Name: Enrolment No:	UPES – UNIVERSITY WITH A PURPOSE

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

Course: Applied Numerical Methods **Semester: VII**
Program: B. Tech. EE **Time 03 hrs.**
Course Code: MATH 306 **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 general form of a second order linear Partial Differential Equation. Classify it in Parabolic, Elliptic and Hyperbolic equations.	4	CO3
Q 2	Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's $\frac{3}{8}$ rule taking $h=\frac{1}{6}$.	4	CO4
Q 3	Find a positive value of $(17)^{\frac{1}{3}}$ correct to four decimal places by Newton-Raphson method.	4	CO1
Q 4	Using Lagrange's formula for interpolation find the value of y for x = 9.5 for a function y = f(x) which has following set of values. x: 8, 9, 10 y: 1, 1, 9	4	CO4
Q 5	Prove that $e^x = \left(\frac{\Delta^2}{E}\right)e^x \frac{Ee^x}{\Delta^2 e^x}$, where symbols have their usual meanings.	4	CO4

SECTION B

S. No.		Marks	CO
Q 6	Use Euler's modified method to compute y for x = .05 and x = 0.1 given $\frac{dy}{dx} = x + y$ with initial condition $x_0 = 1, y_0 = 1$. Give the result correct to two places of decimal.	10	CO2
Q 7	Find the first derivative of the function tabulated below at the point $x = 1.1$, using numerical differentiation. x: 1.0, 1.2, 1.4, 1.6 f(x): 0, .1280, .5440, 1.2960	10	CO4

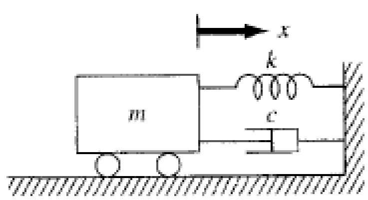
Q 8	The mean atmospheric refraction R, for a star at various altitudes $h°$ above the horizon is given in the table below. Using forward difference interpolation formula, find the refraction for a star at an altitude of $23°$ above the horizon.	**10**	**CO4**

H	22^0	24^0	26^0	28^0
R	$2' 23''.3$	$2' 10''.2$	$1' 58''.9$	$1' 49''.2$

Q 9	Find a positive real root of $x - cosx = 0$ between 0 and 1 by regula - falsi method correct up to 2 decimal places. **OR** Apply Graeffe's root squaring method to solve the equation $x^3 - 8x^2 + 17x - 10 = 0$, squaring twice.	**10**	**CO1**

SECTION-C

Q 10A	Solve the following equations by Gauss Seidel iteration method correct up to 2 decimal places. $20x + y - 2z = 17$; $3x + 20y - z = -18$; $2x - 3y + 20z = 25$	**10**	**CO1**
Q 10B	The motion of a damped spring- mass system shown in the following figure is described by the differential equation $m\frac{d^2x}{dt^2} + c\frac{dx}{dt} + kx = 0$, where x is the displacement from the equilibrium position (m), t is time in seconds, m=10 kg is mass, and c is the damping coefficient which takes values 5 (under damped) and 40 (critically damped). The spring constant k =40 N/m.	**10**	**CO2**



The initial velocity is zero and the initial displacement x=1 m. Solve this system and compare the displacements at t=1 s for under damped as well as critically damped conditions with step size t = 0.5 s.

Q 11	Solve $u_{xx} + u_{yy} = 0$ in $0 \leq x \leq 4$, $0 \leq y \leq 4$ with the given conditions $u(0, y) = 0$; $u(4, y) = 8 + 2y$; $u(x, 0) = x^2/2$ and $u(x, 4) = x^2$ by taking $h = k = 1$. (Obtain the result correct to one place of decimal.) **OR**	**20**	**CO3**

	Using Crank – Nicholson method, solve $u_{xx} = 16\, u_t$, $0 < x < 1$, $t > 0$ given $u\,(x, 0) = 0, u(0, t) = 0$ and $u\,(1, t) = 50t$. Compute u for two steps in t direction tacking $h = ¼$.		