

This question paper contains 7 printed pages.]

Your Roll No.

5229

B.A. (Hons.) Programme B

Discipline Centred Concurrent Course

MATHEMATICS – Mathematical Methods

(Other than Economics)

(Admission of 2005 and onwards)

Time : 2 Hours

Maximum Marks : 38

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

Note : Question No. 1 is compulsory and carries **twelve** marks. Attempt **three** more questions selecting **one** question from each of Sections **I, II, III**. Marks are indicated against each part. Use of scientific calculator is allowed.

- 1 (i) Find the linearization $L(x)$ of function $f(x)=\sqrt{1+x}$ at $x = 0$ and using the linear approximation $f(x) \approx L(x)$. Estimate $\sqrt{1.005}$. 3
- (ii) If the Probability is 0.70 that any one registered voter (randomly selected from official rolls) will vote in a general election, what is the probability that two of five registered vote in the election ? 3
- (iii) A study of air pollution on daily emission of sulphur oxides on a certain plant showed that 80 of them selected at random have emission on the average 18.85 and standard deviation of 5.55. Construct a 95 percent large sample confidence interval for the plant's true average daily emission of sulphur oxides. 3

(iv) A furniture manufacturer wishes to determine the number of tables and chairs to be made by him in order to optimize the use of his available resources. These products utilize two different types of timber and he has on hand 1500 board feet of the first type and 1000 board feet of second type. He has 800 man hours available for the total job. Each table and chair requires 5 and 1 board feet respectively of the first type of timber and 2 and 3 board feet of second type respectively. 3 man hours are required to make a table and 2 man hours are needed to make a chair. He makes a profit of ₹ 12 on a table and ₹ 5 on a chair. Write out the complete linear programming formulation of the problem in terms of maximising the profit.

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SECTION – I

2. (i) Perform three iterations of the Newton-Raphson method to obtain the approximate value of $(17)^{1/3}$. Take the initial approximation as $x_0 = 2$. 5

- (ii) Solve the following system of equations ?

$$2x_1 + 2x_2 + x_3 = 1$$

$$4x_1 + 2x_2 + 3x_3 = 2$$

$$x_1 + x_2 + x_3 = 3$$

by using Gauss – elimination method with partial pivoting, wherever necessary. 5

3. (i) Perform four iterations of the Bisection method to find the smallest positive root of the equation 5

$$f(x) = x^3 - 2x - 5 = 0.$$

- (ii) Solve the following system of equations by using Gauss – Seidel method :

$$5x_1 + x_2 - 2x_3 = 2$$

$$3x_1 + 4x_2 - x_3 = -2$$

$$2x_1 - 3x_2 + 5x_3 = 10$$

Perform two iterations and take the initial approximation as $x^{(0)} = 0$.

5

SECTION – II

(11 marks)

4. (i) The following data pertain to the chlorine residual in a swimming pool in various time after it has been treated with chemicals :

<u>Number of</u> <u>hours</u>	<u>Chlorine residual</u>
2	1.8
4	1.5
6	1.4
8	1.1
10	1.1
12	0.9

Fit a least square line from which we can predict the chlorine residual in terms of the number of hours since the pool has been treated with chemicals.

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- (ii) What is our mathematical expectation if we win ₹ 10 if a balanced coin comes up heads and lose ₹ 10 if comes up tails ?

2

5. (i) The frequencies distribution of the digits in a set of random numbers was observed to be :

<u>Digit</u>	<u>Frequency</u>
0	24
1	18
2	16
3	14
4	20
5	25
6	17
7	18
8	23
9	25

Test the hypothesis that the digits are uniformly distributed i.e. they have the same frequencies using χ^2 Test. [given that $\chi^2_{.05}$ at 9 d.f = 16.92]

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- (ii) If an applicant for a teaching position feels that the odds are 7 to 4 that she will get the job. What probability is she thus assigning to her getting the job ? 2

SECTION – III

6. Solve the following linear programming problem by simplex method :

$$\begin{array}{ll}
 \text{Maximize :} & 4x_1 + 7x_2 \\
 \text{Subject to :} & 2x_1 + x_2 \leq 1 \\
 & x_1 + 7x_2 \leq 2 \\
 & x_1, x_2 \geq 0
 \end{array}
 \quad \text{5}$$

7. Solve the following two-person zero- sum game graphically :

		Player II	
		1	2
Player I	1	1	2
	2	-1	3
	3	2	1

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