VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD
Accredited by NAAC with A++ Grade
B.E. IV-Semester Advanced Supplementary Examinations, September-2022
Numerical Methods, Probability & Statistics
(Common to Civil, EEE & Mech. Engg.)

Time: **3 hours**   Max. Marks: **60**

*Note: 1.Answer all questions from **Part-A** and any FIVE from **Part-B***
2. Provide normal, t, f and Chi-square tables

Part-A (10× 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Evaluate $\Delta\left(\tan^{-1} x\right)$.	2	1	1	1,12
2.	Construct divided difference table for the following data: 	x	-1	0	3	6	7	 	$f(x)$	3	-6	39	822	1611		2	2	1	1,12
3.	Write the formula for $\dfrac{dy}{dx}$, $\dfrac{d^2 y}{dx^2}$ using Newton's forward interpolation formula.	2	1	2	1,12
4.	Use Euler's method to find the value of y at $x = 0.02$ for $y' + y = 0, y(0) = 1$.	2	3	2	1,2,12
5.	A random variable X has the following probability distribution: 	X	0	1	2	3	4	 	$P(X)$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{15}$	$\frac{2}{15}$	$\frac{2}{5}$	 Find $P(X > 1)$.	2	2	3	1,2,12
6.	If X is a random variable, show that $E(aX + b) = a\,E(X) + b$, where a, b are constants.	2	1	3	1,12
7.	Explain briefly errors in sampling.	2	1	4	1,12
8.	State any two properties of Chi-square distribution.	2	1	4	1,12
9.	Show that the regression coefficients and the correlation coefficient have the same sign.	2	1	5	1,12
10.	From a sample of 200 pairs of observations, the following quantities were calculated. $\sum x = 11.34, \sum y = 20.78, \sum x^2 = 12.16, \sum y^2 = 84.96$ and $\sum xy = 22.13$ Compute the coefficients of the equation $y = a + bx$.	2	3	5	1,2,12

Part-B (5×8 = 40 Marks)

11. a)	The population of a town in decennial census were as under. Estimate the population for the year 1955. 	Year	1921	1931	1941	1951	1961	 	Population(in thousands)	46	66	81	93	101		4	3	1	1,12
b)	Applying Lagrange's interpolation formula, find a cubic polynomial which approximates the following data: 	x	-2	-1	2	3	 	$f(x)$	-12	-8	3	5		4	3	1	1,12

(30)

			M	L	CO	PO

12.a) Use Runge-Kutta method of order 4 to find the approximate value of $y(0.2)$ for $y' = y - x$, $y(0) = 2$ with $h = 0.2$. — 4 3 2 1,12

b) From the following table values of x and y, obtain $\dfrac{dy}{dx}$ for $x = 2.2$. — 4 3 2 1,12

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

13. A continuous random variable X has the probability distribution function. — 8 2 3 1,12

$$f(x) = \begin{cases} k\,x\,e^{-x}, & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$. Find (i) k (ii) $E(X)$

(iii) $E(2X+3)$ and (iv) $Var(2X+3)$.

14. Two samples are drawn from two normal populations. From the following data, test whether the two samples have the same variances at 5% level of significance. — 8 4 4 1,12

Sample I 60   65   71   74   76   82   85   87

Sample II 64   66   67   85   78   88   86   85   63   9

15. a) Show that $-1 \le r \le 1$, where r is the correlation coefficient. — 3 1 5 1,12

b) Find the regression line of x on y from the following data. — 5 2 5 1,2,12

x	10	12	18	24	23	27
y	13	18	12	25	30	10

16. a) Find the missing term in the following table. — 4 2 1 1,12

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

b) Using Taylor series method, find $y(0.1)$ correct to four decimal places if $y(x)$ satisfies $y' = x - y^2$, $y(0) = 1$. — 4 3 2 1,2,12

17. Answer any **two** of the following:

a) The weekly wages of 1000 workers are normally distributed with a mean of Rs.70 and a standard deviation of Rs.5. Estimate the number of workers whose weekly wages will be (i) between Rs.68 and Rs.72 and (ii) less than Rs.63. — 4 3 3 1,2,12

b) A sample of 20 items has mean 42 and standard deviation 5. Test the hypothesis that it is a random sample from a normal population with mean 46. — 4 3 4 1,2,12

c) Using the method of least squares, fit a straight line for the following data. — 4 2 5 1,12

x	5	10	15	20	25
y	20	40	30	60	50

M : Marks;   L: Bloom's Taxonomy Level;   CO; Course Outcome;   PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	18.75%
ii)	Blooms Taxonomy Level – 2	31.25%
Iii	Blooms Taxonomy Level – 3 & 4	50%

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