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Question Paper Code : 60045

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Second Semester

MA 3251 — STATISTICS AND NUMERICAL METHODS

(Common to All Branches (Except Marine Engineering))

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Statistical tables and calculators are permitted for use.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define critical value of a test statistic.
2. What do you mean by degree of freedom?
3. What are the three basic principles of experimental design? Write short notes on Analysis of Variance.
4. Compare randomized block design over Latin square design.
5. State the criterion for convergence of Newton-Raphson method.
6. Find all the Eigen values of $A = \begin{pmatrix} 2 & 3 \\ 3 & 2 \end{pmatrix}$ by Jacobi method.
7. If $f(x) = \frac{1}{x^2}$, find the divided difference $f(a, b)$ and $f(a, b, c)$.
8. Apply Trapezoidal method to evaluate $I = \int_0^1 e^{x^2} dx$, taking $h = 0.2$.
9. Use Euler's formula to find $y(0.2)$ and $y(0.4)$ given $y' = x + y$, $y(0) = 1$.
10. Write down the Adam-Bashforth predictor and corrector formulae.

PART B — (5 × 16 = 80 marks)

11. (a) (i) In a random sample of size 500, the mean is found to be 20. In another independent sample of size 400, mean is 15. Could the samples have been drawn from the same population with S.D.4. Use 1% level of significance. (8)
- (ii) Two independent samples of sizes 8 and 7 contained the following values : (8)
- Sample I : 19, 17, 15, 21, 16, 18, 16, 14
- Sample II : 15, 14, 15, 19, 15, 18, 16
- Is the difference between the sample means significance? Use 5% level of significance.

Or

- (b) (i) Fit a Poisson distribution for the following data and test the goodness of fit at 5% level of significance. (8)
- | | | | | | | | |
|-----|---|----|----|---|---|---|-------|
| x | 0 | 1 | 2 | 3 | 4 | 5 | Total |
| f | 6 | 13 | 13 | 8 | 4 | 3 | 47 |
- (ii) A total number of 3759 persons were interviewed in a public opinion survey on a political proposal. Of them, 1872 were men and the rest women. 2257 persons were favour of the proposal and 917 were opposed to it. 243 men were undecided and 442 women were opposed to the proposal. Justify or contradict the hypothesis that there is no association between sex of persons and their attitude at 5% level of significance. (8)
12. (a) Three varieties of a crop are tested in a randomized block design with four replications, the layout being given as below. The yields are given in Kilograms. Analyze for significance. (16)

C48	A51	B52	A49
A47	B49	C52	C51
B49	C53	A49	B50

Or

- (b) The following data resulted from an experiment to compare three burners B₁, B₂ and B₃. Use the Latin square design to test the hypothesis that there is no difference between the burners. (16)

	Engine-1	Engine-2	Engine-3
Day-1	B ₁ - 16	B ₂ - 17	B ₃ - 20
Day 2	B ₂ - 16	B ₃ - 21	B ₁ - 15
Day-3	B ₃ - 15	B ₁ - 12	B ₂ - 13

13. (a) (i) Find a positive root of $f(x) = 2x - \log_{10} x - 7$ using iterative method. (6)
- (ii) Use Gauss-Seidal iterative method to obtain the solution of the equations :
 $28x + 4y - z = 32$; $x + 3y + 10z = 24$; $2x + 17y + 4z = 35$, correct to 4 decimal accuracy. (10)

Or

- (b) (i) Solve the following system of equations by Gauss-Jordan method. (6)
 $x - y + z = 1$; $-3x + 2y - 3z = -6$; $2x - 5y + 4z = 5$.
- (ii) Find the dominant Eigen value and the corresponding Eigen vector of the matrix $A = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$ by Power method, correct to two decimal places. Choose the initial vector as $\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$. (10)

14. (a) (i) Find the number of students whose weight is between 60 and 70 lbs from the following data using Newton's forward difference interpolation formula. (8)

x Weight in lbs.	0-40	40-60	60-80	80-100	100-120
y No. of students	250	120	100	70	50

- (ii) Find the first two derivatives of the function at $x = 1.5$ from the table below using Newton's forward formula : (8)

x	1.5	2.0	2.5	3.0	3.5	4.0
y	3.375	7.0	13.625	24.0	38.875	59.0

Or

(b) (i) If $f(0) = 1, f(1) = 4, f(3) = 40$ and $f(4) = 85$, find $f(x)$ that satisfies this data using Newton's divided difference formula. Hence, find $f(5)$. (8)

(ii) Evaluate $\int_1^{1.2} \int_1^{1.4} \frac{dx dy}{x+y}$ by Simpson's y_3 Rule by taking $h = k = 0.1$. (8)

15. (a) (i) Solve $\frac{dy}{dx} = x^2 - y$, given $y(0) = 1$ and find values of $y(0.1)$ and $y(0.2)$ using Taylor series method, correct to four decimal places. (8)

(ii) Compute $y(0.1)$ given $\frac{dy}{dx} + y + xy^2 = 0, y(0) = 1$, by taking $h = 0.1$ using Runge-Kutta method of order four, correct to 4 decimal accuracy. (8)

Or

(b) (i) Use Euler's modified method to find $y(0.1), y(0.2)$ given $\frac{dy}{dx} = x^2 + y^2, y(0) = 1$. (8)

(ii) Use Milne's predictor-corrector formula to find $y(0.4)$, given $\frac{dy}{dx} = 0.5(1 + x^2)y^2, y(0) = 1, y(0.1) = 1.06, y(0.2) = 1.12$ and $y(0.3) = 1.21$. (8)