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

Question Paper Code: 41043

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

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. What do you mean by critical region and acceptance region?
2. Write any two properties of the *F* distribution.
3. Write any two differences between randomized block design and Latin square design.
4. What are basic principles of the design of experiments?
5. Derive a formula to find the value of $\sqrt[3]{N}$, where $N \neq 0$, using Newton-Raphson 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) Two samples of sizes nine and eight gave the sums of squares of deviation from their respective means equal to 160 and 91 respectively. Can they be regarded as drawn from the same normal population? (8)

(ii) The following data are collected in two characters.

	Smokers	Non - smokers
Literates	83	57
Illiterates	45	68

Based on this, can you say that there is no relation between smoking and literacy? (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) Four doctors each test four treatments for a certain disease and observe the number of days each patient takes to recover. The results are as follows (recovery time in days).

Treatment				
Doctor	1	2	3	4
A	10	14	19	20
B	11	15	17	21
C	9	12	16	19
D	8	13	17	20

Discuss the difference between (a) doctors and (b) treatments. (16)

Or

(b) The following is a Latin Square of a design when four varieties of seeds are being tested. Set up the analysis of variance table and state your conclusions. You may carry out suitable change of origin and scale.

D	122	A	121	C	123	B	122
B	124	B	123	A	122	D	125
A	120	C	119	D	120	C	121
C	122	D	123	B	121	A	122

(16)

13. (a) (i) Find the real positive root of $3x - \cos x - 1 = 0$ by Newton-Raphson method correct to 6 decimal places. (8)

(ii) Find the largest Eigen value and the corresponding Eigen vector of $A = \begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$. (8)

Or

(b) (i) Solve the equations $8x - 3y + 2z = 20, 4x + 11y - z = 33, 6x + 3y + 12z = 35$ by using Gauss - Seidal method correct to three decimal. (8)

(ii) Find the inverse of the matrix $\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$ by Gauss Jordan method. (8)

14. (a) (i) Given the values:

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

Evaluate *f(9)* using Lagrange's formula. (8)

(ii) Construct Newton's forward interpolation polynomial for the following data.

x	4	6	8	10
y	1	3	8	16

Use it to find the value of *y* for *x = 5*. (8)

Or

(b) Obtain the cubic spline approximation for the function tabulated as follows

x	0	1	2	3
y	1	2	33	244

Assume $M(0) = 0$ and $M(3) = 0$. Hence find an estimate of $f(2.5)$. (16)

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)

(ii) Evaluate $I = \int_0^1 \frac{dt}{1+t}$ by Gaussian two-point and three-point formula. (8)

(ii) Evaluate $\int_0^1 \int_0^1 e^{x+y}\, dx\, dy$ using trapezoidal rule taking $h = k = 0.5$. (8)