

**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.

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(Turn Over)

(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 $(A \cup B) \times C = (A \times C) \cup (B \times C)$.

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

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

show that $(A)^T = A$ $5+3+2=10$

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 :

$$\int_2^6 2x dx \quad 4+4+2=10$$

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) $p_0 = 64$? $5+5=10$
