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EE56

Fifth Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Operational Amplifiers and Linear IC's

Time: 3 hrs. Max. Marks:100

Note : 1. ***Answer any FIVE full questions.***
2. ***Missing data may be suitably assumed.***
3. ***Use of resistor, Capacitor standard values list and Op-amp data sheets is permitted.***

1 a. Sketch the circuit of a capacitor – coupled non – inverting amplifier using single polarity supply and explain it briefly. Also draw the waveforms at input, before and after the output coupling capacitor. **(08 Marks)**

b. A high input impedance capacitor-coupled non-inverting amplifier is to be designed to have $A_v = 120$ and $f_1 = 100$ Hz. The input signal is 50 mV and the total resistance ranges from 2.7 kΩ to 27 kΩ. Design a suitable circuit using a 741 op-amp. **(08 Marks)**

c. Explain briefly the working of notch filter with relevant diagrams. **(04 Marks)**

2 a. Discuss the effects of stray capacitance on op-amp circuit stability. Write the equations to determine the value of input stray capacitance that might produce circuit instability. **(08 Marks)**

b. What are the causes of circuit instability? List the precautions to be taken for circuit stability. **(08 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. **(04 Marks)**

3 a. Draw an op-amp sample-and-hold circuit. Sketch the signal, control, and output voltage waveform. Explain the circuit operation. **(07 Marks)**

b. A 3.3 kHz, ± 2 V square wave with a 600 Ω 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. **(06 Marks)**

c. 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 op-amp minimum slew rate. **(07 Marks)**

4 a. Draw the circuit of an op-amp monostable multivibrator. Show the relevant voltage waveforms and explain its operation. **(06 Marks)**

b. Using a 741 op-amp with a supply of ± 12V, design an inverting Schmitt trigger circuit to have trigger points of ± 2V. **(06 Marks)**

c. Sketch the circuit of capacitor-coupled zero-crossing detector. Show the waveforms at various points in the circuit and explain its operation. **(08 Marks)**

5 a. Sketch the circuit of a triangular / rectangular waveform generator. Draw the output waveforms at different stages and explain the circuit operation. **(09 Marks)**

b. Using a 741 op-amp with a supply of ± 12V, design a phase shift oscillator to have an output frequency of 500 Hz. **(05 Marks)**

c. Draw the circuit of a Wein bridge oscillator. Sketch the output and feedback voltage waveforms and explain the circuit operation. **(06 Marks)**

6 a. Draw the circuit of a first order high-pass filter and derive an expression for gain magnitude and phase angle. **(06 Marks)**

b. Design a wideband-reject filter using first order highpass and lowpass filters having $f_L = 2$ kHz and $f_H = 400$ Hz respectively with pass band gain as 2. **(08 Marks)**

c. Discuss the differences between wideband and narrowband band pass filters. Sketch typical frequency responses for each. Explain the terms – figure of merit, centre frequency and band width with respect to band pass filters. **(06 Marks)**

7 a. Explain with a block diagram the operation of a phase locked loop. Enlist the applications of phase locked loop. **(08 Marks)**

b. Distinguish clearly between small signal amplifiers and power amplifiers. **(04 Marks)**

c. Briefly explain the theory of operation of switched capacitor filter. What are the advantages of switched capacitor filters? **(08 Marks)**

8 a. Explain the terms line regulation, load regulation and ripple rejection for a dc voltage regulator. **(06 Marks)**

b. Explain with a circuit diagram, the operation of a voltage follower regulator. **(06 Marks)**

c. Explain with a schematic diagram LM217 integrated circuit positive voltage regulator. Calculate the resistance of R1 and R2 for the LM217 voltage regulator to produce an output voltage of 9 volts. **(08 Marks)**

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