

La Trobe University
Department of Electronic Engineering
ELE2EMI 2007
Assignment 1
Due: 2 pm, Monday 27 August 2007

You **must** complete, **sign** and **submit** the following **declaration** *with this assignment* in order to receive **any marks** for the assignment.

Name:	Student No:
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DECLARATION

I certify that the attached assignment is my original work and that no part of it has been copied or reproduced from any other person's work without acknowledgement.

Signed:	Date:
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Question 1. (Units and Accuracy)

- (a) for the fundamental SI unit of **luminous intensity**, what are its:
- (i) *name* and
 - (ii) *symbol* ?
- (b) Given one example each of:
- (i) a **direct**,
 - (ii) an **indirect**, and
 - (iii) a **null** measurement.
- (c) In measurement, what are:
- (i) **validity** and
 - (ii) **robustness**?
- (d) *Distinguish* the two concepts in each of the following pairs:
- (i) **error** and **mistake**.
 - (ii) **error** and **accuracy**;
 - (iii) **accuracy** and **precision**;
- (e) *List*:
- (i) three (3) kinds of **reading** errors;
 - (ii) three (3) kinds of **environmental** errors;
 - (iii) four (4) kinds of **characteristic** errors.

Question 2. (Bridge Circuits)

Name the types of AC bridge suitable for measuring:

- (i) High-Q inductors?
- (ii) Capacitance?
- (iii) Low-Q inductors?
- (iv) A wide range of Q values?

Question 3. (Basic Operational Amplifier Circuits)

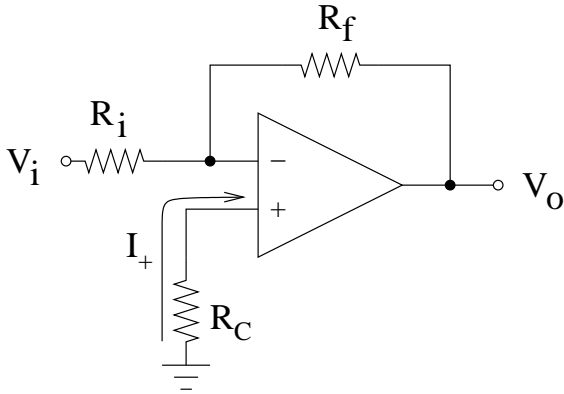
- (a) What are five (5) properties of an **ideal operational amplifier**?
- (b) **Inverting amplifier**:
- (i) *Draw* a simple **inverting** amplifier circuit based on an ideal differential op amp.
 - (ii) Derive the expression for the **voltage gain** of the circuit.
- (c) *Draw* the circuit for an **op-amp integrator**.
- (d) In a **differential op-amp**:
- (i) Define the **input offset voltage**.

(ii) Why does a **real** op-amp have a **nonzero** input offset voltage?

(iii) Why do its inputs have **nonzero** currents?

(e) **Compensation in real op-amps:**

(i) In the following circuit involving a **real** op-amp, what does the **compensation resistor** compensate for?

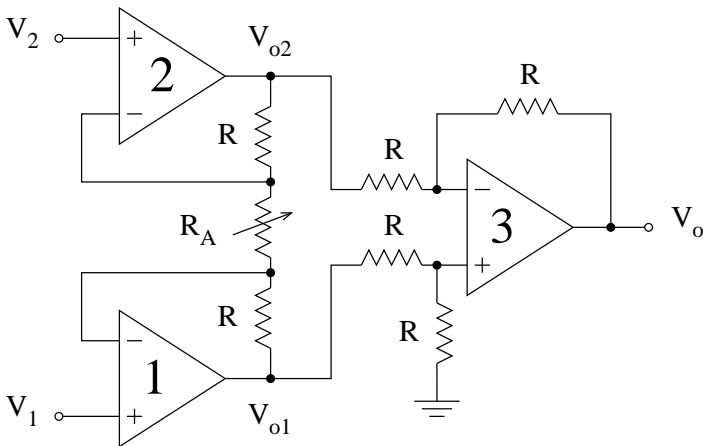


(ii) Given that $R_i = 3\text{k}\Omega$ and $R_f = 4\text{k}\Omega$, what is a suitable value for R_C ?

Question 4. (Instrumentation Operational Amplifiers)

(a) Name two (2) applications of **isolation** amplifiers.

(b) In the following **instrumentation** amplifier, assume that the input impedances of the op-amps are much higher than the values of the resistances R_A and R .



(i) State the **formula** for the **voltage gain** of the circuit.

(ii) If $R_A = 6\text{k}\Omega$ and $R = 8\text{k}\Omega$, calculate the **value** of the voltage gain.

Question 5. (Special Purpose Laboratory Amplifiers)

(a) What is the *unit* for:

(i) **noise specification?**

(ii) **voltage drift?**

(b) **Noise reduction:**

(i) Describe two (2) situations in which the effect of **noise can be reduced**.

(ii) In *each* of those situations, explain the *noise reduction technique* that you would use, and **why** the technique works.

Author: Geoffrey Tobin: Tuesday 31 July 2007.