Sl. No. of Question Paper : 622

Unique Paper Code : 235684

Name of the paper : Mathematics – II (Mathematical Methods) (Other than Economics)

Name of the Course – B. A. (H) – II

Semester : VI

Duration : 3 hours

Maximum Marks : 75

E

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

Question No. I is compulsory and carries thirty one marks.

Attempt three more questions selecting one question

from each of Sections I, II and III.

Marks are indicated against each part.

Use of scientific calculator is allowed.

1. *(i)* Find a fifth degree polynomial approximation to $f(x) = (1+x)^{1/2}$ using the Taylor series expansion about $x = 0$. **6**

   (ii) The height of plants of a certain species are normally distributed, the mean Height being 30 cm and the standard deviation being 5 cm. What is the probability that plant picked at random from the group will be between 26 (Area under the standard normal curve from 0 to 0.8 is 0.2881 and from 0 to 2 is 0.4772) **5**

   (iii) A car hire firm has two cars which it hires out day by day. The number of demand 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. $(e^{1.5} = 0.2231)$ **5**

   (iv) Use the linear approximation $(1+t)^k = 1 + kt$ to find an approximation for the function $f(x) = (3+2x)^{1/4}$ for value of x near 0. **4**

   (v) A study of air pollution on daily emission of sulphur oxide on a certain plant showed that 80 of them selected at random have emission on

average 18.85 ppm and standard deviation of 5.55 ppm. Construct a 95% large sample confidence interval for the plant's true average daily emission of sulphur oxides. **5**

(vi) Solve the following Linear Programming problem by graphical method.

$$\text{Maximize } Z = 2x + y$$

$$\begin{aligned} \text{Subject to: } 3x + 2y &\le 12 \\ x + 2.3y &\le 6.9 \\ x + 1.4y &\le 4.9 \\ x, y &\ge 0 \end{aligned}$$

6

Section I

2. *(i)* Solve $x^3 - 9x + 1 = 0$ for the root lying between 2 and 4. Using bisection method. Perform five iterations. **7**

(ii) Perform four iterations of the Newton-Raphson method to find the smallest positive root of the equation

$$f(x) = x^3 - 5x + 1 = 0$$

in the interval (0, 1). Take the initial approximation as $x_0 = 0.5$. **8**

3. *(i)* Calculate the approximate value of

$$\int_0^{\frac{\pi}{2}} \sin x \, dx$$

by Simpson's one third rule using eleven ordinates. **8**

(ii) Perform four iterations of the bisection method to obtain the smallest positive root of the equation

$$f(x) = \cos x - xe^x = 0.$$

7

Section II

4. *(i)* The dean of a college wants to use the mean of a random sample to estimate the average amount of time students take to get from one class to next, and she wants to be able to assert with 95% confidence that the error is at most 0.25 minute. If it can be presumed from experience that $\sigma = 1.50$ minute, how large a sample will she have to take. **7**

(ii) Seven mice are taken and their body weight (X) and length (Y) are measured.

Mouse	1	2	3	4	5	6	7
Units of weight (X)	1	4	3	4	8	9	8
Units of length (Y)	2	5	8	12	14	19	22

Find the Karl Pearson's coefficient of correlation between the two measures. **8**

(iii) A is known to hit a target in 5 out of 9 shots, whereas B is known to hit 6 out of 11 shots. What is the probability that the target would be hit when they both try? **5**

5. *(i)* If 4 coins are tossed. What is the expectation of the number of heads? **6**

(ii) Three variables have in pairs simple correlations coefficient given by

$$r_{12} = -0.8, \quad r_{13} = 0.7, \quad r_{23} = -0.9$$

Find the multiple correlation coefficient $R_{1,2,3}$ of X_1 on X_2 and X_3. **6**

(iii) In a study designed to test whether or not there is a difference between the average heights of adult females born in two countries, random sample yielded the following results:

$n_1 = 120 \qquad \bar{x}_1 = 62.7 \qquad \sigma_1 = 2.50$

$n_2 = 150 \qquad \bar{x}_2 = 61.8 \qquad \sigma_2 = 2.62$

Where the measurements are in inches. Use the 0.05 level of significance to test the null hypothesis that the corresponding population means are equal against the alternative hypothesis that they are not equal. **8**

Section III

6. *(i)* Solve the following linear programming problem by simplex method:

Maximize: $7x + 5y$

Subject to: $x - y \leq 2$
$5x - 2y \leq 8$
$x, y \geq 0$ **4**

(ii) Consider a modified form of "matching biased coins" game problem. The matching player is paid Rs. 8.00 if the two coins turn both heads and Rs. 1.00 if the coins turn both tails. The non-matching player is paid Rs. 3.00 when the two coins do not match. Given the choice of being the matching or non-matching player, which one would you choose and what would be your strategy? **5**

7. *(i)* Solve the following game using dominance principle :

Player A

$$\text{Player B} \quad \begin{bmatrix} 1 & 7 & 2 \\ 6 & 2 & 7 \\ 5 & 1 & 6 \end{bmatrix}$$

(ii) Define the following terms

(a) Saddle point and value of the game
(b) Maximin-Minimax criterion