[This question paper contains 4 printed pages.]

5367 *Your Roll No.* ....

B.A. Prog. / III **B**

(E)

APPLICATION COURSE – MATHEMATICS FOR SOCIAL SCIENCES

(Admissions of 2004 and onwards)

Time : 2 Hours *Maximum Marks : 55*

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

Question No. **1** *is compulsory and carries* **15** *marks. Attempt* **four** *more questions selecting at least* **one** *question from each Section. Each question carries* **10** *marks.*

Note :– The maximum marks printed on the question paper are applicable for the students of the regular colleges (Cat. 'A'). These marks will, however, be scaled up proportionately in respect of the students of NCWEB at the time of posting of awards for compilation of result.

1. (i) Examine the concavity of the following function :

$$f(x) = x^3 - 3x^2 + 3x - 3. \quad (3)$$

P.T.O.

(ii) Find $\lim_{x \to 1} \frac{x-1}{x^2-1}$. (3)

(iii) If $A = \begin{bmatrix} 3 & 2 \\ 4 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} a & b \\ 3 & 5 \end{bmatrix}$, find a and b such that $AB = BA$. (3)

(iv) If $y = \frac{\log x}{x}$, find $\frac{dy}{dx}$. (3)

(v) Find the second order partial derivatives of the following function

$$Z = 3x^4 - x^2y^2 + xy^3$$ (3)

SECTION – I

2. (i) The total revenue function of product is

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

(i) The average revenue.

(ii) The marginal revenue when $x = 25$. (6)

(ii) Sketch the graph of ellipse $36x^2 + 4y^2 = 144$. (4)

3. (i) Evaluate $\int \frac{x^2}{x^3+5} dx$. (5)

(ii) Find the slope of the curve

$x^2 + y^2 - x + 1 = 0$ at the point (1, 2). (5)

SECTION – II

4. (i) Write down the Taylor's series for e^x and compute $e^{0.1}$ to three places of decimals. (6)

(ii) Prove that $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 6 \\ 2 \end{pmatrix}$ are linearly dependent. (4)

5. (i) Test the convergence of the series

$$\sum_{n=1}^{\infty} \frac{n^2}{n^3 + 4}.$$ (5)

(ii) Solve the differential equation $\frac{dx}{dt} = 2x^2t$ and find the integral curve that passes through $(t, x) = (1, 2)$. (5)

SECTION – III

6. (i) Find the rank of $\begin{bmatrix} 0 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 6 & 3 \end{bmatrix}$. (4)

(ii) Solve the following system of linear equations :

$$x + y - z = 1$$
$$3x + y - 2z = 3$$
$$x - y - z = -1$$ (6)

P.T.O.

7. (i) Use the method of Lagrange multipliers to find the maximum value of $f(x, y) = xy$ subject to the constraint $g(x, y) = x + y - 100 = 0$. (5)

(ii) Use the graphical method to solve the following linear programming problem :

max $(8x + 9y)$ subject to

$$x + 2y \leq 8$$

$$2x + 3y \leq 13$$

$$x + y \leq 6$$

$$x, y \geq 0.$$ (5)