

International Islamic University Chittagong (IIUe)  
 Department of Economics & Banking  
 Semester Ending Examination; Spring~2022  
 Program: BSS (Honors)

Course Code: MA TH-2302  
 Time: 02 Hours 30 Minutes

Course Title: Mathematical Economics  
 Full Marks: 50

Answer any Five (05) of the following questions. All parts of a question must be answered sequentially.  
 Figures in the right margin indicate full marks.

1. Discuss the following concepts with necessary examples:
  - (i) Inter-industry dependence (ii) Input coefficient matrix. (iii) Primary input requirement and Final demand (iv) Technology Matrix
  
2. 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
  - (ii) What does the column sum of input coefficient matrix measure? 01
  - (iii) Find solution output levels of three industries. 05
  - (iv) What is the amount of input supplied by first industry to all three industries? 02
  
3. Find the extreme values of the following functions by the second-derivative test:
  - (i)  $y = x^3 - 12x^2 + 36x + 8$  1
  - (ii)  $z = 2x^2 + x_1x_2 + 4x_2^2 + x_1x_3 + x_3^2 + 2$  0
  
4. Revenue and cost functions of a firm are as below, 10

$$R = 100Q - Q^2$$

$$C = 3Q^3 - 7Q^2 + 111Q + 50$$
  - (i) Formulate the total profit function in terms of  $Q$ .
  - (ii) Compute the maximum profit.
  - (iii) Is revenue maximizing output higher than the profit maximizing output?
  
5. A two product firm faces the demand and cost functions below: 10

$$P_1 = 55 - Q_1 - Q_2$$

$$P_2 = 70 - Q_1 - 2Q_2; \quad C = Q_1 + Q_1Q_2 + Q_2^2$$
  - (i) Find the output levels that satisfy the first order condition for maximum profit.
  - (ii) Check the second order condition.
  - (iii) Find the amount of maximum profit.
  
6. Make a note of the following concepts: 05
  - (i) Objective function (ii) Choice variables and critical values (iii) Stationary value and stationary point (iv) Point of inflection (v) Free optimization and constrained optimization.
  
7. (a) Assume the utility function  $U = (x_1 + 2)(x_2 + 3)$ . Here  $x_1$  and  $x_2$  are the quantities consumed of two goods I and II. Prices of the goods are 4 and 5 respectively. Budget  $M = 120$ . What is the amount of maximum utility? 05
- (b) Find the amount of maximum utility of a consumer who spends tk. 500 for buying two goods X and Y. If utility function is  $U = \ln \left( \frac{x_1}{2} + \frac{x_2}{3} \right)$  05