PRESIDENCY UNIVERSITY, BENGALURU
SCHOOL OF ENGINEERING

Max Marks: 30 Max Time: 55 Mins Weightage: 15 % **Set A**

TEST 3

II Semester 2016-2017 Course: **ECE / EEE A 210 Analog Electronics** 21 April 2017

Instructions:

i. Write legibly
ii. Scientific and non-programmable calculators are permitted.

Part A (2 Q x 3 M = 6 Marks)

1. In the context of filters, define the following:
   (a) An Ideal filter
   (b) Roll-off rate of a filter
   (c) Order of a filter
2. List at least three advantages of active filters over passive filters.

Part B (2 Q x 6 M = 12 Marks)

3. Draw the circuit diagram of an active low pass 1st order filter (using Op-Amp) and derive its transfer function.
4. Draw the circuit diagram of an active high pass 1st order filter (using Op-Amp) and derive its transfer function.

Part C (1 Q x 12 M = 12 Marks)

5. Design a 2nd order Butterworth VCVS low pass filter (LPF) for cut-off frequency ω_c = 250 rad / sec and a gain of 25. Consider the values of capacitors $C_1 = C_2 = 2\ \mu F$ and the resistance $R_A = 4\ k\Omega$ of the feedback circuit. Also draw the circuit diagram indicating the values of the calculated components in the design.
   Given the following relationship: $\omega_c^2 = \frac{1}{R_1 R_2 C_1 C_2} = 1$; and
   $2k = \left[\frac{1}{R_1 C_1} + \frac{1}{R_2 C_1} + \frac{1-K}{R_2 C_2}\right](R_1 R_2 C_1 C_2)^{1/2} = \sqrt{2}$

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TEST 2

II Semester 2016-2017 Course: **ECE / EEE A 210 Analog Electronics** 24 March 2017

Instructions:

i. Write legibly
ii. Scientific and non-programmable calculators are permitted.

Part A (3 Q x 3 M = 9 Marks)

1. Draw only the circuit diagram of an Op-Amp based differentiator circuit. Why differentiators are not used with high frequency input signals?
2. Draw the circuit diagram of a Differential Input Differential Output Amplifier and give its formula for output voltage (don't derive it).
3. Give at least two applications for each of the following Op-Amp amplifiers:
   (a) Bridge amplifier (b) Charge amplifier (c) Isolation amplifier

Part B (2 Q x 5 M = 10 Marks)

4. For a practical Op-Amp based inverting amplifier, draw the circuit diagram and label the components properly. Give only the formula for the following parameters of practical inverting amplifier (don't derive it):
   (a) Closed loop voltage gain (b) Closed loop output resistance
5. (a) Give the equivalence diagram of an Isolation Amplifier and the formula for its output voltage.
   (b) Also give the circuit diagram for an Isolation Amplifier with optical isolation.

Part C (1 Q x 11 M = 11 Marks)

6. For a classic three Op-Amp variable gain instrumentation amplifier, do the following:
   (a) Draw the circuit diagram and derive the formula for its final output Vo.
   (b) Find the value of the variable gain resistor R_1, for the following set of voltages and resistances $V_1 = 0.7$ V, $V_2 = 0.3$ V and $Vo = 2$ V; $R_2 = 10$ KΩ, $R_F = R_3 = 15$ KΩ.

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Max Marks: 30 Max Time: 55 Mins Weightage: 15 % **Set A**

TEST 1

II Semester 2016-2017 Course: **ECE / EEE A 210 Analog Electronics** 25 February 2017

Instructions:

i. Write legibly

ii. Scientific and non-programmable calculators are permitted.

Part A (3 Q x 3 M = 9 Marks)

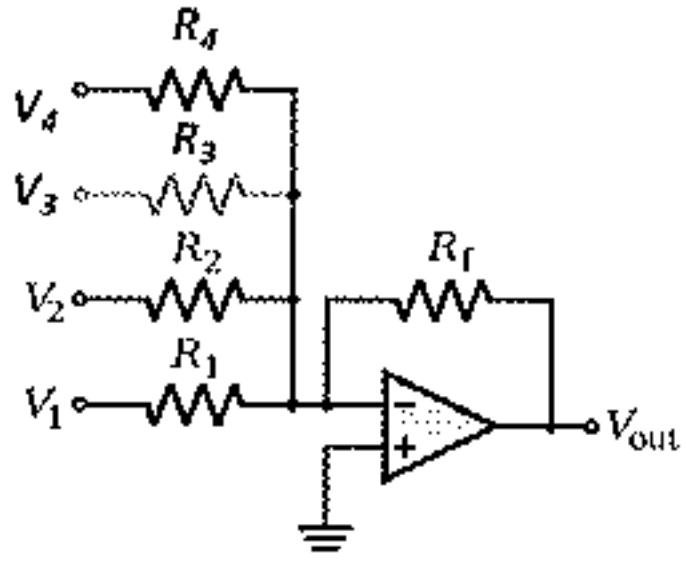
1. Discuss briefly (a) CMRR for operational amplifiers (b) Coupling Capacitors and (c) Bypass Capacitors.
2. Draw only the circuit diagram of a positive clipper circuit and show its output waveform if a sinusoidal signal is applied as an input.
3. Draw the circuit diagram of an Op-Amp based integrator circuit and give its formula for output voltage (don't derive it).

Part B (2 Q x 5 M = 10 Marks)

4. For the Op-Amp (ideal) Circuit shown in Figure below, if $V_1 = V_2 = 2$ V and $V_3 = V_4 = 3$ V, find the output voltage for the following conditions:

   (a) If $R_1 = R_2 = R_3 = R_4 = R_f = 2$ KΩ.

   (b) If $R_1 = R_2 = R_3 = R_4 = 12$ KΩ and $R_f = 3$ KΩ.

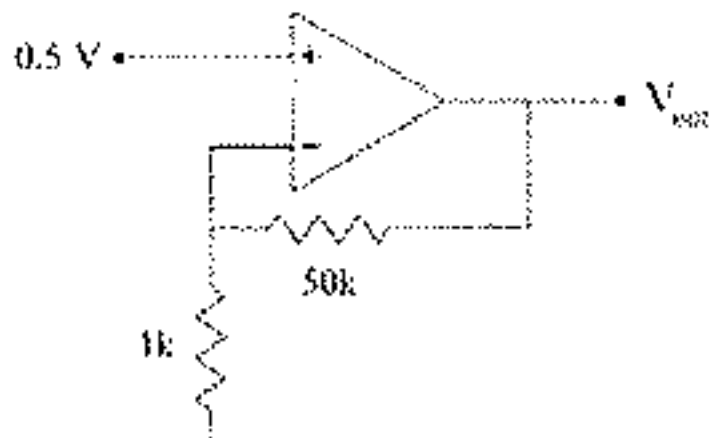


5. The Op-Amp (ideal) Circuit shown in Figure below has a supply voltage of ± 15 V, find

(a) Voltage Gain.

(b) The output voltage V_{out}.

(c) If only the polarities of both the input terminals are swapped, calculate the new Output Voltage, V_{out}.



(1)

Part C (1 Q x 11 M = 11 Marks)

6. For the Op-Amp based circuit shown in Figure below, find v_0 and i_0.

(**Hint:** For finding v_0, write KCL equations at nodes 'a' and 'b' and for finding i_0, write KCL equations at node 'c'.)