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Your Roll No. .....

5285

B.A. (Hons.) Programme J

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 Taylor polynomial approximation of degree 5 of the function $f(x) = \cos x$ around the point $x = 0$. 3

   (ii) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the proportion of days on which some demand is refused. 3

(iii) Suppose that we want to test, on the basis of a random sample of size n = 5, whether or not the fat content of a certain kind of ice cream exceeds 12 percent. What can we conclude about the null hypothesis $\mu = 12$ percent at the 0.01 level of significance, if the sample has the mean $\bar{x} = 12.7$ percent and the standard deviation s = 0.38 percent [$t_{0.01}$ for 4 degree of freedom = 3.747] 3

(iv) Solve the following Linear Programming Problem by graphical method :

Maximize $Z = 2x_1 + 3x_2$

S.t. $x_1 + 2x_2 \leq 10$

$x_1 + x_2 \leq 6$

$x_1 \leq 4$

$x_1, x_2 \geq 0$ 3

SECTION – I

2. (i) Perform three iterations of the Newton-Raphson method to find a positive root of the equation :

$f(x) = x^3 - x - 4 = 0$

which lies in the interval (1, 2) 5

(ii) Solve the following system of equations by Gauss-elimination method :

$2x_1 + x_2 + 4x_3 = 12$

$4x_1 + 11x_2 - x_3 = 33$

$8x_1 - 3x_2 + 2x_3 = 20$ 5

3. (i) Perform four iterations of the bisection method to find the root of the equation

$f(x) = x^3 - x - 1 = 0$

which lies in the interval (1, 2) 5

(ii) Solve the following systems of equations using the Gauss-Seidel method :

$$-3x_1 + x_2 = -2$$
$$2x_1 - 3x_2 + x_3 = 0$$
$$2x_2 - 3x_3 = -1$$

Perform two iterations and take the initial approximation as $x^{(0)} = 0$. 5

SECTION – II

4. (i) The following are mid-term and final examination marks of eight students in a course in European History :

Mid term	Final Examination
75	81
66	57
92	95
86	77
65	71
44	62
60	63
79	84

Find the equation of the least square line which will enable us to predict final examination marks in this course from mid term marks. 9

(ii) A charitable organization raises funds by selling 2000 raffle tickets for a Rs. 500 first prize and Rs. 100 second prize. What is the mathematical expectation of a person who buys one of the tickets ? 2

5. (i) The specifications for the mass production of certain springs require, among other things, that the standard deviation of their compressed lengths should not exceed 0.040 cm. If a random sample of size n = 35 from a certain production lot yields s = 0.053 and the probability of a type-I error is not to exceed 0.01, does this constitute evidence for the null hypothesis $\sigma \leq 0.040$ or for the alternative hypothesis $\sigma > 0.040$? **9**

(ii) Let $\rho(C) = 0.65$, $\rho(D) = 0.40$ and $\rho(C \cap D) = 0.24$. Are the events C and D independent ? **2**

SECTION – III

6. Solve the following Linear Programming Problem by simplex method :

Maximize = $7x_1 + 5x_2$

Subject to $x_1 + 2x_2 \leq 6$

$4x_1 + 3x_2 \leq 12$

$x_1, x_2 \geq 0$ **5**

7. Solve the following two-person zero-sum game graphically : **5**

		Player II		
		1	2	3
Player I	1	1	−1	2
	2	2	3	1