NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

BACHELOR OF COMMERCE HONOURS DEGREE

QUANTITATIVE ANALYSIS FOR BUSINESS 1 – CIN 1106

NOVEMBER/DECEMBER 2005 FIRST SEMESTER EXAMINATION

INSTRUCTIONS TO CANDIDATES

1. Answer all questions in Section A.
2. Choose and answer 6 questions including question 8, in Section B.
3. Graph paper will be provided on request.
4. Statistical tables will be provided on request.
5. You may use a non-programmable Scientific calculator.

QUESTION 1(COMPULSORY) (30 marks)

a) Define the terms:

i) Index number
ii) Annuity
iii) Ordinary Annuity Certain
iv) Marginal Revenue **[8 marks]**

b) Show using derivatives, that **marginal revenue** is equal to **marginal cost** when profit is maximum. **[4 marks]**

c) Show, using derivatives, that **marginal cost** is equal to **average cost** and **marginal revenue** when profit is maximum or when cost is minimum. **[4 marks]**

d) A manufacturer makes two products, product 1 and product 2. One unit of product 1 requires 5 parts of type **A,** and 3 parts of type **B.** One unit of product 2 requires 4 type **A** parts, 6 type **B** parts and 7 type **C** parts.

i) use a 2x3 matrix, **P,** to depict the information. **[2 marks]**

ii) Verify that $[\mathbf{P}^t]^t = \mathbf{P}$, where **P** is the 2x3 matrix in i) above. **[2 marks]**

e) Given:

$$\mathbf{A}= \begin{bmatrix} ab & b^2 \\ -a^2 & -ab \end{bmatrix}$$

What is $\mathbf{A^2}$? **[4 marks]**

f) Demonstrate the effect of multiplying a 3rd order matrix by an identity matrix of the same order. **[2 marks]**

g) Find the present value of an ordinary annuity of $ 600 payable quarterly for 5 years at an interest rate of 16% per annum. **[2 marks]**

h) Find the future value of an ordinary annuity of $ 1 000 deposited monthly for 2 years, if the rate of interest is 17% per annum**.** **[2 marks]**

[Total: 30 marks]

SECTION B (CHOOSE AND ANSWER 6 QUESTIONS, INCLUDING QUESTION 8) (70 MARKS)

QUESTION TWO

Akim's shop produces 2 types of citizen's s-band radios, model B and model C. Each radio must be processed on each of 2 assembly lines. Processing times required are as follows:

	Model B	**Model C**
Assembly line 1	5 hours	4 hours
Assembly line 2	2, 5 hours	6 hours

Assembly line 1 will be available for 40 hours each week but, because of maintenance requirements, assembly line 2 will be available for only 36 hours. Model B radio yields a revenue contribution of $ 80 per unit sold, while model C yields a revenue contribution of $ 60 per unit sold. The manufacturing cost per radio is $15 and $10 for model B and and model C respectively. Demand for radios far exceeds the production capacity of the plant. How many units of each model should Akim's shop produce in order to maximize profit contribution? Formulate a Linear Programming Model that can aid in this decision-making process and solve it using the SIMPLEX method.

[10 marks]

QUESTION THREE

Using the Gaussian method, solve the following system of equations:

$$2x + 6y - z = 18$$
$$y + 3z = 9$$
$$3x - 5y + 8z = 4$$

[10 marks]

QUESTION FOUR

	1996		**1998**	
	SALES ($)	QUANTITY (Kg)	SALES	QUANTITY
RICE	12 000	25	18 000	15
SUGAR	24 000	30	37 000	24
SALT	2 700	6	6 500	6

(1996=100)

Calculate :

i) The price relative for sugar and interpret your answer. **[2 marks]**
ii) Fischer's Ideal Index. **[8 marks]**

QUESTION FIVE

A firm estimates that the number 'N' of units of a product sold after spending 'x' dollars on advertising is given by $N(x) = -0{,}1x^2 + 200x + 60$.

i) How many units are sold when $ 500 is spent on advertising?
ii) What is the instantaneous rate of change of the number of units sold with respect to the amount spent on advertising?
iii) What is the instantaneous rate of change in sales at x = 900; at x = 1 000? **[10 marks]**

QUESTION SIX

Jason invested a total of $ 10 000 in 3 different savings accounts. The accounts paid simple interest at an annual rate of 8%, 9% and 7,5% respectively. Total interest earned for the year was $ 845. The amount in the 9% account was twice the amount invested in the 7,5% account. How much did Jason invest in each account? **[10 marks]**

QUESTION SEVEN

You borrow $ 30 000 from the bank for purposes of paying for your post-graduate project. If interest is charged at the rate of 16% per annum compounded half yearly and the loan is for a period of four(4) years,

a) Calculate the regular payment, R. **[2 marks]**
b) Construct the relevant amortization schedule. **[6 marks]**
c) How much is outstanding after the 6^{th} payment? **[1 mark]**
d) What are the interest and capital portions of the 5^{th} payment? **[1 mark]**

QUESTION EIGHT (compulsory)

A company sells soft drinks and snacks through vending machines located in different public buildings. Presently the company has 9 soft drink-vending machines and 6 snack-vending machines in different locations throughout the municipal air terminal. The daily revenue, in dollars, received from these machines is given by:

$f(x,y) = 20\sqrt{x} + 3y^2 + 15xy + e^{x2/y2}$

where x is the number of soft drink vending machines and y is the number of snack vending machines in one building.

How much additional revenue will be generated if one additional soft drink vending machine but no additional snack-vending machines are installed at the terminal?

How much additional revenue will be generated if one additional snack-vending machine and no additional soft drink-vending machine were installed at the terminal? **[10 marks]**

END OF EXAMINATION