UGANDA MARTYRS UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF ECONOMICS

UNIVERSITY EXAMINATIONS
SEMESTER I, 2012/13

SECOND YEAR EXAMINATIONS FOR BACHELOR OF SCIENCE
(FM, B.ECON & GEN)

ECO 2102: MATHEMATICS FOR ECONOMISTS

DATE: 14TH DECEMBER 2012

TIME: 9:00 – 12:00 NOON

Instructions:

i) Attempt any four questions.
ii) All questions carry equal marks
iii) Show all the necessary working
iv) Do not write anything on this question paper.

Question One

(a) Given that $f(x) = 2x^3 - 5x^2 + 8x - 20$. Find

(i) $f(-4)$ [4*marks*] (ii) $f(3)$ [3*marks*]

(b) The equilibrium condition for a three commodity market model is given by

$$7P_1 - P_2 - P_3 = 0$$
$$10P_1 - 2P_2 + P_3 = 8$$
$$6P_1 + 3P_2 - 2P_3 = 7$$

Use matrix inversion to find the equilibrium price for each market [10*marks*]

(c) The commodity market model is described by the following demand and supply functions

$3P + Q^2 + 5Q - 102 = 0$ (Demand function)

$P - 2Q^2 + 3Q + 71 = 0$ (Supply function)

Find the equilibrium price and quantity in the market [8*marks*]

Question two

(a) The two sector economy is characterized by the following macroeconomic models

Product market: $Y = C + I$, $C = 15 + 0.5Y$, $I = 200 - 2000R$

Money market: Transaction demand for money, $M_t = 0.4Y$, Speculative demand for money, $M_{sp} = 110 - 1500R$ and Money supply, $M_s = 150$

Find the;

(i) equilibrium values of Y and R using crammer's rule [8*marks*]

(ii) level of C, I, M_t and M_{sp} when the economy is in equilibrium [8*marks*]

(b) Given the input matrix, A and final demand vector, D for a three industry economy below

$$A = \begin{bmatrix} 0.2 & 0.3 & 0.2 \\ 0.4 & 0.1 & 0.2 \\ 0.1 & 0.3 & 0.2 \end{bmatrix} \quad D = \begin{bmatrix} 30 \\ 15 \\ 10 \end{bmatrix}$$

Find the solution equilibrium output levels for the three industries [9*marks*]

Question three

(a) Given the average revenue function for a firm as $AR = \frac{1}{4}q^3 - q^2 + q + 10$. Derive the Marginal revenue function for the firm. Hence find the marginal revenue when output is 6 units [8*marks*]

(b) Given the total cost function for a firm as $TC = -q^3 + \frac{9}{2}q^2 - 6q + 6$. Find the level of output that minimizes the total costs of production [8marks]

(c). If the utility function of an individual takes the form $U(X,Y) = (X+2)^2(Y+3)^3$, where U is the total utility and X and Y are the quantities of two commodities consumed. Find the;

(i) marginal utility functions for each of the two commodities [6marks]

(ii) value of the marginal utility of commodity X when three units of each commodity are consumed [3marks]

Question Four

(a) The firm's total revenue and total cost functions are given by $TR(Q)$ and $TC(Q)$ respectively. Derive and explain the necessary and sufficient conditions required for the firm to maximize profits [7marks]

(b) A discriminating monopolist has the following demand functions corresponding to the rural and urban markets for its product: $Q_R = 21 - 0.1P_R$ and $Q_U = 50 - 0.4P_U$. If the total cost function is given by $C = 200 + 10Q$, where $Q = Q_R + Q_U$

(i) Determine the price charged in each market under price discrimination by the monopolist so as to maximize profits [8marks]

(ii) Find the price elasticities in each market and comment on the price charged visa vis the elasticities [6marks]

(iii) What price would the monopolist charge without price discrimination [4marks]

Question Five

(a) Given that the total revenue function of a firm is $R = f(Q)$, where output q is a function of labour (L) or $q = g(L)$. Find the economic expression for $\frac{dR}{dL}$. What are the economic terms involved [7marks]

(b) The Total revenue the firm obtains from selling two products X and Y is given by the function $R(X,Y) = -X^2 - 16X - 2.5Y^2 - 30Y + 10XY$. Find the marginal revenue from selling one extra unit of:

(i) X when $X = 4$ and Y=3 [4marks]

(ii) Y when $X = 4$ and Y=3 [4marks]

(c) Given that $U(X,Y)=\frac{2X-3Y}{X+Y}$, find the

(i) partial derivatives in a simplified form [6marks]

(ii) value of each partial derivative when $X=1$ and $Y=2$ [4marks]

Question Six

(a) Using relevant examples, distinguish between a definite integral and an improper integral [4marks]

(b). Evaluate the following integral $\int_0^3 x\sqrt{(1+x)}dx$ [6marks]

(c) Given that the marginal revenue of the firm is given by $MR=60-2Q-2Q^2$. Find the

(i) Total revenue function

(ii) Total revenue when $Q=9$ units [5marks]

(d) The market demand function is given by $P=42-5Q-Q^2$. Suppose the equilibrium price is 6, find the level of consumer's surplus. [3marks]

[7marks]

END. (GOOD LUCK)