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Question Paper Code : 10879

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

Use Statistical Table is permitted.

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. A random sample of 500 pineapples was taken from a large consignment and 65 were found to be bad. Find the percentages of bad pineapples in the consignment.
2. The means of 2 large samples 1000 and 2000 members are 67.5 inches and 68 inches respectively. Can the samples be regarded as drawn from the same population of standard deviation 2.5 inches.
3. State the advantages of Latin square design over other designs.
4. Write down the ANOVA table for one way classification.
5. Gauss Seidel method is better than the Gauss Jacobi method. Why?
6. Derive Newton Raphson formula to find the cube root of a positive number K.
7. Find the divided difference table for the following :

$X:$	0	1	4	5
$F(x):$	8	11	78	123
8. What is the Lagrange's formula to find $y(x)$ if three sets of values (x_0, y_0) , (x_1, y_1) , (x_2, y_2) are given?
9. Solve the equation $y' = \log(x + y)$ using modified Euler's method.
10. Write down the predictor corrector formula for Adam's Bashforth method.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) A group of 10 rats fed on diet A and another group of 8 rats fed on diet B, recorded the following increase in weight (gms) (8)

Diet A: 5 6 8 1 12 4 3 9 6 10

Diet B: 2 3 6 8 10 1 2 8

Does it show superiority of diet A over diet B?

- (ii) Two independent samples of sizes 9 and 7 from a normal population had the following values of the variables (8)

Sample 1: 18 13 12 15 12 14 16 14 15

Sample 2: 16 19 13 16 18 13 15

Do the estimates of the population variance differ significantly at 5% level?

Or

- (b) (i) The following is the distribution of the hourly number of trucks arriving at a company's warehouse. (8)

Trucks arriving/hour: 0 1 2 3 4 5 6 7 8

Frequency: 52 151 130 102 45 12 5 1 2

Find the mean of the distribution and using it mean as the parameter λ , fit a poisson distribution. Test for goodness of fit at the level of significance $\alpha = 0.05$.

- (ii) A random sample of 16 values from a normal population showed a mean of 41.5 inches and the sum of squares of deviations from this mean equal to 135 square inches. Show that the assumptions of a mean 43.5 inches for the population is not reasonable. Obtain 95 percent and 99 percent confidential limits for the same. (8)

12. (a) (i) The following figures relate to production in kgs. Of three varieties A, B, C of wheat shown on 12 plots. (8)

A 14 16 18

B 14 13 15 22

C 18 16 19 19 20

Is there any significant difference in the production of the varieties?

- (ii) The yield of four strains of Gallipoli wheat planed in five randomized blocks in kgs per plot is given below (8)

Strains	Blocks				
	1	2	3	4	5
A	32	34	34	35	36
B	33	33	36	37	34
C	30	35	35	32	35
D	29	22	30	28	28

Test for differences between blocks and differences between strains.

Or

- (b) (i) The following is a Latin square of a design when 4 varieties of seeds are being tested. Set up the analysis of variance table and state your conclusion. You may carry out suitable change of origin and scale. (8)

A	105	B	95	C	125	D	115
C	115	D	125	A	105	B	105
D	115	C	95	B	105	A	115
B	95	A	135	D	95	C	115

- (ii) Find out the main effects and interaction in the following 2^2 factorial experiment and write down the analysis of variance table. (8)

Block	Treatments			
I	(1)	kp	k	p
	64	6	25	30
II	k	(1)	kp	p
	14	75	33	50
III	kp	p	k	(1)
	17	41	12	76
IV	p	k	(1)	kp
	25	33	75	10

13. (a) (i) Find the inverse of $\begin{pmatrix} 2 & 2 & 6 \\ 2 & 6 & -6 \\ 4 & -8 & -8 \end{pmatrix}$ using Gauss Jordan method. (8)

- (ii) Solve the system of equations $4x + 2y + z = 14$; $x + 5y - z = 10$; $x + y + 8z = 20$ by using Gauss Seidal iteration method. (8)

Or

- (b) (i) Using power method to find the dominant eigenvalue and eigenvector of $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$. Take $X_0 = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$. (8)
- (ii) Solve the following equation using Jacobi's iteration method $30x - 2y + 3z = 75$; $x + 17y - 2z = 48$; $x + y + 9z = 15$. (8)
14. (a) (i) From the given table, the values of Y are consecutive terms of a series of which 23.6 is the 6th term. Find the first and then the terms of the series. (8)
- | | | | | | | | |
|----|-----|-----|------|------|------|------|------|
| X: | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Y: | 4.8 | 8.4 | 14.5 | 23.6 | 36.2 | 52.8 | 73.9 |
- (ii) Evaluate the following integration by Trapezoidal and Simpson's 1/3rd rules of $\int_1^2 \int_3^4 \frac{1}{(x+y)^2} dx dy$, $h = k = 0.5$. (8)
- Or
- (b) (i) A rod is rotating in a plane. The following table gives the angle θ through which the rod has turned for various values of the time T seconds. (8)
- | | | | | | | |
|------------|---|------|------|------|------|------|
| T: | 0 | 0.2 | 0.4 | 0.6 | 0.8 | 1 |
| θ : | 0 | 0.12 | 0.49 | 1.12 | 2.02 | 3.20 |
- Calculate the angular velocity and the angular acceleration of the rod when $T = 0.6$ seconds.
- (ii) Evaluate the following integration by Trapezoidal and Simpson's 1/3rd rule. Evaluate it by actual integration and hence find the value of $\pi \int_0^1 \frac{1}{(1+x^2)} dx$, $n = 6$. (8)
15. (a) (i) Find the values of $y(0.2)$ and $y(0.4)$ using Runge – Kutta method of fourth order with $h = 0.2$, given that $y' = \sqrt{x^2 + 4}$; $y(0) = 0.4$. (8)
- (ii) Given that $y' = (1/x^2) - (y/x)$, $y(1) = 1$, $y(1.1) = 0.996$; $y(1.2) = 0.986$ and $y(1.3) = 0.972$ find the value of $y(1.4)$ and $y(1.5)$ using Milne's Predictor-corrector method. (8)
- Or
- (b) (i) Solve by Taylor's series method: $y'' + y^2 y' = x^3$. (8)
- (ii) Using the Adam's Bashforth method, find $y(1.4)$ given $y' = x^2(1+y)$, $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$ and $y(1.3) = 1.979$. (8)