POST-GRADUATE DEGREE PROGRAMME
Term End Examination — December, 2024
ECONOMICS
Paper-IV : MATHEMATICS FOR ECONOMICS

Time : 2 hours] [Full Marks : 50

Weightage of Marks : 80%

Special credit will be given accuracy and relevance in the answer. Marks will be deducted for spelling, untidy work and illegible handwriting. The weightage for each question has been indicated in the margin.

Use of scientific calculator is strictly prohibited.

1. Answer any *four* of the following questions : $2\frac{1}{2} \times 4 = 10$

   a) Define Polynomial function.

   b) What is Euler's theorem ?

   c) What is the degree of homogeneity of the demand function $q = AP^{-\alpha} M^{\beta}$?

   d) State the relation between *AC* and *MC*.

   e) Let $U = f(q_1, q_2)$. Deduce the slope of an Indifference curve.

   f) Evaluate $\int_1^3 7x^2 \, dx$.

2. Answer any *four* of the following questions : $5 \times 4 = 20$

   a) State Young's theorem. Show with the help of an example that cross partial derivatives are equal.

   b) The demand function is $D = 74 - 2p - p^2$. Calculate the price elasticity of demand when $D = 50$.

   c) Prove that under Cobb-Douglas production function, the elasticity of factor substitution is equal to unity.

d) Let $C = x^3 - 6x^2 + 15x$ be the total cost function. Show that when AC is minimum, $AC = MC$.

e) The utility function is $U = aq_1 + bq_2 + g\sqrt{q_1 q_2}$. Determine MRS.

f) Suppose we have : $S = -90 + 0 \cdot 375Y$, $I = 150 - 100r$, $L_1 = 0 \cdot 25Y$, $L_2 = 50 - 200r$, $M_0 = 180$. Using Cramer's Rule, determine the equilibrium rate of interest and the equilibrium level of income.

3. Answer any *two* of the following questions : 10 × 2 = 20

a) Solve the matrix equation $AX = B$ where

$$A = \begin{bmatrix} 1 & 2 & -1 \\ 3 & -1 & 2 \\ 2 & -2 & 3 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}, B = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}.$$

b) i) $P = 45 - \dfrac{q}{2}$ is the demand function. Find consumer's surplus if $P = 32 \cdot 5$. 6

ii) Evaluate $\int (x^3 + 3x + 5)\, dx$. 4

c) i) Let the production function be $q = \sqrt{KL}$. Show that $MRTS_{LK} = \dfrac{K}{L}$. 5

ii) $U = q_1 q_2$ and $P_1 = 2, P_2 = 5$ and M = 100. Determine the optimum value of q_1 and q_2, so that U is maximum. 5

d) Show mathematically that under diminishing MRS, an indifference curve will be strictly convex.