MACHAKOS UNIVERSITY

University Examinations 2019/2020
SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SIT 404: MANAGEMENT MATHEMATICS

DATE: **TIME:**

INSTRUCTIONS:

Answer question ONE and any other TWO questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Describe the following terms as used in management mathematics
   (i) A function
   (ii) Breakeven point (2 marks)

b) If the total costs are given by $c(x) = 360 + 10x + 0.2x^2$ and total revenue are given by $R(x) = 50x - 0.2x^2$
   i) Form the profit function. (2 marks)
   ii) Determine the maximum profit point. (4 marks)

c) Given that $y = \frac{3x^3 - 2\sqrt{x} + 5\sqrt[3]{x^4}}{x^2}$ evaluate $\frac{dy}{dx}$ (6 marks)

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

e) Evaluate the value of the integral $\int_2^3 (\frac{2t^2-1}{t})\, dt$ (4 marks)

f) A factory produces x calculators per day. The total daily cost in shillings incurred is $5x^2 + 700x + 500$. If the calculators are sold for sh (1000-10x) each, determine the calculators that would maximize the daily profit (5 marks)

g) 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 manufacturer has identified that his marginal cost of producing a unit product is given $mc(x) = 0.000003x^2 - 0.003x - 240$.Given that his total costs are ksh 112,500 when no production is taking place (i.e his fixed costs).

i) Determine the total cost function. (6 marks)

ii) The number of units which the total cost is minimized (4 marks)

b) A manufacturer makes two products p and q.the cost of making 15 units p and 10 units of q is sh 600.The cost of making 5 units p and 8 units of product q is sh 340.The manufacturer makes a profit of 20% and 25% on each unit of product p and product q respectively.

(i) Calculate the cost of making one unit of product p and product q. (6 marks)

(ii) Calculate te selling price of one unit of product p and product q. (4 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 function . (1 mark)

(ii) The cost function. (6 marks)

(iii) The profit function . (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 Max ltd employed a cost accountant who developed two functions to describe the operations of the firm .He found the marginal revenue function to be $MR = 25 - 5x - 2x^2$ and the marginal cost function to be $MC = 15 - 2x - x^2$ where x is the level of output.Using the above information determine the profit maximizing output and the total output (10 marks)

b) Jones ltd has acquired a second hand machine for making spanners with a 45000 units capacity per run;the financial manager has come up with the equation below that represents the total cost function for the machine.

$$C(x) = 250000 + 0.08x + \frac{200{,}000{,}000}{x}$$

(i) Determine how many spanners should be produced to maximize total cost (7 marks)

(ii) Calculate the minimum cost of the company (3 marks)

QUESTION FIVE (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 company that manufactures computers has determined that its production function is given by $p(x,y) = 50x + 800y + 3x^2y + x^3 - \frac{y^4}{4}$ where x is the size of labor force(measured in work-hour) and y is the capital(measured in units \$100) invested. Determine the marginal productivity of labor and capital when x=50 and y=20. (6 marks)

c) 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. (8 marks)

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