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**Question Paper Code: 34023**

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

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. Define Null hypothesis and Alternative hypothesis.
2. Write any two properties of the  $F$  distribution.
3. What is ANOVA?
4. What are the basic principles of experimental design?
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. State Simpson's 1/3 and 3/8 rule of numerical integration formula.
10. Write the formula to compute  $\frac{dy}{dx}$  at  $x = x_0 + ph$  for a given data  $(x_i, y_i)$   $i = 0, 1, 2, \dots, n$ .

PART - B (5 x 16 = 80 Marks)

11. (a) (i) In a large city *A*, 20 percent of a random sample of 900 school boys had a slight physical defect. In another city *B*, 18.5 percent of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant? (Use a level of significance of 0.05). (8)

(ii) Test the significance of the difference between the means of the samples, drawn from two normal populations with the same S.D. from the following data: (Use a level of significance of 0.05.) (8)

	Size	Mean	S.D
Sample I	100	61	4
Sample II	200	63	6

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) The table below shows the yields per hectare of a certain variety of paddy in a particular type of soil treated with manures *A*, *B* and *C*. Analyze the results for manure effects. (16)

A	49	50	48	49
B	48	48	49	47
C	50	50	51	49

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

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

$$A = \begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}. \quad (8)$$

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) Using Newton's divided difference formula, find the value of  $f(8)$  using the following data;

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

(16)

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) (i) The table below gives the velocity  $v$  of a particle for 20 seconds at an interval of 5 seconds. Find the initial acceleration at time  $t=0$ . (8)

$t(\text{seconds})$	0	5	10	15	20
$v(\text{m/s})$	0	3	14	69	228

- (ii) Evaluate  $\int_0^1 \frac{dx}{1+x^2}$  by using Trapezoidal rule taking  $t=0.2$ . Hence determine the approximate value of  $\pi$ . (8)

Or

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

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