5/H–16 (vi) (Syllabus–2015)

2 0 1 8

(October)

ECONOMICS

(Honours)

(Mathematics for Economists)

Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, taking at least **one** from each Unit

UNIT—I

1. *(a)* Find the equation of the straight line passing through the points (2, 2) and (4, 8). 2

   (b) Determine the equation of the line having intercept *a* on *x*-axis and intercept *b* on *y*-axis. 2

(c) What are the differences between an ordered pair (1, 2) and a set {1, 2}?   3

(d) Prove the distributive laws using Venn diagrams.   4+4=8

2. (a) Differentiate between explicit and implicit functions.   3

(b) Three daily newspapers are published in a city with a literate population of 4000. Following are the reading habits :

48% read A, 54% read B, 64% read C, 28% read A and B, 32% read B and C, 30% read C and A and 6% do not read any of the newspapers

Find the number of persons who read (i) all three newspapers and (ii) B and C not A.   4+4=8

(c) Briefly explain the methods of denoting a set.   4

UNIT—II

3. (a) Distinguish between a symmetric matrix and a skew-symmetric matrix.   4

(b) Prove that $(ABC)^T = B^T C^T A^T$. Given

$$A = \begin{bmatrix} 2 & 1 \\ 4 & 2 \end{bmatrix}, B = \begin{bmatrix} 3 & 0 \\ 1 & 5 \end{bmatrix}, C = \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$$ 7

(c) Prove that matrix multiplication is not commutative.   4

4. (a) Solve the following linear programming problem graphically :   5

Maximize $Z = 45x + 80y$

subject to
$$5x + 20y \leq 400$$
$$10x + 15y \leq 450$$
$$x \geq 0, y \geq 0$$

(b) A factory has 90, 80 and 50 running feet respectively of teak, pinewood and rosewood. Product A requires 2, 1 and 1 running feet and product B requires 1, 2 and 1 running feet of teak, pinewood and rosewood respectively.

If A could sell for ₹ 48 and B could sell for ₹ 40 per unit, how much of each should be produced and sold to maximize gross income out of his stock of wood? Give a mathematical formulation of this linear programming problem and solve by graphical method.

$5+5=10$

UNIT—III

5. *(a)* Given the demand and average cost functions of a monopolistic firm as $P = 32 - 3Q$, $AC = Q + 8 + \dfrac{5}{Q}$. What level of output will maximize total profit and what are the corresponding values of MC and MR?

$6+2+2=10$

(b) Find the elasticity of demand (e) and MR at $p = 2$, if the demand function $q = 30 - 5p - p^2$.

5

6. *(a)* Explain an inflection point with suitable illustrations from economics. For the given function $y = x^3 - 3x^2 + 7$, find the point of inflection.

$3+3=6$

(Continued)

(b) Find the total differential of the following :

$3 \times 3 = 9$

(i) $Z = \dfrac{x^2 - y^2}{x^2 + y^2}$

(ii) $Z = (x^2 + y)(2x - y^2)$

(iii) $Z = \log(x^2 + y^2)$

UNIT—IV

7. *(a)* Use the substitution rule to find

$$\int \frac{4x^3 + 2}{(4x^4 + 8x)^5} dx$$

3

(b) Find the total revenue function and the demand function from the given marginal revenue function

$$MR = 3 - 2x - x^2$$

$2+3=5$

(c) What is producer's surplus? If a producer's supply function is given by $Q = \sqrt{-4 + 4p}$ and the market price is 10, find the producer's surplus.

$2+5=7$

(Turn Over)

8. *(a)* The demand and supply functions are $P_d = (6-q)^2$ and $P_s = 14+q$ respectively. Find the consumer's surplus under perfect competition. 9

(b) Find the integrals of the following : 3×2=6

(i) $\int \dfrac{I_n(x)}{x} dx$

(ii) $\int \dfrac{8x}{(2x^2 + 1)} dx$

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