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NEW SCHEME

Fifth Semester B.E. Degree Examination, July 2007
Electrical and Electronics
Operational Amplifiers and Linear IC's

Time: 3 hrs.] [Max. Marks:100

Note : *1. Answer any FIVE full questions.*
2. Use of register and capacitor standard values list and Op-Amp data sheets are permitted.

1 a. With a neat circuit diagram, explain the operation of a high Z_{in} capacitor coupled non – inverting amplifier circuit. Justify the practical values. **(08 Marks)**

b. Discuss the effects of input and output capacitors used in capacitor coupled amplifiers. **(06 Marks)**

c. Design a capacitor coupled voltage follower using a 741 Op-Amp. The lower cut-off frequency of the circuit is to be 115 Hz. The load resistance RL is 6.8 kΩ. **(06 Marks)**

2 a. List the precautions that should be observed for Op-Amp circuit stability. **(08 Marks)**

b. Show how feedback in a non-inverting amplifier circuit can produce instability. Define i) Frequency compensation ii) Loop gain iii) Loop phase shift. **(06 Marks)**

c. Calculate the slew rate limited cut-off frequency for a voltage follower circuit using 741 Op-Amp. The peak of the sine wave output is to be 5V. The slew rate of Op-Amp is 0.5V/μ sec. Determine the maximum peak value of the sinusoidal output voltage that will allow the voltage follower circuit to operate at 500 kHz unity gain cut-off frequency. **(06 Marks)**

3 a. With a neat circuit diagram and block diagram show how a half wave precision rectifier can be combined with a summing circuit to produce a fullwave precision rectifier. Draw the voltage waveforms at relevant stages of the circuit and write equations to show that full wave rectification is performed. **(08 Marks)**

b. Explain the operations of an adjustable peak clipper circuit with back-to-back connected zener diodes. Write the equations with Vo(max) = ± 4V. **(06 Marks)**

c. A 5 kHz, ± 5V square wave with 100Ω 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 2.5%. **(06 Marks)**

4 a. Draw circuits to show how diodes may be used to select the trigger points upper and lower for an inverting Schmitt trigger circuit. Explain the operation and draw the output / input characteristic. **(06 Marks)**

b. Draw the circuit of an Op-Amp mono stable multi vibrator. Show the relevant voltage waveforms and explain its operation. **(08 Marks)**

c. A capacitor coupled zero crossing detector is to provide an output voltage of approximately ± 15V, when a 5kHz, ± 3V square wave input is applied. Design a suitable circuit to use a bipolar Op-Amp. Tilt at the non inverting terminal ΔV is to be 0.75V. **(06 Marks)**

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5 a. State Barkhansen criteria and explain how it is fulfilled in the phase shift oscillator. **(06 Marks)**

b. Design a triangle / rectangular waveform generator to have an output frequency of 5kHz. The triangle output amplitude of ± 6V and square wave output amplitude of approximately ± 10V. Use bipolar Op-Amp and estimate a minimum suitable Op-Amp slew rate. **(08 Marks)**

c. Draw the circuit of an output stage for controlling the output amplitude and dc voltage level of a signal generator. Explain the operation. **(06 Marks)**

6 a. Draw the circuits of a 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 low pass active filter to have a cut-off frequency of 3.3 kHz. Use 741 Op-Amp. **(08 Marks)**

7 a. With a neat circuit diagram explain the operation of a precision voltage regulator. **(08 Marks)**

b. Explain the following performance parameters of a voltage regulator i) Line regulation ii) Load regulation iii) Ripple rejection. **(06 Marks)**

c. Explain the operation and applications of a phase locked loop circuit. **(06 Marks)**

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

a. Explain the significance of upper cut-of frequency of an Op-Amp and show how the cut-off frequency can be set for inverting amplifier.

b. Operation of a sample and hold circuit.

c. Universal active filter.

d. Peak detector. **(20 Marks)**

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