

Visvesvaraya National Institute of Technology, Nagpur
Department of Mathematics

Numerical Methods and Probability Theory (MAL205)

First Sessional examination, September 2014.

Max. Marks: 15

Time: 1:00 Hour

Answer any five Questions, all numerical calculations has to be up to four decimal accuracy. Use of non-programmable calculator and Statistical table is permitted.

1. Derive the formula of Regula Falsi Method. Find a root of the equation $4e^{-x} \sin x - 1 = 0$ by the same method given that the root lies between 0 and 0.5.
2. Find the rate of convergence of Secant method.
3. The equation $f(x) = 3x^3 + 4x^2 + 4x + 1 = 0$ has a root in the interval $(-1, 0)$. Determine an iteration function $\varphi(x)$, such that the sequence of iterations obtained from $x_{k+1} = \varphi(x_k)$, $x_0 = -0.5$, $k = 0, 1, \dots$, converges to the root. Perform four iteration to approximate the root.

4. Solve the system of equations
$$\begin{bmatrix} 2 & 1 & 1 & -2 \\ 4 & 0 & 2 & 1 \\ 3 & 2 & 2 & 0 \\ 1 & 3 & 2 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} -10 \\ 8 \\ 7 \\ -5 \end{bmatrix}$$
 using Gauss elimination method with partial pivoting.

5. Solve the following system of non linear equations by Newton Raphson method using $x_0 = 0.5$, $y_0 = 0.5$

$$3yx^2 - 10x + 7 = 0$$

$$y^2 - 5y + 4 = 0.$$

6. Find the necessary and sufficient condition on k so that the Gauss Seidel iteration method converges for solving the system of equations $AX = b$ where $A = \begin{bmatrix} 1 & 0 & k \\ 2 & 1 & 3 \\ k & 0 & 1 \end{bmatrix}$ and b is arbitrary.