(8 pages) **Reg. No. : .....**

Code No.: 7435 **Sub. Code: WESM 23**

M.A. (CBCS) DEGREE EXAMINATION, APRIL 2024.

Second Semester

Economics – Core

MATHEMATICAL ECONOMICS

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (15 × 1 = 15 marks)

Answer ALL questions.

Choose the correct answer :

1. The number of elements in the Power set $P(A)$ of the set $A = \{1, 2, 3,\}$ is :

   (a) 4 (b) 8

   (c) 2 (d) 3

2. A diagonal matrix in which all the diagonal elements are equal is called the ———— matrix.

   (a) Square (b) Upper Diagonal

   (c) Scalar (d) Null

3. Input - Output analysis assumes that ———— is the only primary input.

   (a) Land (b) Labour

   (c) Capital (d) None

4. The process of finding out the rate of change of one variable with respect to very small change in another variable is known as

   (a) Differentiation (b) Integration

   (c) Marginal Utility (d) Average Cost

5. Find the derivative of the Inverse Function $y = x^2$

   (a) $2x$ (b) $2x^3$

   (c) $\frac{1}{2x}$ (d) x^2

6. The second order condition for Maxima is

   (a) $\frac{dy}{dx} = 0$ (b) $\frac{d^2y}{d^2x} = 0$

   (c) $\frac{d^2y}{dx^2} > 0$ (d) $\frac{d^2y}{dx^2} < 0$

7. Differentiate the function x^5y^2 with respect to x

   (a) $5x \cdot 2y$ (b) $5x^4y^2$

   (c) $x^5 2y$ (d) $10x^4y$

8. If $u = 5xy - y^2$, compute marginal utility of y

(a) $5x - 2y$ (b) $5y - 2y$

(c) $5y$ (d) $5x$

9. A function that is Homogeneous of degree _____ is known as a "Linear Homogeneous Function".

(a) one (b) two

(c) three (d) four

10. The first step in formulating a LPP is

(a) Understand the problem

(b) Identify the decision variables

(c) State the constraints

(d) Identify the feasible solution

11. In solving an LPP by the simplex method, the _____ variable is associated with equality type constraint.

(a) Artificial

(b) Slack

(c) Surplus

(d) Both Slack and Surplus

12. _____ has been applied in a variety of industries to address different types of problems.

(a) Linear Programming

(b) Iso-Profit Line

(c) Input-Output Analysis

(d) Corner Point

13. Integrate the equation $\frac{dR}{dx} = 2 - 2x + 3x^2$

(a) $R = -2 + 6x$

(b) $R = 2 + 6x + C$

(c) $R = 2x - x^2 + x^3 + C$

(d) $2x - 2x^2 + 3x^3$

14. Who coined the term 'Cobweb Theorem'?

(a) Nicholas Kaldor (b) Henry Schultz

(c) Umberto Ricci (d) R.A. Fisher

15. Which one of the following models assumes a constant saving - income ratio?

(a) Kaldor Model

(b) Leontief Model

(c) Harrod - Domar Model

(d) Joan Robinson Model

PART B — ($5 \times 4 = 20$ marks)

Answer ALL questions, choosing either (a) or (b).
Each answer should not exceed 250 words.

16. (a) Solve $5x^2 + 14x + 8 = 0$.

Or

(b) The technology matrix of an economic system of two industries is $\begin{bmatrix} 0.2 & 0.2 \\ 0.7 & 0.2 \end{bmatrix}$. Test whether the system is viable as per Hawkins-Simon's conditions.

17. (a) Find the elasticity of demand for the demand function $Q = 50 - 5p - p^2$ at $p = 2$.

Or

(b) Show that $\lim_{x \to 3} \frac{x^2 + x - 12}{x - 3} = 7$.

18. (a) Explain the properties of Linear Homogeneous Function.

Or

(b) Find all the partial derivatives of the function $u = 12 - x^2 - y^2 + xy$ and prove $\frac{\partial^2 u}{\partial x \, \partial y} = \frac{\partial^2 u}{\partial y \, \partial x}$.

19. (a) Construct the dual of the following Linear Programming Problem:

Minimize $C = 3u + 4v$ subject to

$$5u + 6v \geq 7,\ 8u + 9v \geq 10,\ u, v \geq 0$$

Or

(b) Define the term L.P.P and describe the steps in the formulation of L.P.P.

20. (a) Solve $\frac{dy}{dx} = 3xy$.

Or

(b) Write a brief note on Solow's model.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceed 600 words.

21. (a) Solve the following equations by Cramer's Rule.

$x + 6y - z = 10$; $2x + 3y + 3z = 17$;
$3x - 3y - 2z = -9$

Or

(b) The data below concerns an economy of two industries A and B. The values are in lakhs of rupees. Determine the outputs when the final demand changes to 15 for A and 10 for B.

Producer	User		Final Demand	Total output
	A	B		
A	16	12	12	40
B	12	8	4	24

22. (a) Calculate the value of maxima and minima from the function $y = 2x^3 - 15x^2 + 36x + 11$.

Or

(b) If $C = \frac{1}{5}Q^3 - 6Q^2 + 150Q$, find the minimum AC. Also, prove that AC = MA at the minimum point of AC.

23. (a) The demand functions for the two markets and the total cost function of the monopoly firm are given below :

$P_1 = 14 - 2q_1$ $P_2 = 35 - 4q_2$ and $C = 2q_1 + 3q_2 + 4$

Determine the quantities of output that maximize the profit of monopolist and also find the prices of commodities and the maximum profit.

Or

(b) Find the total differential of $z = (2x^2 + 3y^2)(x^2 - y^2)$.

24. (a) Solve the following LPP by graphical method.

Maximize $z = 48x + 40y$

Subject to the constraints :

$2x + y \leq 90$,

$x + 2y \leq 80$,

$x + y \leq 50$,

and $x \geq 0,\ y \geq 0$

Or

(b) Solve the following linear programming problem by Simplex method.

Maximize $z = x_1 + 3x_2$

Subject to $3x_1 + 6x_2 \leq 8$

$5x_1 + 2x_2 \leq 10$

$x_1, x_2 \geq 0$

25. (a) Examine the Cob-Web model in detail.

Or

(b) Critically analyze Domar's model.
