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Semester I 2005/2006 **EE303 Electronics II** **Final Test**

ATTEMPT ALL QUESTIONS
TIME ALLOWED THREE HOURS

Q1. Consider the circuit shown in Fig. 1 and answer the following questions:

a. Assuming ideal operational amplifier, find the condition and the frequency of oscillation of this circuit.
b. It is required to design a function (sinusoidal/square/triangular wave) generator using the circuit shown in Fig.1. Design this function generator. Draw a complete circuit diagram for your suggested design.
c. In practice, there are no ideal operational amplifiers. Obviously this will limit the performance of the proposed function generator. For example, if we have operational amplifiers with gain-bandwidth product = 1MHz and slew rate= 1 V/μsec , how these non-idealities will affect the performance of your function generator?

Q2. Consider the circuit shown in Fig. 2 and answer the following questions:

a. Calculate the input and output resistances.
b. Calculate the medium-frequency voltage gain. (v_o/v_s)
c. Find the frequency range within which this circuit can provide a gain not less 3 dB than below the value obtained in part (b).
d. Upon testing this circuit it was found that it produces 10% second harmonic distortion. This is unsatisfactory and it is required to reduce this percentage harmonic distortion to 1% using negative feedback. Suggest a feedback configuration to achieve this goal. Draw a complete circuit diagram showing your proposed feedback configuration.
e. What is the effect of your proposed feedback configuration on the input and output resistances.

Q3. Assuming ideal operational amplifier, identify the circuit shown in Fig. 3. Find the major parameters of this circuit and sketch its transfer function. Select appropriate values for the resistors and capacitors to provide center frequency = 10.0 kHz and bandwidth = 1.0 kHz.

Q4. Design a circuit to realize the following function:

$$f(t)=5\ v_1(t)+3\frac{dv_2(t)}{dt}-2\int v_3(t)dt$$

Remember that a successful design must use the minimum number of active and passive electronic components.

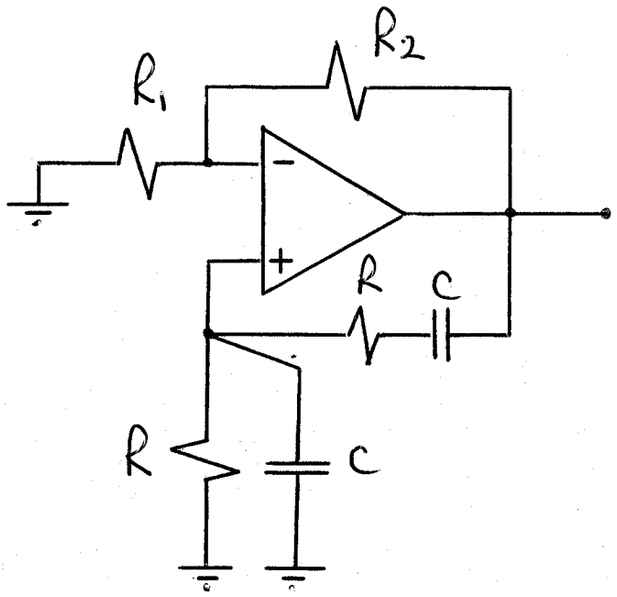

Fig. 1

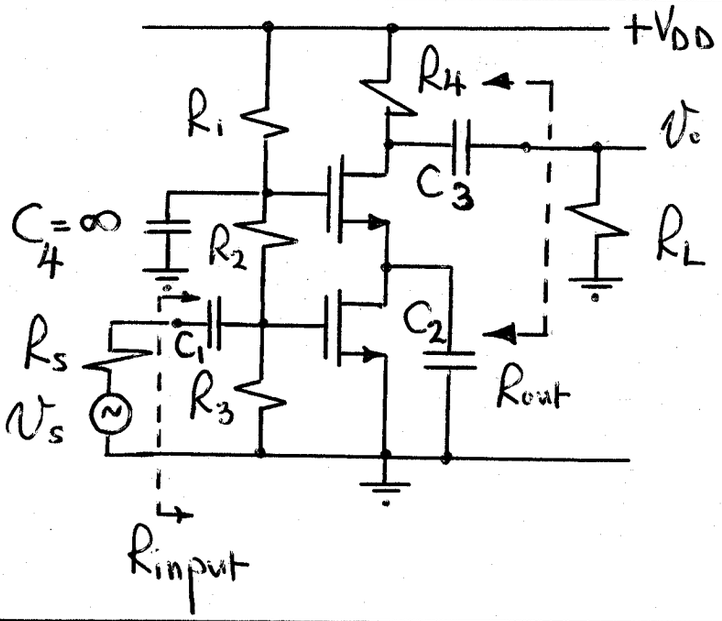

Fig. 2

$R_s = 50\ \Omega$
$R_1 = R_2 = R_3 = 1\ M\Omega$
$R_4 = 10\ K\Omega$
$C_1 = C_3 = 1\ \mu F$
$C_2 = 10\ pF$
$C_4 = \infty$
$g_{m_1} = g_{m_2} = 10\ mA/V$
$R_L = 100\ K\Omega$

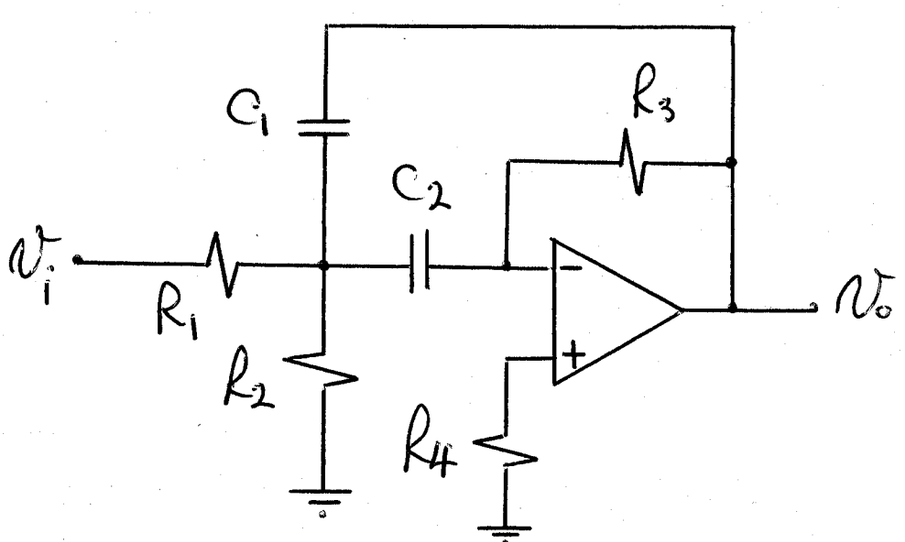

Fig. 3