Dept. Mathematics, IIT Kharagpur
Mid-Semester Examination: Spring 2012
Subject: MA 30110 Advanced Numerical Techniques
3rd/ 4th Yr. B.Tech/ M.Sc. No. of Students: 70
Maximum Marks: 30 Time: 2hrs
Answer ALL the Questions

1. Obtain the block tri-diagonal system of algebraic equations to solve the BVP by finite difference method when h=1/4

$$\frac{d^3y}{dx^3} + 4\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 1$$

with boundary conditions y(0)=y`(0)=0 and y`(1)=1.
Describe an algorithm to solve the resulting block tri-diagonal system. [10]

2. Derive the block tri-diagonal system of linear algebraic equations to solve the non-linear BVP iteratively by Newton's linearization technique for 0<x<4

$$f''' + f\,f'' + 1 - (f')^2 = 0$$
$$f(0) = 0,\ f'(0) = 0,\ f'(4) = 1.$$

Find an expression for truncation error and show that the finite difference scheme is consistent. [10]

3. Describe the Thomas algorithm to solve a tri-diagonal system of linear algebraic equations.

Solve the following BVP using Thomas algorithm

$$\frac{d^2y}{dx^2} - 2y = 0$$

y(0)=0, y`(1)=-0. Choose step size h=0.2. [3+7]

Note: Here prime (`) denotes derivative

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