UGANDA MARTYRS UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF ECONOMICS

UNIVERSITY EXAMINATIONS

SEMESTER I, 2013/14

SECOND YEAR EXAMINATIONS FOR BACHELOR OF SCIENCE

(FM, B.ECON & GEN)

MATHEMATICS FOR ECONOMISTS

DATE: 13TH DECEMBER 2013

TIME: 10:00 - 1:00 PM

Instructions:

i) Attempt any four questions.

ii) Show all the necessary working.

iii) Do not write anything on this question paper.

Question one

(a) Distinguish between the following terms as applied to matrices

(i) Diagonal matrix and Symmetric matrix (02*marks*)

(ii) Minor of a matrix and cofactor of a matrix (02*marks*)

(b) Solve the following pair of simultaneous equations using matrix inversion

$$P_1 + 2P_2 + 3P_3 = 3$$
$$2P_1 + 4P_2 + 5P_3 = 4 \qquad (10marks)$$
$$3P_1 + 5P_2 + 6P_3 = 8$$

(c).The demand functions for two products in the market are given by $Q_{d1} + P_1 = \frac{1}{4}P_2 + 10$ *and* $Q_{d2} + \frac{1}{2}P_2 = \frac{3}{4}P_1 + 10$, where Q_{d1} *and* Q_{d2} are the quantities of goods 1 and 2 demanded, and P_1 *and* P_2 are the corresponding prices of the goods.

(i) What is the nature of goods 1 and 2? Give a reason for your answer (03*marks*)

(ii) If the quantity demanded of each good is 8, use Crammer's rule to determine the price at which each good will be sold (08*marks*)

Question two

(a) What is meant by Comparative static analysis (02*marks*)

(b) The demand and supply functions for a market model are given by:

$$3P^2 + Q = 16 \qquad (Demand\ function)$$
$$P^2 + 2P + 5 = Q \qquad (Supply\ function)$$

Determine the equilibrium price and quantity (07*marks*)

(c) Consider the following single commodity market model:

$$Q_d + \alpha_2 P = \alpha_1 \qquad (Demand\ function)$$
$$Q_s - \beta_1 = \beta_2 P \qquad (Supply\ function)$$

(i) Obtain the equilibrium expressions for the endogenous variables in the model (6*marks*)

(ii) Perform and interpret the comparative static analysis on the equilibrium endogenous variables with respect to α_1 *and* β_2 . Illustrate your answers graphically. (10*marks*)

Question Three

(a) The supply function for a certain commodity is given by $Q + \alpha_1 = \alpha_2 P$ *for* $\alpha_1, \alpha_2 > 0$

(i) Determine the price elasticity of supply of the commodity when $P = \frac{1}{\alpha_2}$ (5*marks*)

(ii) Using the answer obtained in (i) above, under what conditions will the supply function of the commodity be elastic (5*marks*)

(b) The commodity and money markets for an economy are defined by the following macroeconomic models:

Commodity market	Money market
$Y = C + I$	$M_T = \frac{2}{5}Y$
$C = 15 + \frac{1}{2}Y$	$M_{SP} = 110 - 1500R$
$I = 200 - 2000R$	$M_S = 150$

(i) Derive the IS and the LM functions of the economy. $(04 marks)$

(ii) Write the IS and LM functions in matrix form and use crammers rule to determine the equilibrium levels of income and interest rate of the economy $(07 marks)$

(iii) Determine the level of aggregate demand at equilibrium conditions of the economy $(04 marks)$

Question Four

(a) State any five uses of the input-output model. $(05 marks)$

(b) The Leontief matrix of a three sector economy is given by

$$\begin{pmatrix} 0.5 & -0.1 & -0.3 \\ -0.2 & 0.2 & -0.1 \\ -0.1 & 0 & 0.6 \end{pmatrix}$$

(i) Obtain the matrix of input coefficients and give the interpretation of the elements in the second row $(06 marks)$

(ii) Suppose the government has planned a final demand of 450, with sectoral components being $D_1 = 100, D_2 = 150, and\ D_3 = 200$. Use Crammers rule to compute the equilibrium output for each sector that is required to realize this level of final demand $(09 marks)$

(iii) Compute the total primary input requirement necessary to realize this final demand, $(05 marks)$

Question Five

(a) At an output level of $10\ units$, the firm has total costs of $330\ units$ and fixed costs of $30\ units$. If the firm has a quadratic total cost function of the form $TC = \alpha + \beta Q^2$, determine the level of marginal cost of the firm at $Q = 10\ units$ $(5 marks)$

(b) ABC is a soap manufacturing company whose aim is to maximize profits. As a hired consultant of this company, you have been availed with the following total cost and total revenue functions for the company $TC = \frac{1}{6}Q^3 - \frac{17}{4}Q^2 + 25Q + 5$ and $TR = 11Q - \frac{1}{4}Q^2$ where Q is the quantity of soap produced. Determine the;

(i) Marginal costs of the firm when $Q = 10\ units$ $(04 marks)$

(ii) Profit maximizing level of output $(08 marks)$

(iii) Variable costs at the profit maximizing level of output $(03 marks)$

(iv) Maximum profits and show that the second order condition for profit maximization is satisfied $(05 marks)$

Question Six

(a) Given that $y = (x-3)^2(x^2+1)$, find $\frac{dy}{dx}$ using the product rule (05*marks*)

(b). A consumer has the utility function $U(X_1 X_2) = X_1^{\alpha} X_2^{1-\alpha}$ and the budget constraint $M = P_1X_1 + P_2X_2$. Find her utility maximizing expressions for X_1 *and* X_2 in terms of α, M, P_1 *and* P_2 (10*marks*)

(c). If the demand function is given by $P + Q^2 + 3Q - 20 = 0$, and the supply function is $P - 3Q^2 + 10Q - 5 = 0$. Find the consumer's and producer's surplus (10*marks*)

END (GOOD LUCK)