TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Business and Social Studies

DEPARTMENT OF BUSINESS STUDIES

UNIVERSITY EXAMINATIONS FOR DEGREE IN

BACHELOR OF BUSINESS ADMINISTRATION

BACHELOR OF COMMERCE

BMS 4102: MANAGEMENT MATHEMATICS II

SPECIAL/SUPPLEMENTARY EXAMINATIONS

SERIES: MARCH 2015

TIME: 2 HOURS

INSTRUCTIONS:

- Answer Question **ONE (Compulsory)** and any other **TWO** questions.
- Do not write on the question paper

This paper consists of Six printed pages

QUESTION 1 (Compulsory)

a) Find the product C = AB when

$$A = \begin{bmatrix} 4 & 2 & 12 \\ 6 & 8 & 20 \\ 1 & 0 & 5 \end{bmatrix} \text{ and } B = \begin{bmatrix} 10 & 0.5 & 1 \\ 6 & 3 & 8 \\ 4 & 4 & 2 \end{bmatrix}$$

(2 marks)

b) Use cramer's rule to solve the following set of simultaneous equations:

$$5x_1 + 0.4x_2 = 12$$
$$3x_1 + 3x_2 = 21$$

(3 marks)

c) Solve the matrix equation by finding the inverse

$$A = \begin{bmatrix} 3 & -4 \\ 9 & 2 \end{bmatrix}$$

(3 marks)

d) Solve the following system of equation using matrices:

$$x_1 + 2x_2 = 5$$
$$x_1 - x_3 = -15$$
$$-x_1 + 3x_2 + 2x_3 = 40$$

(5 marks)

e) Differentiate the following functions:

i) $Y = \frac{2x^2 + 3}{x}$ **(3 marks)**

ii) $Y = \frac{2}{(2t^3 - 5)^4}$ **(3 marks)**

iii) $Y = 2x^3 \cos 3x$ **(3 marks)**

iv) $Y = 10e^{5x^2 - 4x}$ **(2 marks)**

f) Find the following integrals

i) $\int (65 + 1.5x^{-2.5}. + 1.5x^2)\ dx$

ii) $\int 3x^4\ dx$

iii) $\int \frac{2}{x^2}\ dx$

g) A dietitian is planning the menu for the evening meal at a University dining hall. Three meals will be served all having different nutritional content. The dietitian is interested in providing at least the minimum daily requirement of each of the three vitamins in this one meal.

The table below summarizes the vitamin content per ounce of each type of foods, the cost per ounce of each food and the minimum daily requirements for the three vitamins. Any combinations of the three foods may be selected as the total serving size is at least 9 ounces.

	Vitamin			
Food	**1**	**2**	**3**	**Cost per oz**
1	50 mg	20 mg	10 mg	0.10
2	30mg	10 mg	50 mg	0.15
3	20mg	30 mg	20 mg	0.12
Minimum requirement	290mg	200 mg	210 mg	

The problem is to determine the number of ounces of each food to be included in the meal. The objective is to minimize the cost of each meal subject to satisfying minimum daily requirements of the three vitamins as well as restriction on minimum serving size.

Required:
Formulate the linear programming model for this problem. **(4 marks)**

QUESTION 2

a) Determine solution to the system of equations:

$$2x_1 + 3x_2 = 1$$
$$4x_1 + 7x_2 = 3$$

(2 marks)

b) Determine the inverse of the following matrices by using the matrix of co-factors approach:

i) $\begin{pmatrix} 3 & 7 \\ 2 & 5 \end{pmatrix}$ **(4 marks)**

ii) $\begin{pmatrix} 1 & -1 \\ -4 & 4 \end{pmatrix}$

c) Differentiate with respect to x

i) $\frac{x^6}{5} + \frac{x^5}{4} + x - 1$ **(1 mark)**

ii) $Y = \frac{x-1}{\sqrt{x+1}}$ **(2 marks)**

d) Minimize $z = 200x_1 + x_2 \geq 200$

Subject to:

$$x_1 + x_2 \geq 200$$
$$x_1 + 3x_2 \geq 400$$
$$x_1 + 2x_2 \leq 350$$

(4 marks)

e) Find the following derivative:

$y = x^2 e^x$ **(3 marks)**

f) Given a firm's marginal revenue function, find the total revenue function:

$MR = 360 - 2.5q$ **(2 marks)**

g) Integrate the following:

$\int e^{2x}\, dx$ **(2 marks)**

QUESTION 3

a) Find the matrix of co-factors for the following matrices:

$$\begin{pmatrix} 4 & 12 & -7 \\ 6 & 10 & 0 \\ 3 & -7 & 8 \end{pmatrix}$$ **(4 marks)**

b) A diet has to be decided to fulfill the daily requirements of proteins, fats and carbohydrates at the minimum cost. The choice is to be made from four different foods whose yields per unit are given below:

	Yield per unit			
Food	**Proteins**	**Fats**	**Carbohydrates**	**Cost/unit**
1	3	2	6	45
2	4	4	4	40
3	8	7	7	85
4	6	5	4	65
Minimum requirements	80	200	700	

Required:
Formulate the linear programming model for this problem. **(4 marks)**

c) Differentiate with respect to x:

i) $Y = \frac{1}{x^3}$ **(3 marks)**

ii) $Y = \frac{4}{\sqrt{x}}$ **(3 marks)**

d) Differentiate the following:

$Y = \frac{4}{3e^{5t}}$ **(2 marks)**

e) Find the following integrals

i) $\int 3\cos 2x \, dx$

ii) $\int 7\sin 3\Theta \, d\Theta$ **(4 marks)**

QUESTION 4

a) Given the matrix A

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & 4 & 0 \end{bmatrix} \; Show\ that\ Adj\ A = \begin{bmatrix} -12 & 4 & -1 \\ 3 & -1 & -1 \\ 7 & -4 & 1 \end{bmatrix}$$

Hence find A^{-1}

b) Differentiate the following functions:

i) $Y = (x^3 - 4x)\,(x^{1/2} - 1/2)$ **(3 marks)**

ii) $Y = \dfrac{2}{7e^{2x}}$ **(4 marks)**

c) Differentiate with respect to x

$Y = 3x^2 \ \sin\ 2x$ **(4 marks)**

d) Integrate the following functions:

i) $\int \frac{3}{2}\, dx$

ii) $\int \sqrt{2\,dx}$

iii) $\int 0\,dx$ **(3 marks)**

e) Identify the advantages of matrix algebra. **(3 marks)**

QUESTION 5

a) Solve for x and y by use of Cramer's rule

$4x + 2y = 2$

$3x - 5y = 21$ **(3 marks)**

b) Differentiate the following functions:

i) $Y = \sqrt{7x^4 - 5x - 9}$ **(3 marks)**

ii) $\dfrac{x^2}{1+x}$ **(3 marks)**

iii) $Y = \dfrac{3 - x^2}{\sqrt{x^2 - 6x + 2}}$ **(3 marks)**

c) Differentiate the following functions:

i) $Y = Ln(4x^2 - 16x)$ **(2 marks)**

ii) $f(t) = 2\cos(5t + 0.20)$ **(2 marks)**

iii) $\frac{f(t)}{dt} = 2\cos 3t$ **(2 marks)**

d) Integrate the following:

i) $\int 5x \, dx$

ii) $\int \frac{x^2}{2} \, dx$ **(2 marks)**