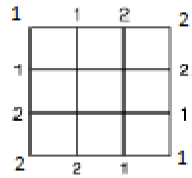
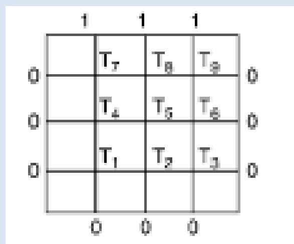
Question Bank-Unit 4 (MATH2300)

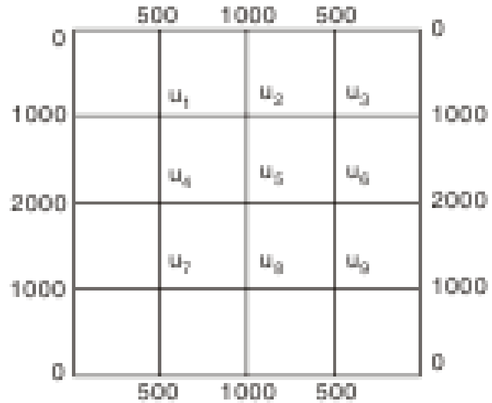
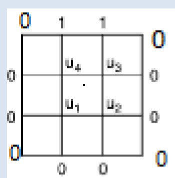
(Numerical solution of ODE and PDE)

S. No.	Questions	CO	Bloom's Taxonomy Level	Difficulty Level	Area	Topic
1	State Taylor series method in solving IVP.	CO4	K1	L	Numerical Solution of ODE	Taylor's series Method
2	State a basic difference between Euler and Modified Euler methods.	CO4	K1	L	Numerical Solution of ODE	Euler's Method
3	Write down the Runge Kutta fourth order formula.	CO4	K1	L	Numerical Solution of ODE	R-K Method
4						
5	Define initial value problems (IVP) and boundary value problems (BVP).	CO4	K1	L	Numerical Solution of ODE	Basics of ODE
6						
7	Write down Euler's formula for solving ODE.	CO4	K2	M	Numerical Solution of ODE	Euler's Method
8						
9	What are limitations of Taylor's series method.	CO4	K2	L	Numerical Solution of ODE	Taylor's series Method
10	Write down finite difference scheme for the differential equation- y''+2y=0.	CO4	K1	L	Numerical Solution of ODE	
11	Classify the following PDE- $u_{xx} + 4u_{xy} + 4u_{yy} - u_x + 2u_y = 0$	CO6	K2	M	Numerical Solution of PDE	Classification of PDE
12	Classify the given partial differential equation- $x^2 u_{xx} + (1 - y^2)u_{yy} = 0$, $-1 \leq y \leq 1$	CO6	K2	M	Numerical Solution of PDE	Classification of PDE
13	Classify the given partial Differential equation- $(1 + x^2)u_{xx} + (5 + 2x^2)u_{xy} + (4 + x^2)u_{yy} = 0$	CO6	K1	L	Numerical Solution of PDE	Classification of PDE
14	Explain diagonal five-point formula by Liebman's method.	CO6	K2	M	Numerical Solution of PDE	Elliptic Equations-Solution of Laplace Equation

15	Explain standard five point formula by Liebman's method.	CO6	K1	L	Numerical Solution of PDE	Elliptic Equations- Solution of Laplace Equation
16	Write down explicit formula in solving parabolic equations.	CO6	K2	M	Numerical Solution of PDE	Parabolic Equations- Bender Schmidt
17	Write down Von- Neumann's stability condition.	CO6	K1	M	Numerical Solution of PDE	Parabolic Equations- Bender Schmidt
18	Write down implicit formula in solving parabolic equations.	CO6	K2	M	Numerical Solution of PDE	Parabolic Equations- Crank- Nicolson
19	Write down the expression for one dimensional wave equation.	CO6	K2	L	Numerical Solution of PDE	Hyperbolic Equations
20	Write down the expression for Laplace equation.	CO6	K2	M	Numerical Solution of PDE	Laplace Equations
21	Using Taylor's series method, find the value of y at x=0.1 and 0.2, where $\frac{dy}{dx} = x + y \ , \ y(0) = 1$	CO4	K2	M	Numerical Solution of ODE	Taylor's Series
22	Using Euler's method, find an approximate value of y corresponding to x=2, given that $\frac{dy}{dx} = x + 2y$ and $y(1) = 1$.	CO4	K2	M	Numerical Solution of ODE	Euler's Method
23	Using Runge's method to find the value of y at x= 0.2, where $\frac{dy}{dx} = x^2y - 1 \ , \ y(0) = 1$	CO4	K4	M	Numerical Solution of ODE	Runge Kutta Method
24	Using Ranga kutta's fourt order method, find the value of y at x= 0.2, where $\frac{dy}{dx} = x + y \ , \ y(0) = 1$	CO4	K2	M	Numerical Solution of ODE	Runge Kutta Method
25	Using Ranga kutta's fourt order method, find the value of y at x=0.4 and 0.2, where $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2} \ , \ y(0) = 1$	CO4	K4	L	Numerical Solution of ODE	Runge Kutta Method
26	Using Taylor's series method, find the value of y at x=0.1 and 0.2, where $\frac{dy}{dx} = x^2y - 1 \ , \ y(0) = 1$	CO4	K2	M	Numerical Solution of ODE	Taylor's Series
27	Using Euler's method, find an approximate value of y corresponding to x=1.6, given that $\frac{dy}{dx} = y^2 - \frac{y}{x}$ and $y(1) = 1$.	CO4	K3	H	Numerical Solution of ODE	Euler's method

28	Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x, 0) = sin\pi x$, 0< x < 1, ; $u(0,\ t) = u(1,\ t) = 0,\ \ t \geq 0$. Find u for x=0.6 at t =.04.	CO6	K3	M	Numerical Solution of PDE	Bender Schmidt
29	Solve the equation $2\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x, 0) = x(4 - x)$, 0< x < 5, $u(0,\ t) = u(4,\ t) = 0,\ \ t \geq 0$ taking h=1 Find the values of u upto t=5.	CO6	K4	M	Numerical Solution of PDE	Bender Schmidt
30	Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, subject to the conditions u(x,0)=0, u(0,t)=0 and u(1,t)=t, for two time steps.	CO6	K3	M	Numerical Solution of PDE	Crank Nicolson Method
31	Solve BVP defined by $u_{tt}=4u_{xx}$ subject to the conditions- u(0,t)=0=u(4,t), $u_t(x,0)=0$, $u(x,0)=4x-x^2$.	CO6	K4	H	Numerical Solution of PDE	Wave Equation
32	Write method of solving Laplace equation by Liebman's method. [only for 3x3 table]	CO6	K2	M	Numerical Solution of PDE	Laplace Equation
33	Define Runge Kutta 4th order formula for solving ordinary differential equations.	CO6	K1	M	Numerical Solution of ODE	R-K Method
34	Using Euler's modified method, find the value of y at x=0.3 where $\frac{dy}{dx} = x + y \quad , \quad y(0) = 1$	CO6	K3	M	Numerical Solution of ODE	Euler's Modified method
35	Given that $\frac{dy}{dx} = x(x^2 + y^2)e^{-x}, y(0) = 1$, find y at x=0.1, 0.2, 0.3 by Taylor's series method and compute $y(0.4)$ by Milne's method.	CO4	K3	M	Numerical Solution of ODE	Taylor's Series/ Milne's Method
36	Using Runge's method, find the value of y at x=0.2 where $\frac{dy}{dx} = x + y \quad , \quad y(0) = 1$	CO4	K4	H	Numerical Solution of ODE	Runge Kutta Method
37	Apply Euler's modified method to solve $\frac{dy}{dx} = x + 3y$ subject to $y(0) = 1$ and, hence find an approximate value of y when x=1. Take h=0.2	CO4	K3	H	Numerical Solution of ODE	Euler's modified method
38	Using Euler's modified method, find the value of y at x=0.2 where $\frac{dy}{dx} = y + e^x \quad , \quad y(0) = 0$	CO4	K4	H	Numerical Solution of ODE	Milne's method
39	Using Euler's modified method, find the value of y at x=1.2 where $\frac{dy}{dx} = \log(x + y) \quad , \quad y(0) = 2 \ , takeh = 0.2$	CO4	K4	L	Numerical Solution of ODE	Euler's modified method
40	Using Taylor's series method, find the value of y at x=0.1, 0.2 and 0.3, where $\frac{dy}{dx} = (x^3 + xy^2) / e^x \quad , \quad y(0) = 1$	CO4	K4	M	Numerical Solution of ODE	Taylor's Series
41		CO4	K3	M	Numerical Solution of ODE	Finite difference Method
42	Using Euler's method, find the value of y at x=1 where	CO4	K4	H	Numerical	Eulers Method

	$\frac{dy}{dx} = x + y \;\; , \;\; y(0) = 1$				Solution of ODE	
43	Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ within the square given below. Perform three iterations. 	CO6	K4	H	Numerical Solution of PDE	Laplace equation
44	Solve $\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$ in the domain of the figure given below by Liebman's method, 	CO6	K4	H	Numerical Solution of PDE	Laplace equation
45	Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x,0) = x^2(25 - x^2)$, $0 < x < 5$, $u(0,\ t) = u(5,\ t) = 0,\ t \geq 0$ taking h=1, k= 1/2.	CO6	K3	M	Numerical Solution of PDE	Bender Schmidt Method
46	Solve the equation $16\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $0 < x < 1$, $t > 0$; u(x,0)=0, $u(0,\ t)$ =0, u(1,t)=100t. Compute u for one step in t direction taking h=1/4.	CO6	K3	M	Numerical Solution of PDE	Crank Nicolson's Method
47	Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ by Liebman's iteration process for the domain of the figure, given below:	CO6	K3	L	Numerical Solution of PDE	Laplace equation

						
48	Evaluate the pivotal values of the equation $\frac{\partial^2 u}{\partial t^2} = 16\frac{\partial^2 u}{\partial x^2}$, taking h=1 up to t=1.25. The boundary conditions are $u(0,t) = u(5,t) = 0,\ u_t(x,\ 0) = 0$ and $u(x,0) = x^2(5-x)$.	CO6	K3	H	Numerical Solution of PDE	Hyperbolic
49	Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x,0) = sin\pi x$, 0< x < 1, ; $u(0,\ t) = u(1,\ t) = 0,\ t \geq 0$. Find u for x=0.6 at t =.04.	CO6	K3	M	Numerical Solution of PDE	Crank Nicolson's Method
50	Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$ = 0 within the square given below. Perform three iterations. 	CO6	K3	M	Numerical Solution of PDE	Laplace equation
51.	Write the standard five point formula to solve the Laplace equation $u_{xx} + u_{yy} = 0$	CO6	K1	L		
	For what value of c the wave equation $u_{tt} = c^2 u_{xx}$ has the accurate and stable solution	CO6	K2	M		