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

Code No. : 8367 **Sub. Code : ZESM 23**

M.A. (CBCS) DEGREE EXAMINATION, APRIL 2022

Second Semester

Economics — Core

MATHEMATICAL METHODS

(For those who joined in July 2021 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The number of rows and columns of a matrix is called

(a) Order (b) Dimension

(c) Size (d) All the above

2. If $a_{ij} = -a_{ij}$ is called as

(a) Symmetric matrix

(b) Skew symmetric matrix

(c) Square matrix

(d) Diagonal matrix

3. The sum of diagonal elements of a square matrix A is called

(a) Trace (b) Transpose

(c) Determinant (d) Rank

4. Input-output analysis are widely used in

(a) National income accounting

(b) Economic planning

(c) The effects of war and trade cycles

(d) All the above

5. If $y = e^x$, $\frac{dy}{dx} = ?$

(a) e^x (b) xe^x

(c) $x^2.e^x$ (d) $2xe^x$

6. If $y = f(x)$, second order condition for maxima is

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

(c) $\frac{d^2y}{dx^2} = 0$ (d) $\frac{d^2y}{dx^2} \geq 0$

7. When the average cost curve is rising upwards, its slope will be positive, that is,

(a) MC < AC (b) AC = MC

(c) MC > AC (d) MR = MC

8. $\int x^5 dx = ?$

(a) $\frac{x^6}{6} + C$ (b) $\frac{x^2}{2} + C$

(c) $x + C$ (d) $4\frac{x^9}{9} + C$

9. Linear programming problem standard form involves

(a) One part (b) Two parts

(c) Three parts (d) Four parts

10. The number of non-zero variables is equal to the number of structured constraint is

(a) Feasible solution (b) Basic solution

(c) Dual problem (d) Optimal solution

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Find B, if $-A + 2B = 6C$, where $A = \begin{bmatrix} 1 & 2 & -1 \\ 3 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 2 & -1 & -7 \\ 3 & 0 & 0 \\ 4 & -1 & -5 \end{bmatrix}$.

Or

(b) If $A = \begin{bmatrix} 3 & 6 \\ 7 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 7 \\ 8 & 4 \end{bmatrix}$ and $C = \begin{bmatrix} 5 & 4 \\ 1 & 9 \end{bmatrix}$ verify that $(A + B) - C = A + (B - C)$.

12. (a) Find the inverse of the matrix $A = \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$.

Or

(b) What are the types of input-output model?

13. (a) Find $\frac{dy}{dx}$ of following function, if $y = (x^4 + x^3)(x^2 + x)$.

Or

(b) Find the elasticity of demand and marginal revenue, at $P = 1$, if the demand function $q = 7 - 2p$.

14. (a) Integrate : $\int \frac{3x}{(x^2 - 2)^2} dx$.

Or

(b) Integrate : $\int_2^3 (x^3 - 2x - 3)\, dx$.

15. (a) What are the assumptions of linear programming problem?

Or

(b) Obtain dual of the following linear programming problem

Maximize $Z = 2x_1 + 3x_2$

Subject to

$x_1 + 3x_2 \leq 12$

$2x_1 + x_2 \leq 6$

$x_1 + 5x_2 \leq 10$, and $x_1, x_2 \geq 0$.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Examine the properties of determinants of a matrix.

Or

(b) Given $A = \begin{bmatrix} 8 & 1 & -2 \\ -9 & 9 & 9 \\ 6 & -3 & 9 \end{bmatrix}$,

$B = \begin{bmatrix} 1 & -2 & 3 \\ 5 & -6 & -4 \\ 7 & -9 & 8 \end{bmatrix}$ and $C = \begin{bmatrix} 4 & -3 & 1 \\ 6 & 2 & -1 \\ 0 & -4 & 3 \end{bmatrix}$

Show that (i) $A(B + C) = AB + AC$ and (ii) $(A + B)C = AC + BC$.

17. (a) Solve the following linear equations

$2x_1 + 3x_2 = 5$

$11x_1 - 5x_2 = 6$.

Or

(b) In an economy of two industries A and B, the data in million of rupees is given below.

		Purchase by A	Purchase by B	Final Demand	Total Output
Sales By	A	12	6	6	24
	B	6	3	9	18

Determine the total output, if the final demand changes to 18 for A and 36 for B.

18. (a) Examine the features of Cobb-Douglas production function.

Or

(b) Find first and second order partial derivatives of the following function

$Z = 2x^3 + 5x^2y + xy^2 + y$ and also verify that $\frac{\partial^2 Z}{\partial x \partial y} = \frac{\partial^2 Z}{\partial y \partial x}$.

19. (a) Evaluate the following :

(i) $\int 4x^2(x^3+5)^3 dx$

(ii) $\int_2^3 (x+5x+7)\,dx$.

Or

(b) The demand function for a commodity $P = 30 - 2D$. The supply function $P = 3D$. Find consumer's surplus.

20. (a) Solve the following problems by graphical method $5x + 5y \geq 20$. Min $Z = 2x + 3y$, Subject to the constraint

$5x + 5y \geq 20$

$5x + 10y \geq 30$ and

$x, y \geq 0$.

Or

(b) Use graphical method to solve the following LPP.

Maximise $Z = 3x_1 + 4x_2$

Subject to the constraints

$2x_1 + x_2 \leq 40$

$2x_1 + 5x_2 \leq 180$

$x_1, x_2 \geq 0$.
