 kHz. **(05 Marks)**

c. Using a 741 op-amp with a ± 15V power supply, design a wein bridge oscillator to have an output frequency of 12 kHz. **(05 Marks)**

6 a. Sketch the circuit of a second order active high pass filter. Explain its operation with the expected frequency response. **(06 Marks)**

b. Show how a band pass filter can be constructed by the use of a low pass filter and a high pass filter. Sketch the expected frequency response and explain the band pass filter operation. **(06 Marks)**

c. Design a band stop filter using first order high pass, first order low pass and a summing circuit. The upper cutoff frequency for low pass filter is 10 kHz and lower cutoff frequency for high pass filter is 100 kHz. The pass band gain is 1 and the input signal amplitude is 1 V. Use 741 op-amp. **(08 Marks)**

7 a. With a neat circuit diagram, explain the operation of a voltage follower regulator. Write the equations for line regulation and load regulation for a voltage follower regulator. **(10 Marks)**

b. With a neat circuit diagram, explain the operation of a precision voltage regulator. **(06 Marks)**

c. List any four applications of phase locked loop principle. **(04 Marks)**

8 a. Sketch the basic circuit of a 723 integrated circuit DC voltage regulator and briefly explain it. Show how a 723 regulator can be used as a positive voltage regulator. **(12 Marks)**

b. What is a power booster? Why is it needed? **(04 Marks)**

c. List the advantages of the switched capacitor filter. **(04 Marks)**

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