Printed Pages : 6

EEC-509

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 121502

Roll No.

B. Tech.

(SEM. V) (ODD SEM.) THEORY EXAMINATION, 2014-15

ANALOG INTEGRATED ELECTRONICS

Time : **3** Hours] [Total Marks : **100**

Note : Attempt all questions. All questions carry equal marks. Missing data if any may be suitably assumed and mentioned.

1 Attempt any four parts of the following : **5×4=20**

(a) Explain the need of compensating network in op-amp circuits.

(b) Derive a mathematical expression representing the frequency response of an Op-amp.

(c) Draw the high frequency equivalent circuit of an op-amp and obtain the transfer function for its frequency response behavior.

(d) Justify stability of an Op-amp? Explain the various stability specifications with constant bandwidth product.

(e) Briefly explain the open-loop voltage gain as a function of frequency and also determine the gain in decibels at different frequencies.

(f) For the circuit shown in Fig. 1 verify that,

$$V_O = \left(1 + \frac{R_2}{R_1} + \frac{2R_2}{R}\right)(V_2 - V_1)$$

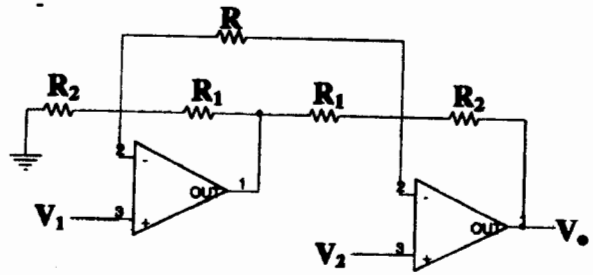

Figure-1

2 Attempt any two parts of the following : **10×2=20**

(a) Draw the circuit diagram of an instrumentation amplifier using Transducer Bridge and prove that the expression for its output voltage is given by the expression:

$$V_O = \frac{R_F}{R_1}\frac{\Delta R}{4R}V_{dc}$$

Also discuss the advantages of instrumentation amplifier over differential amplifier.

(b) Show that the circuit in Fig. 2 has

$A_F = -(1 + R_3 / R_4)\, R_1 / R_2$.

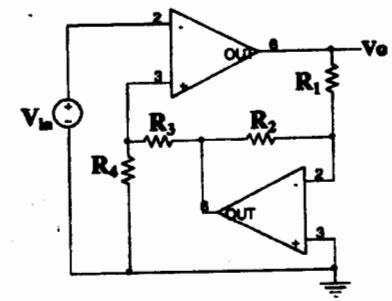

Figure-2

(c) (i) Draw the circuit diagram of V-I-converter with grounded load and show the output current depend on input voltage.

(ii) Design a differentiator shown in Fig. 3 to differentiate an input signal that varies from 200Hz to 1 KHz.

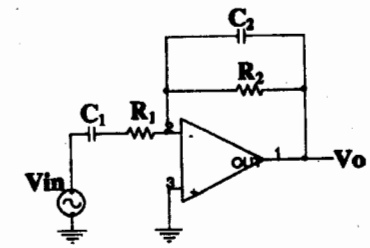

Figure-3

3 Attempt any two parts of the following : **10×2=20**

(a) The Low-Pass filter shown in Fig. 4 is referred to as a –KRC filter ("minus" KRC filter) because the Op-Amp is operated as an inverting amplifier with a gain of –K. Find H_{OLP}, ω_0 and Q for the case $C_1 = C_2 = C$ and $R_1 = R_2 = R_3 = R_4 = R$.

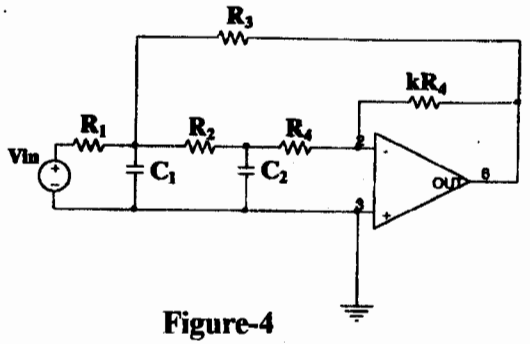

Figure-4

(b) What is a digital-to-analog converter? Draw the circuit of an R-2R ladder type D/A converter and explain its operation. What are the advantages of R-2R ladder network DAC over weighted resistor DAC?

(c) Design a Second order Band Reject filter with neat and clean circuit diagram and draw its Transfer Function H(s) with its cut-off frequency and Quality factor.

4 Attempt any two parts of the following : **10×2=20**

(a) With the help of neatly labeled circuit diagram explain the working of Precision Half Wave improved rectifier and Precision Full Wave Rectifier.

(b) (i) Draw the block diagram of a Frequency to voltage converter for an input frequency f_I.

(ii) With the help of neatly labeled circuit diagram explain the working of inverting and non inverting Schmitt Triggers. Design and calculate the threshold voltage levels and hysteresis of inverting Schmitt trigger if $V_{cc} = \pm 15V$, $V_{sat} = 0.5V_{cc}$, $R_1 = R_2 = 2k\Omega$.

(c) With the help of neat diagram explain the working of following circuit :

(i) Linear Regulators.

(ii) Switching Regulators.

5 Attempt any two parts of the following : **10×2=20**

(a) Discuss in detail about these circuits :

(i) PLL circuit (ii) VCO.

(b) Prove that the expression for the output voltage shown in Fig. 5 is given by :

$$V_O = \left(1 + \frac{R_2}{R_{TC}}\right)\frac{kT}{q}\ln\left(\frac{V_i}{V_{ref}}\right)$$

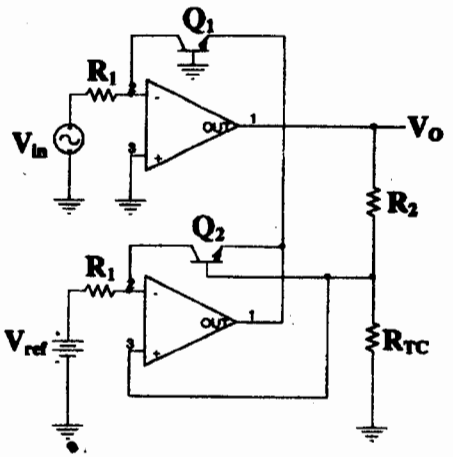

Fig. 5

(c) Discuss about the basic characteristics and the equivalent circuit of Operational Trans-conductance Amplifier (OTA). Draw the inverting and non inverting amplifier using OTA.