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

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

Course: MTech. | **Semester: I**
Program: Applied Mathematics In Petroleum Engineering | **Time 03 hrs.**
Course Code: MATH 7001 | **Max. Marks: 100**
Instructions: Attempt all Questions, Scientific calculator allowed.

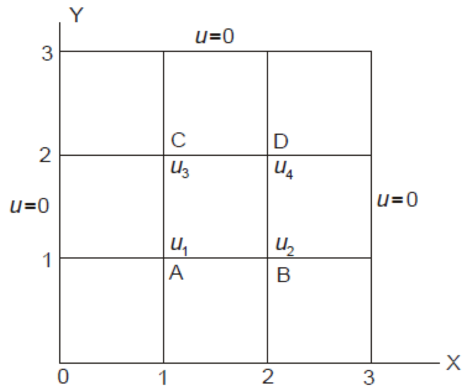
SECTION A

S. No.		Marks	CO
Q1	Find the root of the equation $\cos x = xe^x$ using the bisection method correct to two decimal places.	**4M**	**CO3**
Q2	Evaluate $\Delta^{10}[(1-ax)(1-bx^2)(1-cx^3)(1-dx^4)]$	**4M**	**CO1**
Q3	Evaluate $\int_0^1 \frac{1}{1+x}dx$, correct to three decimal places using trapezoidal rule.	**4M**	**CO2**
Q4	Estimate the eigenvalues of the matrix $A = \begin{bmatrix} 1 & 2 & -1 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$ using the Gerschgorin bounds.	**4M**	**CO4**
Q5	Using Taylor series method, find $y(0.1)$ correct to three decimal places given that $$\frac{dy}{dx} = x^2y - 1, \quad y(0) = 1$$	**4M**	**CO5**

SECTION B

S. No.		Marks	CO
Q 6	Transform the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$ to tridiagonal form by Givens method.	**10M**	**CO4**
Q7	Solve the heat conduction problem $$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$ subject to the conditions $u(x,0) = \sin \pi x, \ 0 \le x \le 1$, and $u(0,t) = u(1,t) = 0$.Use Bender-Schmidt's formula to compute the value of $u(0.6,0.04)$.	**10M**	**CO5**

Q8	The population of a town in the decennial census was as given below. Estimate the population for the year 1895 <table><tr><td>Year: x</td><td>1891</td><td>1901</td><td>1911</td><td>1921</td><td>1931</td></tr><tr><td>Population: y (in thousands)</td><td>46</td><td>66</td><td>81</td><td>93</td><td>101</td></tr></table>	**10M**	**CO1**
Q9	Solve the system of equations $20x + y - 2z = 17$ $3x + 20y - z = -18$ $2x - 3y + 20z = 25$ by Gauss-Seidal method. **OR** Solve the system of equations $10x + y - z = 11.19$ $x + 10y + z = 28.08$ $-x + y + 10z = 35.61$ by Jacobi's iteration method.	**10M**	**CO4**
SECTION-C			
Q 10a	Using the Jacobi method find the eigenvalues of the matrix $\begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{bmatrix}$	**10M**	**CO4**
Q10b	Apply Runge-Kutta method to find approximate value of y for $x = 0.2$, in steps of 0.1, given that $\frac{dy}{dx} = x + y^2, \quad y(0) = 1.$	**10M**	**CO5**
Q11	Solve the equation $\nabla^2 u = -10(x^2 + y^2 + z^2)$ over the square with sides $x = 0 = y$, $x = 3 = y$ with $u = 0$ on the boundary and mesh length equal to one.	**20M**	**CO6**

	 OR Solve the equation $u_{xx} + u_{yy} = 0$ in the domain of fig given below by Gauss-Seidal method.