



# **SOUTH EASTERN KENYA UNIVERSITY**

## **UNIVERSITY EXAMINATIONS 2016/2017**

**YEAR SEMESTER EXAMINATION FOR THE BACHELOR OF ECONOMICS, BACHELOR OF ECONOMICS AND STATISTICS AND BACHELOR OF EDUCATION**

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### **XEQ 203: MATHEMATICS FOR ECONOMISTS I**

**DATE: 8<sup>TH</sup> DECEMBER, 2016**

**TIME: 1.30-3.30PM**

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#### **INSTRUCTIONS TO CANDIDATES**

- a) Answer Question ONE and any other TWO questions.
- b) Begin answering a new question on a separate page on the booklet provided
- c) Credit will be given to the clarity of argument and use of local examples.

#### **QUESTION ONE (COMPULSORY) (30 MARKS)**

- a) A single commodity market is given by the following model:

$$Q = 9 - \frac{2}{3} P$$

$$Q = -3 + \frac{3}{4} P$$

- i. Using the model and with reasons, identify the demand and supply functions. (3 marks)
- ii. Use graphical method to determine the equilibrium of the market (5 marks)

- b) The consumption (C) of a given commodity is related to income (Y) as shown by the following function:  $C = \alpha + \beta Y$ :

- i. State the slope of the consumption function (1 mark)
- ii. State the conditions that must prevail for the consumption function to hold. (2 marks)

- iii. Compute the level of consumption, given that marginal propensity to consume is 0.75, income is Kshs 10,000 and autonomous consumption is Kshs 1,000. (2 marks)
- c) Consider the following national income model for an economy with no external trade  
 $Y=C+I+G$

If the consumption function, investment and government expenditure are:

$$C = 100+0.8Y$$

$$I = 70$$

$$G = 40$$

- Find: (i) Derive the savings function (2 marks)  
 (ii) Compute and interpret the marginal propensity to save (2 marks)  
 (ii) Equilibrium income (2 Marks)  
 (ii) Equilibrium Consumption (3 marks)

- d) An economy has the following import and export functions:

$$M = 20+0.2Y$$

$$X = 70$$

Find the level of income at which the economy enjoys trade balance. (2 marks)

- e) TKK MATS a carpet manufacturing and exporting firm has to supply an order for 5000 pieces of wooden carpets of two varieties X and Y to KICC for conference rooms. The joint cost function for the two varieties of the carpets is given by  $C = 100X^2 + 150Y^2$ . The quantity of X and Y are not specified and so the firm is forced to supply any combination. The main goal of the firm is to minimize the cost of producing the carpets but meeting the demand by KICC. Determine how many of each type of carpet the firm will produce to minimize cost. What will be the minimum cost? (6 marks)

### **QUESTION TWO (20 MARKS)**

- a) Given the demand for beans as  $Q_b = 4850 - 5P_b + 1.5P_p + 0.1Y$

Income  $Y = 10,000$

Price of beans  $P_b = 200$

Price of peas  $P_p = 100$

- i. Compute own price elasticity of demand (2 marks)  
 ii. Find the income elasticity of demand (2 marks)  
 iii. Find the cross elasticity of demand (2 marks)  
 iv. How are the two goods related? explain (2 marks)

b) Apply Euler's' theorem to determine the degree of homogeneity for the following functions:

i)  $AK^{1/2}L^{3/4}$  ( 3 marks)

ii)  $\frac{K^3}{K^2L + L^3}$  ( 3 marks)

c) A discriminating monopolist producing a single product is faced with the following two demand functions from each of the two markets.

$$P_1 = 25 - 2Q_1$$

$$P_2 = 40 - \frac{3}{2}Q_2$$

The monopolist has the following total cost function

$$C = 60 + 4Q \quad Q = Q_1 + Q_2$$

Required: Find the profit maximizing levels of outputs and prices (4 marks)

d) Given a utility function  $U = U(x, y)$  show that the slope of indifference curve is equal to

negative Marginal Rate of Substitution ( $\frac{dy}{dx} = -MRS_{xy}$ ) (2 marks)

### **QUESTION THREE (20 MARKS)**

a) A firm in a perfectly competitive market produces two goods  $Q_1$  and  $Q_2$  priced at \$50 and \$60 respectively. The firm's total cost function is:

$$TC = 3Q_1^2 + 3Q_1Q_2 + 2Q_2^2 + 10$$

(i) Find the total revenue of the firm (2 mark)

(ii) Find the profit function of the firm. (2 mark)

(iii) Find the critical values of  $Q_1$  and  $Q_2$  for profit maximization (3 marks)

b) Consumer is faced with the following constrained utility maximization problem.

$$\text{Maximize } U = 3xy$$

$$\text{Subject to } 4x + 2y = 24$$

Find the critical values  $\bar{x}, \bar{y}, \bar{U}$  and  $\bar{\lambda}$ . (8 marks)

c) Given a monotonic production function of the form  $Q(L, K) = a \ln L + b \ln K$ , compute marginal rate of technical substitution ( $MRTS_{L,K}$ ) (5marks)

**QUESTION FOUR (20 MARKS)**

The goods and money markets of a given economy are presented below:

**Good market**

$$Y = C+I$$

$$C= 204+0.7Y \quad \text{(Consumption function)}$$

$$I=300-200r \quad \text{(Investment function)}$$

**Money Market**

$$M_s = 600 \quad \text{(money supply)}$$

$$M_{DT} = 0.5Y \quad \text{(transaction demand for money function)}$$

$$M_{DS} = 248 - 400r \quad \text{(Speculative demand for money function)}$$

Required:

- i. Derive the IS curve **(6 marks)**
- ii. Derive the LM curve **(6 marks)**
- iii. Derive the equilibrium level of income and rate of interest **(8 marks)**

**QUESTION FIVE (20 MARKS)**

a) Suppose for a particular economy

$$I = 25 \quad \text{(Investment)}$$

$$G = 50 \quad \text{(Government Spending)}$$

$$T= 0.25Y \quad \text{(Tax function)}$$

$$C = 25 + \frac{2}{3}Y^d \quad \text{(Consumption function)}$$

Required:

- i. Compute equilibrium T, C, Y and S (savings) **(8 marks)**
- ii. Calculate and interpret the government expenditure multiplier **(4 marks)**
- iii. Compute the budget surplus/deficit **(2 marks)**

b) Given the following total revenue function and total cost function of a firm, compute the level of output Q that maximizes the profit of the firm and check for the second order condition. **(6 marks)**

$$TR = 45Q - 0.5Q^2$$

$$TC = Q^3 - 8Q^2 + 57Q + 2$$