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(5th Semester)

ECONOMICS

(Honours)

Paper No. : ECO–503 (b)

(Mathematical Economics)

Full Marks : 70

Pass Marks : 45%

Time : 3 hours

The figures in the margin indicate full marks for the questions

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

UNIT—I

1. *(a)* Distinguish between constrained and unconstrained optimisation. 7

   (b) Find the extreme values of the following functions : 3+4=7

   (i) $y = -3x^2 + 18x + 12$

   (ii) $y = \frac{1}{3}x^3 - 3x^2 + 5x + 3$

2. *(a)* Find all the first-order and second-order partial derivatives of the following utility function : 6

   $$U = 2x^2 + 4xy + 5y^2$$

(b) Define 'first-order difference equation'. In a market model

demand $(Q_{dt}) = 10 - 2P_t$

supply $(Q_{st}) = -5 + 3P_{t-1}$

Find intertemporal equilibrium price and also determine whether you will get stable equilibrium. 2+6=8

UNIT—II

3. *(a)* *(i)* Define 'pure quadratic equation'. Give example.

(ii) Find the solution of the following quadratic equation :

$$ax^2 + bx + c = 0$$ 3+4=7

(b) If α, β are the roots of the equation

$$36x^2 - 13x + 1 = 0$$

show that $\sqrt{\alpha}$, $\sqrt{\beta}$ are the roots of the equation $6x^2 - 5x + 1 = 0$. 7

4. *(a)* Distinguish between 'order' and 'degree' of differential equation with example. 7

(b) Solve the following differential equation

$$\frac{dy}{dx} + 5y = 8$$

when $y_0 = 3$. 7

UNIT—III

5. A consumer has an utility function $u = Ax^a y^{1-a}$, where x and y are goods purchased and his budget constraint is given by $P_x \cdot x + P_y \cdot y = B$. Find consumer's demand function for x and y and also derive—

(a) the own price elasticities;

(b) the cross price elasticities;

(c) the income elasticities. 14

6. *(a)* Consumer's demand function is given by

$$Q = 100 - 2P + 0{\cdot}004\,P^2$$

where Q and P are quantity and price. Calculate elasticity of demand when $P = 10$. 7

(b) If $Q = \sqrt{60 - \frac{3}{2}P}$ is the consumer's demand function where Q is quantity and P is price. Find consumer's surplus if price of the commodity is 16. 7

UNIT—IV

7. A firm has the short-run production function $Q = -2L^3 + 16L^2$, where Q is output and L is labour employed.

(a) Does the above production function fulfil required restriction on its coefficient?

(b) Show that $MP = AP$ when AP attains maximum.

(c) Find the value of L where total output is maximum. Also derive maximum total product value. 3+5+6=14

8. (a) Differentiate between homogeneous and non-homogeneous production function. 4

(b) Show that the production function

$$Q = f(a, b) = \sqrt{2Hab - Aa^2 - Bb^2}$$

where H, A, B are constants, is Homogeneous of degree 1 and verify Euler's theorem. 3+7=10

UNIT—V

9. A monopolist discriminates in prices between two markets and the price equations are given by

$$P_1 = 60 - 4Q_1$$
$$P_2 = 42 - 3Q_2$$

where, Q_1 and Q_2 are the outputs of first and second markets. The total cost function is given by

$$C = 50 + 12Q$$

where $Q = Q_1 + Q_2$. Find—

(a) profit maximising output;

(b) profit maximising prices;

(c) elasticities of demand of the markets;

(d) maximum profit. 6+2+4+2=14

10. A radio manufacturer produces x sets per week at a total cost of ₹ $(x^2 + 78x + 2500)$. He is a monopolist and the demand function for his product is $x = \frac{600 - P}{8}$, where P is the price per set. Show that maximum net revenue is obtained when 29 sets are produced per week. Also find monopoly price and profit level. 8+3+3=14

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