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**M.Sc. Mathematics (Semester – 2<sup>nd</sup>)**

**NUMERICAL ANALYSIS**

**Subject Code: MMAT1-209**

**Paper ID: [19220510]**

**Time: 03 Hours**

**Maximum Marks: 60**

**Instruction for candidates:**

1. Section A is compulsory. It carries 16 marks. It consists of 4 questions of 4 marks each.
2. Section B consist of 4 questions of 8 marks each. The student has to attempt any 3 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**

**(4 marks each)**

Q1. Find order of convergence of Newton Raphson method.

Q2. Use the partition method, to find the inverse of

$$A = \begin{bmatrix} 13 & 14 & 6 & 8 & -1 & 13 & 6 & 7 & 3 & 4 & 9 & 2 & 9 & 5 & 16 & 11 & \end{bmatrix}$$

Q3. Use Romberg's method to compute  $\int_0^1 \frac{dx}{1+x^2}$  correct to four decimal places.

Q4. Given  $y' = x^2(1 + y)$  and  $y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979$ , evaluate  $y(1.4)$  by Adams-Bashforth method.

**Section – B**

**(8 marks each)**

Q5. i) Use iteration method, to find a root of the equation  $x^3 + x^2 - 1 = 0$  correct to four decimal places.

ii) Evaluate the value of  $(30)^{-1/5}$  using Newton iteration method.

Q6. i) Obtain by power method, the numerically dominant eigen value and eigen vector of the matrix

$$A = \begin{bmatrix} 15 & -4 & -3 & -10 & 12 & -6 & -20 & 4 & -2 \end{bmatrix}.$$

ii) What do you mean by the order of convergence?

Q7. i) Derive Newton-Cotes formula.

ii) Compute the value of  $\int_{0.2}^{1.4} (\sin x - \log x + e^x) dx$  using Simpson's 3/8 rule.

Q8. i) Find the value of  $y$  for  $x = 0.1$  by Picard's method given that  $y' = \frac{y-x}{y+x}, y(0) = 1$ .

ii) Using Runge-Kutta method of fourth order, solve  $y' = \frac{y^2 - x^2}{y^2 + x^2}$  with  $y(0) = 1$  at  $x = 0.2, 0.4$ .

**Section – C**

**(10 marks each)**

Q9. Solve the equations  $27x + 6y - z = 85$ ,  $x + y + 54z = 110$ ,  $6x + 15y + 2z = 72$  by Gauss-Jacobi and Gauss Siedal method. Which method converges fast?

Q10. i) Apply Bessel's formula to obtain  $y_{25}$ , given  $y_{20} = 2854$ ,  $y_{24} = 3162$ ,  $y_{28} = 3544$ ,  $y_{32} = 3992$ .

ii) The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds. Find the acceleration using the entire data:

Time t(sec)	0	5	10	15	20
Velocity (m/sec)	0	3	14	69	228

Q11. i) Find the maximum and minimum value of  $y$  from the following data:

$x$	-2	-1	0	1	2	3	4
$y$	2	-0.25	0	-0.25	2	15.75	56

ii) Find order of error in Simpson's 1/3 rule.