B.SC. THIRD SEMESTER (HONOURS) EXAMINATIONS, 2021

Subject: Mathematics **Course ID: 32113**

Course Code: SH/MTH/303/C-7 **Course Title: Numerical Methods**

Full Marks: 25 **Time: 1 Hour 15 Minutes**

The figures in the margin indicate full marks

Notations and symbols have their usual meaning

1. Answer any five questions. $\mathbf{1 \times 5 = 5}$

a) What do you mean by 'significant digits'? Round off the number 0.00237852 correct up to 3 significant digits.

b) Find $\Delta^2 f(x)$ where $f(x) = 2x^2$, taking $h = 1$.

c) What is the number of arithmetic operations required to solve a system of n linear algebraic equations in n unknowns using *Gauss Elimination* method, for large values of n .

d) Estimate the missing term:

x:	0	1	2	3	4
y:	1	3	9	--	81

e) Write the iterative formula of Regula-Falsi method to find a real root of an equation $f(x) = 0$.

f) State geometrical interpretation of Trapezoidal rule.

g) Prove that $\Delta \log f(x) = \log [1 + \frac{\Delta f(x)}{f(x)}]$.

h) State the condition of convergence of Gauss-Seidel iteration method for solving numerically a system of linear algebraic equations.

2. Answer any two questions $\mathbf{5 \times 2 = 10}$

a) Using a suitable interpolation formula, find the polynomial of least degree which attains the same values as the function y at the points as given in the following table:

x	0	1	2	3	4
y	2	3	12	35	78

Hence obtain the value of $y(0.2)$. 4+1

b) Find the approximate value of

$$\int_0^1 \frac{dx}{1+x^2}\, dx$$

correct up to 3 places of decimals by using *Simpson's* $\frac{1}{3}$ rd quadrature formula. Hence obtain the value of π correct up to 3 places of decimals. 4+1

c) Apply *Euler's modified method* to obtain the value of $y(0.02)$ from the following *initial value problem* (IVP):

$\frac{dy}{dx} = y + x^2, \ y(0) = 1,$ taking $h = 0.01$.

d) If $f(x) = x^3$, then show that $\Delta^3 f(x) = 3!\, h^3$, where $h$be the length of the interval of differencing.

3. Answer any one question. $\mathbf{10 \times 1 = 10}$

a) i) Describe briefly *Gauss-Seidel* iterative method for solving a system of n linear algebraic equations in n unknowns. Also state the condition of convergence of this method.

ii) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.1$ from the following table:

x	1.1	1.2	1,3	1.4	1.5
y	2.0091	2.0333	2.0692	2.1143	2.166

(4+1)+(3+2)

b) (i) Describe the Newton-Raphson method for computing a simple root of the equation $f(x) = 0$.
(ii) Compute y(0.2) by fourth order R-K method correct up to three decimal places from the equation $\frac{dy}{dx} = xy, \ y(0) = 2$, taking $h = 0.2$. 5+5

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