USN | | | | | | | | | | | **06EC46**

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.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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 MΩ, R_o = 75 Ω, I_{Bmax} = 500 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, $f_1 = 120$ Hz and $f_2 = 5$ kHz. Assume $R_L = 2$ kΩ 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 V/μsec. **(04 Marks)**

4 a. Explain the operation of a low resistance voltage source and design the same to provide a constant Vout of 10 V. The load varies from 100 Ω to 1 KΩ and the available supply is ± 15 V. Use 1N758 zener of $V_z = 10V$ and design the various circuit elements. **(08 Marks)**

b. Draw the circuit of an instrumentation amplifier and derive and 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 KΩ ± 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 a output frequency of 5 kHz. Use LM741 with ± 15V 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
ii) Voltage-level detector. **(06 Marks)**

c. Design a 2^{nd} 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 $V_0 = 20$ V and $I_{omax} = 250$ mA. Given $V_{in-unreg} = 30V \pm 10\%$. **(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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