UNIVERSITY OF DUBLIN

TRINITY COLLEGE

Faculty of Engineering, Mathematics and Science

School of Computer Science and Statistics

B.A. (Mod.) Computer Science   Trinity Term 2010
Junior Freshman Examination

CS1025/CS1031 Electrotechnology/Telecommunications

Tuesday 4th May 2010   RDS-Main   14.00 – 17.00

Dr. Eamonn O Nuallain

Instructions

(i)   This paper is divided into two sections, namely 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 must be answered for full marks.

(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.

(i) State Coulombs Law. (3 Marks)

Given a point charge of 500pC at the origin, find the potential difference between points a and b at distances 5m and 15m respectively along the x axis. (10 Marks)

(ii) State Ampere's Law for an infinite, straight current carrying wire. (2 Marks)

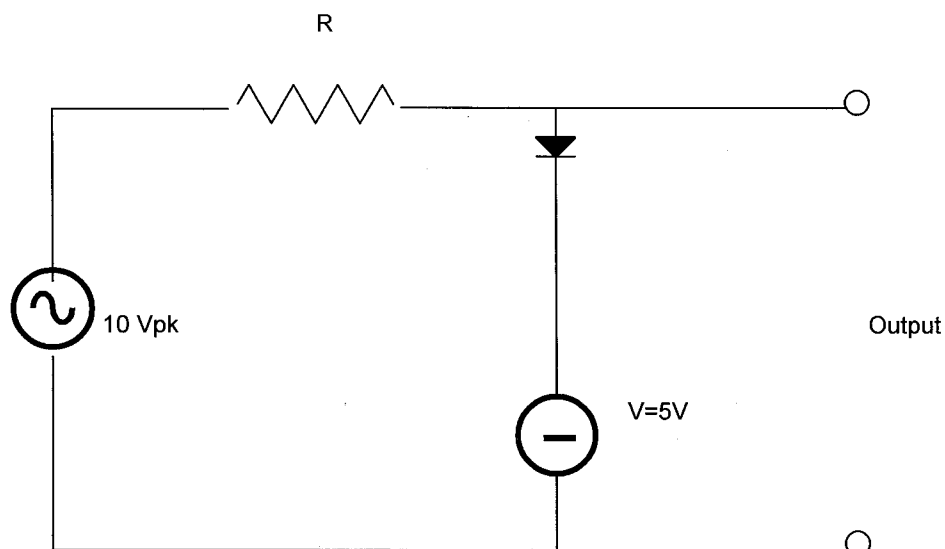There exists an infinite straight wire carrying a current of 5.0A in the $\hat{a}_y$ direction at x = 2m, z = -2m. Find the magnetic field strength at the origin. (10 Marks)
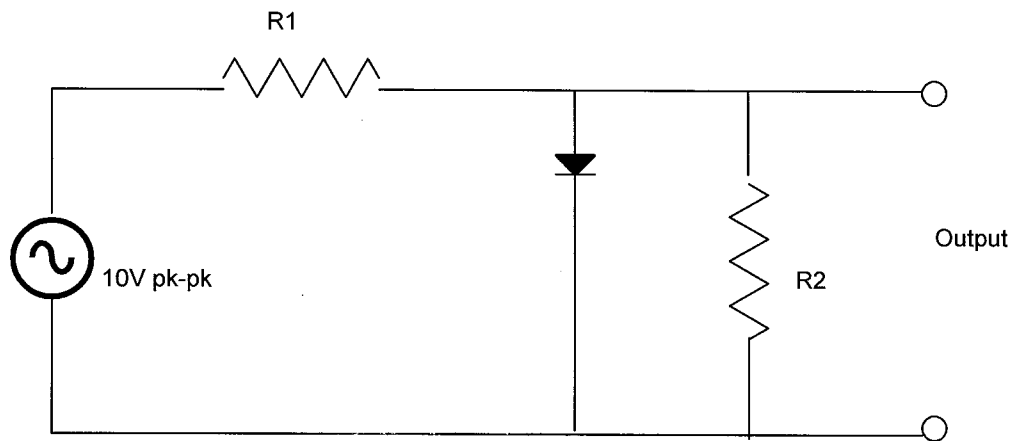
Q2.

Assuming ideal circuit components (forward voltage drop of diode ~ 0V) and supplies, sketch the output voltage waveforms of the following circuits:

(i)

(5 Marks)
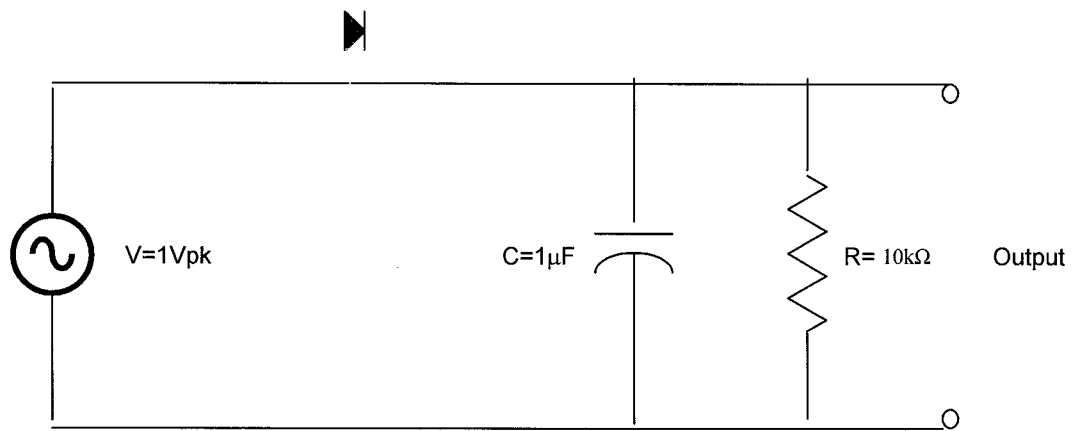
(ii)

R1

10V pk-pk

Output

R2

(5 Marks)

(iii)

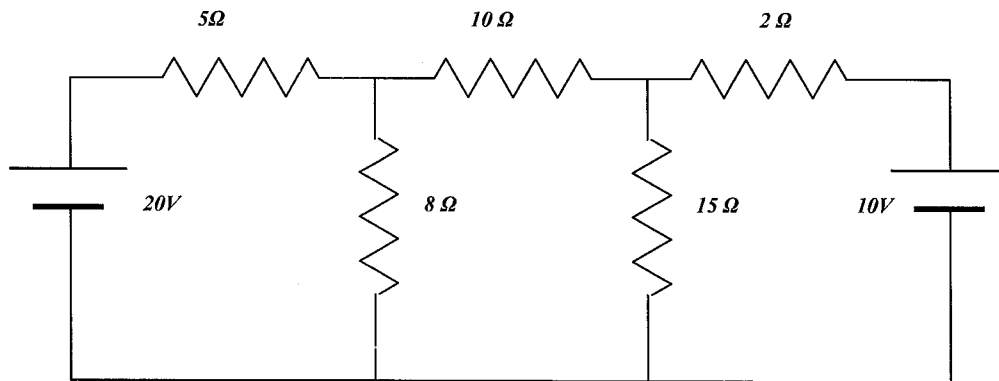V=1Vpk

C=1μF

R= 10kΩ

Output

(5 Marks)

For this latter circuit, (iii), sketch (approximately) the output where the value of the capacitor is increased and decreased.

(2 X 5 Marks)

Q3. Find the current in the 10Ω resistor using the Principle of Superposition:

(25 Marks)

Section B

Q4.

Explain the purpose of obtaining the Fourrier Series of a periodic function.   (5 Marks)

Calculate the Fourrier Series of the following periodic function:

$$f(t)= \begin{cases} 0; & -0.2 \le t < -0.1 \\ \cos(5\pi t); & -0.1 \le t \le 0.1 \\ 0; & 0.1 < t < 0.2 \end{cases}$$

(15 Marks)

Plot the amplitude spectrum and comment on your result.   (5 Marks)

Q5.

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

(i) Amplitude Modulation (AM)

(ii) Frequency Modulation (FM)

Illustrate your answers with diagrams. Your answers should refer to both the time and frequency domains.

(2 X 10 Marks)

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

(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)