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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) What do you mean by differentiation?
Explain briefly the use of differentiation
in Economics. 2+4=6

- (b) Find the partial derivatives from the
following functions : 2+3+3=8

(i) $Y = 3x_1^3 + 7x_2^2 + 6x_1$

(ii) $Y = x_1^3 - 3x_1 - x_2 + x_2^2$

(iii) $Y = 2x_1^2 - 2x_1 + x_2^2$

2. (a) What do you mean by difference equation? Explain iterative method to solve a homogeneous difference equation with an example. 2+5=7

(b) Find the inter-temporal equilibrium price of the following market model and test whether the time path is stable or not : 7

$$Q_{dt} = 30 - 3P_t$$

$$Q_{st} = -10 + 4P_{t-1}$$

UNIT—II

3. (a) Find the solution of the following quadratic equations : 3+3+4=10

(i) $5x^2 - 10x = 0$

(ii) $2x^2 - 85x + 200 = 0$

(iii) $(2x + 3)(3x - 1) = -5$

(b) A firm faces the average cost function as $AC = 40x^{-1} + 10x$, where x is output. Find the level of output when $AC = 40$. 4

4. (a) Define differential equation. Distinguish between exact and non-exact differential equations with an example. 2+5=7

(b) Given the market model

$$Q_d = a - bP$$

$$Q_s = -c + dP$$

where a , b , c and d are constants. Does time path of price (P_t) dynamically unstable when change in price over time maintains direct proportional relation with excess demand? Also determine the conditions for dynamic stability.

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UNIT—III

5. (a) Define utility. If the total utility (TU) function is given as $TU = 2\sqrt{Q} + 4Q$, where Q is output then

(i) find the marginal utility (MU);

(ii) does MU represent diminishing trend? Give reason. 2+5=7

(b) Define elasticity of demand. If demand function is given as $P = 16 - 40q + 25q^2$, where q is quantity demanded, find the level of q when elasticity of demand is unity. 2+5=7

6. Define producer surplus and consumer surplus. Given the demand function and supply function as

$$P_d = 12 - 5 \cdot 5q$$

$$P_s = -4 + 2 \cdot 5q$$

where q is quantity. Find out consumer surplus and producer surplus. 4+5+5=14

UNIT—IV

7. (a) Establish relationship between average cost (AC) and marginal cost (MC). 6
- (b) If $TC = 5Q^3 - 20Q^2 + 75Q + 120$, where Q is output, find the level of output at which AC is minimum. Also check whether at that output level $AVC = MC$. 8
8. (a) Establish the relationship between average product (AP) and marginal product (MP) of a factor of production. 6
- (b) A firm has the production function $Q = 4K^{1/4}L^{1/2}$, where L is labour and K is capital. Prices of factor input and output are given as $P_L = 2$, $P_K = 4$ and $P_Q = 2$ per unit. Find the—
- (i) profit maximizing input level;
 - (ii) maximum profit;
 - (iii) equilibrium level of output. 4+2+2=8

UNIT—V

9. In a competitive market, total revenue (TR) and total cost (TC) of a firm are given as

$$TR = 270Q - 5Q^2$$

$$TC = 4Q^2 - 8Q + 200$$

where Q is output. If the government imposes a sales tax of ₹ 8 per unit of output, then find out the—

- (a) profit maximizing output;
- (b) equilibrium price;
- (c) maximum profit;
- (d) impact of sales tax on equilibrium price, output and profit level of the firm.

$$4+2+2+6=14$$

10. The demand functions of a monopoly firm are given as

$$Q_1 = 40 - 2P_1 - P_2$$

$$Q_2 = 35 - P_1 - P_2$$

where Q_1 , Q_2 and P_1 , P_2 are the quantities and prices in markets I and II. The total cost function is $TC = Q_1^2 + 2Q_2^2 + 10$. Find the—

- (a) level of output that maximizes profit of the firm;

(6)

- (b) equilibrium prices in each market;
- (c) maximum profit;
- (d) point elasticity of demand in each market.

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