NEW SCHEME

EE56

USN | | | | | | | | | | |

Fifth Semester B.E. Degree Examination, January/February 2005

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 of a high Z_{in} capacitor coupled voltage follower. Briefly explain its operation. (6 Marks)

   (b) Draw the circuit of capacitor coupled non-inverting amplifier using a single polarity supply and briefly explain it. (8 Marks)

   (c) A capacitor coupled voltage follower is to be designed to have a lower cutoff frequency of 120 Hz. The load resistance is 8.2 $k\Omega$ and the op-amp used has a maximum input bias current of 600 nA. Design a suitable circuit. (6 Marks)

2. (a) Explain why an operational amplifier with a lower closed loop gain is more likely to be unstable. (6 Marks)

   (b) Discuss the effect of Slew Rate on :

   i) Bandwidth and output amplitude

   ii) Output pulse rise time and amplitude. (8 Marks)

   (c) Calculate the minimum rise time and maximum undistorted output pulse amplitude at that rise time for an amplifier with closed loop gain 50, using a 741 op-amp. (6 Marks)

3. (a) Sketch the circuit of an inverting amplifier converted to a non-saturating half wave precision rectifier. Draw the input and output waveforms and explain the circuit operation. (6 Marks)

   (b) Sketch a precision rectifier peak detector circuit, draw the input and output waveforms and explain the circuit operation. write the expression for calculating the capacitor value and the op-amp minimum slew rate. (8 Marks)

   (c) A non-saturating precision half-wave rectifier using a BIFET op-amp with $V_{cc} = \pm 20V$ is to produce a 3V peak output. The input signal has 1V peak amplitude and a frequency of 50 kHz. Assume diode current of $500\mu A$. Calculate the resistor value R_1 and specify diode reverse recovery time. Use gain formula for A_v to calculate R_2 and then determine R_3. (6 Marks)

4. (a) Draw an op-amp inverting Schmitt trigger circuit. Sketch typical input and output waveforms. Explain the circuit operation and shape of the waveforms. (6 Marks)

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

(c) A non-inverting Schmitt trigger circuit is to have UTP=0 and LTP=2.5 V. Design a suitable circuit using a bipolar op-amp and $a \pm 18V$ supply. **(6 Marks)**

5. (a) With relevant circuit and output and feedback voltage waveforms, explain the circuit operation of a phase shift oscillator. **(6 Marks)**

(b) Sketch the circuit of a triangular/rectangular waveform generator. Draw the output waveforms at different stages and explain the circuit operation. **(8 Marks)**

(c) Draw the circuit of a Wein bridge oscillator. Explain the circuit operation with relevant voltage waveforms. **(6 Marks)**

6. (a) Draw the circuits of first-order, low-pass and first-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, low-pass filter circuit to have a cutoff frequency of 5 kHz. use a 741 op-amp. **(8 Marks)**

7. (a) Briefly explain the action of a DC voltage regulator. Write equations for line regulation, load regulation and ripple rejection. **(8 Marks)**

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

(c) Explain the operation of a Phase locked loop. **(6 Marks)**

8. Write explanatory notes with relevant circuit diagrams and waveforms, wherever applicable : **(5×4=20 Marks)**

i) Sample-and-hold circuit

ii) Op-amp based astable multivibrator

iii) Oscillator amplitude stabilization

iv) Universal active filter.

** * **