problem by taking fundamental solution $w(x,\bar{x}) = -\frac{1}{2}|x-\bar{x}|$ with a parameter $\bar{x}$. [Hints. Convert the domain integrals into boundary integrals and obtain the boundary integral equation for a domain point, then assemble the matrix equation]. 10

3. Solve the integral equation

$$f(x) - \frac{1}{2}\int_0^1 (x+u) f(u)\, du = x$$

numerically by approximating the integral using Trapezoidal rule after dividing the interval [0, 1] into two equal parts. 10



# M. Sc. Mathematics Examination, 2022

( 2nd Year, 2nd Semester )

## Advanced Numerical Analysis

## Paper – Unit-4.1 (Theory)

Time : One hour Full Marks : 20

*All questions carry equal marks.*

Symbols and notations have their usual meanings.

Answer ***any two*** questions.

1. Consider a boundary value problem

$$\frac{d^2u}{dx^2} + u = x^2;\ 0 < x < 1$$

subject to the boundary conditions $u(0) = 0,\ u(1) = 0$.

Using piecewise linear elements with local shape functions $N_i^{[e]}(x) = \frac{x_{i+1} - x}{h_i}$ , $N_{i+1}^{[e]}(x) = \frac{x - x_i}{h_i}$

for $x \in [x_i,\ x_{i+1}]$, taking two equal subintervals find the local stiffness matrix $K^{[e]}$ and the local load vector $F^{[e]}$ to construct a linear system $KU = F$, where $h_i = x_{i+1} - x_i$. 10

2. Consider a one-dimensional problem of Laplace's equation $u^n = 0,\ \forall x \in (0,1)$

with the boundary conditions $u(0) = 100,\ u(1) = 0$.

Use boundary element method to solve the above