(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY
(MMUST)

UNIVERSITY supplementary EXAMINATIONS

2016/2017 ACADEMIC YEAR

SECOND year FIRST semester EXAMINATION

FOR THE DEGREE
OF
Bachelor of Education Arts

COURSE CODE: BCB 102

COURSE TITLE: BUSINESS MATHEMATICS

DATE: MONDAY 25TH SEPTEMBER 2017   TIME: 4.00–6.00PM

INSTRUCTIONS TO CANDIDATES
Answer question ONE and any other TWO questions

TIME: 2 HOURS

MMUST observes ZERO tolerance to examination cheating

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QUESTION ONE (COMPULSORY) (30 MARKS)
(a)   Explain the importance of set theory in business.   (4 marks)
(b)   By use of Matrix algebra, develop the Leontief inverse matrix.   (8 marks)
(c)   Digital Ltd. Manufactures and sells floppy disks at Nairobi Industrial area. The average
total cost (ATC) and average revenue (AR) (in thousands of shillings) of producing x floppy
disks are given by the following functions:

$$ATC = \frac{1}{2}x^2 - \frac{5x}{2} + 50 + \frac{500}{x}$$

and
$$AR = 800 - 2x^2$$
Where: x is the number of floppy disks produced.
Required:
   (i)   The profit function.   (3 marks)
   (ii)   The number of floppy disks required to maximize profit.   (3 marks)
   (iii)   The maximum profit.   (2 marks)
a) Total cost of producing x units in a factory is $C(x) = 3x^2 + 7x + 12$. Find the average cost
    function and marginal cost function and determine AC and MC when x = 3 and 5. (5 marks)
b) An employee who received fixed annual increments had a final salary of Ksh 9000 p.a. after
    10 years. If his total salary was Ksh 65,000 over the 10 years, what was his initial salary? (5
    marks)

QUESTION TWO (20 MARKS)
Your company manufacturers large scale units. It has been shown that the marginal (or variable)
cost, which is the gradient of the total cost curve, is $(92 - 2x)$ Ksh. thousands, where x is the
number of units of output per annum. The fixed costs are Ksh. 800,000 per annum. It has also
been shown that the marginal revenue which is the gradient of the total revenue is $(112 - 2x)$
Ksh. thousands.

Required
   i.   Establish by integration the equation of the total cost curve (3marks)
   ii.   Establish by integration the equation of the total revenue curve (3 marks)
   iii.   Establish the break even situation for your company (4 marks)
   iv.   Determine the number of units of output that would
           a) Maximize the total revenue and (4 marks)
           b) Maximize the total costs, together with the maximum total revenue and total costs
               (6 marks)

QUESTION THREE (20 MARKS)
a) A firm is considering two separate capital projects with cash flows as follows

Year	0	1	2	3	4	5
Project 1	(80,000)	18,000	20,0000	25,000	38,000	45,000
Project 2	(120,000)	30,000	50,000	50,000	50,000	15,000

i) Using the NPV criterion and a discount rate of 15%, choose the project that is more
    profitable (5 marks)
ii) Find the NPVs using a discount rate of 20% and use the results to estimate the IRR for each
    project. Verify that using the IRR criterion, the decision in (i) is reversed and attempt to
    explain why. (8 marks)

a) The following information is about the raw material requirements to manufacture 3 types of jute bags B_1, B_2, B_3 with 3 qualities of jute J_1, J_2, J_3. The available raw material is also given determine with these details, how many bags the industry can manufacture (000) units. (7 marks)

Type of jute	Jute bags required			Jute available
	B_1	B_2	B_3	
J_1	4	3	5	27
J_2	1	6	2	19
J_3	3	1	3	15

QUESTION FOUR (20 MARKS)

Three clients of safaricom Ltd P, Q and R are direct competitors in the Mpesa business. In the first week of the year P had 300 customers Q had 250 customers and R had 200 customers. During the second week, 60 of the original customers of P transferred to Q and 30 of the original customers of P transferred to R. similarly in the second week 50 of the original customers of Q transferred to P with no transfers to R and 20 of the original customers of R transferred to P with no transfers to Q.

Required

a) Display in a matrix the pattern of retention and transfers of customers from the first to the second week (4 marks)
b) Re-express the matrix that you have obtained in part (a) showing the elements as decimal fractions of the original numbers of customers of P, Q and R (2 marks) *Refer to this re expressed matrix as B*
c) Multiply matrix B by itself to determine the proportions of the original customers that have been retained or transferred to P, Q and R from the second to the third week. (4 marks)
d) Solve the matrix equation (xyz)B = (xyz) given that $x + y + z = 1$ (8 marks)
e) Interpret the result that you obtain in part (d) in relation to the movement of customers between P, Q and R (2marks)

QUESTION FIVE (20 MARKS)

a) Determine the total demand (x) for the industry 1, 2, 3 given the matrix of technical coefficients (A), Capital and the final demand vector B. (10 marks)

$$A = \begin{matrix} 1 \\ 2 \\ 3 \end{matrix} \begin{pmatrix} 0.3 & 0.4 & 0.1 \\ 0.5 & 0.2 & 0.6 \\ 0.1 & 0.3 & 0.1 \end{pmatrix} \quad B = \begin{pmatrix} 20 \\ 10 \\ 30 \end{pmatrix}$$

b) Solve the equation $2x^2 - 11x + 22 = 10$ (5 marks)
c) The hire purchase value of a sewing machine is 25% more than its cash price. The HP terms require a customer to pay 32 ½ % of the HP price as deposit followed by 9 monthly instalments of Sh. 1500 each. Calculate the cash price of the sewing machine. (5 marks)

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