Reg. No. : | | | | | | | | | | | |

MECH

Question Paper Code : 70134

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Second Semester

Civil Engineering

MA 3251 – STATISTICS AND NUMERICAL METHODS

(Common to : All branches (Except Marine Engineering))

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define Type-I and Type-II errors.

2. Write down the uses of χ^2 distribution.

3. What do you mean by two-way classification in analysis of variance?

4. Give the reason, why a 2×2 Latin square is not possible?

5. State the condition for convergence of Newton-Raphson method and the order of convergence.

6. Solve $5x - 3y = 8$; $3x + y = 2$ by Gauss-Jordan method.

7. State the Newton forward formulae for the first and second order derivatives at $x = x_0$ upto the fourth order difference term.

8. Evaluate $\int_1^2 \frac{x}{1+x^2}dx$ using Trapezoidal rule, taking $h = 0.2$.

9. Using Euler's method find $y(0.2)$, given $\frac{dy}{dx} = x^2 + y,\ y(0) = 1$.

10. What is the condition to apply Adams-Bash forth predictor corrector method?

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Test whether the sample having the values 63, 63, 64, 55, 66, 69, 70, 70 and 71 has been chosen from a population with mean of 65 at 5% level of significance. (8)

(ii) Two random samples of 11 and 9 items show that the samples standard deviations of their weights as 0.8 and 0.5 respectively. Assuming the weight distributions are normal, test the hypothesis that the true variances are equal, against the alternative hypothesis that they are not. (8)

Or

(b) (i) To compare the prices of certain production in two cities, ten shops were selected at random in each town. The prices were noticed below.

City (x) :	61	63	56	63	56	63	59	56	44	61
City (y) :	55	54	47	59	51	61	57	54	64	58

Test whether the average prices can be said to be the same in two cities. (8)

(ii) The following data represents the monthly sales (in Rs.) of a certain retail stores in a leap year. Examine if there is any seasonality in the sales. 6,100, 5,600, 6,350, 6,050, 6,250, 6,200, 6,300, 6,250, 5,800, 6,000, 6,150 and 6,150. (8)

12. (a) In order to determine whether there is significant difference in the durability 3 makes of computers, sample of size 5 are selected from each make and the frequency of repair during the first year of purchase is observed. The results are as follows :

	A	5	6	8	9	7
Makes :	B	8	10	11	12	4
	C	7	3	5	4	1

In view of the above data, what conclusion can you draw? (16)

Or

(b) A variable trial was conducted on wheat with four varieties is a Latin square design. The plan of the experiment and the per plot yield are given below: (16)

C 25	B 23	A 20	D 20
A 19	D 19	C 21	B 18
B 19	A 14	D 17	C 20
D 17	C 20	B 21	A 15

Analyze data and interpret the result.

13. (a) (i) Find a real root of the equation $\cos x = 3x - 1$ correct to 4 decimal places using fixed point iteration method. (8)

(ii) Using Jacobi method to find the eigen values and the corresponding eigen vectors of the matrix $\begin{pmatrix} 6 & \sqrt{3} \\ \sqrt{3} & 4 \end{pmatrix}$. (8)

Or

(b) (i) Solve the system of equations by Gauss-Seidal method $x - y + 4z = 4$, $x + 5y + 3z = 6$ and $5x - y - z = 1$. (8)

(ii) Using Power method find the largest eigen value and the corresponding eigen vector of the matrix $\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$. (8)

14. (a) (i) Using Newton's divided difference formula, find the polynomial $f(x)$ and hence find $f(4)$ from the following data : (8)

x :	–2	–1	1	2	6
$f(x)$:	–15	–10	0	29	1705

(ii) Using Newton's backward interpolation formula, find the polynomial $f(x)$ from the following data and hence find $f(5)$. (8)

x :	–2	0	2	4	6
$f(x)$:	31	–7	11	133	407

Or

(b) (i) The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds. Find the final acceleration using the entire data : (8)

t :	0	5	10	15	20
v :	0	3	14	69	228

(ii) Evaluate $\int_2^3 \int_1^2 \frac{dx\,dy}{x^2 + y^2}$ using Simson's rule by four sub intervals. (8)

15\. (a) Apply Runge-Kutta method of order 4 to find an approximate value of y for $x = 0.2$ and $x = 0.4$, taking $h = 0.2$, if $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ given that $y = 1$ when $x = 0$. (16)

Or

(b) (i) Using Modified Euler method, find $y(0.1)$ and $y(0.2)$ given $\frac{dy}{dx} = 1 - y$; $y(0) = 0$. (8)

(ii) Solve $\frac{dy}{dx} = y - x^2$ at $x = 0.8$ by Milne's predictor and corrector method, given $y(0) = 1$, $y(0.2) = 1.12186$, $y(0.4) = 1.46820$ and $y(0.6) = 1.7379$. (8)