QP Code: 22/PT/13/IVA

POST-GRADUATE COURSE

Term End Examination — June, 2022/December, 2022

MATHEMATICS

Paper-4A : NUMERICAL ANALYSIS

Time : 2 hours] [Full Marks : 50

Weightage of Marks : 80%

Special credit will be given for accuracy and relevance in the answer. Marks will be deducted for incorrect spelling, untidy work and illegible handwriting. The marks for each question has been indicated in the margin.

Use of scientific calculator is permitted.

Answer Question No. **1** and any *four* from the rest :

1. Answer any *five* questions : $2 \times 5 = 10$

   a) If a number is rounded off to 4 decimal point what will be the maximum round off error ? Give an example when this maximum error is attained.

   b) What do you mean by condition number of a function ?

   c) If a $n \times n$ matrix A is factorised by $A = LU$ then how $AX = b$ can be solved ?

   d) For a second order linear partial differential equation, specify types of equation depending on boundary condition.

   e) Write a scheme to generate a sequence $\{x_n\}$ where $\lim x_n = \alpha$ and α is a multiple root of order k of the equation $f(x) = 0$.

   f) What is inverse interpolation ? Is it possible to find root of an equation using inverse interpolation ?

   g) What is the difference between open type and closed type numerical quadrature formula ?

2. What is the difference between single step and multistep method for solving ordinary first order differential equation ? Derive Adams-Bashforth method. Outline this method to solve $\frac{dy}{dx} = f(x, y)$ $y(a) = y_0$ in the interval [a, b]. Is it possible to use this method for solving second order equations ? 10

3. Deduce and describe Baristow method to solve an Algebraic equation. Can it be used for a transcendental equation ? 10

4. Write down the wave equation in a 2-dimensional region with mixed boundary conditions and deduce the scheme for solving it by finite difference method. 10

5. Deduce and describe power method to find dominant eigenpair of a square matrix. How to find numerically minimum eigenpair using this method ? What do you mean by shifted power method ? 5 + 3 + 2

6. If we have a polynomial approximation of $f(x)$ then describe how to find more efficient approximation using Chebyshev polynomial. Write down the result clearly which you used. 10

7. a) Outline the method to find $\int_a^b f(x)\,dx$ using Gaussian quadrature formula and write its error term.

   b) If we try to find $\int_0^2 (x^3 + 3 \cdot 1x^2 - 2 \cdot 6x + 4 \cdot 9)\,dx$ by using Simpson's $\frac{1}{3}$rd rule then what is the expected error ? 7 + 3