Shyam Lal College, University of Delhi

Tentative Teaching Plan

Academic Year: 2024-25

Teacher Name: Dr Rajni Arora

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 nonˇ homogeneous 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	Discussion and illustration	[1]: Chapter 2 (Sections 2.1 to 2.3, and 2.5).

	differential equations.		
Weeks 12 & 13	Canonical forms and method of separation of variables for first-order partial differential equations	Discussion and illustration	[1]: Chapter 2 (Sections 2.6, and 2.7).
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.

Shyam Lal College, University of Delhi

Tentative Teaching Plan

Academic Year: 2024-25

Teacher Name: Dr Rajni Arora

Course Name: B.Sc. (Hons) Mathematics

Paper Name: Discrete Mathematics (Theory + Practical)

Semester: III (August 1, 2024 to November 28, 2024)

UPC: 2352012303

Theory classes

Week	Topic to be covered	Activity	Remarks (References/ Resources)
Week 1	The cardinality of a set	Discussion and illustration	[2] Chapter 3 (Section 3.3).
Weeks 2 & 3	Definitions, examples and basic properties of partially ordered sets, Order-isomorphisms, Covering relations, Hasse diagrams	Discussion and illustration	[1]: Chapter 1 (Sections 1.1 to 1.5, Section 1.6 (up to second bullet page 4), Sections 1.14 to 1.18). [3]: Chapter 1 (Subsection 1.1)
Weeks 4 & 5	Dual of an ordered set, Duality principle, Bottom and top elements, Maximal and minimal elements, Zorn's lemma, Building new ordered sets, Maps between ordered sets.	Discussion and illustration	[1]: Chapter 1 (Sections 1.19 to 1.24, Section 1.25 (only definition of product of partially ordered sets and diagrams to be done), Sections 1.26, 1.34, 1.35(1), and 1.36). [1]: Chapter 2 (Sections 2.1 to 2.2); [3]: Chapter 1 (Subsections 1.2 to 1.4)
Weeks 6 & 7	Lattices as ordered sets, Lattices as algebraic structures, Sublattices, Products, Lattice isomorphism	Discussion and illustration	[1]: Chapter 2 (Sections 2.3 to 2.5, 2.6 (excluding portion on down-set and up-set), 2.7 (only definition of lattices Sub G and N-Sub G to be done), 2.8 to 2.19, 2.22 to 2.25; all results to be stated without proof). [3]: Chapter 1 (Subsections

			1.5 to 1.20).
Weeks 8 & 9	Definitions, examples and properties of modular and distributive lattices	Discussion and illustration	[1]: Chapter 4 (Sections (4.1 to 4.9); [3]: Chapter 1 (Subsections 2.1 to 2.6).
Week 10	The M3–N5 theorem with applications, Complemented lattice, Relatively complemented lattice, Sectionally complemented lattice	Discussion and illustration	[1]: Chapter 4 (Section 4.10 (result to be stated without proof), and Section 4.11). [3]: Chapter 1 (Subsections 2.7, 2.8 (except example(v)), 2.9 - 2.14).(Results in 2.12, and 2.13 to be stated without proof)
Weeks 11 & 12	Boolean algebras, De Morgan's laws, Boolean homomorphism, Representation theorem, Boolean polynomials, Boolean polynomial functions, Equivalence of Boolean polynomials.	Discussion and illustration	[3]: Chapter 1 [Subsections 3.1 to 3.8, and 3.9 (example(i); example (ii) and (iii) both without proofs); For 3.10 to 3.16 (Definitions and examples to be done. All results to be stated without proofs.)]. [3]: Chapter 1 [Subsections 4.1 to 4.10 (Definitions and examples to be done. All results to be stated without proofs)].
Weeks 13 & 14	Disjunctive normal form and conjunctive normal form of Boolean polynomials; Minimal forms of Boolean polynomials, Quine-McCluskey method, Karnaugh diagrams.	Discussion and illustration	[3]: Chapter 1 [Subsections 4.11 to 4.14, 4.16 to 4.18 (Definitions and examples to be done. All results to be stated without proofs)]. [3]: Chapter 1 [Subsections 6.1 to 6.6 (Definitions and examples to be done. All results to be stated without proofs)].
Week 15	Switching circuits and applications, Applications of Boolean algebras to logic, set theory and probability theory.	Discussion and illustration	[3]: Chapter 2 [Subsections 7.1 to 7.5; 8.1, 8.3 to 8.5; 9.1 to 9.13, 9.14{(i) to (iii)}].

Practical classes:

Week	Topic to be covered	Activity
Week 1	Learning basics of Mathematica	Discussion and illustration on Mathematica
Weeks 2	Expressing relations as ordered pairs and creating relations	Discussion and illustration on Mathematica
Weeks 3 & 4	Finding whether or not, a given relation is: i. Reflexive ii. Antisymmetric iii. Transitive iv. Partial order	Discussion and illustration on Mathematica
Weeks 5 & 6	Finding the following for a given partially ordered set i. Covering relations. ii. The corresponding Hasse diagram representation. iii. Minimal and maximal elements	Discussion and illustration on Mathematica
Weeks 7 & 8	Finding the following for a subset S of a given partially ordered set P i. Whether a given element in P is an upper bound (lower bound) of S or not. ii. Set of all upper bounds (lower bounds) of S. iii. The least upper bound (greatest lower bound) of S, if it exists.	Discussion and illustration on Mathematica
Week 9 & 10	Creating lattices and determining whether or not, a given partially ordered set is a lattice.	Discussion and illustration on Mathematica
Weeks 11	Finding the following for a given Boolean polynomial function: i. Representation of Boolean polynomial function and finding its value when the Boolean variables in it take particular values over the Boolean algebra {0,1}. ii. Display in table form of all possible values of Boolean polynomial function over the Boolean algebra {0,1}.	Discussion and illustration on Mathematica
Weeks 12	Finding the following: i. Dual of a given Boolean polynomial/expression. ii. Whether or not two given Boolean polynomials are equivalent. iii. Disjunctive normal form (Conjunctive normal form) from a given Boolean expression. iv. Disjunctive normal form (Conjunctive normal form) when the given Boolean polynomial function is expressed by a table of value	Discussion and illustration on Mathematica
Week 13	Representing a given circuit diagram (expressed using gates) in the form of Boolean expression. 9) Minimizing a given Boolean expression to find minimal expressions	Discussion and illustration on Mathematica
Week 14 & 15	Practice sessions and test	

Reference Books:

1. Davey, B. A., & Priestley, H. A. (2002). Introduction to Lattices and Order (2nd ed.). Cambridge University press, Cambridge.
2. Goodaire, Edgar G., & Parmenter, Michael M. (2006). Discrete Mathematics with Graph Theory (3rd ed.). Pearson Education Pvt. Ltd. Indian Reprint.
3. Lidl, Rudolf & Pilz, Gunter. (2004). Applied Abstract Algebra (2nd ed.), Undergraduate Texts in Mathematics. Springer (SIE). Indian Reprint

Additional Readings:

1. Donnellan, Thomas. (1999). Lattice Theory (1st ed.). Khosla Pub. House. Indian Reprint.
2. Rosen, Kenneth H. (2019). Discrete Mathematics and its Applications (8th ed.), Indian adaptation by Kamala Krithivasan. McGraw-Hill Education. Indian Reprint 2021.

Assessment Activity Schedule: The assessment will be conducted during the course, preferably after the completion of each unit. Weeks 1-5, weeks 6-10 and weeks 11-15 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.