Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 50837

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

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 of Statistical Table and Non-Programmable calculator is permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. In a rural area where no development was undertaken, 160 out of a sample of 250 farmers were indebted. In another area, where development work was in progress, 84 out of a sample of 150 farmers were indebted. Would you consider that the latter area is enjoying greater prosperity as indebted by a lower percentage of indebted?

2. A die was thrown 498 times. Denoting x to be the number appearing on the top face of it, the observed frequency of x is given below.

x	1	2	3	4	5	6
f	69	78	85	82	86	98

What opinion you would form for the accuracy of the die?

3. What are the uses of analysis of variance?

4. What are the basic principles in the design of experiment?

5. Using Newton's method, find the root between 0 and 1 of $x^3 = 6x - 4$ correct to 5 decimal places.

6. Solve the system by Gauss-Elimination method $2x + 3y - z = 5$; $4x + 4y - 3z = 3$ and $2x - 3y + 2z = 2$.

7. Form the divided difference table for the following data:

x	-2	0	3	5	7	8
$y = f(x)$	-792	108	-72	48	-144	-252

8. Using Lagrange's interpolation formula, find $y(10)$ from the following table:

x	5	6	9	11
y	12	13	14	16

9. Using Taylor series method, find, correct to four decimal places, the value of $y(0.1)$ given $\frac{dy}{dx} = x^2 + y^2$ and $y(0) = 1$.

10. Compute y at $x = 0.25$ by Modified Euler method given $y' = 2xy, y(0) = 1$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) A group of five patients treated with medicine 'A' weigh 42, 39, 48, 60, and 41 kg; the second group of 7 patients from the same hospital treated with medicine 'B' weigh 38, 42, 56, 64, 68, 69, and 62 kg. Do you agree with the claim that medicine B increases the weight significantly? (8)

(ii) From the following two sample values, find out whether they have come from the same population. (8)

Sample I : 17, 27, 18, 25, 27, 29, 27, 23, 17

Sample II: 16, 16, 20, 16, 20, 17, 15, 21

Or

(b) (i) Fit a Poisson distribution to the following data and test the goodness of fit. (8)

x	0	1	2	3	4	5	6
f	275	72	30	7	5	2	1

(ii) In a study of the effect of chemicals on the Laboure's in a chemical unit, the following results were obtained on their systolic blood pressures. Examine whether differences in blood prespressure significant. (8)

	Males		Females	
	Exposed group	Controlled group	Exposed group	Controlled group
No	250	55	103	50
Mean	117.5	121.6	111.7	112.5
S.D >	10.58	10.82	9.33	9.38

12. (a) In a Latin square experiment noted below, the yields is quintals per acre on the paddy crop carried out for testing the effect of five fertilizers A, B, C, D, E are given. Analyze the data for variations. (16)

B25	A18	E27	D30	C27
A19	D31	C29	E26	B23
C28	B22	D33	A18	E27
E28	C26	A20	B25	D33
D32	E25	B23	C28	A20

Or

(b) (i) The table below gives the weights of twelve individuals drawn from four different sources situated in three different states. Carryout analysis of variance. (8)

	States		
Sources	1	2	3
A	61	62	63
B	63	64	63
C	68	69	69
D	66	67	68

(ii) Three samples A, B, C have been obtained from normal populations with equal variances. Test whether the population means are equal at 5% level. (8)

	A	12	14	12	9	13
Samples	B	9	9	5	7	10
	C	7	8	10	11	14

13. (a) (i) Solve the system of equations by Gauss-Jordan method: (8)

$$x + y + z + w = 2$$
$$2x - y + 2z - w = -5$$
$$3x + 2y + 3z + 4w = 7$$
$$x - 2y - 3z + 2w = 5$$

(ii) Find the dominant eigen value of $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ by power method and hence find the other eigen value also. Verify your results by any other matrix theory. (8)

Or

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(b) Solve the following systems by Gauss-Jacobi and Gauss-Seidel methods. (16)

$10x - 5y - 2z = 3$; $4x - 10y + 3z = -3$; $x + 6y + 10z = -3$

14. (a) (i) The hourly declination of the moon on a day is given below. Find the declination at $3^h\ 35^m\ 15^s$ and 5^h. (6)

Hour :	0	1	2	3	4
Dec :	8°29'53.7"	8°18'19.4"	8°6'43.5"	7°55'6.1"	7°43'27.2"

(ii) Using Newton's divided difference formula, find the values of $f(2)$, $f(8)$ and $f(15)$ given the following table: (6)

x :	4	5	7	10	11	13
$f(x)$:	48	100	294	900	1210	2028

(iii) Find the first two derivatives of $(x)^{1/3}$ at $x = 50$ and $x = 56$ given the table below: (4)

x :	50	51	52	53	54	55	56
$y = x^{1/3}$:	3.6840	3.7084	3.7325	3.7563	3.7798	3.8030	3.8259

Or

(b) (i) Evaluate $\int_0^1 \int_0^1 \frac{dxdy}{x+y+1}$ by using trapezoidal rule and taking $h = 0.5$ and $k = 0.25$. (8)

(ii) Evaluate $\int_0^2 \int_0^1 4xydxdy$ by using Simpson's rule and taking $h = 0.25$ and $k = 0.5$. (8)

15. (a) Solve the initial value problem $dy/dx = x - y^2, y(0) = 1$ to find $y(0.4)$ by using Adams method. Starting solution required are to be obtained using R-K method of order 4 using step value $h = 0.1$.

Or

(b) Given $y' = x(x^2 + y^2)e^{-x}$, $y(0) = 1$, find y at $x = 0.1$, 0.2 and 0.3 by Taylor's series method and compute $y(0.4)$ by Milne's method.
