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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 z_{in} 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 $R_L = 3.9 \text{ k}\Omega$. Also determine the minimum theoretical input impedance of the circuit. [For 741 op-amp, input bias current $I_{B(max)} = 500 \text{ nA}$. 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 $V_{CC} = \pm 18\text{V}$, 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 $\pm 9V$ 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 $\pm 15V$ 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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