A   Reg. No. : ☐☐☐☐☐☐☐☐☐☐

Question Paper Code: 54023

B.E./B.Tech. DEGREE EXAMINATION, MAY 2022
Fourth Semester

Mechanical Engineering

15UMA423 - STATISTICS AND NUMERICAL METHODS

(Regulation 2015)
(Statistical tables may be permitted)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Sample size for Small sample   CO1- R

    (a) ≤ 30 (b) < 30   (c) > 30   (d) = 30

2. t-test is for testing means in   CO1- R

    (a) Small Sample   (b) Large Sample   (c) both   (d) None

3. Degree of freedom for SSE in RBD is   CO2- R

    (a) (c-1)(r-1)   (b) (c-1)   (c) (r-1)   (d) n-k

4. The conclusion of ANOVA based on   CO2- R

    (a) F-test   (b) t-test   (c) Chi-Square test   (d) Normal

5. In what form is the coefficient matrix transformed into when AX = B is   CO3- R
    solved by Gauss-Jordan method.

    (a) Upper triangular   (b) Diagonal   (c) Scalar   (d) None

6. What is the order of convergence of Newton-Raphson method?   CO3- R

    (a) 1   (b) 2   (c) 3   (d) 4

7. Newton's divided difference formula used only for _____ intervals   CO4- R

    (a) Equal   (b) Unequal   (c) Both   (d) None

8. The order of convergence of cubic spline is   CO4- R

    (a) 4   (b) 6   (c) 8   (d) 2

9. What is the restriction on the number of intervals for Simpson's 3/8 rule?   CO5- R

    (a) Odd   (b) Even   (c) Multiple of 3   (d) None

10. Gaussian two point formula is exact for polynomials upto degree   CO5- R

    (a) 2   (b) 3   (c) 4   (d) 5

PART – B (5 x 2= 10 Marks)

11. Write 95% confidence limits for the sample mean.   CO1- R

12. Write the ANOVA table for completely randomized design.   CO2- R

13. For solving linear system, compare Gaussian elimination method and Gauss-Jordan Method.   CO3- R

14. Find the divided difference table for the following data   CO4- App

x	2	5	10
f(x)	5	29	109

15. Evaluate   CO5- App

$$\int_{0}^{1} x\,dx$$ .by using Gauss 2-point formula.

PART – C (5 x 16= 80Marks)

16. (a) (i) A manufacturer claims that only 4% of his products supplied by him are defective. A random sample of 600 products contained 36 defectives. Test the claim of manufacturer.   CO1- App   (8)

    (ii) A certain injection administered to each of 12 patients resulted in the following increases of blood pressure: 5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4. Can it be concluded that the injection will be in general, accompanied by an increase in BP?   CO1- App   (8)

Or

(b) (i) Two independent samples of sizes 9 and 7 from a normal population had the following values of the variables. Do the estimates of the population variances differ significantly at 5% level?   CO1- App   (8)
Sample1   18 13 12 15 12 14 16 14 15
Sample2   16 19 13 16 18 13 15

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(ii) The theory predicts that the proportion of beans in the four groups A,B,C, and D should be 9:3:3:1. In an experiment among 1600 beans, the numbers in the four groups were 882, 313, 287 and 118. Do the experimental results support the theory. CO1- App (8)

17. (a) The following data represent the number of units of production per day turned out by 5 different workers using 4 different types of machines. CO2- Ana (16)

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

(a) Test whether mean productivity is the same for the different machine types.

(b) Test whether the 5 men different respect to mean productivity.

Or

(b) The following data resulted from an experiment to compare three burners B1, B2, and B3. A Latin square design was used as the tests were made on 3 engines and were spread over 3 days. CO2- Ana (16)

	Engine-1	Engine-2	Engine-3
Day-1	B1-16	B2-17	B3-20
Day-2	B2-16	B3-21	B1-15
Day-3	B3-15	B1-12	B2-13

18. (a) (i) Find a root of $x \log_{10} x - 1.2 = 0$ by Newton's method correct to three decimal places. CO3- App (8)

(ii) Solve the system of equations by Gauss Jordan Method CO3- App (8)
$x + y + 5z = 7; \; 2x + 10y + z = 13 \; ; \; 10x + y + z = 12 \; ;$

Or

(b) (i) Solve by Gauss Seidal Method CO3- App (8)
$$28x + 4y - z = 32,$$
$$x + 3y + 10z = 24,$$
$$2x + 17y + 4z = 35.$$

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(ii) Using Gauss-Jordan method, find the inverse of   CO3- App   (8)

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & -3 & 3 \\ -2 & -4 & -4 \end{bmatrix}.$$

19. (a) (i) Find f (8) by Newton's divided difference formula for the data: CO4- Ana   (8)

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

(ii) Find the polynomial f(x) by using Lagrange's formula and hence find f(3) for   CO4- Ana   (8)

x	0	1	2	5
f(x)	2	3	12	147

Or

(b) The population of a town is as follows.   CO4- Ana   (16)

Year	1941	1951	1961	1971	1981	1991
Population in Lakhs	20	24	29	36	46	51

Estimate the population increase during the period 1946 to 1976.

20. (a) (i) By dividing range into ten equal parts evaluate   CO5- E   (8)

$\int_{0}^{\pi} \sin x\, dx$ by trapezoidal rule and Simpson's rule. Verify your answer with actual integration.

(ii) Evaluate   CO5- E   (8)

$\int_{0}^{2} \dfrac{x^2 + 2x + 1}{1 + (x + 1)^4} dx$ by Gaussian three point formula.

Or

(b) Using Romberg's method evaluate   CO5- E   (16)

$\int_{0}^{1} \dfrac{dx}{1 + x}$ correct to 3 places of decimals.

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