MACHAKOS UNIVERSITY

University Examinations for 2022/2023 Academic Year

SCHOOL OF BUSINESS, ECONOMICS AND HOSPITALITY AND TOURISM MANAGEMENT

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF COMMERCE

BMS 100: MANAGEMENT MATHEMATICS I

DATE: **TIME:**

INSTRUCTIONS

Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

(a) Distinguish between the following terms as used in management mathematics.

i. Marginal Revenue and Marginal Cost (2 marks)

ii. Subsets and overlapping sets (2 marks)

(b) Identify the components of a mathematical model in solving business problems (2 marks)

(c) A sample of 200 voters revealed the following information about the three candidates, A, B and C who are running for chairman, secretary and treasurer respectively. 28 were in favour of both A and B , 98 in favour of A or B but not C . 42 in favour of B but not C or A. 122 in favour of B or C but not A. 64 in favour of C but not A or B. 14 in favour of A and C but not B. Represent the above in a Venn diagram and determine the percentage of voters who were in favor of all the three candidates. (3 marks)

(d) Find the turning points of the curve $f(x) = 2x3 - 15x2 = 36x = 12$ *a*nd distinguish among them (3 marks)

(e) The total cost of a company making Q speakers is given by the linear function ; C=250x+3000.The total revenue function of the company is given by the linear function ;R=450x.Required;

(i) On the same axes, graphically show a sketch of the company's loss and profit regions. What does the vertical intercepts represent? (3 marks)

(ii) Deduce the profit function hence the break-even quantity for this company (3 marks)

(f) An investor has sh. 20,000 to invest. If part of the invested at 8% and the rest at 12%, how much should be invested at each rate to yield 11% on the total amount invested. (2 marks)

(g) Githeru and Kabiru Certified Public Accounts have recently started to give business advice to their clients. Acting as consultants, they have estimated the demand curve of a clients firm to be:AR= 200-8Q, Where AR is average revenue in Millions of shillings and Q is the output in units. Investigators of the client firm's cost profile shows that marginal cost (MC) is given by MC = Q2-28Q+211 (In millions of shillings).Further investigations have shown that the firm's cost when not producing output is sh. 10 million.

Required:

i. The total cost function (1 mark)

ii. The total revenue function (1 mark)

iii. The level of output that minimize profit. (3 marks)

(h) The joint Revenue function of two products is given by;R=18x=10y+24xy-5x2-8y2

i) Find the partial derivatives dR/dx and dR/dy (2 marks)

ii) Find the values of x and y for which revenue is maximum (3 marks)

QUESTION TWO (20 MARKS)

a) XYZ Ltd. has a nine-year contract which is expected to generate the following cash flows.

Year	1	2	3	4	5	6	7	8	9
Cash flows (sh. 000)	600	750	500	550	550	550	550	550	550

The discount rate is 10% . Compute the present value of the cash flows. (6 marks)

b) A company sells two products. Total revenue from the two products is estimated to be function of the numbers of units of the two products. Specifically, the function $R = 30000x + 15000y - 10x^2 - 10y^2 - 10xy$ where R equals total revenue and x and y equal the number of units sold of the two products. Determine the number of each product that should be produced in order to maximize total revenue and hence the maximum revenue. (6 marks)

c) State and discuss the importance of calculus in business organizations and management of institutions (4 marks)

d) Discuss the various phases of a managerial decision problem (4 marks)

QUESTION THREE (20 MARKS)

a) In a geometric progression, the sun is 224 and the last term is 128 and the common ratio is 2. Find the first term and the number of terms. (3 marks)

b) Apex Ltd. is planning to launch a new product next year. It has carried out a survey on the products prototype's colour , brand name and packaging. 200 potential customers were given questioners and were requested to indicate their liking or otherwise of each of the three attributes of the product. Their responses were as follows.

24 persons liked the packaging and brand name.

77 persons liked the brand name or the colour but not the packaging

40 persons liked the colour only

120 persons liked the brand name or the colour

23 persons liked the colour and the packaging

43 persons liked atleast two attributes

5 persons did not like any of the three attributes.

25 of the customers did not return the questioners.

The company accepted an attribute to be incorporated in the product if at least 50% of those who responded to the questionnaire liked it.

Required.

i) Present the above information in a venn diagram (5 marks)

ii) The number of persons that liked all the three attributes (2 marks)

iii) The proportion of person that liked the colour (2 marks)

iv) The proportion of persons that liked the brand name. (2 marks)

v) The proportion of persons that liked the packaging (2 marks)

vi) Attribute (s) to be incorporated. (1 marks)

(c) What compound rate of interest will be required to produce sh. 5,000 after five years with an initial investment of sh. 4,000? (3 marks)

QUESTION FOUR (20 MARKS)

a) The atmospheric pressure P in pounds per square inch at X miles above sea level is given approximately by $p = 14.7e^{-0.21x}$. At what height will the atmospheric pressure be half the sea – level pressure? (3 marks)

b) Given the universal set U={x:x€ℕ, x≤9} and the sets;A={2,6,8,9,},B={1,6,7,8},C={3,4,7}.Required;

(i)P(C)=2c,the power of C (2 marks)

(ii)(B-A)UC" (2 marks)

(iii) find AxBxC (2 marks)

(c) ABC 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-2x2 and the marginal cost function to be MC=15-2x - x2 where x is the level of output. Determine the profit maximizing output and the total profit at that point. (5 marks)

(d) State the DeMorgans law and give relevant examples (6 marks)

QUESTION FIVE (20 MARKS)

a) A firm has a monopoly on its markets ,so it can decide for which price to sell its products .If it sells the products for price p, the demand is q=300-2p;while the cost of producing q units are given by the function C(q)=30+30q-1/10q2 the revenue is R(p)=pq

Required;

(i) Determine revenue function in terms of q (2 marks)

(ii) Determine the profit function (2 marks)

(iii) Calculate the value of q that will yield maximum profit (2 marks)

(iv) What will the price be if the capacity of the firm was limited to 120 units (3 marks)

b) 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 (1325-10x) each.

Required

i. Find the number of calculators that would maximize the daily profit. (5 marks)

ii. Determine the maximum daily profit. (3 marks)

c) A manufacturer makes two products i.e. product Q and product M . The cost of making 15 units of product Q and 10 units of product M is sh. 600. The cost of making 5 units of product Q and 88 units of product M , respectively.

i) Formulate a system of simultaneous equation to represent this information (2 marks)

ii) Solve the equation to determine the cost of making one unit of product Q and product M (2 marks)

iii) calculate the selling price of one unit of product Q and product M (2 marks)