EE56

NEW SCHEME

Reg. No. | | | | | | | | | | |

Fifth Semester B.E. Degree Examination, January/February 2006

Electrical & Electronics Engineering

Operational Amplifiers and Linear ICs

Time: 3 hrs.) (Max.Marks : 100

Note: *1. Answer any FIVE full questions.*
2. Use of resistor and capacitor standard values list and op-amp data sheets are permitted.

1. (a) Sketch the circuit a high input impedance capacitor coupled non-inverting amplifier. Briefly explain its operation. **(6 Marks)**

(b) Briefly discuss the upper cutoff frequency of an op-amp circuit and show how the cutoff frequency can be set for inverting, non-inverting amplifiers. **(8 Marks)**

(c) Using a 741 op - amp, design a high Zin non inverting amplifier to operate with a +36 V power supply. The load resistance is $12k\Omega$. The lower cutoff frequency is to be $150Hz$ and the voltage gain is to be 7. **(6 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. **(6 Marks)**

(b) Discuss the effects of stray capacitance on an op-amp circuit stability. Write the equations to determine the value of input stray capacitance that might produce circuit instability. **(8 Marks)**

(c) Determine the upper cutoff frequency for (i) a voltage follower using a 741 op-amp and ii) a unity gain non-inverting amplifier using a 741 op-amp. Unity gain frequency for 741 op-amp is $800kHz$.. **(6 Marks)**

3. (a) Sketch an op-amp precision clamping circuit. Draw its input and output waveforms and explain the circuit operation. **(6 Marks)**

(b) Show how a half wave precision rectifier can be combined with a summing circuit to produce a full wave precision rectifier. Draw the voltage waveforms at various stages of the circuit and write equations to show that full wave rectification is performed. **(8 Marks)**

(c) A $3.3kHz, \pm 2V$ square wave with a 600Ω source resistance is to have its negative peak clamped at ground level. Using a bipolar op-amp, design a suitable precision clamping circuit. The tilt on the output is not to exceed 2 percent. **(6 Marks)**

4. (a) Sketch the circuit of a capacitor coupled zero crossing detector. Show the waveforms at various points in the circuit and explain its operation. **(6 Marks)**

(b) Draw the circuit of an op-amp astable multivibrator. Show the relevant voltage waveforms and explain its operation. **(8 Marks)**

(c) A capacitor coupled zero crossing detector is to provide an output voltage of approximately $\pm 17V$, when a $3kHz, \pm 2V$ square wave input is applied. Design a suitable circuit to use a bipolar op-amp. **(6 Marks)**

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5. (a) Sketch the circuit of a Triangular/Rectangular waveform generator. Draw the output waveforms at different stages and explain the circuit operation. **(6 Marks)**

   (b) Design a triangular/rectangular waveform generator to have an output frequency of $1kHz$, triangular output amplitude of $\pm 6V$ and square wave output amplitude of approximately $\pm 10V$. Use bipolar op-amps and estimate a minimum suitable op-amp slew rate. **(8 Marks)**

   (c) State Barkhausen criteria and explain how it is fulfilled in the phase shift oscillator. Write the equation for oscillation frequency in a phase shift oscillator. **(6 Marks)**

6. (a) Draw the circuits of second - order, low-pass and second order, high - pass active filters. Sketch the frequency response for each circuit and briefly explain the operation of each filter. **(12 Marks)**

   (b) Design a second - order, high - pass active filter to have a cutoff frequency of $12kHz$. Use a 715 op-amp and estimate the highest signal frequency that will be passed. **(8 Marks)**

7. (a) Discuss the operation of a Voltage follower regulator, with a relevant circuit diagram. **(6 Marks)**

   (b) Sketch the circuit of a precision voltage regulator. Explain its operation and discuss how it differs from voltage follower regulators. **(8 Marks)**

   (c) Explain the basic circuit of a 723 integrated circuit DC voltage regulator. **(6 Marks)**

8. Write explanatory notes with relevant circuit diagrams and waveforms, wherever applicapable :

   (a) Op-amp based circuit stability precautions

   (b) Inverting Schmitt trigger circuit and its I/O characteristic.

   (c) Design of a Bandpass active filter

   (d) Operation and applications of PLL **(20 Marks)**

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