

(Set-1)

**B.Tech-4th**  
**Mathematics-IV**

Full Marks : 70

Time : 3 hours

Answer any six questions including Q. No. 1

*The figures in the right-hand margin indicate marks*

1. Answer *all* the questions : 2 × 10

(i) Find the sum of  $0.123 \times 10^3$  and  $0.456 \times 10^2$ .  
Write the result in three-digit mantissa form.

(ii) What will be the error when a third degree polynomial is integrated by Simpson's  $\frac{1}{3}$  rule? Justify your answer.

(iii) Find the value of  $\nabla^2 y_3$  from the data given below :

x	1	2	3	4	5
y	2	5	10	17	26

( Turn Over )

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- (iv) Define basic feasible solution and degenerate basic feasible solution.
- (v) What are the limitations of Lagrange interpolation?
- (vi) Define Karl-Pearson's coefficient of correlation of two random variables  $X$  &  $Y$ . What do you mean by range of coefficient correlation?
- (vii) Define Null hypothesis.
- (viii) Six dice are thrown 729 times. How many times do you expect at least three dice to show a five or a six?
- (ix) In a poisson distribution if  $2P(X=1) = P(X=2)$ , then find standard deviation.
- (x) The probability distribution of a continuous random variable  $X$  is given by
- $$f(x) = \begin{cases} 6x(1-x), & 0 \leq x \leq 1 \\ 0, & \text{otherwise.} \end{cases}$$
- Check that  $f(x)$  is a probability density function. Hence, evaluate  $P(0 \leq X \leq \frac{1}{2})$ .

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2. (a) Find the real root of the equation  $x \log_{10} x - 1.2 = 0$ , correct to three decimal places by using Newton-Raphson method. 5
- (b) Find the real root of the equation  $xe^x - \cos x = 0$  by Regula-Falsi method correct to three decimal places. 5
3. (a) Using Gauss-Seidal method to solve the system of linear equations  $2x + y = 3$ ,  $x + 3y + z = 5$ ;  $y + 2z = 3$ . 5
- (b) Find the approximate value of  $\log_e 5$  by calculating to 4 decimal places, by Simpson's  $\frac{1}{3}$  rule,  $\int_0^5 \frac{dx}{4x+5}$ , dividing the range into 10 equal parts. 5
4. (a) Using Runge-Kutta method of order 4 solve for  $y(0.1)$ ,  $y(0.2)$  and  $y(0.3)$  given that  $y' = xy + x^2$ ,  $y(0) = 1$ . 5
- (b) Given that  $\sin 45^\circ = 0.7071$ ,  $\sin 50^\circ = 0.7660$ ,  $\sin 55^\circ = 0.8192$ ,  $\sin 60^\circ = 0.8660$  find  $\sin 52^\circ$ , using Newton's forward interpolation formula. 5

5. (a) Using simplex method solve the following LPP:

$$\text{Max. } Z = 3x_1 + 2x_2$$

$$\begin{aligned} \text{subject to } & x_1 + x_2 \leq 4, \\ & -x_1 + x_2 \geq -2, \\ & x_1, x_2 \geq 0. \end{aligned}$$

- (b) Using penalty method solve the following LPP:

$$\text{Minimize } Z = 4x_1 + x_2$$

$$\begin{aligned} \text{subject to } & 3x_1 + x_2 = 3, \\ & 4x_1 + 3x_2 \leq 6, \\ & x_1 + 2x_2 \leq 3, \\ & x_1, x_2 \geq 0. \end{aligned}$$

6. (a) Find the mean and variance of a binomial distribution.

- (b) From the following data, obtain the regression equation of  $y$  on  $x$ .

$x$	6	2	10	4	8
$y$	9	11	5	8	7

7. (a) 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 a poisson distribution with mean 1.5. Calculate the proportion of days on which (i) neither car is used (ii) some demand is refused.

- (b) Define normal distribution. Write down the four properties of normal probability curve.

8. (a) For sample I,  $\sum_{i=1}^{1000} x_i = 49000$ ,

$$\sum_{i=1}^{1000} (x_i - \bar{x})^2 = 784000. \text{ For sample II,}$$

$$\sum_{i=1}^{1500} x_i = 70500, \quad \sum_{i=1}^{1500} (x_i - \bar{x})^2 = 2400000.$$

Discuss the significance of the difference of the sample means.

( 6 )

(b) Write the short notes on :

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(i) Confidence interval

(ii) Estimation of parameters.

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