S.E. E&TC, Sem-II
Nov-Dec 2012, 2008 pattern

Total No. of Questions—12] [Total No. of Printed Pages—4+2

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## S.E. (E&TC) (Second Semester) EXAMINATION, 2012

## INTEGRATED CIRCUITS AND APPLICATIONS

## (2008 PATTERN)

**Time : Three Hours** **Maximum Marks : 100**

***N.B.*** :— (*i*) Answer any *three* questions from each Section.

(*ii*) Answers to the two Sections should be written in separate answer-sheets.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.



## SECTION I

**1.** (*a*) Which are the different configurations of differential amplifiers ? Derive the expressions for Q-point parameters of Dual-Input balanced output differential amplifier. [8]

(*b*) The dual-input balanced output differential amplifier has the following specifications : [8]

$R_c$ = 2.5 kΩ, $R_E$ = 4.8 kΩ, $R_{b1} = R_{b2} = R_b$ = 50 Ω, + $V_{cc}$ = +10 V, $-V_{EE}$ = −10 V, β = 100, $V_{BE}$ = 0.8 V.

P.T.O.

Assume $h_{ie}$ = 1.1 kΩ.

Calculate :

(1) Q-point values

(2) Voltage gain

(3) Input and output resistance.

*Or*

**2.** (*a*) Explain any *two* level shifter circuits used in op-amp used to shift the level. [6]

(*b*) Write short notes on : [10]

(1) Current Mirror

(2) Widlar Current Source.

**3** (*a*) An Op-Amp has a slew rate of 5 V/μs. Find the rise time for an o/p voltage of 10 V amplitude resulting from a rectangular pulse input if the op-amp is slew-rate limited [6]

(*b*) Define the following characteristics of an Op-Amp :

(1) CMRR

(2) Input bias current

(3) Slew rate

(4) Input offset voltage. [4]

(*c*) Explain the effect of feedback on closed loop stability of op-amp. [6]

*Or*

**4.** (*a*) Explain different types of noises associated with op-amp. Draw noise model of op-amp and give expression for noise voltage. [8]

(*b*) What is the need of frequency compensation ? Explain any *two* methods of frequency compensation. [8]

**5.** (*a*) Design a practical integrator using Op-Amp IC741C to satisfy the following specifications :

Assume $V_{cc}$ = +15 V.

(1) 3-dB cut-off frequency = 1.5 kHz

(2) D.C. gain = 10

Sketch the frequency response of the circuit. [8]



(*b*) Explain grounded load V to I converter with necessary derivation. [6]

(*c*) Explain the concept of defined non-linearity. [4]

*Or*

**6.** (*a*) Design a practical differentiator to differentiate an input signal that varies in frequency from 10 Hz to 500 Hz. Draw its frequency response. [8]

(*b*) Compare the salient features of an integrator and differentiator using Op-Amp. [4]

(*c*) Draw a neat diagram of three inputs inverting summing amplifier using op-amp and obtain expression for output voltage. [6]

## SECTION II

**7.** (*a*) Explain the operation of inverting comparator with appropriate output waveforms. [6]

(*b*) Explain peak detector using op-amp. [6]

(*c*) Design an inverting Schmitt Trigger circuit whose $V_{UT}$ and $V_{LT}$ are $\pm 5V$. Draw input and output waveforms. Assume op-amp saturates at $\pm 13.5$ V. [6]

*Or*

**8.** (*a*) Explain the requirements of an instrumentation amplifier. [4]

(*b*) Derive the output voltage of 3 op-amp instrumentation amplifier. [6]

(*c*) Explain the operation of precision full wave rectifier with necessary waveforms. [8]

**9.** (*a*) Explain the following with reference to DAC : [6]

(1) Linearity

(2) Accuracy

(3) Settling time.


(*b*) Draw the circuit diagram of voltage mode R-2R ladder DAC and explain its working. [6]

(*c*) List various specifications of ADC. [4]

*Or*

**10.** (*a*) With the help of neat circuit diagram, explain the operation of Dual Slope ADC. [8]

(*b*) Draw the neat diagram of F to V converter and explain its operation. [8]

**11.** (*a*) Explain the operation of PLL using a neat block diagram. Define the terms Centre frequency and capture time related to PLL. [8]

(*b*) Write short notes on : [8]

(1) Graphic equalizer

(2) Frequency synthesizer using PLL.

*Or*

**12.** (*a*) Calculate output frequency $f_o$, lock range and capture range of PLL if the timing parameters are $C_T$ = 0. 1 µf, $R_T$ = 1 kΩ. The filter capacitor is 10 µf. [6]

(*b*) Write a short note on Sallen and Key second order active low pass filter. [6]

(*c*) Compare active and passive filters. [4]