TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF BUSINESS

DEPARTMENT OF MANAGEMENT SCIENCE

UNIVERSITY EXAMINATION FOR:

BACHELOR OF BUSINESS AND OFFICE MANAGEMENT, BACHELOR OF BUSINESS INFORMATION TECHNOLOGY, BACHELOR OF COMMERCE, BACHELOR OF BUSINESS ADMINISTRATION.

BMS 4102: MANAGEMENT MATHEMATICS II

END OF SEMESTER EXAMINATION

SERIES:APRIL2016

TIME:2HOURS

DATE:20 May 2016

Instructions to Candidates

You should have the following for this examination

-*Answer Booklet, examination pass and student ID*

This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

QUESTION ONE

a) Given the following matrices:

$$A = \begin{bmatrix} 7 & 2 \\ 3 & 1 \end{bmatrix} \qquad B = \begin{bmatrix} 4 & 6 \\ 5 & 8 \end{bmatrix}$$

Find i) A+B ii) A-3B iii) $B^T.A$ (5 marks)

b) Find the derivatives of the following functions using appropriate rules of differentiation.

i. $y = (x^3 + 7x)(x^4 - x^2 + 3)$ (3 marks)

ii. $y=(x^3+6x^2+9)^4$ (3 marks)

c) A cargo plane has three compartments for storing cargo: front, center, and back. These compartments have capacity limits on both weight and space, as summarized below:

Compartment	**Weight Capacity (Tons)**	**Space Capacity (Cubic Feet)**
Front	12	7,000
Center	18	9,000
Back	10	5,000

The following four cargoes have been offered for shipment on an upcoming flight as space is available:

Cargo	**Weight (Tons)**	**Volume (Cubic Feet/Ton)**	**Profit (Kshs / Ton)**
1	20	500	320
2	16	700	400
3	25	600	360
4	13	400	290

Any portion of these cargoes can be accepted. The objective is to determine how much (if any) of each cargo should be accepted to maximize the total profit for the flight.

Required:

Formulate (but do not solve) a linear programming model for this problem (4marks)

d) Find x and y using Cramer's rule from the following set of simultaneous equations.

$$5x+3y=1$$
$$2x-3y=-8$$

(4marks)

e) Determine the derivative of the function y = f(x) = $2x^2$ using the first principles method. (5 marks)

(f) A firm's Marginal cost function is given by $MC = 180 + 0.3q^2$ while marginal revenue is given by $MR = 540 - 0.6q^2$ where q is total quantity produced and sold. Fixed costs are shs 800.

(i) Determine the number of units that maximizes profit. (3 marks)

(ii) Determine the maximum profit . (3 marks)

QUESTION TWO

a) A manufacturer of furniture makes two products – chairs and tables. Processing of this product is done on two machines A and B. A chair requires 2 hours on machine A and 6 hours on machine B. A table requires 5 hours on machine A and no time on machine B. There are 16 hours of time per day available on machine A and 30 hours on machine B. Profit gained by the manufacturer from a chair and a table is Kshs. 2 and Kshs. 10 respectively. What should be the daily production of each of two products? (Hint: formulate and solve graphically) (12 marks)

b) When do the following situations arise?

i. Multiple optimal solution
ii. Degenerate condition
iii. Unbounded Solution
iv. An extreme point (8 marks)

QUESTION THREE

(a) Differentiate the following functions:

i. $\frac{2Cos3x}{x^3}$ (4 marks)

ii. $\frac{(3x^2 - 5)}{1 - x^3}$ (4 marks)

(b) Integrate the following functions:

i. $\int (12x + 24x^2)\ dx$ (2marks)

ii. $\int (48x - 0.4x^{-1.4})\, dx$ (2marks)

iii. $\int 3\ Cos\ 2x$ (2marks)

iv. $\int 5e^{3x}$ (2marks)

(c) Find the inverse matrix A^{-1} for $A = \begin{bmatrix} 20 & 5 \\ 6 & 2 \end{bmatrix}$ using the matrix of cofactors. (4 marks)

Question FOUR

A book vendor sold 5 Statistics books, 10 Mathematics books and 6 Economics books for Sh.240 to Technical University of Mombasa. The Vendor sold 7 statistics books, 12 Mathematics books and 3 Economics books for Sh.314 to Mombasa Technical Training Institute. The Vendor also sold 4 statistics books, 9 Mathematics books and 5 Economics books for Sh.203 to Pwani University.

Required:

(a) Formulate three simultaneous equations to represent the above problem. (6 marks)

(b) i) Write the equations in Matrix form. (3 marks)

ii) Determine the cofactor matrix of the coefficients matrix. (3 marks)

iii) Evaluate the determinant of the coefficients matrix. (2 marks)

iv) Determine the adjoint of the coefficients matrix. (1 mark)

v) Find the inverse of the coefficients matrix. (2 marks)

vi) Use the inverse obtained in (V) above to solve the simultaneous equations. (3 marks)

Question FIVE

(a) Find the area under graph of $f(x) = 4x^3 - 3x^2 + 4x + 2$ between x=1 and x=3. (4 marks)

(b) A manufactures marginal cost function is given by $\frac{dc}{dq} = 0.006q^2 - 0.8q + 80$ where *c* and *q* are total cost of production and quantity produced respectively. Fixed costs are Sh.40,000.

Required:

(i) Determine the total cost function. (3 marks)
(ii) Determine the cost involved to increase production from 90 to 150 units. (3 marks)

c) Consider the function $f(x) = \frac{x^3}{3} - \frac{x^2}{2} - 2x + 2.$

Determine the following:

(i) The derivative of *f(x).* (2 marks)

(ii) The *x* and *y* coordinates of all critical points. (4 marks)

(iii) Use the second derivative test to classify each critical point as a maximum, minimum or point of inflexion. (4 marks)