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Code No. : 14144 AS

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 $\Delta(\tan^{-1} x)$.	2	1	1	1,12												
2.	Construct divided difference table for the following data: <table border="1" style="margin-left: 20px;"> <tr> <td>x</td> <td>-1</td> <td>0</td> <td>3</td> <td>6</td> <td>7</td> </tr> <tr> <td>$f(x)$</td> <td>3</td> <td>-6</td> <td>39</td> <td>822</td> <td>1611</td> </tr> </table>	x	-1	0	3	6	7	$f(x)$	3	-6	39	822	1611	2	2	1	1,12
x	-1	0	3	6	7												
$f(x)$	3	-6	39	822	1611												
3.	Write the formula for $\frac{dy}{dx}$, $\frac{d^2y}{dx^2}$ 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: <table border="1" style="margin-left: 20px;"> <tr> <td>X</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>$P(X)$</td> <td>$\frac{1}{5}$</td> <td>$\frac{1}{5}$</td> <td>$\frac{1}{15}$</td> <td>$\frac{2}{15}$</td> <td>$\frac{2}{5}$</td> </tr> </table> <p>Find $P(X > 1)$.</p>	X	0	1	2	3	4	$P(X)$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{15}$	$\frac{2}{15}$	$\frac{2}{5}$	2	2	3	1,2,12
X	0	1	2	3	4												
$P(X)$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{15}$	$\frac{2}{15}$	$\frac{2}{5}$												
6.	If X is a random variable, show that $E(aX+b) = aE(X)+b$, 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 $y = a + bx$. <p align="center">Part-B (5 × 8 = 40 Marks)</p>	2	3	5	1,2,12												
11. a)	The population of a town in decennial census were as under. Estimate the population for the year 1955. <table border="1" style="margin-left: 20px;"> <tr> <td>Year</td> <td>1921</td> <td>1931</td> <td>1941</td> <td>1951</td> <td>1961</td> </tr> <tr> <td>Population(in thousands)</td> <td>46</td> <td>66</td> <td>81</td> <td>93</td> <td>101</td> </tr> </table>	Year	1921	1931	1941	1951	1961	Population(in thousands)	46	66	81	93	101	4	3	1	1,12
Year	1921	1931	1941	1951	1961												
Population(in thousands)	46	66	81	93	101												
b)	Applying Lagrange's interpolation formula, find a cubic polynomial which approximates the following data: <table border="1" style="margin-left: 20px;"> <tr> <td>x</td> <td>-2</td> <td>-1</td> <td>2</td> <td>3</td> </tr> <tr> <td>$f(x)$</td> <td>-12</td> <td>-8</td> <td>3</td> <td>5</td> </tr> </table>	x	-2	-1	2	3	$f(x)$	-12	-8	3	5	4	3	1	1,12		
x	-2	-1	2	3													
$f(x)$	-12	-8	3	5													

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 $\frac{dy}{dx}$ for $x = 2.2$.	4	3	2	1,12																
	<table border="1"> <tr> <td>x</td> <td>1.0</td> <td>1.2</td> <td>1.4</td> <td>1.6</td> <td>1.8</td> <td>2.0</td> <td>2.2</td> </tr> <tr> <td>y</td> <td>2.7183</td> <td>3.3201</td> <td>4.0552</td> <td>4.9530</td> <td>6.0496</td> <td>7.3891</td> <td>9.0250</td> </tr> </table>	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				
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. $f(x) = \begin{cases} k x e^{-x}, & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$. Find (i) k (ii) $E(X)$ (iii) $E(2X+3)$ and (iv) $Var(2X+3)$.	8	2	3	1,12																
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. Sample I 60 65 71 74 76 82 85 87 Sample II 64 66 67 85 78 88 86 85 63 9	8	4	4	1,12																
15. a)	Show that $-1 \leq r \leq 1$, 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																
	<table border="1"> <tr> <td>x</td> <td>10</td> <td>12</td> <td>18</td> <td>24</td> <td>23</td> <td>27</td> </tr> <tr> <td>y</td> <td>13</td> <td>18</td> <td>12</td> <td>25</td> <td>30</td> <td>10</td> </tr> </table>	x	10	12	18	24	23	27	y	13	18	12	25	30	10						
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																
	<table border="1"> <tr> <td>x</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>y</td> <td>1</td> <td>3</td> <td>9</td> <td>--</td> <td>81</td> </tr> </table>	x	0	1	2	3	4	y	1	3	9	--	81								
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																
	<table border="1"> <tr> <td>x</td> <td>5</td> <td>10</td> <td>15</td> <td>20</td> <td>25</td> </tr> <tr> <td>y</td> <td>20</td> <td>40</td> <td>30</td> <td>60</td> <td>50</td> </tr> </table>	x	5	10	15	20	25	y	20	40	30	60	50								
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%
