International Islamic University Chittagong
Department of Economics & Banking
Semester Ending Examination, Spring-2023
Program: BSS(Honors)

Course Code: MATH 2302 | Course Title: Mathematical Economics
Time: 02 Hours & 30 Minutes | Full Marks: 50

Answer following questions. All parts of a question must be answered sequentially. Figures in the right margin indicate full marks.

QN	Description of questions	Marks	CLO PLO	Cognitive learning
1	Consider the following input coefficient matrix and final demand vector: $A = \begin{bmatrix} 0.1 & 0.3 & 0.2 \\ 0.2 & 0.3 & 0.4 \\ 0.1 & 0.0 & 0.1 \end{bmatrix}; d = \begin{bmatrix} 130 \\ 40 \\ 580 \end{bmatrix}$			
	i. Write out the economic meanings of 0, 0.2, 0.4 and 40.	02	CLO-3 & PLO-1	Remember
	ii. What does the 1st column sum of input coefficient matrix measure?	01		Evaluate
	iii. Find solution output levels of three industries.	04		
	iv. Determine the amount of input supplied by first industry to all three industries?	03		
2(a)	Use the Lagrangian multiplier method to find the stationary value of Z: $Z = xy$, subject to $x + 2y = 2$	04	CLO-4 & PLO-4	Apply
2(b)	Define the following concepts with numerical example : (i) Local and global optimum, (ii) Point of inflection ,(iii) Technology matrix	06		Evaluate
	Or			
2(a)	Use the Lagrangian multiplier method to find the stationary value of z: $Z = xy$, subject to $2x + 3y = 500$	04	CLO-4 & PLO-4	Apply
2(b)	Assume a production function $Q = 96K^{0.3}L^{0.7}$. Determine maximum production at C = 1000, $P_k = 10, P_l = 5$.	06		Evaluate
3(a)	Distinguish between free optimization and constrained optimization.	02		
3(b)	Determine the extreme value(s) of $Z = 2x_1^2 + x_1x_2 + 4x_2^2 + x_1x_3 + x_3^2 + 2$	05	CLO-4 & PLO-4	Analyze
3(c)	Determine the relative extrema of the function $y = -2x^2 + 4x + 9$	03		Evaluate
	Or			
3(a)	Distinguish between free optimization and constraint optimization.	02		
3(b)	Determine the extreme value(s) of (i) $y = 3x^2 - 6x + 2$ (ii) $Z = x_1^2 + 3x_2^2 - 3x_1x_2 + 4x_2x_3 + 6x_3^2$	05	CLO-4 & PLO-4	Analyze Evaluate
4	A two product firm faces the demand and cost functions below: $P_1 = 55 - Q_1 - Q_2$ $P_2 = 70 - Q_1 - 2Q_2$ $C = Q_1^2 + Q_1Q_2 + Q_2^2$			
	(i) Determine the output levels that satisfy the first-order condition for maximum profit.	04	CLO-4 & PLO-4	Create
	(ii) Develop the second-order sufficient condition.	04		Remember
	(iii) What is the maximum profit?	02		
5	A firm faces the following demand and cost functions: $Q = 100 - P$ $C = \frac{1}{3}Q^3 - 7Q^2 + 111Q + 50$			
	(i) Write out the total revenue function R in terms of Q.	10	CLO-4 & PLO-4	Remember
	(ii) Formulate the total profit function in terms of Q.			Create
	(iii) Determine the profit-maximizing level of output.			Evaluate
	(iv) Prove that, revenue-maximizing level of output is greater than the profit maximizing level of output.			
	(v) What is the maximum profit?			