

2002 SCHEME

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Fifth Semester B.E. Degree Examination, Dec.09/Jan.10 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.

3. Any missing data may be suitably assumed.

1. a. With a neat circuit diagram, explain the operation of capacitor coupled voltage follower using op-amp. (08 Marks)
b. With a neat sketch, briefly explain the circuit of a capacitor coupled inverting operational amplifier using a single polarity supply. (04 Marks)
c. Using LF353 BIFET Op-amp, design a high Z_{in} capacitor coupled non-inverting amplifier to have a low cutoff frequency of 120 Hz. The input and output voltages are to be 10 MV and 2 V respectively and the minimum load resistance is 12 k Ω . (08 Marks)
2. a. Sketch circuits for lag compensation, lead compensation and Miller-effect compensation. Explain the operation of each circuit, and how each affects the op-amp frequency response. (12 Marks)
b. i) Calculate the cutoff frequency-limited rise time for a voltage follower circuit using a 741 op-amp. Also determine the slew rate-limited rise time if the output amplitude is to be 5 V.
ii) Determine the maximum undistorted pulse output amplitude for the 741 voltage follower if the output rise time is not to exceed 1 μ s.
iii) Calculate the minimum output rise time and the maximum pulse amplitude at that rise time for a 741 amplifier with an upper cutoff frequency of 100 kHz. (08 Marks)
3. a. With a neat circuit diagram, explain the operation of high input impedance full wave precision rectifier. Draw the voltage waveforms throughout the circuit and write the appropriate equations to show that full wave rectification is performed. (08 Marks)
b. Draw an op-amp sample-and-hold circuit. Sketch the signal control and output voltage waveforms. Explain the circuit operation. (06 Marks)
c. For voltage follower type peak detector, the pulse type signal voltage has a peak value of approximately 3 V with a rise time of 6 μ s and the output voltage is to be held at 3 V for a time of 120 μ s. The maximum output error is to be approximately 1%. Calculate the required component values and specify the output current and slew rate of the operational amplifiers. (06 Marks)
4. a. Draw an op-amp non-inverting Schmitt trigger circuit and explain its operation. (06 Marks)
b. Discuss the design process for an op-amp monostable multivibrator and write the equations for calculating each component value. (06 Marks)
c. Design an astable multivibrator using a BIFET op-amp to have a ± 9 V output with a frequency of 1 kHz. (08 Marks)

- 5 a. What is an oscillator? What are the conditions to get sustained oscillation? Differentiate amplifier and oscillator. (06 Marks)
- b. Discuss the operation of wein bridge oscillator using op-amp with neat circuit diagram. (06 Marks)
- c. Design the phase shift oscillator with amplitude stabilization network to give a maximum output of $\pm 3\text{ V}$ with an oscillation frequency of 6 kHz. Include distortion minimization adjustment. (08 Marks)
- 6 a. What is an active filter? How it differs from passive filter. (04 Marks)
- b. Derive the equation for phase shift in an all pass phase lag network. (08 Marks)
- c. Design an all pass circuit using op-amp 741 to have a phase lag adjustable from 80° to 100° . The input signal has a 1 V amplitude and a 5 kHz frequency. (08 Marks)
- 7 a. What is switched-capacitor filter? Discuss the theory of operation of switched-capacitor filter. (10 Marks)
- b. What is a phase locked loop? Define the term lock range and capture range. (04 Marks)
- c. Discuss with block diagram, a frequency multiplier using PLL. (06 Marks)
- 8 a. Sketch the circuit of a tracking plus-minus supply. Explain its operation. (06 Marks)
- b. Discuss fold-back current limiting circuit. (06 Marks)
- c. Design a positive voltage regulator using IC723 to have an output of 18 V. Determine suitable resistance values, select an appropriate input voltage and determine the maximum load current that may be supplied. (08 Marks)

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