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M.Sc. Mathematics (Semester – 2nd)

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

$$A = [\ 13\ 14\ 6\ 8\ -1\ 13\ 6\ 7\ 3\quad 4\ 9\ 2\ \ 9\quad 5\ 16\ \ 11\quad]$$

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

$$A = [15\ -4\ -3\ -10\ 12\ -6\ -20\ 4\ -2\ ].$$

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

Q7. i) Derive Newton-Cotes formula.

ii) Compute the value of $\int_{0.2}^{1.4} (\sin sin\, x - logx + e^x)dx$ 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.