


Name: Enrolment No:	 UPES UNIVERSITY WITH A PURPOSE
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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, May 2021

Course: Numerical Methods	Semester: VI
Program: B.Tech ASE	Time: 03 hrs.
Course Code: MATH 2002	Max. Marks: 100

Instructions: All questions are compulsory.

SECTION A (Each question carries 5 marks)

S. No.		CO
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' , $x_{n+1} = \frac{f(x_n)}{f'(x_n)}$ E. 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 1/3 rd 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	CO1

	<p>B. A3-B2-C1-D4</p> <p>C. A1-B4-C2-D3</p> <p>D. A4-B1-C2-D3</p>															
Q6	<p>Which of the following is true for backward difference operator?</p> <p>A. $\nabla^2 f(x) = f(x - 2h) - 2f(x - h) + f(x)$</p> <p>B. $\nabla^2 f(x) = f(x - 2h) + 2f(x - h) + f(x)$</p> <p>C. $\nabla^2 f(x) = f(x - 2h) - 2f(x - h) - f(x)$</p> <p>None of these</p>	CO3														
SECTION B (Each question carries 10 marks)																
Q7	<p>Let z be the true value of a quantity and z_1 be its approximate value. Define absolute error, relative error and percentage error. If $z = xy$, find the percentage error in z when $x = 56.54 \pm 0.005$ and $y = 12.40 \pm 0.050$.</p>	CO1														
Q8	<p>From the following table, find the number of students who obtained marks between 80 and 85.</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Marks obtained</th> <th>0 – 35</th> <th>35 – 45</th> <th>45 – 55</th> <th>55 – 65</th> <th>65 – 75</th> <th>75 – 85</th> </tr> </thead> <tbody> <tr> <td>Number of students</td> <td>15</td> <td>25</td> <td>15</td> <td>35</td> <td>20</td> <td>10</td> </tr> </tbody> </table>	Marks obtained	0 – 35	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85	Number of students	15	25	15	35	20	10	CO3
Marks obtained	0 – 35	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85										
Number of students	15	25	15	35	20	10										
Q9	<p>Show that Newton-Raphson method has a second-order convergence. Find the smallest positive real root of the equation $x e^x = \cos x$ by Newton-Raphson method, correct to 4 significant digits.</p>	CO2														
Q10	<p>Solve with Gauss Siedal Method, show four iterations</p> $2x + y + 6z = 9$ $8x + 3y + 2z = 13$ $x + 5y + z = 7$	CO4														
Q11	<p>An experiment gave the following values</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tbody> <tr> <td><i>Velocity (v)ft/min</i></td> <td>350</td> <td>400</td> <td>500</td> <td>600</td> </tr> <tr> <td><i>Time (t) min</i></td> <td>61</td> <td>26</td> <td>7</td> <td>2.6</td> </tr> </tbody> </table> <p>It is known that v and t are connected by the relation $v = at^b$. Find best possible values of a and b.</p> <p style="text-align: center;">OR</p>	<i>Velocity (v)ft/min</i>	350	400	500	600	<i>Time (t) min</i>	61	26	7	2.6	CO5				
<i>Velocity (v)ft/min</i>	350	400	500	600												
<i>Time (t) min</i>	61	26	7	2.6												

A slider in a machine moves along a fixed straight rod. Its distance 'x' cm along the road is given below for various values 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

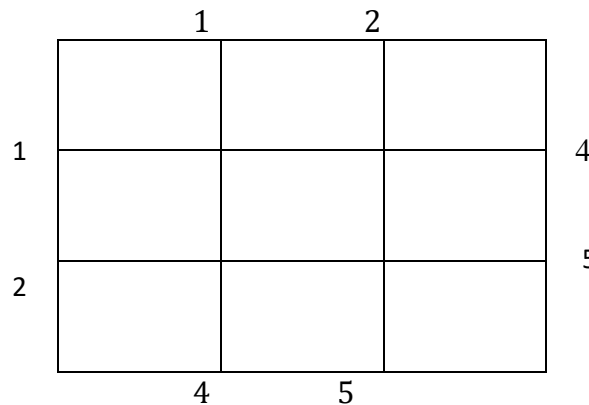
SECTION-C (This question carries 20 marks)

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 = 0.1

OR

Solve the equation $u_{xx} + u_{yy} = 0$ for the square mesh with the boundary values as shown in Fig.



C06