Reg. No.															

Question Paper Code	13578

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Fourth Semester

Civil Engineering

(Common to Electrical and Electronics Engineering, Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Mechanical and Automation Engineering & Mechanical Engineering)

20BSMA403 - STATISTICS AND NUMERICAL METHODS

Regulations - 2020

(Use of statistical table is permitted)

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	The value at which the Null Hypothesis gets rejected is called as? (a) Significant Value (b) Rejection Value (c) Acceptance Value (d) Critical Value	1	K1	CO1
2.	What is the degree of freedom (df) in a t-test for two independent means? (a) df= $n_1 + n_2 - 2$ (b) df= $n_1 + n_2 - 1$ (c) df= $n_1 - n_2 - 1$ (d) df = $n_1 - n_2 + 1$	1	K1	CO1
3.	ANOVA stands for (a) Assessment for Normality (b) Analysis of variability (c) Analysis of Variance (d) Analysis of Variation	1	K1	CO2
4.	In a Latin Square Design the number of treatments, rows and columns are? (a) Unequal (b) Equal (c) Seldom equal (d) Usually equal	1	K1	CO2
5.	The Condition for convergence of the Newton Raphson method is (a) $\lvert f(x)f''(x)\rvert > \lvert f'(x)\rvert^2$ (b) $\lvert f(x)f''(x)\rvert < \lvert f'(x)\rvert^2$ (c) $\lvert f(x)f'(x)\rvert > \lvert f''(x)\rvert^2$ (d) $\lvert f(x)f'(x)\rvert > \lvert f''(x)\rvert^2$	1	K1	CO3
6.	For the matrix, $\begin{bmatrix} 1 & -5 \\ -3 & -1 \end{bmatrix}$, let $x_0 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ the value of x_1 is (a) $\begin{bmatrix} -4 \\ -4 \end{bmatrix}$ (b) $\begin{bmatrix} 4 \\ 10 \end{bmatrix}$ (c) $\begin{bmatrix} -10 \\ -4 \end{bmatrix}$ (d) $\begin{bmatrix} 10 \\ 10 \end{bmatrix}$	1	K2	CO3
7.	The error of trapezoidal rule is (a) h^3 (b) h^2 (c) h^5 (d) h^6	1	K1	CO4
8.	What is the value of 'h' for the integral $\int_1^2 \int_1^2 f(x)\,dx\,dy$ taking 4 sub intervals (a) 0.5 (b) 2 (c) 0.25 (d) 0.20	1	K2	CO4
9.	Classify the following equation $\frac{\partial^2 u}{\partial x^2} + 2\frac{\partial^2 u}{\partial x \partial y} + \frac{\partial^2 u}{\partial y^2} = 0$ (a) Parabolic (b) Elliptic (c) Hyperbolic (d) Laplace	1	K2	CO5
10.	The value of k in the one-dimensional heat equation $u_{xx} = 32u_t$ by taking h = 0.25 for $t > 0, 0 < x < 1$ is _____. (a) 0 (b) 1 (c) 0.25 (d) 0.5	1	K2	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

		Marks	K – Level	CO
11.	Define Null Hypothesis and Alternative Hypothesis.	2	K1	CO1
12.	State the applications of F-distribution.	2	K1	CO1
13.	Define Type-I and Type-II errors.	2	K1	CO1
14.	Write the basic assumptions in analysis of variance.	2	K1	CO2

15. Write any two differences between CRD and RBD. *2 K1 CO2*
16. Why a 2 x 2 Latin square is not possible? Explain. *2 K2 CO2*
17. Using Gauss elimination method solve x + y = 2, 2x + 3y = 5. *2 K2 CO3*
18. Solve the linear system x – 4y = –2, 3x + y = 7 by Gauss-Jordon method. *2 K2 CO3*
19. Find the divided difference of $f(x) = x^3 + x + 2$ arguments 1, 3, 6, 11. *2 K2 CO4*
20. State Newton's forward formula for interpolation. *2 K1 CO4*
21. Given $y' = x + y,\ y(0) = 1$. Find $y(0.1)$ by Euler's method. *2 K2 CO5*
22. Write down the standard five - point formula to solve Laplace's equation $u_{xx} + u_{yy} = 0$. *2 K1 CO5*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23. a) Two independent samples of sizes 9 and 7 from a normal population had the following values of the variables. *11 K3 CO1*

Sample I	18	13	12	15	12	14	16	14	15
Sample II	16	19	13	16	18	13	15		

Do the estimates of the population variance differ significantly at 5% level?

OR

b) In an investigation into the health and nutrition of two groups of children of different social status, the following results are got. *11 K3 CO1*

Health's Status	Social Status	
	Poor	Rich
Below	130	20
Normal:	102	108
Above	24	96

Discuss the relation between the Health and their social status.

24. a) An experiment was designed to study the performance of 4 different detergents for cleaning fuel injectors. The following "cleanliness" readings were obtained with specially designed equipment for 12 tanks of gas distributed over 3 different models of engines: *11 K3 CO2*

	Engine 1	Engine 2	Engine 3
Detergent A	45	43	51
Detergent B	47	46	52
Detergent C	48	50	55
Detergent D	42	37	49

Perform the ANOVA and test at 1% level of significance, whether there are differences in the detergents or in the engines.

OR

b) A variable trial was conducted on wheat with 4 varieties in a Latin Square Design. The plan of the experiment and the plot yield are given below. Analyse data and interpret the result. *11 K3 CO2*

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

25. a) Solve the system of equations by Gauss-Seidel method *11 K3 CO3*
27x + 6y – z = 85, x + y + 54z = 110, 6x + 15y + 2z = 72.

OR

b) Determine the numerically largest Eigen value and the corresponding Eigen vector of the following matrix, using the power method $\begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$. *11 K3 CO3*

26. a) The following data are taken from the steam table : *11 K3 CO4*

Temp. ℃	140	150	160	170	180
Pressure kgf/cm^2	3.685	4.854	6.302	8.076	10.225

Find the pressure at temperature $t = 142^{\circ}$and$t = 175^{\circ}$.

OR

b) Evaluate $\int_0^1 \int_1^2 \frac{2xy}{(1+x^2)(1+y^2)} dx\, dy$, by Trapezoidal rule with $h = k = 0.25$. *11 K3 CO4*

27. a) Apply Runge-Kutta method to find approximate value of y for x=0.1,0.2, if $\frac{dy}{dx} = x + y^2$ given that y =1 when x=0. *11 K3 CO5*

OR

b) Solve the equation Using Crank-Nicholson method, solve $u_{xx} = 16u_t$, $0 < x < 1, t > 0, u(x,0) = 0, u(0,t) = 0, u(1,t) = 100t$. Compute $u(x,t)$ for one step with $h = 1/4$. *11 K3 CO5*

28. a) i) Find the polynomial $f(x)$ by using Lagrange's formula and hence find $f(3)$ for *6 K3 CO4*

x	0	1	2	5
$f(x)$	2	3	12	147

ii) Apply modified Euler's method to find y(0.2) and y(0.4) given $y' = x^2 + y^2$, y(0)=1 by taking h=0.2 *5 K3 CO5*

OR

b) i) By using Newton's divided difference formula find $f(8)$, given *6 K3 CO4*

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

ii) Solve $y' = x + y, y(0) = 1$ by Taylor's series method. Find the values of y at $x = 0.1$ and $x = 0.2$ *5 K3 CO5*