Name:

Enrolment No:

UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: Applied Numerical Methods **Semester: VII**
Programme: B. Tech. Electronics Engineering **Code: MATH-306**
Time: 03 hrs. **Max. Marks: 100**

SECTION A

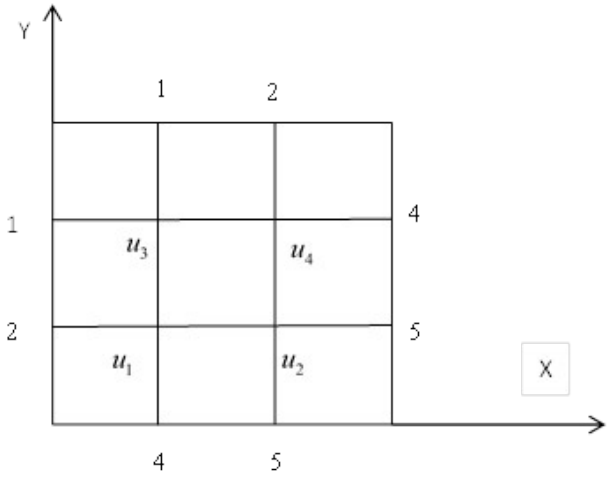
S. No.		Marks	CO
Q 1	Given that $\frac{dy}{dx} = y - x$, $y(0) = 2$. Find $y(0.1)$ taking $h = 0.1$ using Runge-Kutta method of fourth order.	4	CO5
Q 2	Prove that $\Delta^3 y_2 = \nabla^3 y_5$.	4	CO1
Q 3	Using Newton Raphson method, find the real root of $x \log_{10} x = 1.2$ correct to 4 decimal places.	4	CO3
Q 4	Solve the equations $\frac{dy}{dx} = 1 - y$ with the initial condition $x = 0,\ y = 0$ using Euler's method and tabulate the solution at $x = 0.1, 0.2$.	4	CO5
Q 5	Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's 1/3rd rule with 4 subintervals.	4	CO2

SECTION B

S. No.		Marks	CO
Q 6	Find the value of $\log_{10} 58.75$ using Newton's backward difference formula, given that:	10	CO1

x	40	45	50	55	60	65
$\log_{10} x$	1.60206	1.65321	1.69897	1.74036	1.77815	1.81291

Q 7	Solve the following system of equations using Gauss elimination method: $10x + y + z = 12$ $2x + 10y + z = 13$ $x + y + 3z = 5$	10	CO4
Q 8	A boundary value problem is defined by $y'' + y + 1 = 0,\ 0 \le x \le 1$ where $y(0) = 0$ and $y(1) = 0$. Use finite difference method to determine the value of $y(0.5)$ where $h = 0.25$.	10	CO5
9	Given that $\frac{dy}{dx} = \log_{10}(x + y)$ with the initial condition $y = 1$ when $x = 0$. Find y for $x = 0.2$ and $x = 0.5$ using modified Euler's method. **OR** Use Picard's method to obtain y for $x = 0.2$ correct to three decimal places, given:	10	CO5

	$\frac{dy}{dx} = x - y$ with initial condition $y = 1$ when $x = 0$.		
	SECTION-C		
Q10 (A)	The table below gives the result of an observation. θ is the observed temperature in degrees centigrade of a vessel of cooling water, t is the time in minutes from the beginning of observations: t: 1, 3, 5, 7, 9 θ: 85.3, 74.5, 67, 60.5, 54.3 Find the approximate rate of cooling at $t = 3$.	**10**	**CO2**
Q10(B)	Find the root of $x^3 + 9x^2 - 18 = 0$ using Horner's method correct to 2 decimal places.	**10**	**CO3**
Q11(A)	Solve the heat conduction problem: $$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$ subject to the condition $u(x,0) = \sin \pi x$, $0 \le x \le 1$, and $u(0,t) = u(1,t) = 0$. Use Bender-Schmidt's method to compute $u(0.6, 0.04)$. **OR** Solve the Laplace equation in the following domain using Gauss-Seidal method in 2 iterations:  	**10**	**CO6**
Q11(B)	From the table, estimate the number of students who obtained marks between 40 and 45. **Marks**: 30-40, 40-50, 50-60, 60-70, 70-80 **No. of students**: 31, 42, 51, 35, 31 **OR** The following are the number of deaths in four successive ten year age groups. Find the number of deaths at 45-50 and 50-55. **Age group**: 25-35, 35-45, 45-55, 55-65 **Deaths**: 13229, 18139, 24225, 31496	**10**	**CO1**

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SECTION A

S. No.		Marks	CO
Q 1	Use Picard's method to obtain y for $x=0.1$ in 2 approximations. Given that $\frac{dy}{dx}=3x+y^2$, $y=1$ at $x=0$.	4	CO5
Q 2	Prove that $\left(E^{1/2}-E^{-1/2}\right)(1+\Delta)^{1/2}=2+\Delta$.	4	CO1
Q 3	Evaluate $\sqrt{12}$ correct to four decimal places by Newton Raphson method.	4	CO3
Q 4	Solve the equations $\frac{dy}{dx}=\frac{y-x}{y+x}$ with the initial condition $x=0,\ y=1$ using Euler's method taking $h=0.1$.	4	CO5
Q 5	Evaluate $\int_0^1 \frac{dx}{1+x}$ using Simpson's 1/3rd rule with 4 subintervals.	4	CO2

SECTION B

S. No.		Marks	CO
Q 6	From the following table of half-yearly premium for policies maturing at different ages, estimate the premium for policy maturing at the age of 63:	10	CO1

Age	45	50	55	60	65
Premium (In rupees)	114.84	96.16	83.32	74.48	68.48

Q 7	Solve the following system of equations using Gauss Jordan method: $2x+y+z=10$ $3x+2y+3z=18$ $x+4y+9z=16$	10	CO4
Q 8	A boundary value problem is defined by $y''-y=0$ where $y(0)=0$ and $y(2)=3.62686$. Use finite difference method to determine the value of $y(1)$ where $h=0.5$.	10	CO5
Q 9	Given that $\frac{dy}{dx}=x-y^2$ with the initial condition $y=0.2$ when $x=0.2$. Find y for $x=0.4$ using modified Euler's method correct to 3 decimal places taking $h=0.2$.	10	CO5

OR

Use Runge Kutta method of fourth order to obtain y for $x=0.2$, given: $\frac{dy}{dx}=x+y$ with initial condition $y=1$ when $x=0$ taking $h=0.1$.

SECTION-C

Q10 (A) — **10** — **CO2**

Find $f'(1.1)$ from the following table:

x	1.0	1.2	1.4	1.6	1.8	2.0
$f(x)$	0.0	0.1280	0.5540	1.2960	2.4320	4.0

Q10(B) — **10** — **CO3**

Apply Graeffe's root squaring method to solve the equation with three squaring:

$$x^3 - 8x^2 + 17x - 10 = 0$$

Q11(A) — **10** — **CO6**

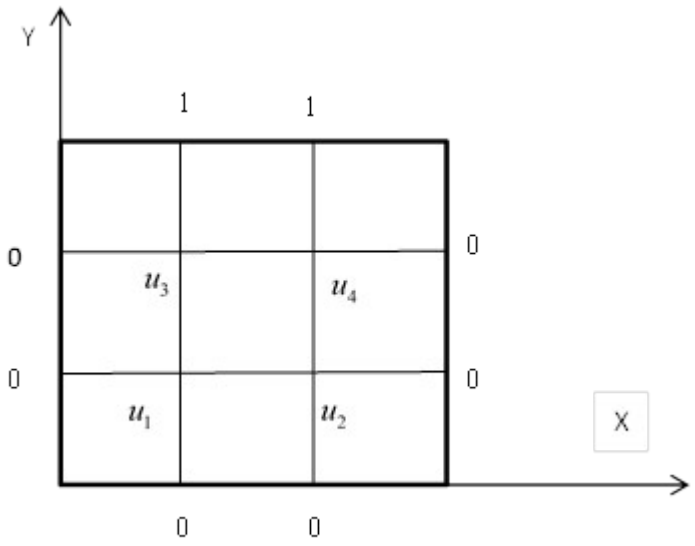
Solve the heat conduction problem:

$$\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$$

subject to the condition $u(x,0)=0$, $0 \le x \le 1$, and $u(0,t)=0$ and $u(1,t)=t$. Use Crank Nicolson's method to compute $u(1/2,1/8)$.

OR

Solve the Laplace equation in the following domain using Gauss-Jocobi method in 2 iterations:



Q11(B) — **10** — **CO1**

Estimate the value of $f(3.2)$ using only four of the given values applying Newton forward interpolation formula:

x	0	1	2	3	4	5	6
$f(x)$	2	4	10	16	20	24	38

OR

Find the cubic polynomial which takes the following values:

x	0	1	2	3
$f(x)$	1	2	1	10
