CORK INSTITUTE OF TECHNOLOGY

INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Semester 2 Examinations 2007/08

Module Title: Electrical Principles 2

Module Code: ELTR 6008

School: Electrical & Electronic Engineering

Programme Title:
Bachelor of Engineering (Honours) in Electronic Engineering – Stage 1

Programme Code: EELXE_8_Y1

External Examiner(s): Prof. G. Hurley
Dr. S. Foley

Internal Examiner(s): Dr. M. Cranitch

Instructions: Answer Question 1 and two other questions.

Duration: 2 Hours

Sitting: Summer 2008

Requirements for this examination:

Note to Candidates: Please check the Programme Title and the Module Title to ensure that you have received the correct examination paper.

If in doubt please contact an Invigilator.

Q1. (a) In comparing the relative merits of ac and dc power supplies, outline the advantages of each. **[5 Marks]**

(b) State the equations for both inductive reactance (X_L) and capacitive reactance (X_C). In each case, sketch the curve of reactance versus frequency. **[10 Marks]**

(c) Explain what is meant by 'admittance'. Using this concept and its associated terminology, state the equation for two impedances in parallel. **[5 Marks]**

(d) Define the term 'power factor' as applied to an ac circuit. Indicate what the ideal value of this circuit parameter should be. **[5 Marks]**

(e) State (i) Thevenin's theorem, and (ii) Norton's theorem. In each case, draw the diagram of the appropriate equivalent circuit. **[10 Marks]**

(f) Explain the maximum power transfer theorem. Outline an 'everyday' example in which this theorem applies. **[10 Marks]**

(g) A step-down transformer (5kV to 250V), which has 60 turns in the secondary coil, delivers a current of 50A. Neglecting losses, calculate (i) the number of primary turns, and (ii) the primary current. **[5 Marks]**

Q.2 A series RLC circuit, consisting of R=5.6kΩ, L=10mH, C=470pF, is connected to an ac supply of 24V at a frequency of 100kHz.

(i) Calculate the impedances of the reactive components. **[6 Marks]**

(ii) Determine the total impedance in both rectangular and polar forms. **[8 Marks]**

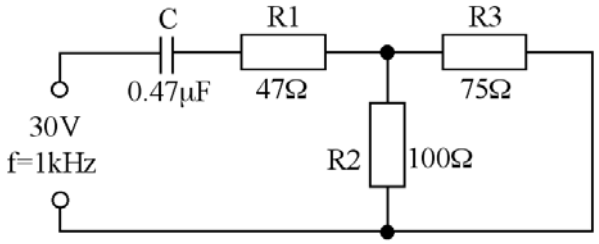
(iii) Indictate whether the circuit is inductive or capacitive, and explain why. **[5 Marks]**

(iv) Calculate the input current, and hence the voltage across the resistor R. **[6 Marks]**

Q.3 (a) With reference to an ac circuit, state the respective mathematical equations for (i) real power (P), and (ii) reactive power (Q). What is the phase relationship between voltage and current in each case? **[10 Marks]**

(b) For the circuit in the following diagram, determine (i) the magnitude and phase angle of the total impedance, (ii) the real power, (iii) the reactive power, and (iv) the power factor.

[15 Marks]



Q.4 (a) Sketch the current/frequency response for a series RLC circuit, and derive the formula for the resonant frequency, $f_o = \frac{1}{2\pi\sqrt{LC}}$. **[7 Marks]**

(b) Explain the terms 'Q-factor' and '3dB bandwidth' with reference to a resonant circuit. **[6 Marks]**

(c) For a series RLC circuit with R=0.6Ω, L=22μH and C=8nF, calculate (i) the resonant frequency, (ii) the Q-factor at resonance, and (iii) the 3dB bandwidth. **[12 Marks]**