Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.TECH. (CHEMICAL & BIOTECHNOLOGY)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: MATHEMATICAL & NUMERICAL TECHNIQUES FOR CHEMICAL AND BIOTECHNOLOGY ENGINEERING [MAT- 5102]

REVISED CREDIT SYSTEM

Time: 3 Hours　　　　MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL FIVE questions**.
- Missing data may be suitable assumed.

1A.	Using Jacobi's method, find all the eigen values and the corresponding eigen vectors of the matrix $A = \begin{bmatrix} 2 & \sqrt{2} & 4 \\ \sqrt{2} & 6 & \sqrt{2} \\ 4 & \sqrt{2} & 2 \end{bmatrix}$	**4**
1B.	Find a real root of the equation $xe^x-1 = 0$ using Newton- Raphson method. Take $x_0 = 1$. Carryout four iterations.	**3**
1C.	Solve by Taylor series method, the equation $\frac{dy}{dx} = \log(xy)$ for y(1.1) and y(1.2), given y(1) = 2.	**3**
2A.	Consider the boundary value problem $y'' + (1+x^2)y = -1,\ \ y(\pm 1) = 0$. Determine the coefficients of the approximate solution $w(x) = a_1(1\text{-}x^2) + a_2x^2(1\text{-}x^2)$ by using Galerkin method.	**4**
2B.	Solve the following system of equations using Gauss-Seidel method. 4x+y-z = 3, 2x+7y+z =19, x – 3y + 12z = 31. Carryout three iterations.	**3**
2C.	Find the seventh term and general term of the series 3, 9, 20, 38, 65,…using interpolation.	**3**
3A.	Using Runge-Kutta method of order four find y(0.3) and z(0.3) from	**4**

Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

: $\frac{dy}{dx}=1+xz,\ \frac{dz}{dx}=-xy$ with y(0) = 0 and z(0) =1..

3B. Find the largest eigen value and the corresponding eigen vector of $A=\begin{bmatrix}1 & 6 & 1\\ 1 & 2 & 0\\ 0 & 0 & 3\end{bmatrix}$ by power method taking $X^{(0)}=\begin{bmatrix}1 & 0 & 0\end{bmatrix}^T$. Carryout four iterations **3**

3C Find the quadratic least square approximation to f(x) = e^x, x $\in$ [-1, 1] with respect to the weight function w(x) = 1. **3**

4A. Solve $y''+(1+x)y'-y=0,\ y(0)=y'(0),\ y(1)+y'(1)=1,\ h=\frac{1}{2}$ **4**

4B. Prove that $\int_0^\infty e^{-x}L_n(x)L_m(x)dx=\begin{cases}0, & m\neq n\\ 1, & m=n\end{cases}$ **3**

4C. Fit the exponential curve y = ae^{bx} to the following data **3**

x	2	4	6	8	10
y	4.077	11.084	30.128	81.897	222.62

5A. Find the Fourier transform of $f(x)=\begin{cases}a^2-x^2, & |x|<a\\ 0, & |x|>a\end{cases}$ and hence deduce that $\int_0^\infty\left(\frac{\sin t-t\cos t}{t^3}\right)dt=\frac{\pi}{4}$. **4**

5B. Solve: 2x+3y+z=9; x+2y+3z=6; 3x+y+2z=8 by LU decomposition method. **3**

5C. Solve: $\frac{\partial^2 u}{\partial t^2}=16\frac{\partial^2 u}{\partial x^2},\ 0<x<5,\ t>0$. u(x,0) = x^2(5-x), $\frac{\partial u(x,0)}{\partial t}=0$, u(0, t) = 0 = u(5, t). h = 1. Compute u(x,t) for 4 time steps. **3**