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Question Paper Code : 40876

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Fourth Semester

Automobile Engineering

MA 8452 — STATISTICS AND NUMERICAL METHODS

(Common to Mechanical Engineering/Mechatronics Engineering/Production Engineering/Robotics and Automation)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

(Statistical tables may be permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by degrees of freedom in the testing of Hypothesis?
2. Distinguish between parameter and statistic.
3. Is a 2×2 Latin square design possible? Why?
4. What do you mean by the term 'Experiment' in design of experiments?
5. Write a sufficient condition for Gauss-Seidel method to converge.
6. What is the order of convergence of Newton-Raphson method?
7. Is it possible to find two different interpolates to the same $(n+1)$ data using Lagrange's interpolation method? Justify.
8. How the accuracy can be increased in Trapezoidal rule of evaluating a given definite integral?
9. Write a significance of Euler - Modified method.
10. What will you do, if there is a considerable difference between predicted value and corrected value in predictor corrector methods?

PART B — (5 × 16 = 80 marks)

11. (a) (i) The following data give the number of air-craft accidents that occurred during the various days of a week

Day :	Mon	Tues	Wed	Thurs	Fri	Sat
No. of accidents :	15	19	13	12	16	15

Test whether the accidents are uniformly distributed over the week.
(Use Chi-square test) (8)

- (ii) The SD of a random sample of 1000 is found to be 2.6 and the SD of another random sample of 500 is 2.7. Assuming the samples to be independent, find whether the two samples could have come from populations with the same SD. (8)

Or

- (b) (i) A sample of size 13 gave an estimated population variance of 3.0, while another sample of size 15 gave an estimate of 2.5. Could both samples be from populations with the same variance? (8)
- (ii) Test the claim of a manufacturer that 95% of his 'stabilizers' confirm to ISI specifications if out of a random sample of 200 stabilizers produced by this manufacturer 18 were faulty. Use 0.01 L.O.S. (8)
12. (a) Four doctors each test four treatments for a certain disease and observe the number of days each patient takes to recover. The results are as follows (recovery time in days). (16)

Treatment				
Doctor	1	2	3	4
A	10	14	19	20
B	11	15	17	21
C	9	12	16	19
D	8	13	17	20

Discuss the difference between doctors and treatments.

Or

- (b) Analyse the variance in the following Latin square of yields (in kgs) of paddy where A, B, C, D denote the different methods of cultivation.

D122	A121	C123	B122
B124	C123	A122	D125
A120	B119	D120	C121
C122	D123	B121	A122

Examine whether the different methods of cultivation have given significantly different yields. (16)

13. (a) (i) Find the real root between 1 and 2 of the equation $2x^3 - 3x - 6 = 0$ by applying Newton's method, correct to five decimal places. (8)

- (ii) Using power method determine the largest eigenvalue and the corresponding eigenvector of the matrix $A = \begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$ initial

vector be $\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$. (8)

Or

- (b) Solve the following system of equations by

(i) Gauss Seidel method (8)

(ii) Gauss Jacobi method (8)

$$8x - 3y + 2z = 20; 4x + 11y - z = 33; 6x + 3y + 12z = 35$$

14. (a) (i) The table gives the distance in nautical miles of the visible horizon for the given heights in feet above the earth's surface :

X height :	100	150	200	250	300	350	400
Y distance:	10.63	13.03	15.04	16.81	18.42	19.90	21.27

Find the value of Y when $X = 218$ ft by using Newton's forward interpolation formulae. (8)

- (ii) Using Lagrange's formula of interpolation find $y(9.5)$ given (8)

x :	7	8	9	10
y :	3	1	1	9

Or

(b) Evaluate $\int_4^{5.2} \log_e x \, dx$ by

(i) Trapezoidal rule

(ii) Simpson's 1/3 rule

(iii) Also check up the results by actual integration. Assume $h = 1$, (16)

15. (a) (i) Using Taylor series method, find, correct to four decimal places, the value of $y(0.1)$, given $\frac{dy}{dx} - 2y = 3e^x$ and $y(0) = 0$. (8)

(ii) Using Euler's method, solve numerically the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ for $x = 0.2$. (8)

Or

(b) Find $y(0.1)$, $y(0.2)$, $y(0.3)$ from $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$ by using 4th order Runge-Kutta method and hence find $y(0.4)$ using Adam's method. (16)