the thermal conductivity of the plate and *n* represents the outward unit normal to the boundaries.

Use Rayleigh-Ritz method to find a one-parameter approximate analytical solution. 8

4. Assemble the overall stiffness matrix $KU = F$ and and solve the following two-point boundary value problem

$$u'' + 2 = 0, \quad 0 < x < 1$$

with the boundary conditions $u(0) = 1,\ u'(1) = 1$ by considering a mesh of two linear elements. 8

M. Sc. Mathematics Examination, 2022

(2nd Year, 2nd Semester)

Computational Fluid Dynamics - II (Theory)

Paper – DSE - 07 (B18)

Time : 1 hour 15 minutes Full Marks : 24

Symbols / Notations have their usual meaning.

Answer ***any three*** questions.

1. Explain Galerkin method of solution of mixed boundary value problems and hence find an approximate analytical solution of $\frac{d^2u}{dx^2} + x = 0,\ 0 < x < 1$, subject to the boundary conditions $u(0) = 2,\ u'(1) = 3$ by taking two parameters to construct the linear system. 3+5

2. Using linear interpolation in two-dimension, show that the area coordinates are same as the shape functions for a 3-node triangular element. 8

3. Consider the following Poisson's equation governing the two-dimensional heat transfer in a square thin plate

$$-k\nabla^2 T = f \text{ in } \Omega = \{(x, y) : 0 < (x, y) < 1\}$$

with the boundary conditions $T = 0$ on the sides $x = 1$ and $y = 1$, $\frac{\partial T}{\partial n} = 0$ on the sides $x = 0$ and $y = 0$,

where *f* is the rate of uniform heat generation, *k* denotes