MACHAKOS UNIVERSITY

University Examinations 2021/2022 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SIT 404: MANAGEMENT MATHEMATICS

DATE: 30/8/2022 **TIME: 8.30-10.30 AM**

INSTRUCTION:

Answer Question One and Any Other Two Questions

QUESTION ONE: (30 MARKS)

a) Differentiate between the terms definite and indefinite integrals. (2 marks)

b) Given that $y = \frac{2te^t}{\cos 2t}$, determine $\frac{dy}{dt}$ (5 marks)

c) A firm's demand function is given by $p = 100 - 2x$ and its cost function is $C(x) = 20x + 3000$. Determine the optimum level of output for profit maximization (6 marks)

d) Evaluate the value of the integral $\int_2^3 (\frac{2t^2-1}{t})\, dt$ (5 marks)

e) Patricia runs a small events-organizing company based in Nairobi. She has just received an order to organize an SME development seminar at the Sarova Stanley hotel hosted by the World Bank. She has concluded that there is a linear relationship between her costs and the number of participants attending the seminar. She is billing the World Bank ksh 10,000per participant while the hotel charges ksh 2500 per participant for meals in addition to ksh 225,000 fixed charge for the hall. Formulate the revenue, cost and profit functions using x as the number of participants attending the event. (6 marks)

f) Given that $k = 2x^2y^3 + 3\sqrt{xy}$, determine $\frac{\partial k}{\partial x}$ and $\frac{\partial k}{\partial y}$ when x=2 and y=3. (6 marks)

QUESTION TWO (20 MARKS)

a) A car costs sh 75000 in the market and the running cost for x kilometers is given by $VC(x) = x + 30x(x - 1)$ .Determine when the total average cost s minimum is. (6 marks)

b) A manufacturer of designer shoe has realized that if he wants to increase his output, he must lower the prices of the prices of his shoes. His total revenue R(x) from output of x shoes is given by:$R(x) = 540x - 2x^2$.His production costs are ksh 10,000 fixed and ksh 40 per unit. Determine

i. The level of production that will maximize his revenue. (5 marks)

ii. His maximum total revenue. (2 marks)

iii. His profits function in terms of output. (2 marks)

iv. The level of output that will maximize the profit. (5 marks)

QUESTION THREE (20 MARKS)

a) A firm's demand function is given by p=100-2x and its cost function is C(x)=20x+3000.Detrmine the optimum level of output for profit maximization. (6 marks)

b) The Kenya wildlife service's has commissioned the inoculation of elephants at the Nairobi National Park to prevent the outbreak of a serious infectious disease among the animals. The tender to carry this task has been awarded to KIPs Animal Sanctuaries who charge ksh 1650 per elephant inoculated. KIPs management has worked out that it will cost ksh 1,650,000 to inoculate 3000 elephants and ksh 1,800,000 to inoculate 6000 elephants. Assuming a linear relationship between costs, revenues, and elephants inoculated, determine

i. The revenue functions. (1 mark)

ii. The cost functions. (6 marks)

iii. The profit functions. (2 marks)

iv. The total cost of inoculating 10500 elephants (2 marks)

v. The number of elephants required to be inoculated to break even (2 marks)

vi. The monetary breakeven level for KIPS. (1 mark)

QUESTION FOUR (20 MARKS)

a) The total profit for a firm has been found to be related to the expenditure when utilizing x units of skilled labor and y units of unskilled labour.The function is give by $profit\ \pi = 48x + 60y + 10xy - 10x^2 - 6y^2$. Determine the values of x and y that maximize profit. (10 marks)

b) A monopolists demand and cost function for a commodity are given by

$$p = 150 - 0.5x$$

$$c(x) = 100 + 3x + 7x^2$$

i. Determine profit maximizing price and output (7 marks)

ii. Would anything be produced in the absence of a subsidy (3 marks)

QUESTION FIVE (20 MARKS)

a) Given that $c = 36 + (q - 8)^2$ where c is the marginal cost of producing q units and $R = 100 - 2q$ where R is the marginal revenue from selling q units.

i. Determine the profit maximizing output for the firm (3 marks)

ii. Derive the equations for total cost and total revenue (assume the fixed costs and fixed revenue i.e the constant terms is zero). (6 marks)

b) A manufacturer has found that if he wants to increase his output .he must lower his price. His total revenue R from an output x is given by the expression $R = x(148 - x)$.His production cost are £1000 fixed and £36 per unit variable and the total cost $c = 1000 + 36x$.Determine

i. The output that would maximize revenue. (3 marks)

ii. The maximum total revenue. (2 marks)

iii. The profit P in terms of the number of units(x) (2 marks)

iv. The output x that would maximize profit (4 marks)