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

Question Paper Code: 34023

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

Fourth Semester

Mechanical Engineering

01UMA423 - STATISTICS AND NUMERICAL METHODS

(Regulation 2013)

(Statistical tables may be permitted)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Write down the formula of test statistic 't' to test the significance of difference between the means(large samples)?
2. Write any two properties of the *F* distribution.
3. What is the aim of the design of experiments?
4. Explain Randomized Block Design briefly?
5. What is the order of convergence of Newton-Raphson method and convergence condition for Newton method?
6. State the condition for convergence of Gauss - Seidal method.
7. Find the second degree polynomial through the points (0, 2), (2, 1) and (1, 0) using Lagrange's interpolation formula.
8. State the properties of cubic spline.
9. Write down the formula for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_0$ by Newton's forward difference formula.

10. Write the formula to compute $\frac{dy}{dx}$ at $x = x_0 + ph$ for a given data (x_i, y_i) $i = 0,1,2\ldots..n$.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) A simple sample of heights of 6400 Englishmen has a mass of 67.85 inches and a standard deviation of 2.56 inches, while a simple sample of heights of 1600 Australians has a mean of 68.55 inches and a standard deviation of 2.52 inches. Do the data indicate the Australians are on the average taller than Englishmen? (8)

(ii) A manufacturer of ball pens claims that a certain pen be manufacturers has a mean writing life of 400 pages with a standard deviation of 20 pages. A purchasing agent selects a sample of 100 pens and puts them for test. The means writing life for the sample was 390 pages. Should the purchasing agent reject the manufactures claim at 5% level? The table value of Z at 5% level is 1.96 for two tail test and 1.64 approximately for one tail test. (8)

Or

(b) Two random samples gave the following results.

Sample	Size	Sample mean	Sum of squares of deviation from mean
I	10	15	90
II	12	14	108

Test whether the samples could have come from the same normal population. (16)

12. (a) A completely randomized design experiment with 10 plots and 3 treatments gave the following results. Analysis the CRD design. (16)

Plots no	1	2	3	4	5	6	7	8	9	10
Treatments	A	B	C	A	C	C	A	B	A	B
Yield	5	4	3	7	5	1	3	4	1	7

Or

(b) A company appoints 4 salesmen *A*, *B*, *C* and *D* and observes their sales in 3 seasons: summer, winter and monsoon. The figures (in lakhs of Rs.) are given in the following table:

Seasons	Salesmen			
	A	B	C	D
Summer	45	40	38	37
Winter	43	41	45	38
Monsoon	39	39	41	41

(16)

13. (a) (i) Solve the following system of equation by Gauss Seidel method.
$27x + 6y - z = 65\,;\, x + y + 54z = 110\,;\; 6x + 15y + 2z = 72.$ (8)

(ii) Using power method, find the numerically largest Eigen value of

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}.$$ (8)

Or

(b) (i) Find the largest Eigen values of the matrix $A=\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ using power method. (8)

(ii) Find the inverse of the matrix $\begin{pmatrix} 1 & 0 & -1 \\ 3 & 4 & 5 \\ 0 & -6 & -7 \end{pmatrix}$ using Gauss-Jordan Method. (8)

14. (a) (i) Using Lagrange's interpolation formula, find $f(4)$ given that
$f(0) = 2, f(1) = 3, f(2) = 12, f(15) = 3587.$ (8)

(ii) Using Newton's forward interpolation formula, find the polynomial $f(x)$ satisfying the following data. Hence, evaluate y at $x = 5.$ (8)

x	4	6	8	10
y	1	3	8	10

Or

(b) Obtain the cubic spline approximation for the function $y = f(x)$ from the following data, given that $y_0'' = y_3'' = 0$ (16)

x	-1	0	1	2
y	-1	1	3	35

15. (a) A rod is rotating in a plane. The angle θ (in radians) through which the rod has turned for various values of time t (seconds) are given below.

t	0	0.2	0.4	0.6	0.8	1	1.2
θ	0	0.122	0.493	1.123	2.022	3.220	4.666

Find the angular velocity and angular acceleration of the rod when t = 0.6 seconds. (16)

Or

(b) (i) Evaluate $\int_0^1 \frac{\sin x}{x} dx$ by using Gaussian 3-point formula. (8)

` (ii) Evaluate $\int_0^1 \int_0^1 e^{x+y} dxdy$ by using Simpson's rule. (8)