

### **ASSIGNMENT-3**

1. **Manually** Solve  $-\frac{d^2u}{dx^2} - u + x^2 = 0$   $0 < x < 1$   $u(0) = u(1)$ 
  - a. with 3 linear elements.
  - b. Quadratic elements.
2. Write a general purpose PROGRAM (you can use any language) for solving the 1 D linear BVP

$$-\frac{d}{dx}\left(a(x)\frac{du}{dx}\right) + c(x)u(x) - f(x) = 0; \quad 0 < x < L$$

- a. Validate the code by solving question 1 again using your code and comparing the results with those obtained in question 1.
- b. Solve any FIVE 1-D BVP using your code and plot your results (If using JN Reddy, choose from chapter 3 exercise problems, but you can choose any other problem that interests you from anywhere else). In case the analytical solution is available, compare your finite element results with the analytical solution.  
*The problems have to be entirely solved using your code. Should not be partly solved manually and partly using the CODE.*

#### **Notes**

- Assume Dirichlet boundary conditions at both ends.
- The code should have two options, either to use the 1D linear element or 1D quadratic element.
- Assume equally space nodes.
- The program should be able to compute the value the solution  $u(x)$  at any point in the domain not just the nodes.
- The code should have sufficient comments so that user understands what the code is doing.
- If possible the code should read all the inputs from a file. The user should not modify the code.
- To the extent possible make the code modular. We will use the same code to build more and more features to it. So spend some time in writing the code.