MACHAKOS UNIVERSITY

University Examinations for 2020/20201Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF ECONOMICS AND STATISTICS

BACHELOR OF ECONOMICS AND FINANCE

BACHELOR OF ECONOMICS

EES 100: MATHEMATICS FOR ECONOMISTS 1

DATE: 2/3/2021   **TIME: 8.30-10.30 AM**

INSTRUCTIONS:

   (i)   **Answer question one (Compulsory) and any other two questions**

   (ii)   **Do not write on the question paper**

   (iii)   **Show your working clearly**

QUESTION ONE (COMPULSORY) (30 MARKS)

a)   Give a distinction between the following concepts:

   i.   A Model and a Function   (2 marks)

   ii.   Exogenous and Endogenous variables   (2 marks)

b)   Of the 200 candidates who were interviewed for a position at a call center, 100 had a two-wheeler, 70 had a credit card and 140 had a mobile phone. 40 of them had both, a two-wheeler and a credit card, 30 had both, a credit card and a mobile phone and 60 had both, a two wheeler and mobile phone and 10 had all three. How many candidates had none of the three?   (3 marks)

c)   Consider the following demand function

$$Q = \frac{1}{P^k}$$

   i.   Determine the price elasticity of demand for the function.   (3 marks)

   ii.   Show that the relation $MR = P(1 + \frac{1}{\frac{\varepsilon d}{p}})$ between marginal revenue and elasticity of demand is valid.   (5 marks)

d) The fundamental equations in an economy are given as:

Consumption function (C)	$= 100 + 0.9Y^d$
Investment function ($\bar{I}$)	$= 600 - 30i$
Income Tax (T)	$= \frac{1}{3}Y$
Government Expenditure (G)	$= 300$
Exports (X)	$= 70$
Imports (M)	$= 12 + 0.2Y$
Transaction demand for money (Md1)	$= 0.4Y$
Speculative demand for money (Md2)	$= -50i$
Money supply (M)	$= 520$

You are required to calculate the following:

i. IS curve (3 marks)

ii. LM curve (2 marks)

iii. Equilibrium income and interest rate (3 marks)

e) The supply and demand functions for a firm are given by:

$$Q_d = 60 - \frac{1}{3}P$$

$$Q_s = -30 + \frac{2}{3}P$$

If the government decides to impose a per unit tax t on quantity supplied, find the tax rate that will maximize government tax revenue. Also determine maximum tax revenue, assuming tax function to be $T = tQ$ (7 marks)

QUESTION TWO (20 MARKS)

a) Given the following set of simultaneous equations for two related goods, x and y, find the equilibrium conditions for each market if the consumers' income is Y=600. What types of goods are x and y? (5 marks)

$$Q_{dx} = 22 - 3P_x + P_y + 0.1Y$$

$$Q_{sx} = -5 + 15P_x$$

b) Assume that a firm can sell all its products it manufactures in a month at Ksh25 each. It has to pay out Ksh300 fixed costs. Also, the firm must pay a marginal cost of Ksh20 for each unit produced. How much does the firm need to produce to earn zero profit (break-even)?

(5 marks)

c)   Solve using Gauss-Jordan elimination method   (10 marks)

$$x + 2y - 3z - t = 0$$
$$-3y + 2z + 6t = -8$$
$$-3x - y + 3z + t = 0$$
$$2x + 3y + 2z - t = -8$$

QUESTION THREE (20 MARKS)

a)   Given the demand and cost functions as:

$$P = 100 - \frac{1}{2}Q$$
$$ATC = 300 + 2Q - 2Q^2$$

Determine the output and price levels that will maximize profits and maximum profit

(7 marks)

b)   Use chain rule to differentiate $R(z) = \sqrt{5z - 8}$ (3 marks)

c)   Assume that it costs Microsoft approximately $C(x) = 14,400 + 550x + 0.01x^2$ dollars to

d)   manufacture x boxes in a day. How many x boxes should be manufactured in order to

minimize average cost? What is the resulting average cost of the box? Give your answer to

the nearest dollar   (6 marks)

e)   Verify the absorption law, given A={4, 5), B = {3,6,7} and C = {2, 3}   (4 marks)

QUESTION FOUR (20 MARKS)

a)   Given the production function stated as:

$$Q = \frac{K^2 - KL + L^2}{L^3}$$

Demonstrate Euler's theorem   (5 marks)

b)   Hercules Films is deciding on the price of the video release of its film Bride of the Son of

Frankenstein. Marketing estimates that at a price of p dollars, it can sell Q = 200,000 -

10,000P copies, but to make one copy it costs Ksh.4. What price will give the maximum

profit?   (6 marks)

The demand for commodity "a" is expressed as a function of some related commodity "b"

as:

$$Q_a = 7 + (P_b)^{-\frac{1}{4}}$$

i.   Find the level of demand for "a" when the price of "b" is 81   (3 marks)

ii. Find the cross elasticity of demand for "a" with respect to price of "b" when $P_b = 16$. Interpret your results (6 marks)

QUESTION FIVE (20 MARKS)

a) The demand and supply functions of a two commodity market model are as follows:

$Q_{d1} = 10 - 2P1 + P2$ $\qquad\qquad$ $Q_{s1} = -2 + 3P1$

$Q_{d2} = 15 + P1 - P2$ $\qquad\qquad$ $Q_{s2} = -1 + 2P2$

Find equilibrium price and quantity (4 marks)

b) You are given the following information about a firm

$P = 4 - \frac{1}{4}Q$

$ATC = 0.05Q^2 - 0.3Q + 2 + \frac{4}{Q}$

i. Find the output level which will maximize the profits of the firm (4 marks)

ii. Find the output level that will maximize the profits of the firm if a lump tax of K is imposed, K being a constant (4 marks)

iii. Explain the outcome in (ii) above (1 mark)

c) i A soft-drink manufacturer can produce 1000 cases of soda in a week at a total cost of sh6000, and 1500 cases of soda at a total cost of sh8500. Find the manufacturer's weekly fixed costs and marginal cost per case of soda. (4 marks)

ii Your college newspaper, The Collegiate Investigator, has fixed production costs of $70 per edition, and marginal printing and distribution costs of 0.4 per copy. The Collegiate Investigator sells for sh. 0.5 per copy. Write down the associated cost, revenue, profit functions and associated profit realized (3 marks)