ஸ்ரீ-ல-ஸ்ரீ காசிவாசி சுவாமிநாத சுவாமிகள் கலைக் கல்லூரி

திருப்பனந்தாள் – 612504

S.K.S.S ARTS COLLEGE, THIRUPPANANDAL - 612504

QUESTION BANK

Title of the Paper

NUMERICAL METHODS WITH MATLAB PROGRAMMING

Course: IIIB.Sc (MATHS)

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CORE COURSE IX
NUMERICAL METHODS WITH MATLAB PROGRAMMING

Objectives:

1. To introduce the exciting world of programming to the students through numerical methods.
2. To introduce the techniques of MATLAB programming.
3. To solve numerical problems using MATLAB programming.

UNIT I

MATLAB Environment : Getting Started – Solving Problems in MATLAB – Saving you works – Predefined MATLAB Functions – Using Predefined Functions – Manipulating Matrices – Computational Limitations-Special Values and Functions.

UNIT II

Plotting : Introduction Two Dimensional Plots – Three Dimensional Plotting – Editing Plots from the Menu Bar – Creating Plots from the Workshop Window – Programming in MATLAB : introduction – Problems with Two Variables – Input/Functions – Statement level Control Structures.

UNIT III

Numerical Techniques : Introduction – Curve Fitting: Linear and Polynomial Regression – Using the Interactive Fitting Tools – Numerical Integration – Numerical Differentiation.

UNIT IV

Curve Fitting – Linear and parabolic curves by the method of least squares principle-Solving algebraic and transcendental equations-Bisection method, false position method and Newton Raphson method – Solving simultaneous algebraic equation – Guass – seidal method – Guass elimination method.

UNIT V

Interpolation – Newton's forward and backward difference formulae – Lagrange's interpolation formulae – Numerical integration using Trapezoidal and Simpson's one – third rules – solution of ODE's = Euler method and Runge – Kutta fourth order method.

Books for Study

1. Delores M.Etter, David C.Kuncicky, Holly Moore. Introduction to MATLAB, Published by Dorling Kindersley (india) Pvt. Ltd., licenses of Pearson Education in South Asia.
2. M.K.Venkatraman, Numerical methods in Science and Engineering, National Publisher Company, Fifth Edition, 2001 (For Units IV and V).

Unit 1 : Chapter 2 & 3
Unit 2 : Chapter 4 & 5

Unit 3 : Chapter 8.
Unit 4 : Chapter 2 section 1.7-1.8, Chapter 3, section 2, 4 and 5, Chapter 4, section 2, 6 of (2).
Unit 5 : Chapter 6, sec 3, 4. Chapter 8, sec 4, Chapter 9, sec 8, 10, Chapter 11, sec

UNIT I

CHOOSE THE CORRECT ANSWER:

1. How would you start a debugger in MATLAB?
    a) There is no M-file in MATLAB
    b) Type edit in MATLAB and press enter
    c) Type debug in MATLAB and press enter
    d) Type M-file MATLAB and press enter

2. What is the extension of script files?
    a) .m
    b) .mat
    c) .script
    d) None of these

3. How do you create a function file in MATLAB?
    a) Begin M-file with function definition
    b) Begin script file with function definition
    c) There is no such thing called function file
    d) An M-file is only a called function file

4. To add comments in MATLAB use _____
    a) //
    b) %/
    c) /%
    d) %

5. To display comments of M-files, we use _____
    a) Echo on
    b) Comment on
    c) Show %
    d) None of these

6. The function to close the windows containing graphs generated from MATLAB Is _____
    a) Close all
    b) Close graphs
    c) Delete graphs
    d) None of these

7. What does MATLAB stand for ?
    a) Math Laboratory
    b) Matrix Laboratory
    c) Math works
    d) None of these
8. This MATLAB command clears all data and variables stored in memory
    a) Clc
    b) Clear
    c) Delete
    d) None of these

9. Which of these is the way to access the first element in a vector named V?
    a) V(0)
    b) V(1)
    c) V
    d) None of these

10. To add a comment to the M-file , the MATLAB command is
    a) %
    b) ;
    c) Comment (‘ ‘)
    d) &

ANSWERS : 1) b 2) a 3) a 4) d 5) a 6) a 7) b 8) b 9) b 10) a

2 Marks:

11. What is MATLAB?
12. Define command window
13. Define edit window
14. Define M-files
15. What is floating point number?
16. Define scalar
17. Define vector
18. Types of display windows?
19. Define colon operator
20. Define composition of functions

5 Marks :

21. Explain command history
22. Explain current folder window
23. Explain graphics window
24. Explain arithmetic operations between two scalars
25. Details about number display
26. Write the table on numeric display format

27. Short note on diary
28. Explain trigonometric functions
29. Write a short note on uniform random numbers
30. Explain about defining matrices

10 Marks:

31. Explain workspace window
32. Explain document window
33. Explain scalar operations on matrices
34. Details about display format
35. Explain saving your work
36. Explain saving variables
37. Details about manipulating matrices
38. Write briefly Gaussian random numbers
39. Explain with special value and functions
40. Explain precedence of arithmetic operations

UNIT II

CHOOSE THE CORRECT ANSWER :

1. Which commands enables a title for the x-axis ?
   a) Xlabel()
   b) Horilabel()
   c) Xlabel[ ]
   d) None of these

2. Which commands enables a title for the Y-axis ?
   a) vertible()
   b) Ylabel()
   c) Ylabel[ ]
   d) None of these

3. How can several graphs for the same function be plotted on the same window
   a) Bode plots
   b) 3-D plots
   c) Contour plots
   d) None of these

4. What is the output of the following command ?
   a) twox^*y matrix
   b) onex^*y matrix
   c) oney^*x matrix
   d) error

5. can we have multiple 3- D plots in MATLAB ?
    a) yes
    b) no
    c) maybe
    d) none of these
6. The function of plot vector fields is _____
    a) Quiver()
    b) Pie3
    c) Ezplot()
    d) None of these

7. How many stages commonly occurs in creation of plots ?
    a) 2
    b) 5
    c) 8
    d) None of these

8. The eval command can evaluate _____
    a) A single function
    b) Only a single command
    c) Multiples commands
    d) None of these

9. The function gets disabled while using evalc() ?
    a) Diary
    b) Sin
    c) Inf
    d) Round

10. How much does the precision change while finding sin(x) using evalcand eval?
    a) 10%
    b) 2%
    c) 20%
    d) No change

ANSWERS: 1) a 2) b 3) c 4) d 5) a 6) a 7) a 8) c 9) a 10) d

2 Marks:

11. Define two dimensional plots?
12. Define three dimensional plots?
13. What about 2 types of surface plots?
14. Define polar plots
15. Define local variables
16. What is meant by for loops?

17. Define output options
18. Define logarithmic plots
19. Define peaks function
20. Define plot

5 Marks:

21. Explain basic plots
22. Explain titles, Lables, and grids
23. Details about creating multiple plots
24. Details plots of complex arrays
25. Write the table of Line, Mark and color options
26. Explain 3 dimensional line plots
27. Details about contour plots
28. Explain saving your plots
29. Explain creating plots from the workspace window
30. Explain about user defined input

10 Marks:

31. Explain about Axis scaling and Annotating plots
32. Explain 3-dimensional plotting
33. Explain types of surface plots
34. Explain pseudo color plots
35. Details about editing plots from the Menubar
36. Explain formatted output
37. Explain about syntax
38. Details about loops
39. Explain rules for writing and using function M-files
40. Explain relational and logical operators

UNIT III

CHOOSE THE CORRECT ANSWER :

1. The int() function gives the _____
    a) General solution of the ODE
    b) Particular integral of a function
    c) General solution of the function
    d) Complementary function

2. The command quad() cannot to _____ integrals
    a) Definite
    b) Indefinite
    c) Particular
    d) None of these

3. Can we do vector integration in MATLAB?
    a) Yes
    b) No
    c) In some cases
    d) None of these
4. How many coefficients do you need to estimate in 9 simple linear regression model?
    a) 1
    b) 2
    c) 3
    d) 4

5. In a simple linear regression model, if we change the input variable by 1 unit, How much output variable will change?
    a) By 1
    b) No change
    c) By its slope
    d) By intercept

6. Function used for linear regression in R is _____
    a) lm(formula,data)
    b) lr(formula,data)
    c) lrm(formula,data)
    d) None of these

7. In syntax of linear model lm(formula,data),data refers to ____
    a) Matrix
    b) Vector
    c) Array
    d) None of these

8. _____ is an incredibly powerful tool for analyzing data
    a) Linear regression
    b) Logistic regression
    c) Gradient
    d) None of these

9. The points where the Newton raphson method fails are called?
    a) Floating
    b) Continuous
    c) Non stationary
    d) Stationary

10. The Newton raphson method is also called _____

a) Tangent method
b) Secant method
c) Chord method
d) None of these

ANSWERS : 1) b 2) b 3) a 4) b 5) c 6) a 7) b 8) a 9) d 10) a

2 Marks:

11. Define curve fitting
12. Define residual
13. What is meant by “eyeballing it”?
14. Define least squares fit?
15. Define Polyfit?
16. Define polyval function
17. Define forward difference
18. What is gradient function?
19. Define trapezoidal rule?
20. Define linear regression?

5 Marks:

21. Explain Polyval function
22. Explain basic fitting tools
23. Details about curve fitting toolbox
24. Explain curve fitting
25. Explain the diff function of numerical integration
26. Difference between actual and calculated values
27. Use the gradient function to find the value of the derivatives
28. Write about difference expressions
29. Explain Trapezoidal rule and Simpson’s Rule
30. Explain polynomial regression

10 Marks:

31. Details about linear regression
32. Explain about polynomial regression
33. Explain about Using the interactive fitting tools
34. Explain Forward, Backward and central difference techniques
35. Explain Numerical integration
36. Consider the equation $y = x^3 + 2x^2 - x + 3$ use the $trapz$ function to estimate the integral of y with respect to x, evaluated from -1 to 1. Use 11 values of x, and calculated the corresponding values of y as input to the $trapz$ function
37. Consider the equation $y = x^3 + 2x^2 - x + 3$ by using $quad$ and $quad1$ functions to find the integral of y with respect to x, evaluated -1 to 1
38. Explain about calculating moving boundary work
39. Explain Cubic spline interpolation

40. Explain $interp1$function

UNIT IV

CHOOSE THE CORRECT ANSWER :

1. Gauss seidal method is also termed as a method of _____?
    a) Successive displacement
    b) Eliminations
    c) False positions
    d) Iterations

2. The equation $f(x)$is given as $x^2 - 4 = 0$, considering the initial approximation at$x = 6$ then the value of x_1 is given as
    a) $10/3$
    b) $4/3$
    c) $7/3$
    d) $13/3$

3. Find the approximating value of x will 4 iterations for $e^{-x} = 3\log(x)$ using bisection Method
    a) 1.197
    b) 1.187
    c) 1.167
    d) 1.176

4. Find the root of $x^2 - x - 10 = 0$ approximately upto 5 iteration using bisection method, Let $a = 1.5$ and $b = 2$
    a) 1.68
    b) 1.88
    c) 1.86
    d) 1.66

5. Find the positive root of the equation $3x - cosx - 1$ using Newton's Raphson method and correct to 4 decimal places
    a) 0.6701
    b) 0.5701
    c) 0.5071
    d) 0.6071

6. The aim of elimination steps in Gauss Elimination method is to reduce the coefficient matrix to
    a) Diagonal
    b) Identity
    c) Lower triangular
    d) Upper triangular
7. Solve the system of Gauss Elimination Method
$$x + y + z = 0, \quad -x - y + 3z = 0, -x - y - z = 2$$
    a) Unique solution
    b) Infinitely many solution
    c) No solution
    d) Finite solution

8. Find x if $x_0 = 0.6, n = 2.6$ and $h = 0.2$ using Newton's forward formula
    a) 12
    b) 1.2
    c) 1.12
    d) 1.22

9. A function is defined as $f(x) = x^2 - 3$, between the interval $[1,2]$ find the root of the function by bisection method
    a) 1.7334
    b) 1.7364
    c) 1.7354
    d) 1.7344

10. A bisection method is also known as _____
    a) Binary Chopping
    b) Quaternary Chopping
    c) Tri region
    d) Hex region

ANSWERS : 1) a 2) a 3) b 4) c 5) d 6) d 7) c 8) c 9) d 10) a

2 Marks :

11. Define algebraic equation give an example
12. Write down the formula for Newton's Raphson Method
13. Define transcendental equation
14. Write the formula for false position method
15. If $f(x) = 3x - cosx - 1$ find the real roots for the equation for bisection method
16. State gauss seidal method.
17. Why gauss seidal method is better than Jacobi's iterative
18. Give write two indirect method to solve system of linear equation?
19. Write down the formula for Newton's Raphson method.

20. Find the roots of a and b for $3x - cosx - 1$ by Newton's Raphson method.

5 Marks :

21. Find the first approximation of the roots lies between 0 and 1 of the equation $x^3 + 3x - 1 = 0$ by using Newtons Raphson method.
22. Find the real root of the equation $3x - cosx - 1$ by using Newtons Raphson method.
23. Find the real root of the equation $x^3 + x^2 - 100$ by using iteration method.
24. Solve the system of equation by Gauss elimination method

$$3x + 4y - z = -6$$
$$-2y + 10z = -8$$
$$4y - 2z = -2$$

25. Solve the following system of equations by Gauss elimination method

$$x + 4y - z = -5$$
$$x + y - 6z = -12$$
$$3x - y - z = 4$$

26. Solve the following equation by Gauss seidal method up to 3 iterations and find the value of x.

$$4x - 3y - z = 40$$
$$x - 6y + 2z = -28$$
$$x - 2y + 12z = -86$$

27. Solve the following equation by Gauss seidal method up to 2 iterations and find the values of x, y, z

$$27x + 6y - z = 85$$
$$6x + 15y + 2z = 72$$
$$x + y + 54z = 110$$

28. Find the real root of the equation $f(x) = 3x^2 - 5x - 2$ using iteration method.
29. Find the real root of the equation $f(x) = x^3 - 3$byusing bisection method.
30. Find the real root of the equation $f(x) = x^3 - 4x - 9$by using bisection method.

10 Marks :

31. Find the real root of the equation$f(x) = x^3 - x - 1$using bisection method.
32. Find the real root of the equation $f(x) = x^3 - x - 11$using bisection method.
33. Find the real root of the equation $f(x) = x^3 - 2x + 0.5$byusing Newton's Raphson method.
34. Compute the real root of the equation $xlogx = 1.2$ to 3 decimal places for using Newton's Raphson method.
35. Find the root of the equation $f(x) = x^2 - 2x + 5$ using iteration method.
36. Solve the equations for Gauss elimination method

$$x + 2y + z = 8$$
$$2x - y + 2z = 6$$
$$3x - 2y - z = 4$$

37. Solve the equations for Gauss elimination method

$$2x + y + z = 10$$
$$3x + 2y + 3z = 18,$$
$$x + 4y + 9z = 16$$

38. Solve the system of equations using gauss seidal iteration method

$$2x + 10y + z = 13$$
$$10x + y + z = 12$$
$$x + y + 5z = 7$$

39. Solve the equations by gauss seidalmethod $2x + 5y = 16\,, 3x + y = 11.$
40. Find the root of the equation $f(x) = x^3 - 9x + 1$ using bisection method.

UNIT V

CHOOSE THE CORRECT ANSWER :

1. Trapezoidal formula is also known as
   a) Simpson's rule
   b) Co-ordinate method
   c) Prismoidal method
   d) Average and area method

2. Which of the following can the Simpson's rule posses?
   a) Negatives
   b) Accuracy
   c) Positives
   d) Zero

3. Which of the following shapes is generally preferred in case of application of Simpson's rule?
   a) Square
   b) Triangle
   c) Trapezoid
   d) Rectangle

4. Given $3\frac{dy}{dx} + 5y^2 = sinx\,, y(0.3) = 5$ and using a step size $h = 0.3$,the value of $y(0.9)$ using Euler's method is most nearly
   a) -35.318
   b) -36.458
   c) -658.91
   d) -669.05

5. Given $3\frac{dy}{dx} + \sqrt{y = e^{0.1x}}, y(0.3) = 5$ using $h = 0.3$, the best estimate of $\frac{dy}{dx}(0.9)$ using Eulers method is nearly
   a) -0.37319
   b) -0.36288
   c) -0.35381
   d) -0.34341

6. Given $3\frac{dy}{dx} + 5y^2 = sinx\,, y(0.3) = 5$ and using a step size $h = 0.3$, the value of $y(0.9)$ using RungeKutta 2nd order most nearly
   a) -4297.4
   b) -4936.7
   c) -0.21336

d) -0.24489

7. Taylor's series method is the
   a) Boundary value problem
   b) Initial value problem
   c) Valued problem
   d) None of these

8. In Euler's method, $Y_{n+1} =$ _____?
   a) Y_n
   b) $Y_n + f(X_n, Y_n)$
   c) $Y_n + hf(X_n, Y_n)$
   d) None of these

9. Find x if $x_0 = 0.6, n = 2.6$ and $h = 0.2$ using Newton's forward formula
   a) 12
   b) 1.2
   c) 1.12
   d) 1.22

10. In which of the following method, we approximate the curve of solution by the tangent in each interval
    a) Picard's Method
    b) Euler's Method
    c) Newtons Method
    d) Rungekutta Method

ANSWERS : 1) d 2) b 3) c 4) a 5) b 6) a 7) a 8) c 9) d 10) b

2 Marks :

11. Write down the formula for Lagrange's Interpolation
12. Write down the formula for Newton's forward difference interpolation
13. Write down the formula for Newton's backward difference interpolation
14. What is the disadvantages in applying Lagrange's formula.
15. Define numerical integration
16. Write the formula for trapezoidal rule?
17. Write the formula for Simpson's 1/3 rule?
18. Compare trapezoidal rule and Simpson's 1/3 rule?
19. Compute $\int_0^{\frac{1}{2}} y dx$ using trapezoidal rule if $\mathrm{y}(0) = 1, \mathrm{y}\left(\frac{1}{4}\right) = 1.0104,$
$$\mathrm{y}\left(\frac{1}{2}\right) = 1.04291$$
20. Evaluate $\int_{1/2}^{1} 1/x \ \ dx$ by using simpson's 1/3 rule, equal to 4 parts

5 Marks :

21. Find the cubic polynomial which takes the following values $y(0) = 1,$

$y(1) = 0, y(2) = 1, y(3) = 10$hence obtain $y(4)$.

22. Find $x = 10$ and for the following table using Lagrange's formula

X	5	6	9	11
Y	12	13	14	16

23. Find the value of $y(3)$ for the following table using by Lagrange's formula

X	0	1	2
Y	0	1	3

24. By using Taylor's method .,obtain $y(1.3)$ if the differential equation is $y^1 = x^2 + y^2$with$y(1) = 0$.
25. Using Euler's method, find $y(0.5)$, given that $y^1 = y^2 - x^2$ with $y(0) = 1$and $h = 0.1$.
26. Evaluate $I = \int_0^1 1/1 + x\, dx$ correct to 3 decimal places by using trapezoidal rule, and $h = 0.2$.
27. Find the value of $I = \int_0^1 e^{-x^2}\, dx$ by taking correct to 3 decimal place using simpson's 1/3 rule.
28. Use trapezoidal rule with $h = 6$ to approximate $\int_0^\pi sin^2 x\, dx$
29. Evaluate $\int_{-2}^2 t\ /5 + 2t\, dt$ using simpson's 1/3 rule.
30. To solve the ordinary differential equation $3\frac{dy}{dx} + 5y^2 = sinx, y(0) = 5$ by Euler's method

10 Marks :

31. The population of a town in the census , given below estimate the population of the year 1895 and 1925

X (year)	1891	1901	1911	1921	1931
Y(population)	46	66	81	93	101

32. In the table of the value of y are consecutive terms of a series in which the number 21.6 is the 6th to find 1st and 10th term of the series

X	3	4	5	6	7	8	9
Y	2.7	6.4	12.5	21.6	34.3	51.2	72.9

33. Using Lagrange's interpolation formula find y(10) from the following table

X	5	6	9	11
Y	12	13	14	16

34. Evaluate $y = \int_0^\pi sinx\, dx$ using trapezoidal and simpson's 1/3 rule by dividing six equal parts

35. Find the value of $\int_4^7 x^2\ logx$ taking 4 strips using trapezoidal and Simpson's 1/3 rule
36. Evaluate $I = \int_0^1 1/1 + x\ dx$ using $h = 0.25$ equal to 4 parts correct to 3 decimal places for trapezoidal rule and Simpson's 1/3 rule
37. Find $y(0.2)$ for $\frac{dy}{dx} = -y$ and initial conditions $y(0) = 1$ and $h = 0.1$ using Euler's method.
38. Using Euler's method $y(0.5)$and $y(0.1)$,given that $y^1 = x + y$ with $y(0) = 1$ and $h = 0.05$.
39. Solve ordinary differential equation $3\frac{dy}{dx} + 5y^2 = sinx, y(0) = 5$,by using Euler's method
40. Using Taylor's series method , obtain $y(4.1)$ and $y(4.2)$ given that $\frac{dy}{dx} = \frac{1}{x^2+y}$ with $y(4) = 4$