

La Trobe University  
Department of Electronic Engineering  
ELE2EMI 2007  
Assignment 3  
Due: 2 pm, Monday 22 October 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:
-------	-------------

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:
---------	-------

### Question 1. (Cathode Ray Oscilloscopes)

- (a) Name the three (3) functional parts of a **cathode ray tube** (CRT).
- (b) List the four (4) *components* of the **vertical deflection system**.
- (c) Name the three (3) *components* of the **horizontal deflection system**.
- (d) **VCO**:
  - (i) Describe what a **voltage controlled oscillator** (VCO) does.
  - (ii) Give one (1) of the uses of a VCO.
- (e) **Draw** the **time-base** waveform produced by a *sweep generator*. **Label** each of the *sections* and *significant points* of the waveform.

### Question 2. (Probes)

- (a) Define the following terms:
  - (i) **probe**;
  - (ii) **twisted pair**;
  - (iii) **shielded wire**.
- (b) A *signal generator* has an output impedance of  $600\ \Omega$ . Two metres (2 m) of *coaxial cable* (with a capacitance of  $100\ \text{pF}$  per metre) connect it to a *CRO channel socket* with an input impedance of  $1\ \text{M}\Omega$  in parallel with  $30\ \text{pF}$ .
  - (i) Draw an **equivalent circuit** (using resistances and capacitances) for the signal generator, coaxial cable, and CRO input.
  - (ii) What is the **capacitive impedance** of the combination of cable and CRO input?
  - (iii) What is the **ratio** of the voltage measured by the CRO *divided by* the signal generator's Thévenin voltage?
- (c) Name two (2) *undesirable* effects that may occur if the **ground-clip** of a probe is **not** used.
- (d) What is the purpose of the **variable capacitor** in a *times-ten* probe?
- (e) What is **flashover**?

### Question 3. (Waveform Analysers)

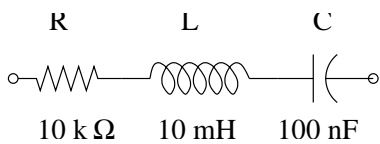
- (a) Draw a *block diagram* of a **spectrum analyser**, labelling all blocks.
- (b) **Wave analysers** measure what three (3) types of quantity?
- (c) Define **total harmonic distortion** (THD).
- (d) Describe how a **distortion analyser** works.
- (e) Name five (5) instruments contained in an **audio analyser**.

**Question 4. (Untuned Amplifiers)**

- (a) Define **frequency response**.
- (b) What is **intermodulation distortion (IMD)**?
- (c) Define **slew rate**.
- (d) What is **full-power bandwidth**?
- (e) Define **input offset voltage**.

**Question 5. (Tuned RF Circuits)**

- (a) Define **tuned circuit**.
- (b) What is a **notch filter**?
- (c) **Calculate** the total (complex) **impedance** of this RLC series resonant tank circuit at an angular frequency  $\omega = 1000$  radians per second:



- (d) Give the **formula** (from the notes) for the **bandwidth** of a *tank* circuit.
- (e) In a *tuned transformer*, there is a *magnetic coupling* between the *primary* and *secondary* windings.
  - (i) If this coupling is *large*, what effect does it have on the **Q** of the tuned transformer?
  - (ii) What happens to the shape of the transformer's **frequency response** curve if the coupling is *very large*?

Author: Geoffrey Tobin: Tuesday 2 October 2007.