Five Year Integrated M.Sc. Examination, 2017

Semester-II

Course: MT-1-2-2

(Scientific Computing)

Time: Three Hours **Full Marks: 40**

Questions are of value as indicated in the margin.

[All the notations and symbols are used in their usual forms]

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

1. Answer ***any two*** questions: 2x2
   a) Establish the relation between difference operator and differential operator.
   b) What is the convergence criterion for fixed point iteration method?
   c) What is error?

2. Describe Gauss-Seidel method to solve a system of linear equations. What is the condition for convergence of this method? Is this condition necessary or sufficient or both? Use this method to solve the following system of equations:

$$3x_1 + x_2 + x_3 = 7$$
$$x_1 - 3x_2 + x_2 = -3$$
$$x_1 - x_2 + 7x_3 = 13$$

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3. Write down Newton Forward Interpolation formula with error term. Use it to find $f(2.5)$ from the following data: 5+4

x	2	3	4	5	6	7	8
$f(x)$	4	9	16	25	36	49	64

4. Derive Newton-Raphson method to solve a transcendental equation. Use this method to solve $3x - \cos x - 1 = 0$. What is the convergence criteria of this method? Can you state any other method(s) to solve above equation? 9

5. Derive composite trapezoidal rule to evaluate $\int_a^b f(x)dx$. Use this method to evaluate $\int_1^{\pi} \left(\sin\left(x^2 - 1\right)\right)dx$. 9

6. Derive Euler's method and modified Euler's method to solve a first order differential equation. Use Euler's method to solve

$\frac{dy}{dx} = x + y$ for $x(0.2)$, $x(0.4)$ and $x(0.6)$; given that $x(0) = 1$ [Take $h = 0.2$]. 9

7. a) Write a short note on difference operator. 4
   b) Write a short note on 'Necessity of Numerical Techniques'. 3
   c) What is the difference between direct method and iterative method? Illustrate. 2

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