UNIVERSITY OF DUBLIN

TRINITY COLLEGE

Faculty of Engineering, Mathematics & Science
School of Computer Science & Statistics

B.A.(Mod.) Computer Science **Trinity Term 2009**
Junior Freshman Examination

1BA5 Electrotechnology

Thursday 4th June 2009 Goldsmith Hall 14:00 - 17:00

Dr Eamonn O'Nullain

Instructions to Candidates:

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

TWO questions must be attempted from each section.

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

A total of FOUR questions must be answered for full marks.

All questions carry equal marks.

Materials permitted for this examination:

Use of non-programmable calculators and log tables is permitted.

Section A

1.

(i.) State the Law of Faraday and Lenz

(3 Marks)

(ii.) A magnetic flux of 400μWb threading a coil of 1200 turns is reversed in 0.1s. Calculate the average value of the E.M.F. induced in the coil.

(11 Marks)

(iii.) Calculate the E.M.F. generated in the axle of a car travelling at 80km/h where the length of the axle is 2.0M and the vertical component of the earth's magnetic field is 40μT.

(11 Marks)

2. 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:

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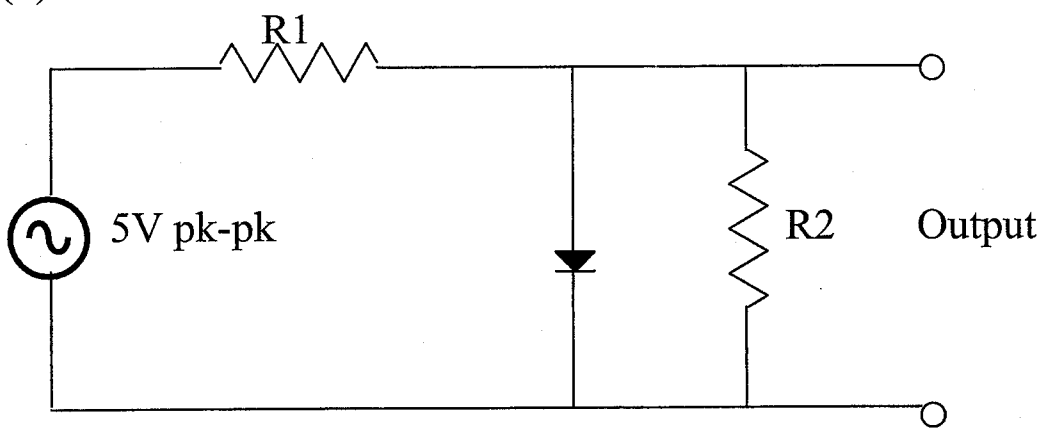
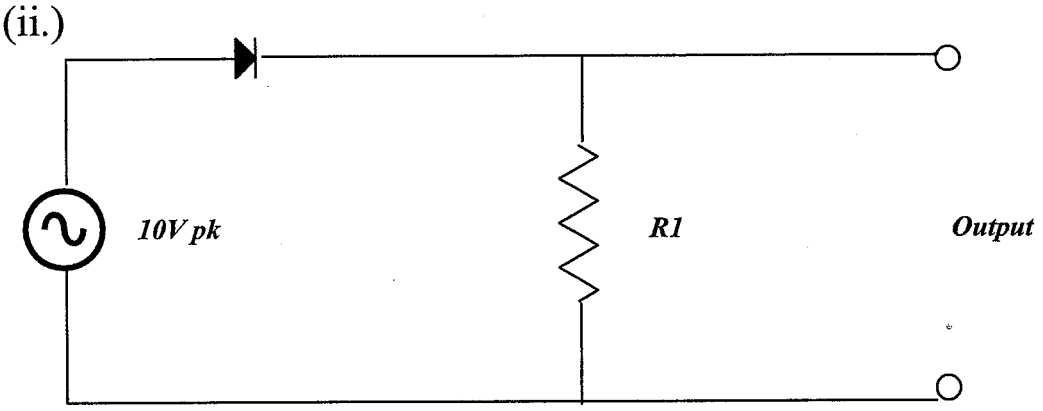
(i.)



(5 Marks)

(ii.)



(5 Marks)

3. Where V1(t)=5V, V2(t)=10V determine:

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

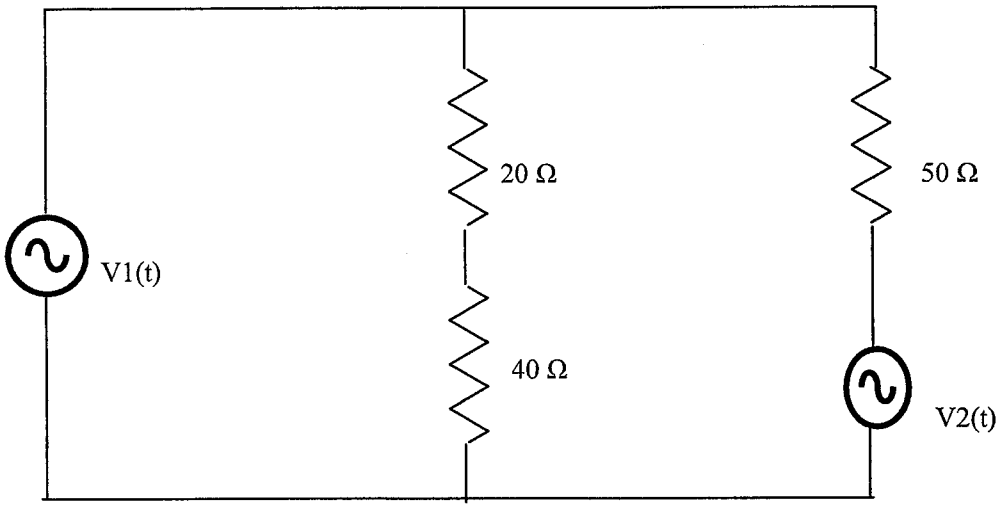
(ii.) The current drawn from the supply in the leftmost branch (V1).

(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

4. 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)

5. Explain what you understand by Frequency Division Multiplexing.

(10 marks)

Use this concept to illustrate the possible operation of a simple multi-user telecommunications system.

(15 Marks)

Illustrate both your answers with diagrams.

6. Given the following relationship, illustrate and discuss the significance of the bilateral exchange between signal power and bandwidth:

$$SNR_2 \approx SNR_1^{B_1/B_2}$$

B_x is the signal bandwidth where the signal-to-noise ratio is SNR_x

(25 marks)