Name:

Enrolment No:

UPES
UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

Course: Applied Numerical Methods **Semester: III**
Program: B Tech FSE **Time 03 hrs.**
Course Code: MATH 2007 **Max. Marks: 100**

Instructions: All questions are compulsory. Internal choice is visible in the question(s). Calculator is allowed.

SECTION A

S. No.		Marks	CO
Q 1	Write done the conditions for the equation $A\frac{\partial u^2}{\partial x^2} + B\frac{\partial u^2}{\partial x \partial y} + C\frac{\partial u^2}{\partial y^2} + D\frac{\partial u}{\partial x} + E\frac{\partial u}{\partial x} + Fu = 0$ to be (i) Elliptic (ii) Parabolic (iii) Hyperbolic. Also, write down the condition for its linearity.	**4**	**CO3**
Q 2	Write the following polynomial in factorial notation: $x^3 + 7x^2 - 5x + 7$.	**4**	**CO4**
Q 3	Find a root of the equation x = cos x, using false position method correct up to one place of decimal.	**4**	**CO1**
Q 4	Estimate the production for the year 1964 from the following data Year: 1961 1962 1963 1964 1965 Production: 200 220 260 --- 350	**4**	**CO4**
Q 5	Prove that $\Delta \log x = \log\left[1 + \frac{\Delta f(x)}{f(x)}\right]$.	**4**	**CO4**

SECTION B

Q 6	Use the finite difference method to solve numerically the equation $y'' + y + 1 = 0$, with boundary conditions $y = 0$ when $x = 0$ and $y = 0$ when $x = 1$. Choose $n = 2$. Where n is number of sub intervals.	**10**	**CO2**
Q 7	The following table gives the marks secured by 100 students in the Statistical Methods. Range of Marks: 30-40 40-50 50-60 60-70 70-80 No. of students: 25 35 22 11 07 Find the number of students who got more than 55 marks using Newton' Forward Difference Interpolation formula.	**10**	**CO4**

<table>
<tr><td>Q 8</td><td>A wind force distributed against the side of a sky scrapper is measured as given in the following table:

<table><tr><td>Height, m</td><td>0</td><td>30</td><td>60</td><td>90</td><td>120</td><td>150</td><td>180</td><td>210</td><td>240</td></tr><tr><td>Force,N/ m</td><td>0</td><td>350</td><td>1000</td><td>1500</td><td>2600</td><td>3000</td><td>3300</td><td>3500</td><td>3600</td></tr></table>
Compute the net force using (i) Trapezoidal rule (ii) Simpson’s 1/3 rule</td><td>10</td><td>CO4</td></tr>
<tr><td>Q 9</td><td>Find a real root of the equation $2x - \log_{10} x = 7$ correct up to two places of decimal. by Newton-Raphson method.
OR
Using fixed point iteration method find a root of $2x - \log_{10} x = 7$ correct up to two places of decimal.</td><td>10</td><td>CO1</td></tr>
<tr><td colspan="4">SECTION-C</td></tr>
<tr><td>Q 10a</td><td>Solve the following system of equations by Cholesky's LU decomposition method.
5x + 3y + 7z= 4, 3x + 26y + 2z = 9, 7x + 2y + 11z = 5.</td><td>10</td><td>CO1</td></tr>
<tr><td>Q 10b</td><td>Solve the following set of differential equations using Euler’s method, assuming that at $x = 0, y_1 = 4,$ and $y_2 = 6$. Integrate to $x = 1.0$ with a step size of 0.5.
$\frac{dy_1}{dx} = -0.5y_1$ and $\frac{dy_2}{dx} = 4 - 0.3y_2 - 0.1y_1$</td><td>10</td><td>CO2</td></tr>
<tr><td>Q 11</td><td>Solve the equation, $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square mesh with sides x = 0, y = 0, x = 3 & y = 3 with u = 0 on boundary and mesh length equal to 1.
OR
Obtain the numerical solution of $u_t = u_{xx}$, 0 ≤ x ≤ 1, t ≥ 0 under the conditions u (0, t) = u (1, t) = 0, and u (x, 0) = $\begin{cases} 2x \ for\ 0 \le x \le \frac{1}{2} \\ 2(1-x)\ for \frac{1}{2} \le x \le 1 \end{cases}$
Use Bender- Smith approach.</td><td>20</td><td>CO3</td></tr>
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