UNIVERSITY EXAMINATIONS 2016/2017

EXAMINATION FOR THE DEGREE OF BACHELOR OF COMMERCE AND BACHELOR OF BUSINESS ADMINISTRATION

YEAR I – 2ND SEMESTER 2016/2017 ACADEMIC YEAR

BMS 4102: MANAGEMENT MATHEMATICS II

END OF SEMESTER EXAMINATIONS

SERIES: JULY 2017

DATE: JULY 2017 **DURATION: 2 HOURS**

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO

QUESTION ONE

(a) Determine the coordinates and nature of any turning points on the curve represented by the function $y = x^3 - 7.5x^2 + 18x + 6$ **(6 marks)**

(b) The total revenue obtained (in \$000) from selling x hundred items in a particular day is given by, which a function of variable x.

Given that $\frac{dR}{dx} = 20 - 4x$

(i) Determine the total revenue function **(5 marks)**

(ii) Find the number of items sold in one day that will maximize the total revenue and evaluate this total revenue **(6 marks)**

(c) Use Cramer's rule for a 3x3 system to solve the following system of equations

$$2X - Y + 6Z = 10$$

$$-3X + 4Y - 5Z = 11$$

$$8X - 7Y - 9Z = 12$$

(13 marks)

QUESTION TWO

(a) Evaluate the inverse of matrix $A = \begin{pmatrix} -2 & 1 & 4 \\ 3 & -2 & 5 \\ 0 & 1 & 3 \end{pmatrix}$ **(8 marks)**

(b) An Economy has three commodities categories:- Agriculture, Manufacturing, and Transportation, all in appropriate units. Production of 1 unit of agriculture requires 0.5 unit of manufacturing and 0.25 unit of transportation; production of 1 unit of manufacturing requires 0.25 unit of agriculture and 0.25 unit of transportation and production of 1 unit of transportation requires 0.33 unit of agriculture and 0.25 unit of manufacturing. Find, using matrix algebra $\underline{X} = \left(\underline{I} - \underline{A}\right)^{-1} \underline{D}$, the production that will satisfy a demand of 500 units of agriculture, 1000 units of manufacturing and 1000 units of transportation. **(12 marks)**

QUESTION THREE

(a) Differentiate from the first principles if $y = 16x + \frac{1}{x^2}$ and find the value of x where the gradient is zero. **(6 marks)**

(b) Determine the coordinates and nature of any turning points on the curve represented by the function $y = 4x^3 - 3x^2 - 6x + 2$ **(6 marks)**

(c) A food processing plant has a particular problem with the delivery and processing of perishable goods with a short life. All deliveries must be processed in a single day and, although there are a number of processing machines available, they are very expensive to run. A researcher has developed the function $y = 12x - 2a - ax^2$ to describe the profit (y, in kshs 00) given the number of machines used (x) and the number of deliveries (a) in a day.

(i) Show that the system is uneconomic if 4 deliveries are made in one day (i.e. a = 4).

(4 marks)

(ii) If three deliveries are made in one day, find the number of processing machines that should be used in order that the profit is maximized. In this case, what is the maximum profit?

(4 marks)

QUESTION FOUR

(a)(i.) $\int\left(3x^2-4x\right)dx$ **(3 marks)**

(ii.) For a particular function, $\frac{dy}{dx}=4x-3$**.** If it is known that when x = 1, y = 5, find y in terms of x. **(3 marks)**

(b) A refrigerator manufacturer can sell all the refrigerators of a particular type that he can produce. The total cost (kshs) of producing *q* refrigerators per week is given by 300*q* +2000. The demand function (kshs) is estimated as 500 – 2*q*.

(i) Derive the revenue function, R. **(3 marks)**

(ii) Obtain the total profit function. **(3 marks)**

(iii) How many units per week should be produced in order to maximize profit? **(3 marks)**

(iv) Show that the solution of the equation $\frac{dR}{dq}=\frac{dC}{dq}$ where C represents the cost function, gives the same value for *q* as in (iii). **(3 marks)**

(v) What is the maximum profit available? **(2 marks)**

QUESTION FIVE

(a) Define the following terminology used in operations research

(i) Feasible solution **(3 marks)** (ii) Optimal solution **(3 marks)**

(b) A manufacturer is to market a new fertilizer which is to be a mixture of two ingredients A and B. The properties of the two ingredients are:

	Ingredient Analysis				
	Bone Meal	**Nitrogen**	**Lime**	**Phosphates**	**Cost/kg**
Ingredient A	20%	30%	40%	10 %	1.2
Ingredient B	40%	10%	45%	5%	0.8

It has been decided that

(a) the fertilizer will be sold in bags containing 100 kgs.

(b) it must contain at least 15% nitrogen.

(c) it must contain at least 8% phosphates

(d) it must contain at least 25% Bone Meal

The manufacturer wishes to meet the above requirements at the minimum cost possible.

(i) Express the problem in a standard manner **(5 marks)**

(ii) By drawing a graph, show the feasible region **(7 marks)**

(iii) From the graph, find the optimum solution. **(2 marks)**