6. (a) Obtain the approximate value of $y(0.1)$ by Euler's method for the equation $y' = \frac{y-x}{y+x}, y(0) = 1$.

(b) Determine approximate value of $y(0.2)$ and $y(0.4)$ from $y' = -xy^2, y(0) = 1$ by Runge-Kutta method of 4th order by taking $h = 0.2$.

7. (a) Solve $y' = 1 + y^2$, $y(0) = 0$ by a predictor corrector formula from $x = 0.2$ to $x = 0.8$ by taking $h = 0.3$.

(b) Using finite difference method, solve the boundary value problem :

$y'' = xy' - y - x^2$ subject to $y(0) = -2$ and $y(1) = 1$ by taking $h = 0.25$.

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Ph.D. (Course Work)

EXAMINATION, May 2019

MAT902

MATHEMATICS

NUmerical Analysis

Time : 3 *Hours*] [*Maximum Marks :* 100

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt any *Five* questions. All questions carry equal marks.

1. (a) Discuss in brief the main sources of errors.

(b) Add $x = 9.12345$ and $y = 7.654321$ in a five-digit decimal computer. Also compute absolute total error, absolute propagated error and relative total error.

2. (a) Compute a real root of $2^x - 3x = 0$ in the interval $0 \leq x \leq 2$ by the bisection method taking at least 5 iterations.

(b) Find the rate of convergence of Newton's method for obtaining the solution of the equation $f(x) = 0$.

3. (a) Using Newton's method solve the following system of non-linear equations with three unknown upto 3 iterations :

$$x - 0.1y^2 + 0.05z^2 - 0.7 = 0$$

$$y + 0.3x^2 - 0.1xz - 0.5 = 0$$

and $$z + 0.4y^2 + 0.1xy - 1.2 = 0$$

(b) What do you mean by polynomial interpolation and Hermit interpolation and also construct the Lagrange's polynomial with the following data :

x_i	:	-1	0	2	5
y_i	:	10	7	7	22

4. (a) Under what conditions Gaussian quadrature formula is used for numerical integration ? Compute $\int_0^1 \cos x \log_e^x dx$ using Gaussian quadrature formula.

(b) Using Simpson's $\frac{1}{3}$rd rule show that approximate value of $\log_e 2$ is 0.69315.

5. (a) Describe Richardson extrapolation in derivative computation.

(b) Solve the initial value problem $y' = x^2 + y^2$, $y(0) = 0$ using Taylor's series method for $0 \leq x \leq 0.4$ and $h = 0.2$ by taking first four terms in Taylor's expansion.