MEE210 ELECTRICAL MACHINES – Experiment #3

LABORATORY CONTENT: Mutual inductance
EQUIPMENT REQUIRED: (students should bring electronic components)

Qty	Description
1	Voltage supply (will be ready at lab.)
1	Oscilloscope (will be ready at lab.)
1	Iron cylinder/rod/ (ferromagnetic material)
1	Plastic pulley (empty inside) (iron rod should get inside the empty part)
1	Amperemeters (you should bring your own amperemeter)(one amperemeter is used from voltage source)
-	Wiring equipments (jumper cables, crocodiles, etc.)

CAUTION:
This experiment includes health and security threats with careless actions. Be cautious about the isolation and the heating problem (doubling the current increases the heat four times, tripling increases nine times!).

PRELIMINARY QUESTIONS:
1) Wrap a coil onto the plastic pulley. Wrap another coil next to it. Note number of turns of the first coil and the second coil.
2) Write down the general mutual inductance equation for the system.

EXERCISE STEPS:
1) Measure the resistance values of each coils

R_1 (Ω)	R_2 (Ω)

2) Apply AC voltage to primary side and read the voltage value in secondary side. (do not forget that the signal generator also has a 50 Ω internal resistor.

V_1 (V)	V_2 (V)

3) Read the current values and fill in the table below for different frequencies.
4) Insert the iron rod into the pulley and repeat the steps.
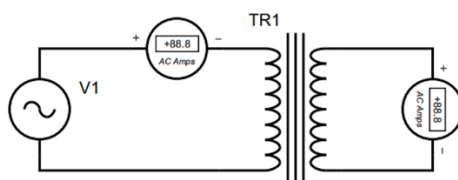
Frequency (Hz)	Air core		Iron core	
	Primary current (A)	Secondary current (A)	Primary current (A)	Secondary current (A)

POSTLIMINARY QUESTIONS:
1) Calculate the self-inductance of each coil with ironcore with the general formula given below (just find an approximate value)

$$L = \frac{\mu_0 \mu_r N^2 A}{l}$$

2) What is the mutual inductance? (for iron-core and just for one condition with iron core)

$$\frac{V_1}{V_2} = \frac{M}{L_1}$$

3) What is the coupling coefficient?

$$M = k\sqrt{L_1 L_2}$$

4) Comment about the relationship of the core material, current and the frequency?

 IMPORTANT NOTE: For the next experiment, you need to build up some contents. So, the ones who are not prepared for the experiment will not be allowed to participate.