Numerical Analysis Set of topics for exam

1. **Nonlinear and transcendental algebraic equations**
   Bysection method
   Method of chords
   Method of tangent lines
   Iteration method
2. **Systems of nonlinear equations**
   Method of tangents (Newton's method)
3. **Systems of linear algebraic equations**
   Method of the inverse of matrix A
   Gaussian elimination
   LU factorization method
   Iteration method
4. **Integrals calculation**
   Trapezoids method for calculation of definite integrals
   Simpson's method for calculation of definite integrals
5. **Interpolation by polynomials**
   Lagrange's polynomial
   Interpolation by splines
   Least-Squares approximation
   Chebyshev polynomials
6. **Finding a minimum of a multivariable function**
   Method of coordinate descent
   Method of gradient descent
   Method of most rapid gradient descent
7. **EigenValue problem**
   Power Method
   QR Method
   Tridiagonal matrixes
8. **The initial value problem**
   Taylor's series
   Picard's method
   Euler's method

Modified Euler's Method

Runge-Kutta Methods

Cubic spline method

9. **Boundary-value problems**

   Finite-difference Method

   Galerkin's Method

10. **Numerical solution of Partial Differential Equations**

    Finite-Difference approximations to derivatives

    Heat Equation in One Dimension (Finite-difference approximation, Bender-Schmidt formula, Crank-Nicolson formula)

    Wave equation

11. **Partial differential equations of elliptic type.**

    Standard five-point formula

    Jacobi's Method

    Gauss-Seidel Method

    Successive Over Relaxation (SOR) Method

    ADI Method

12. **The Finite Element Method**

    General ideas

    The basic steps of finite element method

    Finite Element Method for One-dimensional Problems

13. **Error analysis**

    Types of errors

    Absolute, relative and percentage errors

    A general error formula

    Error in a series approximation

14. **Monte Carlo Method**

    General idea of the method

    Random variables and their types

    Random variables for computer calculation

    Calculation of the queuing system

    Calculation of product quality and reliability

    Calculation of the passage of neutrons through the plate

The questions in the section 14 (The Monte Carlo method) involve presenting ideas in text form without mandatory formulas and algorithms. However, they are not prohibited