

This question paper contains 4+1 printed pages]

Your Roll No. ....

5659

**B.A. (Hons.)/II**

**D**

**DISCIPLINE CENTRED CONCURRENT COURSE**

(Maths for other than Economics)

(Algebra and Calculus)

(Admissions of 2005 and onwards)

Time : 2 Hours

Maximum Marks : 38

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any two questions from each Section.

**Section A**

1. (a) Let  $A = \begin{bmatrix} 3 & -4 \\ -5 & 1 \end{bmatrix}$  and  $B = \begin{bmatrix} 7 & 4 \\ 5 & k \end{bmatrix}$ , what values

of  $k$ , if any, will make  $AB = BA$  ? 4

(b) If  $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ , show that  $A^2 - 5A + 7I = 0$ . 3

P.T.O.

2. (a) Given the matrix,  $X = \begin{bmatrix} 1 & 4 & 2 \\ -1 & 2 & 1 \\ 1 & 3 & 2 \end{bmatrix}$ , show that

$$XX^{-1} = I_3. \quad 3$$

- (b) Using Cramer's Rule, solve the following system of equations for  $x$ ,  $y$  and  $z$ ,

$$x + y + z = 5,$$

$$2x + y - z = 2,$$

$$2x - y + z = 2. \quad 4$$

3. (a) Find the lengths of major and minor axes, co-ordinates of foci and vertices and sketch the graph of ellipse

$$16x^2 + 25y^2 = 400. \quad 4$$

- (b) Find the angle between the straight lines joining the points  $(0, 0)$ ,  $(2, 3)$  and the points  $(2, -2)$ ,  $(3, 5)$ . 3

## Section B

4. (a) Find

$$\frac{dy}{dx}$$

$$\text{if } y^3 - 3xy^2 = x^3 + 3x^2y. \quad 3$$

- (b) Find the value of
- $a$
- so that the function

$$f(x) = \begin{cases} ax + 5, & \text{if } x \leq 2 \\ x - 1, & \text{if } x > 2 \end{cases}$$

$$\text{is continuous at } x = 2. \quad 3$$

5. (a) Examine the function
- $f(x) = x^3 - 3x^2 + 3x - 3$
- for

$$\text{concavity and points of inflection.} \quad 3$$

- (b) Find the intervals on which the function

$$f(x) = 2x^3 - 9x^2 + 12x \text{ is increasing or decreasing.} \quad 3$$

6. (a) Verify Rolle's Theorem for

$$f(x) = \sqrt{1-x^2} \text{ in } [-1, 1]. \quad 3$$

- (b) Obtain Maclaurin's expansion of  $f(x) = \sin x$ . 3

### Section C

7. (a) Evaluate :

$$\int \frac{1}{x^2 - 6x + 13} dx \quad 3$$

- (b) Find the area of the region bounded by the curves

$$y = x^2 \text{ and } y = x. \quad 3$$

8. (a) Solve the differential equation  $\frac{dx}{dt} = 2x^2t$  and find the

integral curve that passes through  $(t, x) = (1, 2)$ . 3

- (b) Evaluate :

$$\int \frac{x^2}{x^3 + 5} dx \quad 3$$

9. (a) Test the convergence of the sequence  $\langle a_n \rangle$ , where

$$a_n = 1 + \frac{1}{3} + \frac{1}{3^2} + \dots + \frac{1}{3^{n-1}}.$$

Find  $\lim_{n \rightarrow \infty} a_n$ .

3

- (b) The total revenue function of product is

$$R(x) = 200 + \frac{x^2}{5}.$$

Find :

(i) The average revenue

(ii) The marginal revenue when  $x = 25$ .

3