U.G. 3rd Semester Examination - 2022

MATHEMATICS

[HONOURS]

Course Code : MATH-H-CC-T-07

Numerical Methods (Theory)

Full Marks : 40 Time : $2\frac{1}{2}$ Hours

The figures in the right-hand margin indicate marks.

Symbols and notations have their usual meanings.

1. Answer any **five** questions: $2\times5=10$

a) Find the absolute error and relative error in taking $\pi = 3.141593$ as $\frac{22}{7}$.

b) Show that $\Delta \log f(x) = \log\left\{1+\frac{\Delta f(x)}{f(x)}\right\}$.

c) State fundamental theorem of finite difference calculus.

d) What do you mean by the degree of precision of a quadrature formula?

e) Is it possible to find numerically least eigen value for a matrix A by power method? Discuss.

f) State the advantage of Lagrange's interpolation.

[Turn over]

g) What do you mean by the diagonally dominant for system of linear equations?

h) State the basic principle of Newton-Raphson method.

2. Answer any **two** questions: 5×2=10

a) Establish Newton's forward interpolation formula when is this formula used?

b) By integrating Newton's forward interpolation formula, obtain the basic form of Simpson's one-third rule for numerical integration, taking the error term.

c) Discuss the method of iteration for numerical solution of an algebraic and transcendental equation.

d) Describe the Gauss-elimination method for numerical solution of a system of linear algebraic equations.

3. Answer any **two** questions: 10×2=20

a) Establish Gauss-Seidel iteration method for numerical solution of a system of n linear equations with n unknowns. Deduced the condition of convergence for this method.

6+4=10

b) Describe Newton's divided difference formula for interpolation formula with remainder. Hence deduce Newton's forward difference interpolation formula from this method.

7+3=10

c) i) Describe power method for finding numerically largest eigen value of a square matrix. State the condition of convergence. 6

ii) Deduce the iterative formula for Picard's method for solving initial value problem.

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d) Established Lagrange's polynomial interpolation formula. If $x_1, x_2, \ldots, x_n$ be the interpolating points and $l_i(x)$ $(i = 0,1,2,\ldots, n)$ be the Lagrangian functions then show that $\sum_{i=0}^{n} l_i(x) = 1$. 10
