EE56

USN

2002 SCHEME

Fifth Semester B.E. Degree Examination, Dec.08/Jan.09

Operational Amplifiers and Linear IC's

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. Explain the operation of high input impedance capacitor coupled non-inverting amplifier with a neat circuit diagram. (06 Marks)

b. Give the description of capacitor coupled non-inverting amplifier using a single polarity supply with the aid of a circuit diagram. (06 Marks)

c. A capacitor coupled voltage follower is to be designed for a load resistance of 4.7kΩ having a lower cutoff frequency of 120Hz. The opamp used has a maximum bias current of 600nA. Design and draw a suitable circuit. (08 Marks)

2 a. Discuss the effect of stray Capacitance on an opamp circuit stability. Hence write the equations to determine the value of input stray capacitance that might produce circuit instability. (07 Marks)

b. Explain the effects of slew rate on (i) Bandwidth and output amplitude. (ii)Output pulse rise time and amplitude. (07 Marks)

c. Calculate the minimum rise time and the maximum undistorted output pulse amplitude at that rise time for an amplifier with a closed loop gain of 50, using 741 opamp. Given slew rate of opamp as 0.5V/μsec (06 Marks)

3 a. With a neat circuit diagram, explain half wave precision rectifier combined with a summing circuit to realise a full wave rectifier. Hence draw the voltage waveforms at various stages. (08 Marks)

b. With the aid of a neat circuit diagram and related expression for the holding capacitor and output current explain precision peak detector. (06 Marks)

c. Using bipolar opamps design the peak detector circuit to handle peak input voltage of 1V. The minimum rise time of the input is 30μsec and the holding time is to be 360μsec, the maximum output error is to be 5%. Given the discharge current for capacitor I_d=1 μA (06 Marks)

4 a. Describe capacitor coupled zero crossing detector with the aid of a neat circuit diagram and wave form. (07 Marks)

b. Draw the circuit of an opamp astable multi-vibrator and explain with related waveforms. (07 Marks)

c. Using a bipolar opamp with a −18V supply Design an inverting schmitt trigger circuit to have UTP=1.5V and LTP=2V. Assume diode forward current of 500μA. Hence sketch the circuit. (06 Marks)

5 a. Sketch the circuit of a triangular Rectangular waveform generator and explain the circuit operation with relevant waveforms. (07 Marks)

b. Derive an expression for the frequency of oscillations and gain for the Wein bridge oscillator. (07 Marks)

c. Using 741 opamp with a supply of −9V, design a phase shift oscillator to have an output frequency of 10 kHz. Assume current in the feedback path as I_f=50μA. (06 Marks)

6 a. Explain first order low pass active filter with circuit diagram and frequency response curve. (08 Marks)

b. Give the description of band stop filter with the aid of frequency response curve. (06 Marks)

c. Design a single stage band pass filter to have a voltage gain of 1 and a passband from 300Hz to 30 kHz selecting C_2=1000pF hence sketch the circuit. (06 Marks)

7 a. Discuss the operation of a voltage follower regulator with a relevant circuit diagram. (06 Marks)

b. Explain the basic circuit of a 723 integrated DC voltage regulator. (06 Marks)

c. In a voltage follower regulator circuit V_i=25V, R_s=20Ω, R_1=470Ω, V_z=15V, Z_z=10Ω and I_{Lmax} =75mA. Analyze the circuit to determine the line regulation, load regulation and ripple rejection. (08 Marks)

8 Write explanatory notes with relevant circuit diagrams and waveforms wherever applicable:
a) Universal active filters
b) Oscillator amplitude stabilization
c) Opamp based circuit stability precautions
d) Operation and applications of PLL. (20 Marks)