Shyam Lal College, University of Delhi

Tentative Teaching Plan

Academic Year: 2024-25
Teacher Name: Sandeep kumar
Course Name: B.Sc. (Physical Sciences)
Paper Name: Differential Equations (Theory + Tutorial)
Semester: III (August 1, 2024 to November 28, 2024)
UPC: 2352572301

Week	Topics to be covered	Activity	Remarks (References/ Resources)
Weeks 1 & 2	First order ordinary differential equations: Basic concepts and ideas, First order exact differential equations, Integrating factors and rules to find integrating factors	Discussion and illustration	[2]: Chapter 1 (Sections 1.1, and 1.2), Chapter 2 (Sections 2.1, 2.2, and 2.4 up to page 64).
Week 3	Linear equations and Bernoulli equations, Initial Value Problems, Applications of first order differential equations: Orthogonal trajectories and Rate Problems	Discussion and illustration	[2]: Chapter 2 (Sections 2.3), Chapter 3 (Section 3.1 up to page 74, and Section 3.3 up to page 94).
Weeks 4 & 5	Basic theory of higher order linear differential equations, Wronskian and its properties	Discussion and illustration	[2]: Chapter 4 (Sections 4.1 up to page 115).
Weeks 6 & 7	Linear homogeneous equations with constant coefficients, Linear nonhomogeneous equations, Method of undetermined coefficients	Discussion and illustration	[2]: Chapter 4 (Section 4.1 from page 120 onwards, Sections 4.2, and 4.3).
Weeks 8 & 9	Method of variation of parameters (only second order), Two-point boundary value problems, Cauchy-Euler equations, Systems of linear differential equations.	Discussion and illustration	[2]: Chapter 4 (Sections 4.4, and 4.5). [2]: Chapter 1 (Section 1.3 up to page 16). [2]: Chapter 7 (Sections 7.1, and 7.3).
Weeks 10 & 11	Partial differential equations: Basic concepts and definitions, Classification and construction of first-order partial differential equations, Method of characteristics and general solutions of first order partial differential equations.	Discussion and illustration	[1]: Chapter 2 (Sections 2.1 to 2.3, and 2.5).
Weeks 12 & 13	Canonical forms and method of separation of variables for first-	Discussion and	[1]: Chapter 2 (Sections 2.6, and 2.7).

	order partial differential equations	illustration	
Weeks 14 & 15	Classification and reduction to canonical forms of second-order linear partial differential equations and their general solutions.	Discussion and illustration	[1]: Chapter 4 (Sections 4.1 to 4.4).

Reference Books:

1. Myint-U, Tyn and Debnath, Lokenath (2007). Linear Partial Differential Equations for Scientist and Engineers (4th ed.). Birkhäuser. Indian Reprint.
2. Ross, Shepley L. (1984). Differential Equations (3rd ed.). John Wiley & Sons.

Additional Readings:

1. Edwards, C. Henry, Penney, David E., & Calvis, David T. (2015). Differential Equations and Boundary Value Problems: Computing and Modeling (5th ed.). Pearson Education.
2. Kreyszig, Erwin. (2011). Advanced Engineering Mathematics (10th ed.). Wiley India.
3. Sneddon I. N. (2006). Elements of Partial Differential Equations. Dover Publications.

Assessment Activity Schedule: The assessment will be conducted during the course, preferably after the completion of each unit. Weeks 1-5, weeks 6-9 and weeks 10-15 contain three units of syllabus. Besides tests and assignments, students are encouraged to give presentation on the topic of their choice covering the content of the syllabus and applications of the theory.

Teacher: Sandeep Kumar
Course: B.Sc. (Physical Sciences)
Subject: Mathematics
Semester: 5
Paper(DSC):Elements of Real Analysis

Weeks 1 and 2: Field and order properties of R, basic properties and inequalities of the absolute value of a real number.
[1]: Chapter 1 (Sections 1.1, and 1.2).

Weeks 3 and 4: Bounded above and bounded below sets, Suprema and infima, The completeness axiom and the Archimedean property of R.
[1]: Chapter 1 (Section 1.6 [1.6.1 to 1.6.14, Theorems 1.6.2 and 1.6.10 without proofs]).
[1]: Chapter 1 (Section 1.5 [1.5.1, 1.5.2, and 1.5.9]).

Weeks 5 and 6: Convergence of a real sequence, Algebra of limits.
[1]: Chapter 2 (Section 2.1).
[1]: Chapter 2 (Section 2.2 [2.2.1 to 2.2.14, Theorems 2.2.8, 2.2.12, and 2.2.13 (d to f) without proofs]).

Week 7: The squeeze principle and applications.
[1]: Chapter 2 (Section 2.3 [2.3.1 to 2.3.14, Theorems 2.3.6, 2.3.10, and 2.3.14 without proofs]).

Weeks 8 and 9: Monotone sequences, Monotone convergence theorem and applications.
[1]: Chapter 2 (Section 2.5 [2.5.1 to 2.5.10, Theorems 2.5.5 and 2.5.7 without proofs).
Week 10: Cauchy sequences, Cauchy criterion for convergence and applications.
[1]: Chapter 2 (Section 2.7 [2.7.1 to 2.7.6, Theorem 2.7.4 without proof]).
Week 11: Convergence and divergence of infinite series of real numbers, Necessary condition for convergence, Cauchy criterion for convergence of series.
[1]: Chapter 2 (Section 8.1).
Weeks 12 to 14: Tests for convergence of positive term series, Applications of the integral test, Comparison tests, D’ Alembert’ s ratio test, Cauchy’ s nth root test, Raabe’ s test.
[1] : Chapter 2 (Section 8.2 [8.2.1 to 8.2.12, 8.2.14, 8.2.15, 8.2.17, 8.2.21, and 8.2.22, with all theorems without proofs]).

Week 15: Alternating series, Leibniz alternating series test, Absolute and conditional convergence.
[1] : Chapter 2 (Section 8.3 [8.3.1 to 8.3.10, Theorems 8.3.2, and 8.3.4 without proofs]).

Essential Reading

1. Denlinger, Charles G. (2011). Elements of Real Analysis. Jones & Bartlett India Pvt. Ltd. Student Edition. Reprinted 2015

Academic Year: 2024-25
Teacher Name: Sandeep kumar
Course Name: B.Sc. (Physical Sciences)
Paper Name: Calculus (Theory + Tutorial)
Semester: I (August 1, 2024 to November 28, 2024)

Weeks 1 and 2: Limit of a function, definition of a limit, Infinite limits, Continuity and types of discontinuities.
[1] Chapter 2.
Weeks 3 and 4: Differentiability of a function, Successive differentiation: Calculation of the nth derivatives, Leibnitz theorem.
[1] Chapter 3 (Sections 3.1, and 3.2), and Chapter 5.
Week 5: Partial differentiation, Euler's theorem on homogeneous functions.
[1] Chapter 12 [Section 12.2 (12.21 without proof, exclude 12.22 and 12.23), and Section 12.3].
Weeks 6 and 7: Rolle's theorem, Mean value theorems and applications to monotonic functions and inequalities.
[1] Chapter 7 (Sections 7.4 to 7.6).
Weeks 8 and 9: Taylor's theorem with Lagrange's and Cauchy's form of remainders, Definition and examples of convergent sequences and series, Taylor's series, Maclaurin's series expansions of and sin x, cos x, log(1+x).
[1] Chapter 6 (Brief introduction of convergence from the Sections 6.1 and 6.2).
[1] Chapter 7 (Sections 7.7, and 7.8).
Week 10: Indeterminate forms.
[1] Chapter 16.
Week 11: Asymptotes (parallel to axes and oblique).
[1] Chapter 9 (Sections 9.1 to 9.4).
Weeks 12 and 13: Concavity and inflexion points, Singular points (cusp, node and conjugate), Tangents at the origin and nature of singular points, Curve tracing (cartesian and polar equations).
[1] Chapter 10 (Section 10.7).
[1] Chapter 11. Use only statement for nature of double points in the Section 11.4.
Week 14 and 15: Reduction formulae and their applications. [2] Chapter 4 (Sections 4.1, 4.11, 4.12, and 4.13).
References:
1. Prasad, Gorakh (2016). Differential Calculus (19th ed.). PothishalaPvt. Ltd. Allahabad.
2. Prasad, Gorakh (2015). Integral Calculus. Pothishala Pvt. Ltd. Allahabad

NAME:- DR. SWATI YADAV
DEPARTMENT:- MATHEMATICS

Teaching Plan

GE-5(i): Numerical methods

Weeks 1 to 2: Errors: Roundoff error, Local truncation error, Global truncation error; Order of a method, Convergence and terminal conditions.

[2]: Chapter 1 (Sections 1.3.1, and 1.3.2).

[3]: Chapter 1 (Section 1.3).

Week 3 and 4: Bisection method, Secant method, Regula−Falsi method, Newton−Raphson method. [2]: Chapter 2 (Sections 2.1 to 2.3).

[3]: Chapter 2 (Sections 2.2, and 2.3).

Weeks 5 to 7: Gaussian elimination method (with row pivoting); Iterative methods: Jacobi method, Gauss−Seidel method.

[2]: Chapter 3 (Section 3.1), Chapter 6 (Sections 6.1, and 6.2), and Chapter 8 (Section 8.1). [3]: Chapter 3 (Sections 3.2, and 3.4).

Weeks 8 to 10: Interpolation: Lagrange form, and Newton form, Finite difference operators. [3]: Chapter 4 (Sections 4.2, and 4.3).

Weeks 11 and 12: Numerical differentiation: First and second order derivatives. [2]: Chapter 11 (Sections 11.1 [11.1.1, and 11.1.2]).

Weeks 13 to 15: Numerical integration: Trapezoidal rule, Simpson's rule; Ordinary differential equations:

Euler's method, and Runge-Kutta method.

[2]: Chapter 11 (Section 11.2 [11.2.1, and 11.2.2]).

[1]: Chapter 22 (Sections 22.2, and 22.4).

Essential Readings

1. Chapra, Steven C. (2018). Applied Numerical Methods with MATLAB for Engineers and Scientists (4th ed.). McGraw-Hill Education.
2. Fausett, Laurene V. (2009). Applied Numerical Analysis Using MATLAB. Pearson. India.
3. Jain, M. K., Iyengar, S. R. K., & Jain R. K. (2012). Numerical Methods for Scientific and Engineering Computation (6th ed.). New Age International Publishers. Delhi.

Document Preparation & Presentation software

Weeks 1 to 2: Introduction

1. Create a LaTeX/ LibreOffice document having several paragraphs, including comments in LaTeX.
2. Organize content into sections, including preface/abstract. Using the article and book class of LaTeX. Handling errors.

Week 3 and 4: Styling Pages

1. Loading and using packages, setting margins, header and footer, and page orientation.
2. Organizing the document into multiple columns

Weeks 5 to 7: Formatting Content

1. Formatting text (styles, size, alignment)
2. Adding colours to a block of text/ page
3. Adding ordered and unordered lists
4. Inserting mathematical expressions — subscripts, superscripts, fractions, binomials, aligning equations, operators, Greek and mathematical symbols, and mathematical fonts.

Weeks 8 to 10: Tables and Figures

1. Create basic tables
2. Adding different types of borders to a table
3. Merging rows and columns
4. Splitting tables across multiple pages.
5. Incorporating figures and subfigures, explore different properties like rotation and scaling.

Weeks 11 : Algorithms and Equations

1. Incorporating algorithms, body typesetting, organizing algorithms across multiple pages.
2. Incorporating equations, indentation, and captioning.

Weeks 12 and 13: Referencing and Indexing

1. Insert captions, labels, and references
2. Incorporate cross-referencing (refer to sections, table, and images)
3. Incorporate a bibliography
4. Create a back index.

Weeks 14 and 15: Making Presentations

1. Create a slideshow
2. Incorporate logo
3. Highlight important points
4. Create a title page
5. Make a table of contents
6. Incorporate special effects in a slideshow.

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VAC : VEDIC MATHEMATICS III

Week 1: Study concepts of Baudhaya
Week 2: Apastamba
Week 3: Aryabhata I, II
Week 4: Bhaskara I, II
Week 5: Lilavati
Week 6: Introduction of Trigonometric ratios
Week 7: Trigonometric Identities
Week 8: BN of Complementary angles
Week 9: BN of sum and difference ($\alpha \pm \beta$) of an angle
Week 10: Application Trigonometry-Height and Distance
Weeks 11, and 12: Inverse Trigonometric Function and Angle between two lines Perpendicular distance from point to line
Weeks 13, and 14: Angle between two lines using Baudhayan Geometry
Week 15: Angle between two lines using *Jyothishya Shastram*-Introduction of Astronomy, Astrology & Time Computation ; *Shilpa Shastram*- Introduction of temple architecture and constructions

Essential Readings

● Vedic Mathematics, Swami Bharati Krishna Trithaji, *Motilal Banarsidas, New Delhi*.
● The Power of Vedic Mathematics with Trigonometry, *Atul Gupta, Jaico Publishing house*.
● Vedic Mathematics For All Ages, Vandana Singhal, *Motilal Banarsidas Publishers.*
● Studies in Indian Mathematics and Astronomy, Aditya Kolachana, K. Mahesh, K. Ramasubramanian, *Springer, Singapore*
● Elements of Vedic Mathematics, Udayan S. Patankar, Sunil M. Patankar, TTU Press.
● Vedic Mathematics: The Problem Solver, Ronak Bajaj, *Black Rose Publications*.
● Vedic Geometry Course, S. K. Kapoor, *Lotus Press*
● Gardner, Robert and J.F. Staal. *Altar of Fire*. Documentary. The Film Study Center at Harvard University, 1976