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Fourth Semester B.E. Degree Examination, December 2010
Linear ICs and Applications

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting
at least TWO questions from each part.**

PART – A

- 1
 - a. What is an op-amp? Explain the working of its basic circuit. (04 Marks)
 - b. Define CMRR of an op-amp. If a non-inverting amplifier is designed for a gain of 100, using an op-amp with 95 dB CMRR, calculate the common mode output (V_{OCM}) for a common mode input (V_{icm}) of 2 V. (06 Marks)
 - c. Design a non-inverting amplifier to provide a gain of 50 for an input of 100 mV. Compute its input and output impedances. Given, $R_i = 2 \text{ M}\Omega$, $R_o = 75 \Omega$, $I_{Bmax} = 500 \text{ nA}$, and $M = 200,000$ for the op-amp (741). (08 Marks)
 - d. How do you provide compensation for the bias current for the amplifier of Q1 (c) above? (02 Marks)
- 2
 - a. Explain the operation of a high Z_{in} voltage follower based AC amplifier. Prove that its Z_{in} is very large, ideally. (08 Marks)
 - b. Design a C-coupled inverting amplifier for a pass-band gain of 100, $f_1 = 120 \text{ Hz}$ and $f_2 = 5 \text{ kHz}$. Assume $R_L = 2 \text{ k}\Omega$ and use the LF353BIFET op-amp. (08 Marks)
 - c. Explain how exactly the circuit of a non-inverting ac amplifier is modified to be used with single-supply op-amps. (04 Marks)
- 3
 - a. With the help of frequency and phase response curves of a typical op-amp, discuss the concept of circuit stability for high gain and low gain amplifiers. (12 Marks)
 - b. Explain the frequency compensation technique, using a phase-lead network. (04 Marks)
 - c. Define the slew rate and determine the slew rate limited cut-off frequency for a 741 based voltage follower. The peak sine wave output should be 10 V. Given ; slew rate of 741 is $0.5 \text{ V}/\mu\text{sec}$. (04 Marks)
- 4
 - a. Explain the operation of a low resistance voltage source and design the same to provide a constant V_{out} of 10 V. The load varies from 100Ω to $1 \text{ K}\Omega$ and the available supply is $\pm 15 \text{ V}$. Use 1N758 zener of $V_2 = 10\text{V}$ and design the various circuit elements. (08 Marks)
 - b. Draw the circuit of an instrumentation amplifier and derive an expression for the gain. (06 Marks)
 - c. With a circuit diagram and waveforms, explain the operation of a non-saturating precision half-wave rectifier. (06 Marks)

PART – B

- 5
 - a. Design a V/I converter to drive a floating load of $1 \text{ K}\Omega \pm 10\%$ with a constant current of 2 mA. (04 Marks)
 - b. Explain how sustained oscillations are obtained in a Weinbridge oscillator. Draw the circuit diagram. (06 Marks)
 - c. Design a RC phase-shift oscillator for an output frequency of 5 kHz. Use LM741 with $\pm 15\text{V}$ power supply. (06 Marks)
 - d. With a suitable derivation, explain a logarithmic amplifier. (04 Marks)

- 6 a. Explain the operation of an op-amp based astable multivibrator. Use relevant waveforms. (06 Marks)
- b. With waveforms, explain the working of : i) Zero-crossing detector, and (06 Marks)
ii) Voltage-level detector.
- c. Design a 2nd order LPF using 741 for a cut-off frequency of 5 kHz. Draw its frequency response and comment on the same. (08 Marks)
- 7 a. Explain the working of a series voltage regulator, with current limit protection. (08 Marks)
- b. Design a 723 based voltage regulator to provide constant $V_0 = 20 \text{ V}$ and $I_{o\max} = 250 \text{ mA}$. Given $V_{in-unreg} = 30\text{V} \pm 10\%$. (06 Marks)
- c. Briefly explain the standard representation / configuration of 78XX type regulators. (06 Marks)
- 8 a. Design a monostable multivibrator using 555 timer to obtain a pulse of width 10 msec. (06 Marks)
- b. Briefly explain the working of a 4-bit binary weighted resistor DAC. (06 Marks)
- c. Explain the operation of a successive approximation ADC using a simplified block-diagram. (06 Marks)
- d. Define lock-in range and capture range with reference to PLLS. (02 Marks)

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