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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 'optimisation'?
Distinguish between constrained and
unconstrained optimisations. 2+6=8
- (b) Differentiate the following functions
w.r.to x : 3+3=6
- (i) $Y = (10 - x^4)(4 - 5x - x^2)$
- (ii) $Y = \frac{100 - 3x - 2x^2}{x^3 - 10}$

2. (a) Distinguish between 'complementary'
and 'particular' solutions of a difference
equation. 6

- (b) Solve the following difference equation by
general method : 8

$$y_{t+1} - ay_t = c$$

Where a and c are constant.

UNIT—II

3. (a) Define 'quadratic equation'. Find the
solutions of the following quadratic
equations : 2+6=8

(i) $(x - 4)(2x - 3) = 6$

(ii) $13x^2 - 5 = 2(x - 8)$

- (b) If α and β are the roots of the equation

$$6x^2 - 5x - 1 = 0$$

show that α^2 and β^2 are the roots of the
equation

$$36x^2 - 13x - 1 = 0 \quad 6$$

4. (a) Distinguish between 'homogeneous' and
'non-homogeneous' differential equations. 6

(3)

- (b) Analyse the following market model for stability : 8

$$\begin{aligned} Q_d &= 14 - 3P \\ Q_s &= 10 + 2P \\ \frac{dP}{dt} &= 4(Q_d - Q_s) \end{aligned}$$

Where Q_d is quantity demanded, Q_s is quantity supplied, P is price and t is time

UNIT—III

5. (a) Define 'marginal utility'. Show that the following utility function displays diminishing marginal utility : 2+6=8

$$U = aQ^b, \text{ where } a > 0; 0 < b < 1$$

U is utility and Q is commodity.

- (b) A consumer consumes 20 units of x and 50 units of y when $P_x = ₹10$ and $P_y = ₹5$.
- (i) Derive the budget equation and his income if he spends entire income on x and y .
- (ii) Determine the consumer's MRS of x for y at the equilibrium position. 6

6. (a) Establish the relationship among AR, MR and elasticity of demand (E_D). 6

(4)

- (b) Define 'consumer surplus'. The demand function of a commodity is

$$P = 20 - 2Q - Q^2$$

where P is price and Q is quantity. Find the consumer's surplus when the demand is 3. 2+6=8

UNIT—IV

7. (a) Distinguish between 'homogeneous' and 'non-homogeneous' production functions. 4

- (b) A firm has total revenue (R) and total cost function as

$$\begin{aligned} R &= 46Q - 3Q^2 \\ C &= 2Q^2 + 4Q + 10 \end{aligned}$$

where Q is quantity of output. An excise tax at the rate t is imposed on the output. Find—

- (i) the tax rate (t) which will maximise tax revenue (T);
- (ii) firm's maximum profit after the payment of tax and price at which the product is sold. 10

8. (a) Explain briefly why the shape of AVC (average variable cost) curve is rectangular hyperbola. 4

(5)

(b) Given the short-run total cost function

$$C = 2Q^3 - 15Q^2 + 30Q - 16$$

- (i) Find out the level of output at which AVC is minimum and also show that MC = AVC at that level of output.
- (ii) Show that when output $Q = 4$, the average cost is minimum and MC = AC. 10

UNIT—V

9. The average revenues and total cost functions of a discriminating firm are given by

$$AR_1 = 80 - 3Q_1$$
$$AR_2 = 104 - 4Q_2$$

$TC = 50 + 10Q + 2Q^2$ where, $Q = Q_1 + Q_2$
 Q_1 and Q_2 are the outputs to be sold in two markets. Find the—

- (i) profit maximising output;
- (ii) equilibrium prices of the two markets;
- (iii) elasticity of demand of the markets;
- (iv) maximum profit. 5+3+4+2=14

(6)

10. (a) Distinguish between 'convergence' and 'divergence' of time path of price in cobweb market model. 6

(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 equilibrium is convergent or divergent. 8
