MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

SECOND YEAR ………. SEMESTER SPECIAL EXAMINATIONS FOR DEGREE IN

BACHELOR OF ECONOMICS

EES 200: MATHEMATICS FOR ECONOMISTS II

DATE: **TIME:**

INSTRUCTIONS TO CANDIDATES

Answer Question ONE and any other TWO questions

QUESTION ONE (COMPULSORY 30MARKS)

i. A firm is a monopolistic producer of two goods G_1 and G_2. The price are related to quantities Q_1 and Q_2 according to the demand equations:
$P_1 = 50-Q_1$
$P_2 = 95-3Q_2$
If the total cost function is $TC = Q_1^2+3Q_1Q_2+Q_2^2$

a) Find the values of Q_1 and Q_2 that maximize profits and deduce the corresponding prices and profit. (7 marks)

b) State whether the critical values of Q_1 and Q_2 give rise to a maximum or a minimum. (3 marks)

ii. Nyanza Industries Company limited operates two businesses: fish industry and sugar industry. To produce Kshs.l worth of output from fish sector requires 15 cents from the fish sector and 10 cents worth of input from the sugar sector. On the other hand, Kshs.l worth of output from the sugar sector requires 5 cents worth of input from the fish sector and 20 cents worth of input from the fish sector and 20 cents from the sugar sector itself. The external demand from the two sectors are estimated to be worth 150m and 200m for the fish and sugar sector respectively. What will be the required total output worth from the two sectors next year. (12 marks)

iii. Suppose a certain commodity has the following linear demand and supply functions:

When	P = Kshs.7500	q=1000 units
	P = Kshs.4625	q = 750 units
When	P = Kshs.2525	q = 100 units
	P = Kshs. 1525	q = 200 units

i) Find the equations for each function in the form of P = f(q) and identify which is the supply and demand functions. (5marks)

ii) Find the point of equilibrium (q, p). (3 marks)

QUESTION TWO (20 MARKS)

i. A competitive firm faces a price of 136 and a total cost function of TC = $7q^2$ -r6q + 5

a) What is the firm's marginal cost function. (2 marks)

b) What quantity should this firm produce? Leave your answer in fraction form (if necessary). (3 marks)

c) Calculate the profit. (2 marks)

ii. If Inverse Demand is P = 2-0.13Q, what is price elasticity if the price is 1.2. Is the demand elastic, inelastic or unit elastic. (3 marks)

iii. Julie is trying to make some bread and cake and uses an input requirement matrix to help her figure out how much she can make. An input requirement matrix represents how many inputs are needed to make one unit of different outputs. For example, the following matrix.

$$\begin{bmatrix} 4 & 3 \\ 4 & 2 \end{bmatrix}$$

says that it takes Julie 4 cups of flour and 4 cups of sugar to make one loaf of bread. Similarly it takes her 3 cups of flour and 2 cups of sugar to make 1 cake, (Julie is not a very good baker and therefore doesn't know the appropriate ratios).

If Julie has 42 units of flour and 36 units of sugar, how much bread and cake can she make? (5 marks)

iv. An individual values two goods. X and Y. according to the following utility function:

U=$X^{1/4}Y^{1/4}$

The price of X is P_x = 2.44 and the price of Y is P_y = 1.95. The individual has 39 dollars. How much X and Y should this individual buy? (Round answers to the nearest whole number). (5 marks)

QUESTION THREE (20 MARKS)

Given the matrix of technical coefficients, A and the final demand D, for industries 1,2 and 3.

$$A = \begin{bmatrix} 0.1 & 0.1 & 0 \\ 0.2 & 0.5 & 0.2 \\ 0.1 & 0.4 & 0.6 \end{bmatrix} \quad D = \begin{bmatrix} 120 \\ 200 \\ 700 \end{bmatrix}$$

Required: Determine $[1 - A]^{-1}$ and the total output required for each sector. (20 marks)

QUESTION FOUR (20 MARKS)

1. A firm produces and sells two commodities. By selling X tons of the first commodity the firm gets a price per ton given by P = 96-4X. By selling y tons of the other commodity the price per ton is given by q = 84-2y. The cost of producing and selling x tons of the first commodity and y tons of the second is given by

   $$C\ (x, y) = 2x^2 + 2\ xy + \ y^2$$

i) Find the critical values of x and y and the stationary value of profit π. (5 marks)

ii) Show that the critical values of X and Y give rise to a maximum value. (2 marks)

iii) Suppose that the production causes pollution and that the authorities for this reason require the firm to produce only 11 tons. Verify that profit n (x,y) actually decreases in the case of production restrictions compared to the case without restrictions. (6 marks)

iv) Show that the critical values of x and y give rise to a maximum value. (3 marks)

2. Maximize or minimize the following functions subject to their constraints

   $Z=10x-x^2 +4y-2y^2 +xy$

   Subject to $2x + 3y = 3100$ (4 marks)

QUESTION FIVE (20 MARKS)

i) For the following function $Y = x^3 + 9x^2 + 15x + 7$; Prove that we have a point of inflection at $x = -3$. (4 marks)

ii) Consider the following pair of problems:

i) Max $f(xj, x2) = 100x_1 - 2x_1^2 + 60x_2 - x^2$

ii) Max$f(x_1, x2) = 100x_1 - 2x_1^2 + 60x_2 - x2^2$

Subject to $g(x_1, x2) = 40 - X_1 - x_2 =$

a) Obtain solutions to both problems. (12 marks)

b) In each case check the second order conditions. (4 marks)