UNIVERSITY OF DUBLIN

TRINITY COLLEGE

Faculty of Engineering and Systems Sciences

Department of Computer Science

B.A.(Mod.) Computer Science
Junior Freshman Examination

Trinity Term 2011

CS1025, CS1031 – Electrotechnology and Telecommunications

Dr. Eamonn O Nuallain

Monday 9th May 2011 **Upper Luce Hall** **14:00 – 17:00**

Instructions

(i) This paper is divided into two sections, Section A and Section B. There are THREE questions in each section.

(ii) TWO questions must be attempted from each section.

(iii) Answers from Sections A and B must be kept in separate answer books.

(iv) A total of FOUR questions should be attempted.

(v) All questions carry equal marks.

(vi) Use of non-programmable calculators and log-tables is permitted.
You must note the make and model of your calculator on your answer book.

Section A

Q1.

State Coulomb's Law.

(2 Marks)

Given a point charge of 100pC at the origin, find the potential difference between points *a* and *b* at distances 2m and 5m respectively along the x-axis. You may take the permittivity of free space to be 8.854×10^{-12} F/m.

(10 Marks)

State the Law of Faraday and Lenz. (3 Marks)

Calculate the E.M.F. generated in the axle of a car travelling at 50km/h where the length of the axle is 2.5M and the vertical component of the earth's magnetic field is 40μT.

(10 Marks)

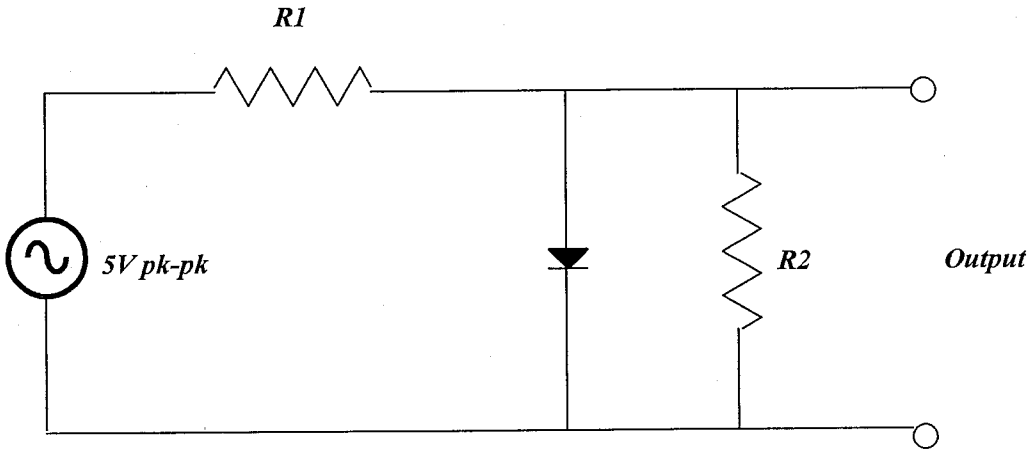
Q2.

Sketch the characteristic curve of the semiconductor diode. Explain the operation of the semiconductor diode with reference to this sketch.

(15 Marks)

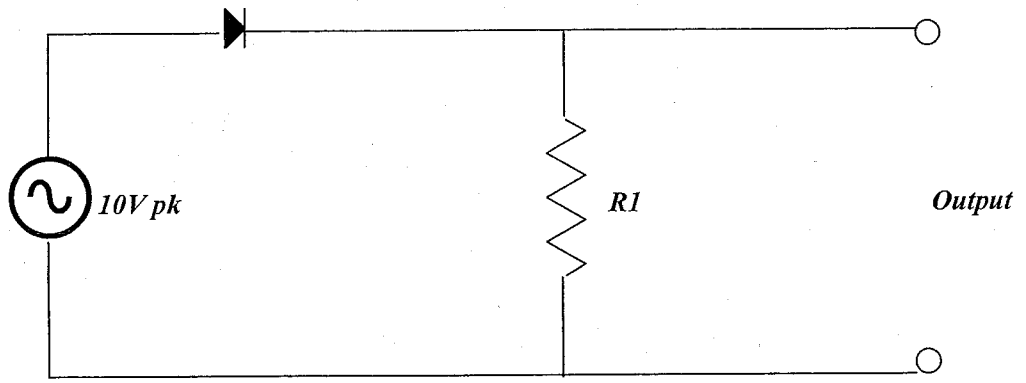
Assuming ideal sources and components (forward voltage drop of diode ~ 0V), sketch the outputs of the following circuits:

(i)



(5 Marks)

(ii)



(5 Marks)

Q3

With reference to the circuit below, where V1=5V, V2=10V determine:

(i) The impedance as 'seen' by the supply in the leftmost branch (V1).

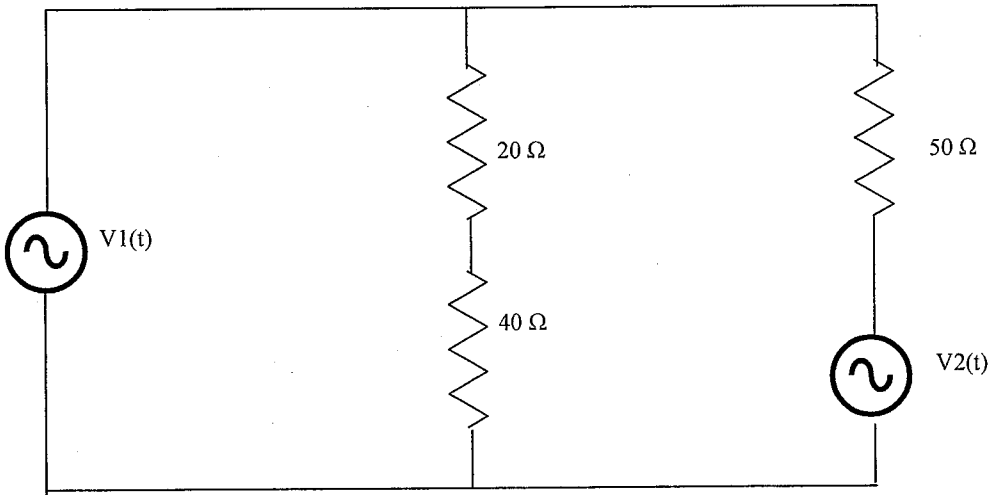
(ii) The current drawn from the supply in the leftmost branch (V1).

(iii) The impedance as 'seen' by the supply in the rightmost branch (V2).

(iv) The current in the rightmost branch

(v) The current in the centre branch.

(5 X 5 Marks)



Section B

Q4.

Find and plot the Fourrier Series representation for the following periodic function:

$$f(\theta) = A;\ 0 \leq \theta \leq \pi$$

$$f(\theta) = -A;\ -\pi < \theta < 0$$

$$A \in \mathcal{R}$$

(20 Marks)

Explain how your plot ought to be interpreted. (5 Marks)

Q4.

Explain what you understand by the following analog-to-analog and digital-to-analog modulation schemes:

(i) Amplitude Modulation (AM)
(ii) Frequency Modulation (FM)
(iii) Amplitude Shift Keying (ASK)
(iv) Frequency Shift Keying (FSK)
(v) Phase Shift Keying (PSK)

Use diagrams to illustrate your answers.

(5 X 5 Marks)

Q6.

Distinguish between Unipolar, Polar and Bipolar digital encoding.

(10 Marks)

Explain what you understand by the following digital-to-digital encoding schemes:

(i) Return to Zero (RZ)
(ii) Non-Return to Zero (NRZ)
(iii) Biphase

Use diagrams to illustrate your answers.

(3 X 5 Marks)