

2017

(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. What do you mean by 'differentiation'?
Differentiate the following functions w.r. to x :

3+3+4+4=14

(i) $y = \frac{12}{7\sqrt{x}}$

(ii) $y = (10 - x^4)(5x + x^2)$

(iii) $y = \frac{100 - 3x + 2x^2}{x^3 - 10}$

Define 'difference equation'. In a market model

$$Q_{dt} = a - bP_t; a, b > 0$$

$$Q_{st} = -c + dP_{t-1}; c, d > 0$$

$$Q_{dt} = Q_{st}$$

obtain the time path P_t and analyse the condition for its convergence. 4+10=14

UNIT—II

3. (a) Define 'quadratic equation'. Give examples.

(b) Solve the following equations :

(i) $10x^2 - 1200 = 10$

(ii) $x^2 - 16x + 63 = 0$

(iii) $9x^2 - 3x - 2 = 0$ 3+(3+4+4)=14

4. Define 'differential equation'. Find the complete solution of the following differential equation : 6+8=14

$$\frac{dy}{dx} + ay = b$$

UNIT—III

5. (a) Define 'total utility' and 'marginal utility'. Find the marginal utility for the following function when the consumer consumes 5 units of commodity x :

$$U = 5x^3 - 40x^2 + 600x + 100$$

(b) A consumer has a utility function

$$U = U(Q) = \alpha Q^\beta ; \alpha > 0; 0 < \beta < 1$$

Prove that the utility function displays diminishing marginal utility. (4+4)+6=14

6. (a) Define 'elasticity of demand'. Establish the relationship among Average Revenue (AR), Marginal Revenue (MR) and Elasticity of Demand (E_D).

(b) If consumer's demand function is given by $Q = f(P) = \sqrt{60 - 2P}$, where Q is output and P is price, find consumer's surplus when market price is ₹12. (2+6)+6=14

UNIT—IV

7. A producer has the following revenue and cost functions :

$$R = 30Q - Q^2$$

$$C = Q^3 - 15Q^2 + 10Q + 100$$

Find—

(a) profit maximising output;

(b) maximum profit;

(c) equilibrium price;

(d) point elasticity of demand at equilibrium level of output. 5+3+3+3=14

8. The Cobb-Douglas production function is given as

$$Q = f(L, K) = AL^\alpha K^\beta$$

where, L and K are labour and capital and $\alpha + \beta = 1$.

- (a) Find the marginal productivity of labour and capital.
 (b) Prove that the output is subject to constant returns to scale.
 (c) Prove that the elasticity of substitution of Cobb-Douglas production function is 1.

$$6+3+5=14$$

UNIT—V

9. What is 'price discrimination'? A monopolist discriminates prices between two markets 1 and 2 and his average revenue functions are given as

$$AR_1 = P_1 = 55 - 4Q_1$$

$$AR_2 = P_2 = 25 - 3Q_2$$

The total cost function is given by $C = 20 - 5Q + 2Q^2$, where $Q = Q_1 + Q_2$.

- (a) Find the profit maximising output to be sold in two markets.
 (b) Show that the market with higher elasticity of demand has lower price and vice-versa.

$$2+6+6=14$$

10. (a) A producer has his cost function $C = 2L + 5K$, where L and K are labour and capital inputs, subject to production function $Q = LK$. Find the optimum combination of L and K which minimise cost of production when $Q = 40$.

(b) Given the demand and supply functions for Cobweb model :

$$Q_{dt} = 10 - 2P_t$$

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

Find intertemporal equilibrium price and also determine whether you will get stable equilibrium.

$$7+7=14$$
