B.Sc. Semester III (Honours) Examination, 2018-19

MATHEMATICS

Course ID : 32113 **Course Code : SHMTH-303C-7(T)**

Course Title : Numerical Models

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

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer *any five* questions: 1×5=5

(a) Find the percentage error in approximate representation of $7/6$ by $1{\cdot}16$.

(b) Round off the numbers 40·3586 and 0·0056812 to four significant digits.

(c) With usual notations, prove that $\Delta - \nabla \equiv \Delta\nabla$.

(d) Find the function $f(x)$ whose first difference is e^x.

(e) State the condition of convergence of the fixed point iteration method for finding a real root of the equation $f(x) = 0$.

(f) Using Euler's method, find $y(0{\cdot}05)$ given that $\frac{dy}{dx} = 1 + y^2, y(0) = 0$ and $h = 0{\cdot}05$.

(g) What is the geometrical significance of Trapezoidal rule for numerical integration?

(h) State Newton Gregory formula for forward interpolation.

2. Answer *any two* questions: 5×2=10

(a) What is interpolation? Using suitable interpolation formula, compute $f(1{\cdot}4)$ and $f(3{\cdot}8)$. from the following data:

x	0	1	2	3	4
$f(x)$	1·0	1·5	2·2	3·1	4·2

5

(b) Explain the method of iteration for numerical solution of an equation of the form $x = \phi(x)$ and obtain the condition of convergence of the process. 5

(c) Establish the Newton-Cotes formula (closed type) in the form $I = (b-a)\sum_{i=0}^{n} H_i y_i$ for the integral $I = \int_a^b f(x)dx$, where H_i's are the Cote's coefficients and $y_i = f(x_i)$. Hence obtain the Trapezoidal formula for the given integral I. 4+1=5

(d) Given $\frac{dy}{dx} = x^3 + y, y(0) = 1$, compute $y(0{\cdot}02)$, by Euler's method correct upto four decimal places taking step length $h = 0{\cdot}01$. 5

3. Answer *any one* question: 10×1=10

(a) (i) The 'rate of convergence of an iterative formula is p'—What do you mean by this statement?

(ii) Show that the Newton-Raphson method has quadratic rate of convergence.

(iii) Determine $u(t)$ at $t = 0{\cdot}2$, $0{\cdot}4$ using the classical fourth order Runge–Kutta method, given that $u' = t/u$, $u(0) = 1$. 2+4+4=10

(b) (i) Describe Gauss-Seidal iterative method for the solution of a system of n linear equations in n unknowns. State the condition of convergence of this method. 4+1=5

(ii) Describe the power method for determining the largest eigen value in magnitude of a matrix A. (4+1)+5=10

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