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B.Sc. (Hons.) Math (Semester – 4th)

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:

$$[2\ 8\ 5\ 1\ 6\ -\ 1\ 2\ -\ 1\ 2\ ]\left[x_1\ x_2\ x_3\right] = [14\ 13\ 5\ ].$$

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 4th 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:

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

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

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