

RESEARCH METHODOLOGY

SEMESTER-IV

COURSE CODE: PPH1013

II-MSC PHYSICS (2016-2018)

STAFF INCHARGE: Mr. M.SATHISH

2 MARKS

1. Why literature survey is important in research study?
 2. How important the use of LCD presentation is better than OHP presentation?
 3. Write Newton's cotes formulae.
 4. What is meant by Monte Carlo technique of evaluating the integral function?
 5. State any 4 properties of eigenvectors.
 6. What is meant by partial pivoting?
 7. What do you understand by the term interpolation and extrapolation?
 8. State gauss backward interpolation formula. When is it used?
 9. Determine the value of each of the following expressions: (int i=8, f=5; float x=0.005; char C = 'C', d = 'd' here C = 99, d = 100)
a) $(3 * I - 2 * j) \% (2 * d - c)$ b) ++x
 10. State the disadvantages of using Go To unconditional control structure?
 11. What is the role of literature survey in identifying a research problem?
 12. What is synopsis and at what stage of your research do you write it?
 13. Describe Euler method to solve a differential equation.
 14. Define Trapezoidal rule.
 15. What is pivoting?
 16. Define condition number of a matrix.
 17. Give an example of a function whose fitting to the data is a nonlinear least square fit problem.
 18. Define interpolation and extrapolation.
 19. How do you declare a real variable in a C program?
 20. Write a C program that computes the factorial of a number fed from the keyboard and prints the answer on the screen?
 21. What are sources of problem?
 22. Give the characteristics of a good research.
 23. Evaluate by using Simpson's 3/8 rule.
 24. Write the third ordered algorithm of Runge kutta method.
 25. Define iterative methods.
-

26. Gauss seidel method is very fast when compared to gauss-Jacobi method. Explain.
 27. Define error in Newton's backward interpolation formula.
 28. Define central difference operator.
 29. Define constant and variables.
 30. What are arrays? Classify them with an example
 31. What are the methods of data collection?
 32. What are the steps to write the synopsis?
 33. Give the formula for Newton's - Raphson method and Simpon's 3/8rule.
 34. Give the order of convergence of an iterative process.
 35. Write the significance of power method.
 36. What are the Eigen values and Eigen vectors?
 37. What is interpolation?
 38. Define principle of Least squares.
 39. What are the different types of operators in C language?
 30. Give short notes on arithmetic operation on string
 31. Explain the significance of reference collection.
 32. Give any two advantages and cautions to be exercised in seeking internet literature survey.
 33. When does Simpson's rule give exact result?
 34. Define numerical differentiation.
 35. What are called iterates?
 36. Which method is suitable to find Eigen values and Eigen vectors for symmetric matrices?
 37. What is called forward difference operator?
 38. Explain the basic structure of C programming.
 39. Name atleast four important search engines that can be used for science literature survey.
 40. Name the advantageous of using power point in seminars.
 41. State Simpson's 3/8 rule. 4. Give the formula for second order Runge-kutta method.
 42. What is the condition to apply Jacobi's method to solve a problem of equations?
 43. State Newton's formula on interpolation?
 44. Write the syntax for reading and writing strings.
 45. What is literature survey?
 46. Write short notes on Reference collection.
 47. What is Eigen vector
 49. Explain propagation of errors.
-

50. Briefly explain data types in C.
60. Briefly explain identifiers in C.
61. How will you identify the research problem?
62. What is the role of Internet browsing in research?
63. Give the formula for Newton's Cotes method and Euler's method.
64. Write the formula for Fourth order Runge – Kutta method.
65. What is the significance of Jacobi method?
66. What is finite differences?
67. Define error in numerical methods.
68. Draw the basic structure of C programming.
69. Give short notes on string variables in C language
70. What is review of literature?
71. What is a research proposal?
72. Evaluate $I=dx$ using Simpson's 3/8 rule.
73. Define gauss-Jordan elimination method.
74. Define error in Newton's forward interpolation formula.
75. Define differential operator.
76. Define character set with an example.
77. What are identifiers? Give an example.
78. Give the formula for second order Runge-kutta method.

5 MARKS

1. What are the possible ways of getting abreast of current literature?
2. Give an account of qualitative and quantitative analysis of data gathered for research
3. Using Newton – Raphson method, establish the formula $X_{n+1} = \frac{1}{2} (x_n) + \frac{N}{x_n}$ to calculate the square root N. Hence find the square root of 5 correct to 4 places of decimals
4. Given evaluate $\frac{d^2y}{dx^2} - y^3 = 0; y(0) = 10, y^1(0) = 5$, evaluate $y(0.1)$ Runge – Kutta method
5. Solve by Gaussian elimination procedure :

$$3.15X - 1.96Y + 3.85Z = 12.95$$

$$2.13X + 5.12Y - 2.89Z = -8.61$$

$$5.92X + 3.05Y + 2.15Z = 6.88$$

6. Find the eigen values and eigen vectors of $A = \begin{pmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{pmatrix}$

7. Given $\sin 45^\circ = 0.7071$, $\sin 50^\circ = 0.7660$, $\sin 55^\circ = 0.8192$, $\sin 60^\circ = 0.8660$
find $\sin 52^\circ$ by using Newton's interpolation formula. Estimate the error.

8. Fit a curve of the form $Y = a + bx + Cx^2$ to the data given below

X	10	20	30	40	50	60
Y	4.5	7.1	10.5	15.5	20.5	27.1

10. Describe the 4 basic data types with suitable examples

11. Identify syntax errors in the following program :

```
define p1 = 3.14159
```

```
main () {
```

```
Int R,C;
```

```
Float perimeter
```

```
Float area
```

```
C = PI ; R=5
```

```
Perimeter = 2.0*C*R
```

```
Area = C* r * R,
```

```
Printf ("% f" , '%d', & perimeter, area)
```

11. Describe different steps involved in undertaking a scientific investigating of a problem.

12. How to prepare a power point presentation such that the research results can be communicated effectively?

13. Describe 4th order Runge Kutta method for solving a system of coupled ordinary differential equation.

14. Derive Simpson's 3/8 rule and comment on the error in solving an integral.

15. Solve the linear system of equations by Gaussian elimination.

$$2x_1 + 4x_2 - 2x_3 = 2$$

$$4x_1 + 9x_2 - 3x_3 = 8$$

$$-2x_1 - 3x_2 + 7x_3 = 10$$

15. Using Jacobi method, find the eigenvalues of the following matrix.

$$\begin{pmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 1 & 1 \end{pmatrix}$$

16. Describe least square method for fitting a data to a polynomial of degree n.

19. Give a detailed analysis of Lagrange interpolation technique.

18. Discuss different types of loops and their syntax in C program.
20. Discuss basic structure of C program.
-

21. Explain the common draw backs in collecting the samples.
22. Given $y' = -y$ and $y(0) = 1$, determine the values of y at $x = (0.01)$ (0.01) (0.04) by Euler method.
23. Explain the Jacobi method of iteration.
24. Solve the system of equations by gauss Jordan method
 $X + 2y + z = 3$; $2x + 3y + 3z = 10$; $3x - y + 2z = 13$
25. Find the missing values of the following table.

X	0	1	2	3	4
Y	1	3	2	4	-11

26. Explain why $(x=3)$ is not $23=8$ in your answer.
27. Find the equation $y=f(x)$ of least degree and passing through the points $(-1,-21)$, $(1, 15)$, $(2,12)$, $(3,3)$ find also y at $x=0$.
28. Explain the various operators in C with an example.
29. With an example explain the structure of C program.
30. Explain the role of computer in research.
31. Discuss the steps in writing a research paper.
32. Derive the general formula for Newton's - Raphson method.
33. Evaluate the integral $I = \int_4^{5.2} \log_e x dx$ using Simpon's 3/8th rule.
34. Find by matrix Inversion method, the inverse of $A = \begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$
35. Find the Eigen value of $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ by Power method.
36. By the method of least squares find the best fitting straight line to the data given below:

X	5	10	15	20	25
Y	15	19	23	26	30

37. Find the divided differences of $f(x) = x^2 + x + 2$ for the arguments

1, 3, 6, 11.

38. Explain Constants and Variables in C programming with example.

39. Explain two dimensional and three dimensional arrays with example.

41. Describe briefly the art of synopsis writing.

42. Discuss the usage of multimedia techniques in paper presentation.

43. The velocity V of the particle at distances from a point on its path is given by the table:

S	0	10	20	30	40	50	60	FEET
V	47	58	64	65	61	52	38	FEET/SEC

44. Estimate the time taken to travel 60 feet by using Simpson's $3/8$ rule.

45. Compute the real root of $x \log_{10} x = 1.2$ correct to three decimal places using Newton's Raphson method.

46. How power method can be applied to find numerically the greatest Eigen value of a square matrix.

47. Explain Eigen values and Eigen vectors.

48. Find the least – squares parabola for the four points $(-3, 3)$, $(0, 1)$, $(2, 1)$ and $(4, 3)$.

49. Construct a forward difference table from the following values of x and y . Show that the third differences are practically constant.

x	35	36	37	38	39	40	41
y	14.298	14.144	13.825	13.661	13.495	13.495	13.328

50. Describe the arithmetic operators on character in C.

51. Explain one dimensional arrays with examples.

52. Briefly explain about i) power point presentation.

ii) OHP presentation.

53. Write notes on Quantitative vs. Qualitative research.

54. Derive the formula for Newton – Raphson method.

55. Find the root of the equation $f(x) = 2x - 3\sin x - 5$ by Newton - Raphson method.

56. a) Find the Jacobi matrix $J(x, y, z)$ of order 3×3 , at the points $(1, 3, 2)$ and $(3, 2, 1)$ for The three functions

$$f_1(x, y, z) = x^2y^2 + y^2 - x^4 + z^2$$

$$f_2(x, y, z) = xy + yz + xz$$

$$f_3(x, y, z) = y/xz$$

57. Solve the following 3x 3 system using the basic Gaussian method.

$$3x_1 + 6x_2 + x_3 = 16$$

$$2x_1 + 4x_2 + 3x_3 = 13$$

$$x_1 + 3x_2 + 2x_3 = 9$$

58. Use method of least square to fit a straight line to the following Data

X	0	5	10	15	20
Y	7	11	16	20	26

59. Write a note on fitting a polynomial function.

60. Explain the use of all the logical and relational operator available in C.

61. Explain the increment and decrement operator in C.

62. Explain the Qualitative and Quantitative analysis in research.

63. Explain the steps in writing the thesis.

64. Find the real positive root of $3x - \cos x - 1 = 0$ by Newton Raphson method correct to 6 decimal places.

65. Evaluate I = using Simpson's 3/8 rule.

66. Solve the system by Gauss – Elimination method

$$2x + 3y - z = 5$$

$$4x + 4y - 3z = 3$$

$$2x - 3y + 2z = 2$$

67. Find the dominant Eigen value and the corresponding Eigen vector of

$$A = \begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$$

68. Explain the theory of method of least squares.

69. Explain the theory of interpolation with equally spaced points.

70. Explain any four operators in C programming with examples.

71. Explain two dimensional and three dimensional arrays and with Examples

72. Discuss the various steps involved in writing research paper.

73. Derive Newton-cote's formula.

74. Obtain the values of y at $x=0.1, 0.2$ using Runge-Kutta of third order for the differential equation. $y'=-y$ given $y(0)=1$.

75. Solve the system of equations by Gauss elimination method.

$$x+2y+z=3; 2x+3y+3z=10; 3x-y+2z=13$$

76. Derive the inversion of a matrix using Gauss-elimination method.

77. Express any value of Y in terms of Y_n and the backward differences of Y_n .

(or)

78. Find the polynomial of degree two which takes the values.

$$X: 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7$$

$$Y: 1 \quad 2 \quad 4 \quad 7 \quad 11 \quad 16 \quad 22 \quad 29$$

79. Write a C program to add two numbers and display the result.

80. Write a C program to calculate the average of n numbers.

10 MARKS

1. Explain the art of writing a research paper and thesis.

2. Solve the equation $y' = 1-y$, given $y(0) = 0$ using modified Euler's method and tabulate the solutions at $x=0.1, 0.2$, and 0.3 . Compare your results with the exact solutions. Also, get the solutions by improved Euler method.

3. Solve the following system of equations by using Gauss-Jacobi method (correct to three decimal places)

$$8x-3y+2z=20$$

$$4x+11y-z=33$$

$$6x+3y+12z=35$$

4. Using Gauss's backward interpolation formula find the population for the year 1936 given that

$$\text{Year } x: \quad 1901 \quad 1911 \quad 1921 \quad 1931 \quad 1941 \quad 1951$$

$$\text{Population } y: \quad 12 \quad 15 \quad 20 \quad 27 \quad 39 \quad 52$$

in thousand

5. Explain the arrays with an example. Also describe the declaration and initialization of arrays.

6. How will you identify the research problem and explain in detail the literature survey.

7. Derive an expression for Newton's cotangent formula and Simpson's $3/8$ rule.

8. Solve the system of equations by Gauss elimination method.

$$x+2y+z = 3$$

$$2x+3y+3z = 10$$

$$3x-y+2z = 13$$

9. Find the 7th term of the sequence 2, 9, 28, 65, 126, 217 and also the general term.

10. Define the following with examples

i) Character set

ii) Identifiers

iii) Variables

iv) Constants

11. Discuss the role and importance drawing recommendation and conclusions in a good Research.

12. Using Runge kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ given $y(0) = 1$ at $x=0.2, 0.4$

13. By Gaussian elimination method find A^{-1} if

$$A = \begin{pmatrix} 4 & 1 & 2 \\ 2 & 3 & -1 \\ 3 & -2 & 2 \end{pmatrix}$$

19. Find the values of y at $x=21$ and $x=28$ from the following data.

X: 20 23 26 29

Y: 0.3420 0.3907 0.4384 0.4848

20. What are operators? Briefly explain the classification of operators with an example.

21. What are the different steps involved in writing
i) a report and ii) a thesis?

22. What is Monte Carlo Simulation? Discuss in detail the Metropolis algorithm.

23. Show that Gaussian elimination algorithm to solve a system of linear equations without pivoting strategy is unstable.

24. What is a spline? How do you determine a cubic spline interpolating three data points $(tRiR, yRiR), i=1,2,3$?

25. Write a C program to solve an integral using a Monte Carlo method. What are global variables in a C program?

26. Discuss the steps to be followed in writing a thesis to be submitted to a university for the award of doctoral degree.
27. Using fourth order Runge-Kutta method find $y(0.2)$ and $y(0.4)$ given $dy/dx = 1 + y^2$ where $y = 0$ when $x = 0$.
28. Solve the following equations by Gauss-Seidel iteration method. $8x - y + z = 18$, $2x + 5y - 2z = 3$ and $x + y - 3z = -6$
29. Find the value of $\cos 51^\circ 42'$ by using Gauss backward interpolation formula from the table given below.

x	50°	51°	52°	53°	54°
$y = \cos x$	0.6428	0.6293	0.6157	0.6018	0.5878

30. Explain the essential of scientific report and also enumerate their types.
31. Derive an expression for Newton's – Raphson method and Euler's method.
32. Solve $e^x - 3x = 0$ by iteration method.
33. Find $y(-1)$ if $y(0) = 2$, $y(1) = 9$, $y(2) = 28$, $y(3) = 65$, $y(4) = 126$, $y(5) = 217$.
34. Explain the types of operators with examples.
35. Briefly write about layout of thesis.
36. Given $\frac{d^2 y}{dx^2} - y = 0$, $y(0) = 10$, $y'(0) = 5$ evaluate $y(0.1)$ using Runge - kutta method.
37. Find the Eigen values and Eigen values of given matrix $\begin{pmatrix} -11 & -10 & 5 \\ 5 & 4 & -5 \\ -20 & -20 & 4 \end{pmatrix}$
38. Discuss the least square method of curve fitting .Derive the normal equation for a straight line.
39. Explain the use of operators available in C with syntax.
40. Explain the complete procedure to be followed while preparing thesis for the coveted Ph.D degree.
41. The following table gives the velocity $v \frac{ds}{dt}$ of a particle at time t ds/dt_____

t (sec)	0	2	4	6	8	10	12
v (m/s)	4	6	16	34	60	94	136

find the distance moved by the particle in 12 seconds and also the acceleration at $t = 2$ seconds by Simpson's rule 3/8.

42. Solve by gauss Jacobi method of iteration the equations

$$27x+6y-z = 85$$

$$6x+15y+2z = 72$$

$$x+y+54z = 110$$

43. Interpolate by means of gauss backward formula the sales of a concern for the year 1966 given that

year 1931 1941 1951 1961 1971 1981

Sale (in LK) 12 15 20 27 39 52

44. i) Write a ID, six element character called LETTERS. Assign characters 'S' 'J' 'C' 'C' to the array element

ii) Define a 2D (3X4) in teger array called n. Assign the following

values to the array elements : $\begin{pmatrix} 10 & 5 & 3 & 2 \\ 0 & 2 & 3 & 4 \\ 0 & 0 & 0 & 1 \end{pmatrix}$

iii) Define a proper dimensional array to store 5 subjects mark of 50 students in a class

45. Explain in detail the art of writing result and discussion and conclusion part in a thesis.

46. Find the values of $y(1.1)$ using Runge-Kutta method of the third order. Given that $x_0 = 1$, $y_0 = 1$ and $h = 0.1$.

47. Solve the following system by Gaussian elimination method

$$x_1 - x_2 + x_3 = 1$$

$$-3x_1 + 2x_2 - 3x_3 = -6$$

$$2x_1 - 5x_2 + 3x_3 = 5$$

48. Using Gauss's interpolation formula, obtain $f(3.5)$ from the following table.

x 2 3 4 5

F(x) 2.626 3.454 4.784 6.986

49. With suitable examples explain the increment, decrement and conditional operators in C.

