Reg. No. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code	12970

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024
Fourth Semester
Civil Engineering
(Common to Electrical and Electronics Engineering, Electronics and Instrumentation Engineering,
Instrumentation and Control Engineering, Mechanical Engineering & Mechanical and Automation Engineering)
20BSMA403 - STATISTICS AND NUMERICAL METHODS
Regulations - 2020
(Use of Statistical table is permitted)

Duration: 3 Hours
Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)
Answer ALL Questions

		Marks	K–Level	CO
1.	A statement made about a population for testing purpose is called?	1	K1	CO1
	(a) Statistic (b) Hypothesis (c) Level of Significance (d) Test-Statistic			
2.	The rejection probability of Null Hypothesis when it is true is called as?	1	K1	CO1
	(a) Level of Confidence (b) Level of Significance			
	(c) Level of Margin (d) Level of Rejection			
3.	Consider a hypothesis H_0 where $\phi_0 = 5$ against H_1 where $\phi_1 > 5$. The test is?	1	K1	CO1
	(a) Right tailed (b) Left tailed (c) Centre tailed (d) Cross tailed			
4.	If the Critical region is evenly distributed then the test is referred as?	1	K1	CO1
	(a) Two tailed (b) One tailed (c) Three tailed (d) Zero tailed			
5.	Analysis of variance is a statistical method of comparing the _____ of several populations.	1	K1	CO2
	(a) standard deviations (b) variances (c) Means (d) proportions			
6.	What is the primary purpose of ANOVA?	1	K1	CO2
	(a) Comparing means across three or more groups			
	(b) Comparing medians across three or more groups			
	(c) Examining the relationship between two categorical variables			
	(d) Identifying normally distributed data			
7.	The sum of squares measures the variability of the observed values around their respective treatment means.	1	K1	CO2
	(a) treatment (b) error (c) interaction (d) total			
8.	Which of the following assumptions does *not* apply to ANOVA?	1	K2	CO2
	(a) Independent observations (b) Normal distribution of continuous variable			
	(c) Homogeneity of variances (d) Inclusion of one bivariate variable			
9.	The Newton-Raphson method formula for finding $\sqrt{R}$ from the equation $x^2 - R = 0$ is,	1	K2	CO3
	(a) $x_{i+1} = \frac{x_i}{2}$ (b) $x_{i+1} = \frac{3x_i}{2}$ (c) $x_{i+1} = \frac{1}{2}\left(x_i + \frac{R}{x_i}\right)$ (d) $x_{i+1} = \frac{1}{2}\left(3x_i - \frac{R}{x_i}\right)$			
10.	Rate of convergence of the Newton - Raphson method is generally _____	1	K1	CO3
	(a) Linear (b) Quadratic (c) Super-linear (d) Cubic			
11.	Give the condition for convergence of iterative method	1	K1	CO3
	(a) $x = \varphi(x)$ (b) $x = \varphi'(x)$ (c) $|\varphi(x)| < 1$ (d) $|\varphi'(x)| < 1$			
12.	Write a sufficient condition to apply Gauss Seidel method to solve a system of equation.	1	K1	CO3
	(a) The given system is diagonally dominant.			
	(b) The given system is not diagonally dominant.			
	(c) All the diagonal elements are zero			
	(d) None of the above			
13.	Which method can be used for both equal and unequal intervals?	1	K1	CO4
	(a) Lagrange's Method (b) Divided difference method			
	(c) Cubic Spline method (d)Newton's method			

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

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14. Newton's divided difference interpolation formula is a interpolation technique used when _____ for all sequence of values. *1 K1 CO4*
    (a) The interval difference is same   (b) The interval difference is zero
    (c) The interval difference is not same   (d) All of the above.
15. The order of error in Simpson's formula is: *1 K1 CO4*
    (a) h^3 (b) h^2 (c) h^4 (d) h
16. The order of error in Trapezoidal formula is: *1 K1 CO4*
    (a) h^3 (b) h^2 (c) h^4 (d) h
17. Which of the following represents the Taylor's series expansion of $y = f(x)$ at $x = 0$ *1 K1 CO5*

    (a) $y(x) = y(0) + xy'(0) + \frac{x^2}{2}y''(0) + \frac{x^3}{3}y'''(0) + \cdots$

    (b) $y(x) = y(0) + xy'(0) + \frac{x^2}{2!}y''(0) + \frac{x^3}{3!}y'''(0) + \cdots$

    (c) $y(x) = y(0) - xy'(0) + \frac{x^2}{2}y''(0) - \frac{x^3}{3}y'''(0) + \cdots$

    (d) $y(x) = y(0) - xy'(0) + \frac{x^2}{2!}y''(0) - \frac{x^3}{3!}y'''(0) + \cdots$

18. Modified Euler's formula is   *1 K1 CO5*

    (a) $y_{n+1} = y_0 + \frac{h}{2}\left[f(x_n, y_n) + f(x_{n+1}, y_{n+1})\right]$

    (b) $y_{n+1} = y_n + \frac{h}{2}\left[f(x_n, y_n) + f(x_{n-1}, y_{n-1})\right]$

    (c) $y_{n+1} = y_0 + \frac{h}{2}\left[f(x_n, y_n) + f(x_{n-1}, y_{n-1})\right]$

    (d) $y_{n+1} = y_n + \frac{h}{2}\left[f(x_n, y_n) + f(x_{n+1}, y_{n+1})\right]$

19. How many prior values are required to predict the next value in Adam's method?   *1 K1 CO5*
    a) One   b) Two   c) Three   d) Four
20. The standard five point formula is :   *1 K1 CO5*

    (a) $u_{i,j} = \frac{1}{4}\left[u_{i-1,j} + u_{i+1,j} + u_{i,j+1} + u_{i,j-1}\right]$

    (b) $u_{i,j} = \frac{1}{4}\left[u_{i+1,j+1} + u_{i-1,j-1} + u_{i,j+1} + u_{i,j-1}\right]$

    (c) $u_{i,j} = \frac{1}{4}\left[u_{i-1,j-1} + u_{i+1,j+1} + u_{i,j+1} + u_{i,j-1}\right]$

    (d) $u_{i,j} = \frac{1}{4}\left[u_{i,j-1} + u_{i,j+1} + u_{i+1,j+1} + u_{i-1,j-1}\right]$

PART - B (10 × 2 = 20 Marks)
Answer ALL Questions

21.	Define Type-I and Type-II errors.	2	K1 CO1
22.	State the uses of chi-square test.	2	K1 CO1
23.	Why a 2 x 2 Latin square is not possible? Explain.	2	K2 CO2
24.	Write any two differences between RBD and CRB.	2	K1 CO2
25.	By Gauss elimination method solve $x + y = 7$, $2x + 3y = 10$.	2	K2 CO3
26.	Compare Gauss Jacobi method and Gauss-Seidel method.	2	K2 CO3
27.	What is meant by interpolation?	2	K1 CO4
28.	Evaluate $\int_0^1 \frac{dx}{1+x}$ with h = 0.5 using Trapezoidal rule.	2	K2 CO4
29.	Given $y' = x + y$, $y(0) = 1$. Find $y(0.1)$ by Euler's method.	2	K2 CO5
30.	State Milne's Predictor corrector formula.	2	K1 CO5

PART - C (6 × 10 = 60 Marks)
Answer ALL Questions

31. a) A sample of heights of 6,400 Englishmen has a mean of 170cm and a SD of 6.4cm, while another sample of heights of 1600 Americans has a mean of 172cm and a SD of 6.3cm. Do the data indicate that Americans are taller than Englishmen?   *10 K3 CO1*

    OR

    b) 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?   *10 K3 CO1*

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

32. a) A company appoints 4 salesmen (A, B, C and D) and observes their sales in 3   *10*   *K3*   *CO2*
seasons as shown. Carry out analysis of variance using two-way classification.

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

OR

b) A variable trial was conducted on wheat with 4 varieties in a Latin Square Design.   *10*   *K3*   *CO2*
The plan of the experiment and the plot yield are given below. Analyze data and
interpret the result.

C25	B23	A20	D20
A19	D19	C21	B18
B19	A14	D17	C20
D17	C20	B21	A15

33. a) Find the smallest positive root of $x^2 - 5x + 1 = 0$, correct to four decimal places by   *10*   *K3*   *CO3*
fixed point iteration method.

OR

b) Determine the numerically largest eigen value and the corresponding eigen vector   *10*   *K3*   *CO3*

of the following matrix, using the power method. $\begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$

34. a) Use Lagrange's interpolation formula to find $f(10)$ from the following data: *10*   *K3*   *CO4*

x	5	6	9	11
$f(x)$	12	13	14	16

OR

b)   *10*   *K3*   *CO4*
Evaluate $\int_1^{1.2} \int_1^{1.4} \frac{1}{1+x} dx\, dy$ by Trapezoidal rule with $h = k = 0.1$.

35. a) Apply Runge - Kutta method to find approximate value of y for x = 0.1 if   *10*   *K3*   *CO5*
$\frac{dy}{dx} = x + y^2$ given that y = 1 when x = 0.

OR

b) Given $\frac{dy}{dx} = x^2(1+y)$, y(1) =1, y(1.1) =1.233 , y(1.2) = 1.548, y(1.3) =1.979.   *10*   *K3*   *CO5*
Evaluate y(1.4) by Adam's Bash-forth method.

36. a) i) Construct the divided difference table for the following data.   *5*   *K3*   *CO4*

x	0	2	3	4	7	9
f(x)	4	2	5	11	46	92

ii) Solve $y' = x + y, y(0) = 1$ by Taylor's series method. Find the values of y at   *5*   *K3*   *CO5*
$x = 0.1$

OR

b) i)   *5*   *K3*   *CO4*
Dividing the range into 10 equal parts, find the approximate value of $\int_0^\pi \sin x\, dx$ by

trapezoidal rule

ii) Using Euler's method find y at x = 0.1 given that $\frac{dy}{dx} = \frac{y-x}{y+x}$, y(0) = 1   *5*   *K3*   *CO5*