

**2024/FYUG/EVEN/SEM/
ECODSC-151T/011**

FYUG Even Semester Exam., 2024

ECONOMICS

(2nd Semester)

Course No. : ECODSC-151T

(Elementary Mathematics for Economics)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

SECTION—A

Answer any ten of the following questions :

2×10=20

1. Define set. Give an example of null set.
2. Mention two conditions of continuity of a function.

(2)

3. If

$$A = \{1, 2, 3, 4\}$$

$$B = \{6, 7, 8\}$$

find $A \cap B$.

4. Define symmetric matrix.

5. Distinguish between singular matrix and non-singular matrix.

6. Find rank of the matrix

$$A = \begin{bmatrix} 8 & 7 & 0 \\ 0 & 7 & 3 \\ 2 & 5 & 2 \end{bmatrix}$$

7. What is convex function?

8. Differentiate $y = a^x$.

9. Mention the order conditions for maximum-minimum values.

(3)

10. Define total derivative.

11. Find partial derivatives of $z = (x+4)(2x+5y)$.

12. Find the total differential of $z = \sqrt{x+y}$.

13. Define integration.

14. The marginal cost function of a product is $(1+x+6x^2)$. Find the total cost function if the fixed cost is ₹ 100.

15. Integrate the following :

(a) $\int 1 \, dx$

(b) $\int \frac{1}{x} \, dx$

SECTION—B

Answer any five of the following questions :

10×5=50

16. (a) Let $A = \{1, 2\}$, $B = \{0, 2\}$ and $C = \{2, 3\}$.
Prove that $(A \cup B) \times C = (A \times C) \cup (B \times C)$.

(4)

- (b) Illustrate the concept of Cartesian product with example.
- (c) Suppose $A = \{1, 2, 3, 4, 5, 6, 7, 8\}$, define a relation R from A to A by $R = \{(x, y) : y = x + 1\}$. What are its domain and range? $3+3+(2+2)=10$

17. (a) Find the limit of the following functions :

(i) $\lim_{x \rightarrow \infty} \frac{5x^2 + 4x^4}{5x^2 - 4x^4}$

(ii) $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - \sqrt{1-x}}{x}$

(b) Show that

$$\lim_{x \rightarrow 0} \frac{e^x - 1}{x} = 1 \quad (3+3)+4=10$$

18. (a) Find the inverse of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 5 \\ 1 & 5 & 12 \end{bmatrix}$$

(b) If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$

find $A^2 - 5A + 7I$

(5)

(c) If $A = \begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix}$

show that $(A')' = A$

$$5+3+2=10$$

19. (a) The IS and LM equations can be reduced to the following :

$$0.4Y + 150i = 209$$

$$0.1Y - 250i = 35$$

Find the equilibrium level of income \bar{Y} and rate of interest \bar{i} .

(b) Illustrate :

Diagonal matrix, Triangular matrix, Orthogonal matrix, Scalar matrix and Identity matrix. $5+5=10$

20. (a) Differentiate the following :

(i) $y = \frac{1}{\sqrt{8x^3 + 5x}}$

(ii) $y = (x^2 + 3)(2x^2 + 7)^3$

(b) Find the second-order derivative of

$$y = \log(ax^2 + bx + c)$$

(c) If the demand law is $x = \frac{20}{p+1}$, find

elasticity of demand (E_d) with respect to price at point $p = 3$. $(2+2)+3+3=10$

21. (a) Find $\frac{d^2y}{dx^2}$:

$$y = 15x^3 - 9x^2 - 8x$$

- (b) The cost function for x units of a product produced and sold by a firm is $C(x) = 250 + 0.005x^2$ and the total revenue is given as $R = 4x$. Find how many items should be produced to maximize the profit. What is the maximum profit? $2 + (5 + 3) = 10$

22. (a) If the utility function is

$$u = \log(ax_1 + bx_2 + c\sqrt{x_1x_2})$$

obtain the ratio of marginal utilities.

- (b) Given $z = x^3e^{2y}$. Find all the partial derivatives of second order.

- (c) Mention the conditions of Hessian determinant for maximization and minimization of two-variable case.

$$4 + 3 + 3 = 10$$

23. A firm's production function is $Q = 5L^{0.7}K^{0.3}$. The price of labour is ₹ 1 per unit and the price of capital is ₹ 2 per unit. Find the minimum cost combination of capital and labour for an output rate of 20. 10

24. (a) Distinguish between definite integral and indefinite integral.

- (b) Evaluate the following :

$$I = \int x^2 \log x \, dx$$

- (c) Evaluate the following :

$$\int_2^6 2x \, dx$$

$$4 + 4 + 2 = 10$$

25. (a) The marginal cost and marginal revenue of a firm are given as

$$MC = 4 + 0.08x, \quad MR = 12$$

Compute the total profit, given that fixed cost is zero.

- (b) If the demand law is $p = 85 - 4x - x^2$, what will be the consumer's surplus if (i) $x_0 = 5$ and (ii) $p_0 = 64$? $5 + 5 = 10$
