

3/ECO-201 Syllabus-2023

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(December)

FYUP : 3rd Semester Examination

MAJOR

ECONOMICS

(Mathematical Methods for Economics—I)

ECO-201

Marks : 75

Time : 3 hours

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

Answer **five** questions, taking at least
one from each Unit

UNIT—I

1. (a) If $A = \{2, 4, 6\}$, find all the subsets of the set A . Also, find the power set of the set A . 3+2=5
- (b) Find the symmetric difference of two sets A and B if $A = \{1, 3, 5, 7, 9\}$ and $B = \{2, 4, 6, 8, 10\}$. 5

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(Turn Over)

- (c) In a class of 50 students, 24 have taken Economics, 16 have taken Economics but not Political Science. Find the number of students who have taken Economics and Political Science, and those who have taken Political Science but not Economics. 5
2. (a) Define the Range and Domain of a function. 4
- (b) Differentiate between the following : $3+3=6$
- (i) Exponential and logarithmic function
- (ii) Convex and concave function
- (c) Plot the curve (i) $y = 3 + 2x$ and $2\frac{1}{2} \times 2 = 5$
(ii) $y = 2x^2 - x + 5$.
3. (a) Distinguish between an equation and an identity with suitable examples. 3
- (b) Find the equilibrium price and equilibrium quantity from the following linear partial equilibrium market model : 5
- $$Q_d = 20 - 7p$$
- $$Q_s = -4 + 5p$$
- (c) Find the equation of the straight line passing through two points (3, 9) and (4, 8). Does the point (5, 7) also lie on it? $5+2=7$

UNIT—II

4. (a) Define limit of a function. 3

(b) Evaluate any *two* of the following : $3 \times 2 = 6$

(i) $\lim_{x \rightarrow a} \frac{\sqrt{x} - \sqrt{a}}{x - a}$

(ii) $\lim_{x \rightarrow \infty} \frac{4x^3 - 3x^2 + x}{6x^3 - 3x^2 - 2x + 5}$

(iii) $\lim_{x \rightarrow 2} \frac{x^3 - 8}{x - 2}$

(c) Examine the continuity of the function at $x = 2$

$$f(x) = \begin{cases} 1+x & \text{when } x \leq 2 \\ 5-x & \text{when } x > 2 \end{cases} \quad 6$$

5. (a) Differentiate any *three* of the following functions : $2 \times 3 = 6$

(i) $y = x^5(2x^2 + 1)$

(ii) $y = \frac{3x+2}{4x^2+3}$

(iii) $y = xe^{x^2}$

(iv) $y = \log(x^2 + 2x)$

(4)

- (b) Given the function

$$z = \log \sqrt{x^2 + y^2}$$

Show that

$$x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} = 1 \quad 5$$

- (c) Find total differential of

$$u = x^2 y^3 + x^3 y^2 \quad 4$$

6. (a) A demand function of a monopolist is given by $P = 100 - x - x^2$. Find marginal revenue for any level of output x . What is MR when : (i) $x = 2$ and (ii) $x = 5$?

$$3+1+1=5$$

- (b) Prove that

$$E = \frac{AR}{AR - MR} \text{ or } MR = AR \left(1 - \frac{1}{E} \right)$$

where E is the elasticity of demand, AR is the average revenue and MR is the marginal revenue.

10

UNIT—III

7. (a) What are the conditions to be satisfied for a function to attain maximum and minimum values?

4

- (b) Find the maximum and minimum values of the function $y = x^3 - 3x + 1$.

$$2+2=4$$

(Continued)

- (c) If the demand function is $P = 100 - 4q$, find the level of output at which total revenue is maximum and also find the maximum revenue. 5+2=7

8. (a) Show that the maximum value of $x + \frac{1}{x}$ is less than its minimum value. 5

- (b) Let the cost function of a firm be given by the equation $C = 300x - 10x^2 + \frac{1}{3}x^3$, where C stands for cost and x for output. Calculate—

(i) output at which marginal cost is minimum;

(ii) output at which average cost is minimum. 5+5=10

9. (a) The demand function and cost function are

$$Q = 100 - p$$

$$C = \frac{1}{3}q^3 - 4q^2 + 108q - 50$$

Determine the level of output which will maximize profit. Also, calculate the maximum profit. 8

- (b) The total cost function is $C = 5x - 2x^2 + x^3$. Show that when average cost is minimum, $AC = MC$. 7

UNIT—IV

10. (a) What is integration? How does it differ from differentiation? $1+2=3$

- (b) Evaluate the following integrals (any four) $3 \times 4 = 12$

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

(ii) $\int (3e^{3x} + 2^x) dx$

(iii) $\int \left(x - \frac{1}{x} \right)^2 dx$

(iv) $\int \left(\frac{3x^6 + 3x^5 - 14x^4 + 10x^2 + 3}{x^3} \right) dx$

(v) $\int_0^4 (\sqrt{x} - 2x + x^2) dx$

(vi) $\int_0^2 (2x + 7) dx$

11. (a) What is meant by integration by parts? 3

- (b) Evaluate the following integrals by using an appropriate method : $4 \times 3 = 12$

(i) $\int x \log x dx$

(ii) $\int \left[(4x - 5) \sqrt{2x^2 - 5x + 3} \right] dx$

(iii) $\int \frac{x}{(x-2)(x-1)} dx$

(7)

12. (a) If the marginal cost for some products is given by $MC = 1 + 2x + 6x^2$, find the total cost when fixed cost is ₹ 100. 3

- (b) Under perfect competition, the demand and supply laws for a commodity are

$$P_d = 10 - x - x^2 \text{ and } P_s = x + 2$$

respectively, find the consumer's surplus (CS) and the producer's surplus (PS) at equilibrium price. 6+6=12
