**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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(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) $\underset{x \to \infty}{Lt} \dfrac{5x^2 + 4x^4}{5x^2 - 4x^4}$

(ii) $\underset{x \to 0}{Lt} \dfrac{\sqrt{1+x} - \sqrt{1-x}}{x}$

(b) Show that

$$\underset{x \to 0}{Lt} \dfrac{e^x - 1}{x} = 1$$ (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 :

$$0 \cdot 4Y + 150i = 209$$
$$0 \cdot 1Y - 250i = 35$$

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

(b) Illustrate :

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

20. (a) Differentiate the following :

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

(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 $x = \dfrac{20}{p+1}$, find elasticity of demand (E_d) with respect to price at point $p = 3$.   (2+2)+3+3=10

(6)

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

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

(b) The cost function for x units of a product produced and sold by a firm is $C(x) = 250 + 0 \cdot 005\, x^2$ 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

$$u = \log(ax_1 + bx_2 + c\sqrt{x_1 x_2})$$

obtain the ratio of marginal utilities.

(b) Given $z = x^3 e^{2y}$. 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 $Q = 5L^{0 \cdot 7} K^{0 \cdot 3}$. 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

(7)

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

(b) Evaluate the following :

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

(c) Evaluate the following :

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

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

$$MC = 4 + 0 \cdot 08x, \ MR = 12$$

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

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