

Roll No.....

Total No. of Printed Pages: [02]

Total No. of Questions: [09]

**B.Sc. (Hons.) Math (Semester – 4<sup>th</sup>)**

**NUMERICAL METHODS**

**Subject Code: BMATS1404**

**Paper ID: [19131219]**

**Time: 03 Hours**

**Maximum Marks: 60**

**Instruction for candidates:**

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

**Section – A**

**(2 marks each)**

Q1. Attempt the following:

- a. Prove that  $(1 + \Delta)(1 - \nabla) = 1$ .
- b. Define algebraic & transcendental equations.
- c. What is the condition for number of sub-intervals for application of Simpson's 3/8 rule?
- d. Define forward operator and Average operator.
- e. Prove that  $E = (1 - \nabla)^{-1}$ .
- f. Write formula for the Euler's modified method.
- g. Define Interpolation and Extrapolation.
- h. What is the rate of convergence of secant method?
- i. For the given data find the value of  $\Delta^3 y_0$  :

X:	3.60	3.65	3.70	3.75
Y:	36.598	38.475	40.447	42.521

j. Find the missing term in the following table

x	1	2	3	4	5
f(x)	2	5	7	f	32

**Section – B**

**(5 marks each)**

Q2. Estimate the value of f(0.6) using following table by Lagrange Interpolation.

X:	0.4	0.5	0.7	0.8
Y:	0.916	0.693	0.307	0.223

Q3. By using Simpson's 1/3 rule, find the value of integral  $\int_{0.2}^{2.2} e^x dx$ .

Q4. Apply Picard's method to solve  $\frac{dy}{dx} = y - x$  with  $x=0, y=2$  up to the third order approximation.

Q5. Solve the following system of equations by Gauss-elimination Method:

$$\begin{bmatrix} 2 & 8 & 5 & 1 & 6 & - & 1 & 2 & - & 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix} = \begin{bmatrix} 14 & 13 & 5 \end{bmatrix}.$$

Q6. Find the root of  $x^3 - 2x - 5 = 0$  by Regula-Falsi Method, correct up to 3 decimal places.

### Section – C

(10 marks each)

Q7. Use Runge-Kutta method of 4<sup>th</sup> order to find  $y(0.4)$  given  $\frac{dy}{dx} = \frac{1}{x+y}$ ,  $y(0) = 1$

$$\frac{dy}{dx} = \frac{1}{x+y}, \quad y(0) = 1, \quad h = 0.2.$$

Q8. From the following table of values of  $x$  and  $y$ , find  $\frac{dy}{dx}$  when (i)  $x=1$ ; (ii)  $x=3$ .

$x$	0	1	2	3	4	5	6
$y$	6.9897	7.4036	7.7815	8.1291	8.4510	8.7506	9.0309

Q9. Solve the following system of equations by LU decomposition method:

$$2x - 3y + 10z = 3$$

$$-x + 4y + 2z = 20$$

$$5x + 2y + z = -12$$