Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, May 2021

Course: Numerical Methods — **Semester: IV**
Program: B.Sc. (Hons.) Physics/ B.Sc. (Hons.) Chemistry — **Time: 03 hrs.**
Course Code: MATH 2017G — **Max. Marks: 100**
Instructions: All questions are compulsory.

SECTION A (Each question carries 5 marks)

S. No.		**Marks**
Q1	Which of the following relation is true? A. $E = \nabla^{-1}$ B. $E = (1+\nabla)^{-1}$ C. $E = (1-\nabla)^{-1}$ D. None of these	**CO1**
Q2	Newton-Raphson method states that. A. $f(x) = 0$, where f assumed to have a continuous derivative f', $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$ B. $f(x) = 0$, where f assumed to have a continuous derivative f', $x_{n+1} = x_n + \frac{f(x_n)}{f'(x_n)}$ C. $(x) = 0$, where f assumed to have a continuous derivative f', $x_{n+1} = \frac{f(x_n)}{f'(x_n)}$ D. None of these	**CO2**
Q3	The factorial notation form of the polynomial $f(x) = 2x^3 - 3x^2 + 3x - 10$ is __________	**CO3**
Q4	The Value of the integral $I = \int_0^1 (1/(1+x))\, dx$ by dividing the interval of integration into 8 equal part and by applying the Simpson's 1/3rd rule is is __________	**CO4**
Q5	**Match the following:** A. Newton-Raphson — 1. Integration B. Runge-kutta — 2. Root finding C. Gauss-seidel — 3. Ordinary Differential Equations D. Simpson's Rule — 4. Solution of system of Linear Equations A. A2-B3-C4-D1 B. A3-B2-C1-D4 C. A1-B4-C2-D3 D. A4-B1-C2-D3	**CO1**

Q6	Which of the following is true for backward difference operator? A. $\nabla^2 f(x) = f(x-2h) - 2f(x-h) + f(x)$ B. $\nabla^2 f(x) = f(x-2h) + 2f(x-h) + f(x)$ C. $\nabla^2 f(x) = f(x-2h) - 2f(x-h) - f(x)$ D. *None of these*	**CO3**
	SECTION B (Each question carries 10 marks)	
Q7	Solve the following system of linear equations by Jacobbi's method $11x_1 + 17x_2 + 18x_3 + 16x_4 = 10$ $23x_1 + 27x_2 + 25x_3 + 28x_4 = 20$ $22x_1 + 32x_2 + 34x_3 + 36x_4 = 30$ $12x_1 + 15x_2 + 41x_3 + 36x_4 = 40$ Perform two iterations.	**CO5**
Q8	Consider the equation $x^2 - \ln x - 2 = 0$. Rewrite the equation in form of $x = \phi(x)$, to find a real root of the equation using Fixed point iteration method. Hence find the root of the equation which lies between 1 and 2. Perform four iterations.	**CO2**
Q9	Use Lagrange's interpolation formula to fit a polynomial to the following data. Hence find y(1). <table><tr><td>x</td><td>-1</td><td>0</td><td>2</td><td>3</td></tr><tr><td>y = f(x)</td><td>-6</td><td>5</td><td>1</td><td>3</td></tr></table>	**CO3**
Q10	A rocket is launched from ground. Its acceleration ($f\ cm/s^2$) is registered during the first 60 seconds, and is given in table below. Find the velocity ($v\ cm/s$) of the rocket at $t = 60$ seconds. <table><tr><td>t</td><td>0</td><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td><td>60</td></tr><tr><td>f</td><td>30</td><td>31.63</td><td>33.34</td><td>35.47</td><td>37.75</td><td>40.33</td><td>43.25</td></tr></table>	**CO4**

Q11

A slider in a machine moves along a fixed straight rod. Its distance 'x' cm along the road is given blow for various value of 't' second. Find the velocity and acceleration of the slider when t=0.1 sec.

t:	0	0.1	0.2	0.3	0.4	0.5	0.6
X:	30.13	31.62	32.87	33.64	33.95	33.81	33.24

CO4

SECTION-C (This question carries 20 marks)

Q 12

Find y for x = 0.1 and 0.2 for $\frac{dy}{dx} = \frac{y^2 - 2x}{y^2 + x}$ given that y(0)=1 by Runge-Kutta method of fourth order by taking h = 0.05

OR

Using Euler's method, find y for x=0.1, 0.2, 0.3 given that $\frac{dy}{dx} = xy + y^2$, y(0)=1.

Continue the solution at x=0.4 using Milne's method.

CO6