Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER MAKEUP EXAMINATIONS, JANUARY- 2019

SUBJECT: COMPUTATIONAL METHODS [MAT 5103]

REVISED CREDIT SYSTEM

Time: 3 Hours (02 /01/2019) MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A.	Solve by Gauss Seidel method: $10x_1 - 2x_2 - x_3 - x_4 = 3$ $-2x_1 + 10x_2 - x_3 - x_4 = 15$ $-x_1 - x_2 + 10x_3 - 2x_4 = 27$ $-x_1 - x_2 - 2x_3 + 10x_4 = -9$ Carryout 3 irterations.	**3 Marks**
1B.	Solve by Newton-Raphson method: $x^2 - y^2 = 3,\ x^2 + y^2 = 13.$ Start with the initial approximation $x_0 = 2.5,\ y_0 = 2.5.$	**3 Marks**
1C.	Solve the system of equations using Thomas method: $2x_1 - x_2 = 6$ $-x_1 + 3x_2 - 2x_3 = 1$ $-2x_2 + 4x_3 - 3x_4 = -2$ $-3x_3 + 5x_4 = 1$	**4 Marks**
2A.	Given $\frac{dy}{dx} = x + y,\ y(0) = 1;$ find $y(0.3)$ with $h = 0.1$ by Euler's modified method.	**3 Marks**
2B.	Evaluate $y(0.2)$ by Taylor's series method, given	**3 Marks**

	$y' = 2y + 3e^x,\ y(0) = 0.$	
2C.	Using Milne's method find $y(4.4)$ given $5xy' + y^2 - 2 = 0$ given $y(4) = 1, y(4.1) = 1.0049, y(4.2) = 1.0097, y(4.3) = 1.0143$	**4 Marks**
3A.	Solve $xy'' + y = 0,\ y(1) = 1,\ y(2) = 2$ with $h = 0.25$ by finite difference method.	**3 Marks**
3B.	Solve $\frac{\partial u}{\partial t} = \frac{1}{16}\frac{\partial^2 u}{\partial x^2}, 0 < x < 1, t > 0, u(x,0) = 100\sin \pi x,$ $u(0,t) = u(1,t) = 0$. Compute u for two time steps with $h = 1/4$ and $\lambda = 1/2$ by Schmidt method.	**3 Marks**
3C.	Solve $u_{xx} + u_{yy} = 0,\ 0 < x < 1,\ 0 < y < 1,$ given $u(x,1) = u(0,y) = 0$ $u(1,y) = 9(y - y^2),\ u(x,0) = 9(x - x^2)$ with $h = 1/3.$	**4 Marks**
4A.	Use Galerkin's method to solve the boundary value problem $y'' = 3x + 4y,\ 0 < x < 1,\ y(0) = 0, y(1) = 0.$	**3 Marks**
4B.	Solve the boundary value problem $y'' + x = 0,\ 0 < x < 1,\ y(0) = y(1) = 0$ by Rayleigh-Ritz method (Use one parameter approximate solution).	**3 Marks**
4C.	Solve by Crank-Nicholson method: $u_t = u_{xx}.$ Given that $u(x,0) = 20,\ 0 < x < 5; u(0,t) = 0$ and $u(5,t) = 100$ for $t \geq 0.$ Compute u for one-time-step with $h = 1$ *and* $\lambda = 1.$	**4 Marks**
5A.	Explain the mathematical modelling through geometry, trigonometry and calculus.	**3 Marks**
5B.	Illustrate 10 characteristics of mathematical modelling.	**3 Marks**
5C.	Solve $u_{tt} = 16u_{xx},\ 0 < x < 5,\ t \geq 0.$ Given that $u(0,t) = u(5,t) = 0,$ $u(x,0) = x^2(5 - x),\ u_t(x,0) = 0.$ Choosing $h = 1,$ compute u upto time $t = 1.25$	**4 Marks**