'समानो मन्त्रः समितिः समानी'

UNIVERSITY OF NORTH BENGAL

B.A./B.Sc. Honours 1st Semester Examination, 2023

CC2-ECONOMICS (102)

MATHEMATICAL METHODS FOR ECONOMICS-I

Time Allotted: 2 Hours | Full Marks: 60

The figures in the margin indicate full marks.

GROUP-A

1. Answer any ***four*** questions: 3×4 = 12

(a) Given the total Cost function

$$C = 5x - x^2 + 5x^3$$

Show that $AC = MC$ when AC is minimum.

(b) What do you mean by homogeneous functions?

(c) Show that production function $Y = AL^{1/2}K^{1/2}$ exhibits Constant Returns to Scale.

(d) Find out the determinant of following matrix:

$$B = \begin{vmatrix} 2 & 0 & 2 \\ 0 & 2 & 4 \\ 1 & 2 & 0 \end{vmatrix}$$

(e) State Euler's Theorem.

(f) State important assumptions of input-output analysis.

GROUP-B

Answer any *four* questions 6×4 = 24

2. Given production function $\varphi = 5\ K^{1/2}L^{1/2}$ of the price of capital $(P_K) = 2$ and price of labour $(P_L) = 3$. Obtain the equation of expansion path.

3. Find the inverse of following matrix:

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & -1 & 3 \\ 3 & 2 & 1 \end{bmatrix}$$

4. State Hawkins-Simon conditions for the viability of input-output system.

5. Let us assume that utility function of consumer is given by $U = XY$. Let us say price of $X = P_X = 1$ and price of $Y = P_Y = 2$. The consumer total income is $M = 50$.

Derive demand function for *X* and *Y*.

6. Derive properties of Cobb-Douglas production function.

7. Given demand function for commodity *X* as following

$\varphi = 10 - 6P_X + P_Y$ where $P_X =$ Price of *X* and $P_Y =$ Price of *Y*.

(a) Find Own price Elasticity of Demand for *X*.

(b) Find Cross price Elasticity of *X*.

GROUP-C

Answer any *two* questions 12×2 = 24

8. Given the following input coefficient matrix:

$$A = \begin{bmatrix} 0.2 & 0.3 & 0.2 \\ 0.4 & 0.1 & 0.2 \\ 0.1 & 0.3 & 0.2 \end{bmatrix}$$ and the output vector X,

$$X = \begin{bmatrix} 24.84 \\ 20.68 \\ 18.36 \end{bmatrix}$$

Find the demand vector *D*.

9. Let the total Cost function is given by $C = \varphi^3 - 61.25\varphi^2 + 1528.5\varphi + 2000$

(i) Find the *MC* equation. 2

(ii) Find the *AC* equation. 2

(iii) Find the slope of *MC* equation. 2

(iv) At what value of output (φ) does *MC* equal *AC* $(MC = AC)$? 6

10. Prove that indifference curve is convex to origin.

11. A producer has the following production function

$\varphi = f(K, L) = 60K^{1/2}L^{1/3}$

If Price of labour $(P_L) = 15$ and Price of capital $(P_K) = 20$.

Find *L* and *K* which produce an output of 4200 units at the minimum cost.

——×——