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Question Paper Code : 70859

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fourth Semester

Mechanical Engineering

MA 8452 — STATISTICS AND NUMERICAL METHODS

(Common to : Automobile Engineering/Mechatronics Engineering/Production Engineering/Robotics and Automation)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What do you mean by degrees of freedom in the testing of hypothesis?
2. Distinguish between parameter and statistic.
3. What is the aim of the design of experiments?
4. Is a 2×2 Latin square design possible? Why?
5. Write a sufficient condition for the Gauss-Seidel method to converge.
6. What is the order of convergence of Newton-Raphson method?
7. How the accuracy can be increased in trapezoidal rule of evaluating a given definite integral?
8. If $f(x) = \frac{1}{x^2}$, then write the first divided difference $f(a, b)$.
9. What will you do, if there is a considerable difference between predicted value and corrected value in predictor corrector methods?
10. State the special advantage of the Runge - Kutta method over the Taylor series method in solving ordinary differential equations numerically.

PART B — (5 × 16 = 80 marks)

11. (a) (i) The demand for a particular spare part in a factory was found to vary from day-to-day. In a sample study the following information was obtained.

Days :	Mon	Tue	Wed	Thur	Fri	Sat
No. of parts demanded :	1124	1125	1110	1120	1126	1115

Test the hypothesis that the number of parts demanded does not depend on the day of week. (9)

- (ii) The fatality rate of typhoid patients is believed to be 17.26%. In a certain year 640 patients suffering from typhoid were treated in a metropolitan hospital and only 63 patients died. Can you consider the hospital is efficient? (7)

Or

- (b) (i) The means of two single large samples of 1,000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population of standard deviation 2.5 inches? (9)

- (ii) A sample of 900 members has a mean 3.4 cms. And s.d. 2.61 cms. Is the sample from a large population of mean 0.25 cms. and standard deviation 2.61 cms? (7)

12. (a) The following data gives the number of units of production per day turned out by 5 different workers using 4 different types of machines:

		Machine Type			
		A	B	C	D
1		44	38	47	36
2		46	40	52	43
Workers	3	34	36	44	32
4		43	38	46	33
5		38	42	49	39

- (i) Test whether the five men differ with respect to mean productivity.
 (ii) Test whether the mean productivity is the same for the four different machine types.

Or

- (b) A completely randomized design experiment with 10 plots and 3 treatments gave the following results:

Plot No :	1	2	3	4	5	6	7	8	9	10
Treat :	A	B	C	A	C	C	A	B	A	B
Yield :	5	4	3	7	5	1	3	4	1	7

Analyze the results for treatment effects.

13. (a) (i) Using Newton's method, find the root between 0 and 1 of $x \log_{10} x = 1.2$ correct to 5 decimal places. (9)

- (ii) Using Power method, determine the largest eigenvalue and the corresponding eigenvector of the matrix $\begin{pmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{pmatrix}$; initial vector

be $\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$. (7)

Or

- (b) Solve the following system of equations by

- (i) Gauss Jacobi method (9)
(ii) Gauss Seidel method. (7)

$$28x + 4y - z = 32; \quad x + 3y + 10z = 24; \quad 2x + 17y + 4z = 35$$

14. (a) Given the value

X :	5	7	11	13	17
Y :	150	392	1452	2366	5202

Evaluate $f(9)$, using

- (i) Newton's divided difference formula. (9)
(ii) Lagrange's interpolation formula. (7)

Or

- (b) Evaluate $\int_0^{10} \frac{dx}{1+x^2}$ with $h = 1$ by (i) Trapezoidal rule (ii) Simpson's 1/3 rule (iii) Compare and comment your answer with the actual integer value. (6+6+4)

15. (a) (i) Using Taylor series method find, correct to four decimal places, the value of $y(1.1)$ and $y(1.2)$, given $\frac{dy}{dx} = x^2 + y^2$ given $y(1) = 2.3$. (9)

(ii) Using Euler's method, solve numerically the following equation for $x = 0.1$ $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$. (7)

Or

(b) (i) Using Modified Euler's method, solve numerically the equation $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}$, $y(1) = 1$ for $x = 1.3$. (9)

(ii) Apply Milne's method, find $y(4, 4)$ if $y(x)$ is the solution of $5xy' + y^2 - 2 = 0$ given $y(4) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$ and $y(4.3) = 1.0143$. (7)