SUBJECT NAME : **Numerical Methods**

SUBJECT CODE : **MA6459**

MATERIAL NAME : **Part – A questions**

REGULATION : **R2013**

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Name of the Student: **Branch:**

Unit – I (Solution of Equations and Eigenvalue Problems)

1. Solve $e^x - 3x = 0$ by the method of iteration.
2. Write sufficient condition for convergence of an iterative method for $f(x) = 0$; written as $x = g(x)$.
3. Write down the order of convergence and the condition for convergence of fixed point iteration method.
4. State the order of convergence and the condition for the convergence in Newton's method.
5. Using Newton's method, find the root between 0 and 1 of $x^3 = 6x - 4$.
6. Solve $3x - \cos x - 1 = 0$ by Newton's method, correct to 6 decimal places.
7. Find an iterative formula to find the reciprocal of a given number N $(N \neq 0)$.
8. Evaluate $\sqrt{15}$ using Newton-Raphon's formula.
9. Arrive a formula, to find the value of $\sqrt[4]{N}$, where $N \neq 0$, using Newton's method.
10. Give two direct methods to solve a system of linear equations.
11. What are the advantages of iterative methods over direct methods for solving a system of linear equations?
12. State the rate convergence of Gauss Jacobi method and Gauss Seidel method.
13. Using Gauss elimination method, solve $5x + 4y = 15$, $3x + 7y = 12$.

14. Use Gauss Jordan method find the inverse of the matrix $\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$.

15. Find the inverse of $A = \begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$ by Gauss-Jordan method.

16. What is the Use of Power method?

17. Write down the procedure to find the numerically smallest eigenvalue of a matrix by power method.

Unit – II (Interpolation and Approximation)

1. State Lagrange's interpolation formula for unequal intervals.

2. Using Lagrange's formula, find the polynomial to the given data.

X:	0	1	3
Y:	5	6	50

3. Find the second degree polynomial through the points $(0,2)$, $(2,1)$, $(1,0)$ using Lagrange's formula.

4. State Newton's divided difference interpolation formula for unequal intervals.

5. State any two properties of divided difference.

6. What is the nature of n^{th} divided differences of a polynomial of n^{th} degree?

7. Form the divided difference table for the data $(0,1),(1,4),(3,40)$ and $(4,85)$.

8. Construct the divided difference table for the following data:

x:	0	1	2	5
$f(x)$:	2	3	12	147

9. Find the divided difference of $f(x) = x^3 + x + 2$ for the arguments 1, 3.

10. Find the second divided difference with arguments a,b,c if $f(x) = \frac{1}{x}$.

11. Distinguish between interpolation and extrapolation.

12. Derive Newton's backward interpolation formula by using operator method.

13. State Newton's forward interpolation formula.

14. State Newton's backward interpolation formula.
15. Define cubic spline function.
16. Define a cubic spline $S(x)$ which is commonly used for interpolation.
17. For cubic splines, what are the 4n conditions required to evaluate the unknowns.

Unit – III (Numerical Differentiation and Integration)

1. Write the formula for the derivative to compute at $\frac{dy}{dx}$ at the point $x = x_0$ by using Newton's forward difference formula.
2. Write down the expression for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_n$ by Newton's backward difference formula.
3. State Trapezoidal rule.
4. Evaluate $\int_{1/2}^{1} \frac{1}{x} dx$ by Trapezoidal rule, dividing the range into 4 equal parts.
5. Evaluate $\int_{0}^{\pi} \sin x \, dx$ by Trapezoidal rule by dividing ten equal parts.
6. Evaluate $\int_{0}^{1} \frac{dx}{1+x^2}$ using Trapezoidal rule.
7. Taking $h = 0.5$, evaluate $\int_{1}^{2} \frac{dx}{1+x^2}$ using Trapezoidal rule.
8. State Simpson's one-third rule.
9. State the local error term in Simpson's 1/3rd rule.
10. Under what condition, Simpson's 3/8 rule can be applied and state the formula.
11. State the Romberg's integration formula with h_1 and h_2. Further, obtain the formula when $h_1 = h$ and $h_2 = h/2$.

12. State Romberg's integration formula to find the value of $I=\int_a^b f(x,y)dx$ for first two intervals.
13. Write down two point Gaussian quadrature formula.
14. State three point Gaussian quadrature formula.
15. Use two – point Gaussian quadrature formula to solve $\int_{-1}^{1}\frac{dx}{1+x^2}$.

Unit – IV (Initial Value Problems for Ordinary Differential Equations)

1. What is the major drawback of Taylor series method?
2. State the advantages and disadvantages of the Taylor's series method.
3. Find $y(0.1)$ if $\frac{dy}{dx}=1+y,\ y(0)=1$ using Taylor series method.
4. Find $y(1.1)$ if $y'=x+y,\ y(1)=0$ by Taylor series method.
5. State Euler's formula.
6. State Euler's method to solve $\frac{dy}{dx}=f(x,y)$ with $y(x_0)=y_0$.
7. Given $y'=x+y,\ y(0)=1$ find $y(0.1)$ by Euler's method.
8. Using Euler's method find $y(0.2)$ from $y'=x+y,\ y(0)=1$ with $h=0.2$.
9. Use Euler's method to find $y(0.2)$ and $y(0.4)$ given $\frac{dy}{dx}=x+y,\ y(0)=1$.
10. Using Euler's method find the solution of the initial value problem $y'=y-x^2+1,\ y(0)=0.5$ at $x=0.2$ taking $h=0.2$.
11. Using Euler's method, find the solution of the initial value problem $\frac{dy}{dx}=\log(x+y),\ y(0)=2$ at $x=0.2$ by assuming $h=0.2$.
12. State modified Euler's method to solve $\frac{dy}{dx}=f(x,y)$ with $y(x_0)=y_0$.

13. State the fourth order Runge-Kutta algorithm.
14. State the Milne's predictor-corrector formula.
15. Write the Adam – Bashforth predictor and corrector formulae.
16. How many prior values are required in predictor-corrector formulae?

Unit – V (Boundary Value Problems in ODE and PDE)

1. Classify the PDE $y(x_0) = y_0$.
2. Classify the PDE $u_{xx} = u_t$.
3. Write down the finite difference formula for $y'(x)$ and $y''(x)$.
4. What is the central difference approximation for y''.
5. State the finite difference scheme to solve the equation $y_{tt} = \alpha^2 y_{xx}$.
6. Obtain the finite difference scheme for the differential equation $2y'' + y = 5$.
7. Write down the explicit finite difference method for solving one dimensional wave equation.
8. Write down the explicit formula to solve the hyperbolic equation $u_{tt} = 9u_{xx}$ when $\Delta x = 0.25$ and $\Delta y = \frac{1}{16}$.
9. Write down Bender-Schmidt's difference scheme in general form and using suitable value of λ, write the scheme in simplified form.
10. State Crank-Nicholson's difference scheme.
11. State whether the Crank Nicholson's scheme is an explicit or implicit scheme. Justify.
12. Write Liebmann's iteration process.
13. State Standard Five Point formula with relevant diagram.
14. State Diagonal Five Point formula with relevant diagram.
15. Write down the standard five point formula to find the numerical solution of Laplace equation.

16. Write the difference "scheme for solving the Poisson equation $\nabla^2 u = f(x, y)$.

---- *All the Best* ----