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**Question Paper Code: 50043**

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

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. A statement that is accepted if the sample data provide sufficient evidence that the null hypothesis is false is called
  - (a) simple hypothesis
  - (b) composite hypothesis
  - (c) statistical hypothesis
  - (d) alternative hypothesis
2. In testing hypothesis, the level of significance is
  - (a) Lower Prob. (Type I error)
  - (b) Prob. (Type II error)
  - (c) Prob. of either a Type I or Type II, depending on the hypothesis to be tested
  - (d) none of these
3. Analysis of Variance (ANOVA) is a test for equality of
  - (a) means
  - (b) variances
  - (c) proportions
  - (d) only two parameters
4. Which of the following is a principles of experimental design?
  - (a) replication
  - (b) randomization
  - (c) local control
  - (d) all the above
5. The order of convergence in Newton-Raphson method is
  - (a) atleast 1
  - (b) 2
  - (c) 3
  - (d) 4
6. In the Gauss elimination method for solving a system of linear algebraic equations, augmented matrix leads to
  - (a) Diagonal matrix
  - (b) Lower triangular matrix
  - (c) Upper triangular matrix
  - (d) Singular matrix

7. Which of the following symbol is called forward difference operator?  
 (a)  $\nabla$  (b)  $\Delta$  (c) E (d)  $\delta$
8. Divided differences method can be used when the given independent variety values are  
 (i) At equal intervals (ii) at unequal intervals  
 (a) (i) only (b) (ii) only (c) both (i) and (ii) (d) none of these
9. Simpson's  $1/3^{\text{rd}}$  rule is used only when  
 (a) ordinates is even (b) n is multiple of 3  
 (c) n is odd (d) n is even
10. Trapezoidal and Simpson's rules can be used to evaluate  
 (a) double integrals (b) differentiation  
 (c) multiple integrals (d) divided difference

PART - B (5 x 2 = 10 Marks)

11. Define Type I and Type II error.
12. Is  $2 \times 2$  Latin square design is possible? Why?
13. Derive the iteration formula for finding the square root of N by Newton-Raphson method.
14. What is a cubic spline?
15. State Newton's formula to find  $f'(x)$  and  $f''(x)$  using backward difference at  $x = x_n$ ?

PART - C (5 x 16 = 80 Marks)

16. (a) (i) The means of two simple large samples of 1000 and 2000 members are 67.5 inches and 68 inches respectively. Can the samples be regarded as drawn from the same population of standard deviation of 2.5 inches? Test at 5% level of significance. (8)
- (ii) Ten individuals are chosen at random from a population and their heights are found to be an inches 63, 63, 66, 67, 68, 69, 70, 70, 71, 71. In the light of this data, discuss the suggestion that the mean height in the universe is 66 inches. (8)

Or

- (b) (i) The data given below are the qualities of ten items (in proper units) produced by two processes A and B. Test whether the variability of quality may be taken to be the same for the two processes. (8)

Process A	3	7	5	6	5	4	4	5	3	3
Process B	8	5	7	8	3	2	7	6	5	7

- (ii) The following table gives the number of aircraft accidents that occurred during the various days of the week. Test whether the accidents are uniformly distributed over the week. (8)

Days	Mon	Tue	Wed	Thu	Fri	Sat	Total
No. of accidents	14	18	12	11	15	14	84

17. (a) Five doctors each test treatments for a certain disease and observe the number of days each takes to recover. The results are as follows (Recovery time in days).

Doctors	Treatments				
	1	2	3	4	5
A	10	14	23	19	20
B	11	15	24	17	21
C	9	12	20	16	19
D	8	13	17	17	20
E	12	15	19	15	22

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

Or

- (b) The following data relate to the results of a Latin Square experiment on four varieties of paddy A, B, C and D.

B 17.6	A 20.9	D 22.5	C 15.4
A 21.2	B 15.8	C 14.7	D 24.7
C 13.3	D 21.8	A 20	B 16.9
D 22.4	C 14.6	B 17.4	A 20.1

Analyse the results and give your comments. (16)

18. (a) (i) Find a root of  $x \log_{10} x - 1.2 = 0$  by Newton Raphson method correct to three decimal places. (8)
- (ii) Solve  $x + 3y + 3z = 16$ ,  $x + 4y + 3z = 18$ ,  $x + 3y + 4z = 19$  by Gauss-Jordan method. (8)

Or

- (b) (i) Solve  $4x + 2y + z = 14$ ,  $x + 5y - z = 10$ ,  $x + y + 8z = 20$  by Gauss-Seidel method. (8)
- (ii) Find the dominant Eigen value and the corresponding Eigenvector of

$$A = \begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix} \text{ by Power method.} \quad (8)$$

19. (a) (i) Find the missing term in the following table using Lagrange's interpolation. (8)

x	0	1	2	3	4
y	1	3	9	-	81

- (ii) Find  $f(x)$  as a polynomial in  $x$  for the following data by Newton's divided difference formula. Also find  $f(3)$ . (8)

x	-4	-1	0	2	5
f(x)	1245	33	5	9	1335

Or

- (b) (i) From the following table:

x	1	2	3
y	-8	-1	18

Compute  $y(1.5)$  and  $y'(1)$  using cubic spline. (8)

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

x	4	6	8	10
f(x)	1	3	8	10

20. (a) (i) Find the first, second and third derivatives of  $f(x)$  at  $x = 1.5$  from the following data. (8)

x	1.5	2.0	2.5	3.0	3.5	4.0
f(x)	3.375	7	13.625	24	38.875	59

- (ii) Evaluate  $\int_0^1 \frac{1}{1+x^2} dx$  by using Romberg's method correct to 4 decimal places.

Hence deduce an approximate value of  $\pi$ . (8)

Or

- (b) (i) Evaluate  $\int_{0.2}^{1.5} e^{-x^2} dx$  using the three point Gaussian quadrature. (8)

- (ii) Evaluate  $\int_0^1 \int_0^2 \frac{2xy}{(1+x^2)(1+y^2)} dx dy$  by Trapezoidal rule with  $h=k=0.25$ . (8)