CE 601 NUMERICAL METHODS

TUTORIAL – 5

Marks – 80 **Date: 06-September-2012**

The responses to the tutorial questions are to be submitted strictly by 11-September-2012 (Tuesday). You can use computational programs like Matlab, Mathematica, Fortran, C, C++, etc. or any other convenient programming language (maybe even MS-Excel) to evaluate matrix multiplications, inverses, function multiplications (or substitutions), or complex number multiplications, etc.

1. There is vertical wall of area $A = 5\times h$ m^2 submerged in water of density ρ_l = 1000 kg.m^{-3}. The hydrostatic pressure acts on the wall and the force due to it is given by the relation $F_p = 0.5\times\rho_l\times g\times h^2\times A/h$, where F_p is the hydrostatic pressure force acting horizontally on the wall, and h is depth of submergence of the wall bottom from water surface. It is assumed that the topmost portion of the wall tip at the water surface. The wall can resist or oppose a maximum of $F_d = 600$ N. At what depth of h do you think the vertical wall will start collapsing (i.e. not able to resist hydrostatic force). Use bisection method to obtain the solution with error tolerance of 1×10^{-4}. **[12 marks]**

2. The function $f(x) = 1.05 - 1.04x + \ln x$ has zero in some interval. Find this closed domain and use regula-falsi method to find a root of the above function. You can take error tolerance of 1×10^{-4}. **[12 marks]**

3. Use Newton's method to find all three roots of the function $f(x) = x^3 + 2x^2 - 3x - 1$. You may take an error tolerance of 1×10^{-4}. **[12 marks]**

4. Use Secant's method to find a root of the function $f(x) = x(1-\cos x)$. You may take an error tolerance of 1×10^{-4}. **[12 marks]**

5. Find all the roots of the polynomial $f(x) = P_4(x) = x^4 + 5x^3 + 7x^2 + 1$. **[12 marks]**

6. Solve the system of non-linear algebraic equations $\begin{matrix} x_2 - e^{-x_1} + 1 = 0 \\ x_1^3 - x_2 = 0 \end{matrix}$ using modified Newton's method. (You may go through the example uploaded) **[20 marks]**