This question paper contains 4 printed pages.]

5537 *Your Roll No. .....*

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

(E)

APPLICATION COURSE – MATHEMATICS FOR SOCIAL SCIENCES

(NC – 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.*

[P.T.O.

1. (i) Discuss the concavity of the following cost function of a firm

$c(x) = 0.001\,x^3 - 0.3x^2 + 30x + 42$

3

(ii) Determine the value of the constant K so that the function

$$f(x) = \begin{cases} \dfrac{x^2 - 3x + 2}{x - 1} & , \text{ if } x \neq 1 \\ \text{K} & , \text{ if } x = 1 \end{cases}$$

is continuous at $x = 1$.

3

(iii) Find y'', when $y = e^x \sin 3x$.

3

(iv) Find all first and second order partial derivatives of the following function

$z = y^2 \log x$.

3

(v) If $\text{A} = \begin{bmatrix} 2 & 8 \\ 3 & 0 \\ 5 & 1 \end{bmatrix}$, $\text{B} = \begin{bmatrix} 2 & 0 \\ 3 & 8 \end{bmatrix}$. Calculate AB.

Can you calculate BA ? Explain your answer.

3

Section I

2. (i) Prove that the curve $3y = x^3 - 3x^2 + 9x + 11$ has a maximum value at $x = -1$, a minimum value at $x = 3$ and a point of inflection at $x = 1$. 6

(ii) Find $\int x^2 \sin x^3 \, dx$. 4

3. (i) Sketch the graph of the curve $x^2 + 4x - 2y - 6 = 0$. 6

(ii) Find $\frac{dy}{dx}$ when $x^3 + y^3 = xy$. 4

Section II

4. (i) Write down the Taylor's sereis for $\cos x$ and compute $\cos(0.1)$ to three places of decimals. 6

(ii) Find all the values of a for which the scalar product of $(a, a + 1, 2)$ and $(a, a, 3)$ is equal to 0. 4

5. (i) Test for convergence the series $\sum_{n=1}^{\infty} \frac{1}{n^2 + n}$. 6

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

Section III

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

5

(ii) Solve the following system of linear equations

$$3x + 2y - z = 4$$
$$x + y + z = 6$$
$$2x - y + z = 3.$$

5

7. (i) Find $\frac{\partial Q}{\partial L}$ and $\frac{\partial Q}{\partial K}$ when $Q = 4L^{3/4} K^{1/4}$.

Also show that $L \frac{\partial Q}{\partial L} + K \frac{\partial Q}{\partial K} = Q$. 5

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

max $(2x + 5y)$ subject to

$-2x + 3y \leq 6$

$7x - 2y \leq 14$

$x + y \leq 5$

$x, y \geq 0$.

5