UNIVERSITY OF DUBLIN

TRINITY COLLEGE

Faculty of Engineering and Systems Sciences

Department of Computer Science

Integrated Computer Science Programme
Junior Freshman Examination
Trinity Term 2012

CS1025, CS1031 – Electrotechnology and Telecommunications

Tuesday 8th May 2012	Drawing Office	14:00 – 17:00
	Museum Building	

Dr. Eamonn O Nuallain

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)

Determine the resultant force acting on a point charge of -2.0×10^{-6} C situated at the origin of a rectangular coordinate system in the vicinity of point charges 3.0×10^{-6} C and -4.0×10^{-6} C at distances 0.12 m along the positive x-axis and 0.08m along the half-line y=x where x, y ≤0 respectively.

(10Marks)

Define Electric Field Strength.

(3 Marks)

Compute the Electric Field Strength midway between two point charges of 30 μC and 40μC when the charges are placed 10cm apart in air.
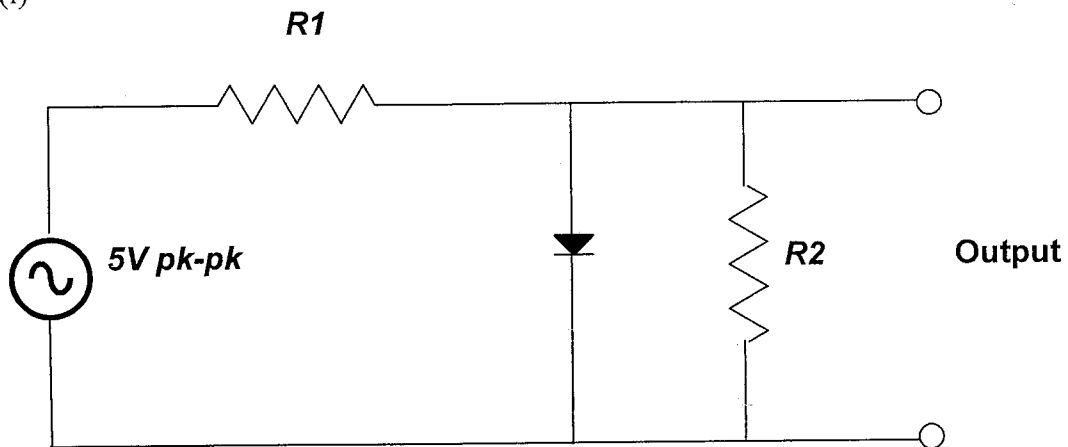
(10 Marks)

Q2.

Sketch the characteristic curve of the semiconductor diode. Explain the operation of the semiconductor diode with reference to this sketch.
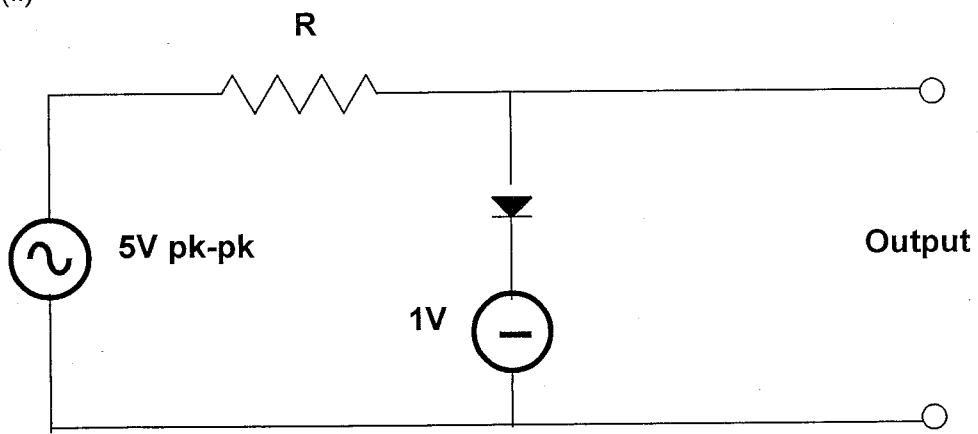
(10 Marks)

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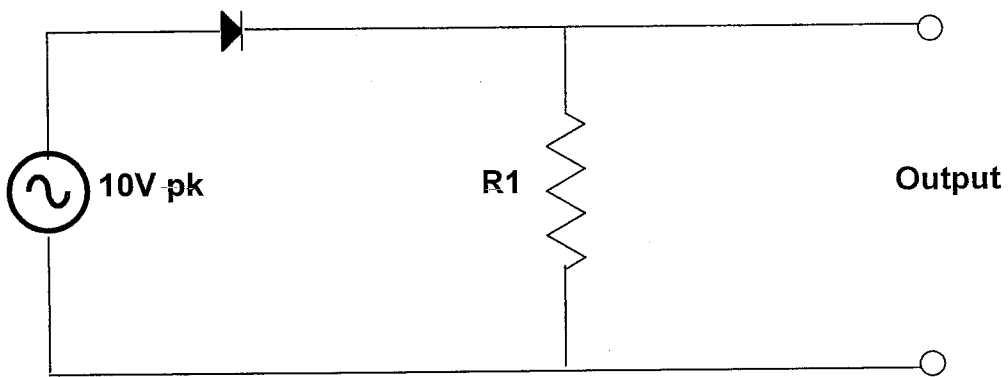
(i)

(5 Marks)

(ii)

R

5V pk-pk

1V

Output

(5 Marks)

(iii)

10V pk

R1

Output
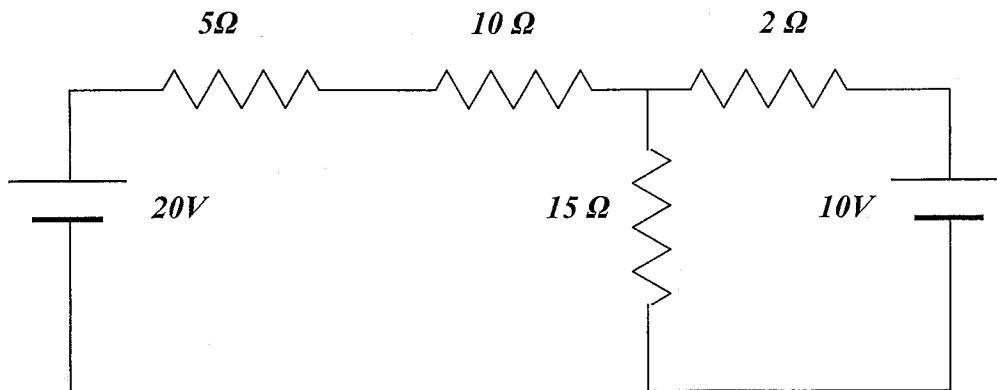
(5 Marks)

Q3

Using the Principle of Superposition determine the current flowing in the 10 Ω resistor. The batteries have an internal resistance of 2Ω each (these must be taken into account).

(25 Marks)

Section B

Q4.

Explain fully what you understand by the following modulation schemes:

    (i)   Amplitude Modulation (AM)
    (ii) Frequency Modulation (FM)
    (iii) Phase Shift Keying (PSK)
    (iv) Quadrature Amplitude Modulation (QAM)

Your answers should refer to both the time and frequency domains.
Use diagrams to illustrate all of your answers.

(4 X 5 Marks)

What are the relative advantages and disadvantages of these modulation schemes?

(5 Marks)

Q5.

Describe Alternate Mark Inversion and Pseudoternary Encoding. What are the major drawbacks of these schemes? Describe how these can be countered.

(15 Marks)

Describe Multiline and Block Encoding. What are the advantages and disadvantages of each?

(2 X 5 Marks)

Use diagrams to illustrate all of your answers.

Q6.

Describe the construction and operation of Shielded Twisted Pair, Coaxial and Optical Fibre cabling. Use diagrams to illustrate all of your answers.

(15 Marks)

We have a channel with a 1-MHz bandwidth. The SNR for this channel is 63. What is the appropriate bit rate and number of signal levels?

(10 Marks)

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