

Reg. No. :

Question Paper Code : 90820

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

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

1. Use the method of testing of hypothesis for solving practical problems.
2. Apply analysis of variance tools in solving various application problems.
3. Use different numerical methods for solving system of linear and nonlinear equations.
4. Able to use interpolation, numerical differentiation and integration for real life problems.
5. Able to apply different methods to arrive numerical solutions for ODE, of dynamical systems.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Explain the critical region and acceptance region in testing of hypothesis.
2. What is the condition for a large and small samples in testing of hypothesis?
3. What is an extraneous variable in the design of experiments?
4. Construct the ANOVA table for two way classification.
5. Write down iterative formula for finding the value of $\frac{1}{N}$ using Newton's method.
6. How do you obtain the solution of a given simultaneous equations by using Gauss elimination method?
7. Write down the Newton's forward and backward interpolation formulae for equal intervals.

8. Form the divided difference table for the following function $f(x)=x^3+x+2$ for the arguments 1, 3, 6, 11.
9. Find $y(0.1)$ by Euler's method, given that $y'+y=0$ with $y(0)=1$.
10. Write down the Milne's predictor and corrector formulae to solve first order ordinary differential equations numerically.

PART B — (5 × 16 = 80 marks)

11. (a) (i) A sample of heights of 6400 Englishmen has a mean of 67.85 inches and a S.D of 2.56 inches, while a sample of heights of 1600 Australians has a mean of 68.55 inches and a S.D of 2.52 inches. Do the data indicate that Australians are on the average taller than Englishmen (use $\alpha = 5\%$) (8)

- (ii) Time taken by workers in performing a job are given below
Method I: 18 13 12 15 12 14 16 14 15
Method II: 16 19 13 16 18 13 15

Do the estimates of the population variance differ significantly at 5% level. (8)

Or

- (b) (i) The following table gives the values of protein from Kangeyam cow's milk and buffalo's milk. Examine if these differences are significant (use $\alpha = 5\%$). (8)

| | | | | | | |
|------------------|------|------|------|------|------|------|
| Cow's milk : | 1.90 | 1.95 | 2.00 | 2.02 | 1.85 | 1.80 |
| Buffalo's milk : | 2.12 | 2.00 | 2.20 | 2.45 | 2.20 | 2.10 |

- (ii) A sample analysis of examination results of 1000 students were made and it was found that 260 failed, 110 first class, 420 second class and rest obtained third class. By applying Chi square test whether the general examination result is in the ratio 2 : 1 : 4 : 3 (use $\alpha = 5\%$). (8)

12. (a) A company appoints 4 salesmen A, B, C, D and observed their sales in 3 seasons namely summer, winter and monsoon. The figures (in lakhs of Rupees) are given in the following table (16)

| Seasons | Salesman | | | |
|---------|----------|----|----|----|
| | A | B | C | D |
| Summer | 38 | 40 | 41 | 39 |
| Winter | 45 | 42 | 49 | 36 |
| Monsoon | 40 | 38 | 42 | 42 |

Perform the two-way analysis of variance at 5% level of significance.

Or

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- (b) Analyze the variance in the Latin square of yields (in Kgs) of paddy where A, B, C and D denote the different methods of cultivation. (16)

A 18 C 21 D 25 B 11
D 22 B 12 A 15 C 19
B 15 A 20 C 23 D 24
C 22 D 21 B 10 A 17

Examine whether the different methods of cultivation have given significantly different yields (use $\alpha = 5\%$).

13. (a) (i) Find a root of $x \log_{10} x = 1.2$ correct to two decimal places by using Newton-Raphson method (8)
(ii) Solve by Gauss elimination method, for the given system of equations
 $3x + 4y + 5z = 18$
 $2x - y + 8z = 13$ (8)
 $5x - 2y + 7z = 20$

Or

- (b) (i) Solve the following system of equations by using Gauss seidel method upto 5 iterations (8)

$$10x - 5y - 2z = 3$$

$$4x - 10y + 3z = -3$$

$$x + 6y + 10z = -3$$

- (ii) Find the largest eigenvalue and the corresponding eigenvector for the given matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ by using power method. Assume

initial vector is $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$. (8)

14. (a) (i) Fit a Lagrangian interpolation polynomial $y = f(x)$ and hence evaluate $f(2)$ for the following data (8)

$$x: \quad 0 \quad 1 \quad 3 \quad 4$$

$$y = f(x): -12 \quad 0 \quad 6 \quad 12$$

- (ii) Find $f(6)$ for the following data using Newton's divided difference formula (8)

$$x: \quad 0 \quad 1 \quad 2 \quad 4 \quad 5 \quad 7$$

$$f(x): \quad 0 \quad 0 \quad -12 \quad 0 \quad 600 \quad 7308$$

Or

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- (b) (i) Find the value of $\sin 38^\circ$ using Newton's interpolation formula (8)

| | | | | | |
|-----------|---|----|----|----|----|
| x° | 0 | 10 | 20 | 30 | 40 |
|-----------|---|----|----|----|----|

| | | | | | |
|----------|---|---------|---------|---------|---------|
| $\sin x$ | 0 | 0.17365 | 0.34202 | 0.50000 | 0.64279 |
|----------|---|---------|---------|---------|---------|

- (ii) Evaluate $\int_{0.5}^{0.7} [\sqrt{x} e^{-x}] dx$ by taking 5 ordinates using Simpson's 1/3 rule. (8)

15. (a) Using Runge - Kutta method of fourth order solve $\frac{dy}{dx} = x^2 + y^2$ given that $y(0)=1$, and find $y(0.1)$ and $y(0.2)$ by taking $h=0.1$. (16)

Or

- (b) Solve $\frac{dy}{dx} = x(x^2 + y^2)e^{-x}$ by using Milne's method at $x=0.4$ given that $y(0)=1$. The values of y at $x=0.1, 0.2$ and 0.3 are to be computed by using Taylor's series methods. (16)

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