2019

(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. Define difference equation. Find the solution of the following difference equations by iterative method or by induction method : 5+3+3+3=14

(a) $\Delta Y_t = 4$ with the given initial condition of $Y_0 = 20$

(b) $Y_{t+1} = aY_{t+b}$

(c) $\Delta Y_t = -0 \cdot 2\, Y_t$

2. Explain the different rules of differentiation. 14

UNIT—II

3. *(a)* Define differential equation. What are different kinds of differential equation? 7

(b) Explain the solution of a differential equation with example. 7

4. *(a)* Give the order and degree of the following differential equations : 7

(i) $x\frac{d^2y}{dx^2} + 5(x+y)\frac{dy}{dx} + 3xy = x^2$

(ii) $\left(\frac{d^2y}{dx^2}\right) - 6\left(\frac{dy}{dx}\right)^3 + xy = 20$

(b) Solve the following differential equations and also test their exactness : 7

(i) $2xy\,dx + (x^2 + 4y)\,dy = 0$

(ii) $(x^2 + y^2)\,dx + 2xy\,dxy = 0$

(iii) $(y^3 - x)\frac{dy}{dx} = y$

(iv) $(2x + 3y + 1)\,dx + (3x - 2y + 1)\,dy = 0$

UNIT—III

5. *(a)* Define utility function. Find the marginal utilities for the following functions, when the consumer consumes 5 units of x (commodity) : 2+3+3=8

(i) $U = 5x^3 - 40x^2 + 600x + 10$

(ii) $U = 9x^3 - 7x^2 + 3x + 3$

(b) A consumer has a utility function $U = x^a y^b$, where x and y are quantities of two commodities and a and b are parameters, $0 < a < 1$ and $0 < b < 1$ and U is utility. Show that the marginal utilities are diminishing to increased consumption of either of the commodity. 6

6. *(a)* Given the price equation $P = 200 - 2\cdot 5Q$, where Q is quantity demanded. Find *(i)* the marginal revenue, *(ii)* the point of elasticity of demand, when $Q = 10$ and *(iii)* the nature of the commodity. 3+3+2=8

(b) Define elasticity of demand. Establish the following relationship : 2+4=6

$$Ed = \frac{AR}{AR - MR}$$

UNIT—IV

7. *(a)* Define production function. Prove that Euler's theorem holds true in the case of Cobb-Douglas production function,

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$$Q = AK^{\alpha}L^{\beta}$$

where L = labour input, K = capital input and A, α and β are constants and Q = output. 2+4=6

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(b) Given the product function

$$Q = f(K \cdot L) = 200\,K^{\frac{1}{2}}L^{\frac{1}{2}}$$

Find—

(i) marginal productivity of labour (L) and capital (K);

(ii) the slope of isoquant $\frac{dK}{dL}$. 4+4=8

8. *(a)* The total cost function of a firm is given by $C = Q^3 - 6Q^2 + 2Q + 50$, where Q is the output and C is the cost.

Find the level of output at which average variable cost (AVC) is minimum. Also show that AVC = MC at that level of output. 3+3=6

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b)

(b) A firm has the following average revenue (AR) and total cost (TC) functions :

$$AR = 160 - Q$$
$$TC = 200 + 4Q + 7Q^2$$

If a subsidy of ₹ 4 per unit of output is paid, find—

(i) profit maximizing output;

(ii) maximum profit;

(iii) the effect of subsidy on equilibrium price. 4+2+2=8

UNIT—V

9. (a) Define discriminating monopoly. What are the different degrees of price discrimination? 5

(b) 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 market. Total Cost (TC) = $50 + 12Q$, where $Q = Q_1 + Q_2$.

Find—

(i) profit maximising prices;

(ii) elasticity of demand of the markets;

(iii) maximum profits. 3+3+3=9

10. *(a)* A producer desires to minimize his cost of production

$$C = 2L + 5K$$

where L and K are inputs, subject to the satisfaction of the production function $Q = LK$. Find the optimum combination of L and K in order to minimize cost, where output is 40. 7

(b) In a Cobweb 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 of P_t and analyze the condition for its convergence. 7

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