VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR
DEPARTMENT OF MATHEMATICS
End Semester Re-Examination - December 2014

III Semester.B.Tech. (Civil & Mining) **Subject: Numerical Analysis** (MAL 202)
Max. Marks: 60 **Duration: 3 hours.**
Date: 24-12-2014

Section A: Answer any five questions from Section A. $5 \times 2 = 10.$

1. (a) Use secant method to determine a root of the equation $cosx - xe^x = 0$.
   (b) Find $f(1.22)$from the following data,

x	1	1.1	1.2	1.3	1.4
f(x)	0.84147	0.89121	0.93204	0.96354	0.98343

   (c) Evaluate $\int_{-1}^{1}(1-x^2)^{\frac{3}{2}}\cos x dx$ by using Gauss-Legendre three point formula.
   (d) Show that the LU decomposition method fails to solve the equations
   $$\begin{bmatrix} 1 & 1 & -1 \\ 2 & 2 & 5 \\ 3 & 2 & -3 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ -3 \\ 6 \end{bmatrix}.$$
   (e) Use Euler method to find $y(2.25)$ for the initial value problem $\frac{dy}{dx} = -y + x\sqrt{y}$, $2 \le x \le 3$, $y(2) = 2$.
   (f) Describe Thomas Algorithm to solve tridiagonal system of linear equations.

Section B: Answer any five questions from Section B:

2. (a) Show that Regular falsi method converges linearly. (5)
   (b) Find x for $y = 7$ from the data

x	1	3	4
y	4	12	19

   by Lagranges inverse interpolation formula. (3)
   (c) State and prove the uniqueness of interpolating polynomial. (2)

3. (a) Derive the composite trapezoidal rule and also find the error involved in it. (5)
   (b) Compute $f'(0.2), f''(0)$ from the following data:

x	0	0.2	0.4	0.6	0.8	1
$f(x)$	1	1.16	3.56	13.96	41.96	101

   . (5)

4. (a) How Romberg integration is used to improve the approximate results. (5)
   (b) The velocity v of a particle at a distance s from a point on its path is given by

s(ft)	0	10	20	30	40	50	60
v(ft/sec)	47	58	64	65	61	52	38

   .
   Estimate the time taken to travel 60 feet by using Simpson's $\frac{1}{3}^{rd}$ rule. (5)

5. (a) Find the inverse of the matrix $\begin{bmatrix} 3 & 2 & 1 \\ 2 & 3 & 2 \\ 1 & 2 & 2 \end{bmatrix}$ by Cholesky's method. (5)
   (b) Find the solution of the system of equations
   $x_1 - \frac{1}{4}x_2 - \frac{1}{4}x_3 = \frac{1}{2}$;$-\frac{1}{4}x_1 + x_2 - \frac{1}{4}x_4 = \frac{1}{2}$; $-\frac{1}{4}x_1 + x_3 - \frac{1}{4}x_4 = \frac{1}{4}$; $-\frac{1}{4}x_2 - \frac{1}{4}x_2 - \frac{1}{4}x_3 + x_4 = \frac{1}{4}$

using Gauss-Seidel method and perform first four iterations. (5)

6. (a) Use Jacobi's method to find eigen pairs of the symmetric matrix $A = \begin{bmatrix} 10 & -1 & 0 \\ -1 & 10 & -2 \\ 0 & -2 & 10 \end{bmatrix}$. (5)

   (b) Find $y(0.2)$ correct to the four decimal places from Taylor's series solution for the initial value problem $y" = 2yy' - e^{-x}$, $y(0) = 0$, $y'(0) = 1$. . . . . (5)

7. (a) Find the approximate solution of the boundary value problem $y" + 8(sin^2 \pi x)y = 0$, $y(0) = y(1) = 1$.Take $n = 4$. (5)

   (b) Using Runge Kutta method of fourth order, solve for y at $x = 1.2$ from $\frac{dy}{dx} = \frac{2xy+e^x}{x^2+xe^x}$; $y(1) = 0$. (5)