ADAMAS UNIVERSITY PURSUE EXCELLENCE	**ADAMAS UNIVERSITY** **END SEMESTER EXAMINATION** (Academic Session: 2020 – 21)		
Name of the Program:	M.TECH (Environmental Engineering)	**Semester:**	II
Paper Title:	Numerical Methods	**Paper Code:**	ENV21014
Maximum Marks:	50	**Time Duration:**	3 Hrs
Total No. of Questions:	**17**	**Total No of Pages:**	3
(Any other information for the student may be mentioned here)	**1.** At top sheet, clearly mention Name, Univ. Roll No., Enrolment No., Paper Name & Code, Date of Exam. **2.** All parts of a Question should be answered consecutively. Each Answer should start from a fresh page. **3.** Assumptions made if any, should be stated clearly at the beginning of your answer.		

Group A **Answer All the Questions (5 x 1 = 5)**			
1	What is the intermediate value property?	**Re**	**CO1**
2	What is interpolation and extrapolation? Discuss with an example.	**U**	**CO4**
3	What is order and degree of $y''^2 + 3xy = 1 + x^2$?	**Re**	**CO3**
4	Classify the PDE $f_{xx} + f_{yy} + f_x + f_y = 0$.	**U**	**CO3**
5	Which part of the (x, y) plane is the following equation to be elliptic? $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial x \partial y} + (x^2 + 4y^2)\ \frac{\partial^2 u}{\partial y^2} = 2\sin(xy)$	**Re**	**CO3**
Group B **Answer All the Questions (5 x 2 = 10)**			
6 a)	i) What is the rate of convergence of the Newton-Raphson method for any real function $f(x)$? ii) If π is taken 3.14 in the place of 3.14156, then find the relative error?	**Re**	**CO1**
(OR)			
6 b)	What will be the rounding off values of the numbers of 43.38256, 0.0326457 and 0.2537623 to four significant digits?	**Re**	**CO1**
7 a)	Find the interval in which a real root of the equation $x^3 - 2x - 5 = 0$ lies.	**Re**	**CO1**
(OR)			
7 b)	Tell the pros and cons of the Newton Raphson method.	**Re**	**CO1**
8 a)	If $f(x)$ is given by x: 0, 0.5, 1 $f(x)$: 1, 0.8, 0.5 Then using Trapezoidal rule, find $\int_0^1 f(x)dx$.	**Re**	**CO3**

(OR)

8 b) Summarize the Newton divided difference table for the following data:

x	-1	0	1	3
y	2	1	0	-1

U **CO3**

9 a) Find the cubic polynomial which takes the following values:

x	0	1	2
$f(x)$	1	2	1

Hence or otherwise find $f'(3)$.

Re **CO3**

(OR)

9 b) Tell the Gaussian 2-point quadrature formula. **Re** **CO3**

10 a) Given $3\frac{dy}{dx} + \sqrt{y} = e^{0.1x}, y(0.3) = 5$, and the step size is of $h = 0.3$. Estimate of $\frac{dy}{dx}(0.9)$ by applying Euler's method. **Ap** **CO4**

(OR)

10 b) Applying Taylor's series method to approximate y when $x = 0.2$ for $\frac{dy}{dx} = x^2y - 1, y(0) = 1$. **Ap** **CO4**

Group C

Answer All the Questions (7 x 5 = 35)

11 a) The bacteria concentration in a reservoir varies as $C = 4e^{-2t} + e^{-0.1t}$. Using Newton-Raphson method, find the time required for the bacteria concentration to be 0.5. **Re** **CO1**

(OR)

11 b) Find a real root of the following equation using Secant method $xlog_{10}x = 1.9$, correct to 3 decimal places. **Re** **CO1**

12 a) Illustrate the mean radiation dose at an altitude of 3000 ft by fitting an exponential curve to the given data:

Altitude (x)	50	450	780	1200	4400	4800	5300
Dose of radiation (y)	28	30	32	36	51	58	69

U **CO2**

(OR)

12 b) One entry in the following table is incorrect and y is the cubic polynomial in x. Apply the difference table to locate and correct the error:

x	0	1	2	3	4	5	6	7
y	25	21	18	18	27	45	76	123

Ap **CO2**

13 a) A Chemical company, wishing to study the effect of extraction time(t) on the efficiency of an extraction operation (e) obtained from the data shown in the following table:

t	27	45	41	19	3	39	19	49	15	31
e	57	64	80	46	62	72	52	77	57	68

Build a straight line to the given data by the method of least

Ap **CO2**

	squares.		
	(OR)		
13 b)	Apply the method of difference to calculate $\Delta^2(\frac{1}{x^2+5x+6})$.	**Ap**	**CO2**
14 a)	Use the Lagrange's formula to find the form of $f(x)$, given x: 1, 3, 4, 6 $f(x)$: -3, 9, 30, 132 And hence find $f(4.5)$.	**U**	**CO3**
	(OR)		
14 b)	The following data gives corresponding value of pressure and specific volume of a super-heated steam: **Volume (v)**: 1.0, 1.2, 1.4, 1.6, 1.8, 2.0 **Pressure (p)**: 0, 0.128, 0.544, 1.296, 2.432, 4.00 Find the rate of change of pressure with respect to volume when $v = 2$.	**Re**	**CO3**
15 a)	Explain the Simpson's 1/3 rd rule to compute the integral $I = \int_0^{0.6} e^{-x^2} dx$, by taking six subintervals.	**U**	**CO3**
	(OR)		
15 b)	Find $\int_0^1 \frac{dx}{1+x}$ correct to three decimal places using the Romberg's method. Hence find the value of $log_e 2$.	**Re**	**CO3**
16 a)	Illustrate three point Gaussian quadrature formula to compute $\int_1^2 \frac{dx}{1+x^3}$	**U**	**CO3**
	(OR)		
16 b)	From the table below, for what values of x, y is minimum? Also, find this value of y. x: 3, 4, 5, 6, 7, 8 y: 0.205, 0.240, 0.259, 0.262, 0.250, 0.224	**Re**	**CO3**
17 a)	Solve the following differential equation by using Euler's method for $x = 1, h = 0.2$, $\frac{dy}{dx} = xy, y(0) = 1.$	**Ap**	**CO4**
	(OR)		
17 b)	Apply R-K method of order four to calculate $y(0.2)$, given that $\frac{dy}{dx} = x + y^2, y(0) = 1$, taking $h = 0.1$	**Ap**	**CO4**

**** End ****