

FYUG Even Semester Exam., 2025

ECONOMICS

(2nd Semester)

Course No. : ECODSC-151

(Elementary Mathematics for Economics)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

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

UNIT—I

1. Answer any *two* of the following questions :

2×2=4

- (a) Define Cartesian product.
- (b) Mention two properties of a function.
- (c) Find all the subsets of the set
 $S = \{1, 2, 3, 4\}$.

UNIT—II

2. Answer either (a) or (b) :

(a) Define limit of a function.

(ii) Find the limit $\lim_{x \rightarrow \infty} \sqrt{x^2 + 1} - \sqrt{x^2 - 1}$

(iii) Find the limit $\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$

(iv) Determine whether the function is continuous at $x = 2$. Justify the conclusion.

$$f(x) = \frac{(x^2 - 4)}{(x - 2)}$$

(b) Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ and let

$$A = \{3, 4, 5, 6, 7\}$$
$$B = \{1, 5, 7, 9\}$$
$$C = \{3, 6, 9\}$$

Find—
(i) $A \cap B$

(ii) $A^c \cap B$

(iii) $(A \cup B) - C$

(iv) $A - C$

(v) $(A \cap C) \cup (B \cap C)$

3. Answer any two of the following questions : $2 \times 2 = 4$

(a) What is transpose of matrix? Give one example.

(b) Mention any two properties of determinant.

(c) Define idempotent matrix.

4. Answer either (a) or (b) :

(a) What is determinant of a matrix?

(ii) If

$$B = \begin{pmatrix} a & h & g \\ h & b & f \\ g & f & c \end{pmatrix}$$

find determinant of B, i.e., $|B|$.

(iii) Evaluate :

$$\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$$

(iv) Let

$$A = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$$

find cofactors of the elements of matrix A. $2+3+3+2=10$

(b) (i) If

$$A = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$$

prove that $A^2 - 4A - 5I_3 = 0$.

following system of

(ii) Solve the equations using matrix inversion method or Cramer's rule :

$$x + 3y = 4$$

$$2x + 6y = 10$$

UNIT—III

5. Answer any two of the following questions :

(a) Define convex function..

(b) Find second-order derivative. Given

$$y = 5x^2 + \frac{5}{x}$$

(c) Mention the conditions for maxima and minima of a single-variable function.

6. Answer either (a) or (b) : 10

(a) Find the derivative of the following : $3+3+2+2=10$

(i) $y = (10^x + x^{10} + e^{x^2})$

(ii) $y = (x^2 + 4x + 6)^5$

(iii) $y = (1 - 4x^3)^{-2}$

(iv) $y = \ln(7x^2 - 3x + 5)$

(b) (i) Assume that an entrepreneur's short-run total cost function is given by $C = q^3 - 10q^2 + 17q + 66$. Determine the output level at which he maximizes profit if price of the product is ₹ 5 per unit.

(ii) For the function $y = 5x^4 + 8x^3 - 2x + 4$

find the higher order derivative

$$\frac{d^4 y}{dx^4}$$

(iii) Define concave function. $4+4+2=10$

UNIT—IV

Answer any two of the following questions :

7. Answer any two of the following questions :

(a) Define total derivative.

(b) Given the function $z = f(x, y)$. Mention the first-order and second-order conditions for maximum and minimum values of the function.

(c) What is constrained optimization?

8. Answer either (a) or (b) :

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

(ii) If the utility function is

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

Obtain the ratio of marginal utilities.

(iii) Examine at what point the following function maximizes or minimizes :

$$z = \frac{4}{3}x^3 + y^2 - 4x + 8y$$

$$3+3+4=$$

(b) (i) Find the total differential of $z = \sqrt{x+y}$.

(ii) Use the method of Lagrangian multiplier to find equilibrium consumption of two goods x and y on the basis of the following information :

Utility function, $U = xy + 2x$, price of $x = ₹ 4$, price of $y = ₹ 2$ and consumer money income = ₹ 60.

$$2+8=10$$

UNIT—V

9. Answer any two of the following questions :

$$2 \times 2 = 4$$

(a) Mention two properties of integration.

(b) Integrate :

$$\int_0^4 x^2 dx$$

(c) The marginal cost function of a firm is $2 + 3e^x$, where x is the output. Find the total cost function if the fixed cost is ₹ 500.

(Turn Over)

10. Answer either (a) or (b) :

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

(ii) Evaluate :

$$\int (6x+9)^8 dx$$

(iii) Evaluate :

$$\int \left(e^x + \frac{1}{x^3} + 1 \right) dx$$

(b) (i) Evaluate :

$$\int x^2 \log x dx$$

(ii) Find

$$\int_0^1 \left(2x + \frac{1}{x} \right) dx$$

(iii) If the demand law is $P = 85 - 4x - x^2$, what will be the consumer's surplus if $x_0 = 5$?