



MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

FIRST YEAR SECOND SEMESTER EXAMINATION FOR BACHELOR OF ARTS

EES 100: MATHEMATICS FOR ECONOMISTS 1

DATE: 30/5/2017

TIME: 11:00 – 1:00 PM

INSTRUCTIONS:

Answer question ONE and any other two questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Consider the following consumption and tax functions:

$$C = 70 + 0.85 Y^d$$

$$T = \alpha_0 + \alpha_1 Y$$

$$Y^d = Y - T$$

- i) Identify the endogenous and exogenous variables (1 mark)
 - ii) What is the name given to the parameter α_1 ? What does it measure? (1 mark)
 - iii) If income increases by 100, how much of that increase will be allocated to consumption. (2 marks)
- b) Sets P and Q, and the corresponding universal set T are given-by:

$$P = \{1, 2, 5\}, \quad Q = \{1, 5, 7, 8\}, \quad T = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

Show that:

- i) $P' \cup Q' = (P \cap Q)'$ (2 marks)

ii) $(P \cup Q)' = P' \cap Q'$ (2 marks)

c) Consider the multivariate demand functions

$$Q_m = 2.2 - 1.8P_m + 1.2P_n - 0.7Y$$

$$Q_n = 1.7 - 1.1P_m - 1.3P_n - 0.9Y$$

i) Are good “m” and “n” complementary or substitutes? (1 mark)

ii) Is good “m” normal or inferior? Explain (1 mark)

iii) Is good “n” normal or inferior? Explain (1 mark)

d) A single commodity market model is defined by the following:

$$Q_d = 16 - 4P$$

$$Q_s = -10 + 6P$$

$$\bar{Q}_d = \bar{Q}_s = \bar{Q}$$

where Q_d is the quantity of the commodity demanded Q_s is the quantity of the commodity supplied and P is the price of the commodity:

i) At what price is equilibrium attained in the market? (2.5 marks)

ii) Find the equilibrium quantity supplied (2.5 marks)

e) Given the following average total costs and the average revenue functions

$$3 + ATC - \frac{15}{Q} - Q = 0$$

$$AR - \frac{4}{9}Q = 12$$

Determine the total costs, average variable costs, average fixed costs and total revenue functions. (4 marks)

f) The commodity and money markets for an economy are defined by the following equation:

$$Y = c + I$$

$$c = 200 + \frac{2}{5}$$

$$I = 1900 - 12r$$

Money market

$$MDT = \frac{1}{2}Y$$

$$MD_s = 100 - 10r$$

$$M_s = 1500$$

- i) Derive the IS and the LM functions of the economy. (4 marks)
 - ii) What is the equilibrium income and the rate of interest for the economy (4 marks)
- g) The marginal propensity to consume is:
 $MPC = 0.8 + \frac{1}{8}Y^{-\frac{1}{8}}$. Determine the corresponding consumption and saving functions? (2 marks)

QUESTION TWO (20 MARKS)

Write short notes on the following topics as used in mathematics for economists. Illustrate your work where necessary.

- i) The laws of set Algebra
- ii) Autonomous tax and Induced tax
- iii) Production transformation curve
- iv) Normal and Inferior goods
- v) IS-LM models
- vi) Relationship between price elasticity of demand and marginal revenue
- vii) Minimization of average variable cost
- viii) Demand and supply of money
- ix) Partial and General equilibrium
- x) Import and export functions.

QUESTION THREE (20 MARKS)

- a) Prove that $P = \frac{1}{\alpha Q}$ demand function has a unitary elasticity (3 marks)
- b) The AR and TC for a firm are given by:

$$AR = 3\frac{1}{2} - \frac{1}{2}Q$$

$$TC = \frac{1}{20}Q^3 - \frac{3}{10}Q^2 + 2Q + 1$$

Find:

- i) The price elasticity of demand at $P = 4$ (3 marks)
 - ii) At what level of Q is ATC at a minimum? (3 marks)
 - iii) When is $ATC = MC$ (2 marks)
 - iv) What do you notice (1 mark)
 - v) The profit maximizing Q if a tax of 2 per unit is imposed on the quantity produced (3 marks)
- c) A two-commodity market model is defined by the following:

$$Q_{d1} = 4 - P_1 + \frac{1}{2}P_2$$

$$Q_{d2} = 10 + P_1 - P_2$$

$$Q_{s1} = -3 + 4P_1$$

$$Q_{s2} = -18 + 4P_2$$

Determine equilibrium prices and quantities for the two commodities. (6 marks)

QUESTION FOUR (20 MARKS)

- a) Consider a demand function given by (3 marks)

$$Q = \frac{3}{P} \text{ determine the following:}$$

- i) The $E_{Q,P}$ which is the price elasticity of demand.
- ii) Show that the relationship between marginal revenue and elasticity of demand is valid (4 marks)

$$MR = P \left\{ 1 + \frac{1}{E_{Q,P}} \right\}$$

- b) The marginal propensity to consume for an economy is 0.72. Determine the savings function for the economy if $Y = 0$ when savings $S = -5$. (3 marks)
- c) The demand and total cost functions facing a firm are:

$$P_1 = 26 - 3Q_1 - Q_2$$

$$P_2 = 33 - Q_1 - 2Q_2^2$$

$$TC = Q_1^2 + Q_1Q_2 + 2Q_2^2$$

Find:

- i) The average revenue functions for commodities Q_1 and Q_2 ,
- ii) The total revenue
- iii) The average cost function with respect to Q_1 and Q_2
- iv) The profit function
- v) The profit maximizing quantity

QUESTION FIVE (20 MARKS)

a) You are given the following national Income model

$$Y = C + I + G + x - m \dots \dots \dots (1)$$

$$C = C_0 + C_1(Y - T) \dots \dots \dots (2)$$

$$T = t_0 + t_1 Y \dots \dots \dots (3)$$

$$I = I_0 \dots \dots \dots (4)$$

$$G = G_0 \dots \dots \dots (5)$$

$$X = x_0 \dots \dots \dots (6)$$

$$M = M_0 + m_1 Y \dots \dots \dots (7)$$

- i) Plot equations 6 and 7 on the same diagram and label curves as X and M, respectively.
Indicate the equilibrium of the system on the diagram, (3 marks)
 - ii) Find the equilibrium income for the system (4 marks)
 - iii) What is the corresponding equilibrium consumption and import. (4 marks)
- b) Consider a demand function given by $Q = 49/P_2$ and determine the consumer's surplus for a market price of $P_2 = 4$. (4 marks)
- c) With the following information

$$ATC = K_1Q - K_2$$

$$AR = \frac{K_1}{Q} - K_2$$

where K_1 and K_2 are constants:

- i) What is the profit maximising Q (3 marks)
- ii) What is the maximum profits (2 marks)