

**DSE Courses of B.A. (Prog.) Semester-VIII**  
**Category-II**

**DISCIPLINE SPECIFIC ELECTIVE COURSE – 4(i): APPLIED ALGEBRA**

**CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE**

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Applied Algebra	4	3	1	0	Class XII pass with Mathematics	Linear Algebra, Abstract Algebra

**Learning Objectives:** The primary objective of this course is to:

- Introduce the applications of linear algebra in the field of science and arts.
- Develop the analytical and numerical skills to apply the algebraic concepts in real-life situations.
- Understand the identification numbers and different check digit schemes that can be used to reduce the errors during their transmission.

**Learning Outcomes:** This course will enable the students to:

- Understand the system of linear equations, matrices and transformations in the fields of economics, science, engineering and computer science.
- Apply the combinatorics and graph theory in scheduling and reliability theory.
- Learn about identification numbers and using check digits to check for errors after the identification number has been transmitted.

**SYLLABUS OF DSE-4(i)**

**UNIT-I: Applications of Linear Algebra (15 hours)**

Applications of linear systems: Leontief input-output model in economics, Traffic flow, and diet problem; Applications to computer graphics, difference equations and Markov chains; Applications to linear models: Least-squares problems, and least-squares lines.

**UNIT-II: Latin Squares and Graph Models (12 hours)**

Latin squares, Table for a finite group as a Latin square, Latin squares as in design of experiments; Mathematical models for matching jobs, Spelling checker, Network reliability, Street surveillance, Scheduling meetings, Interval graph modeling and Influence model, Pitcher pouring puzzle.

**UNIT-III: Various Check Digit Schemes (18 hours)**

Developing identification numbers, Types of identification numbers, Transmission errors, Check digits, Integer division, Modular arithmetic, US postal money orders, Airline ticket identification numbers, The Universal Product Code check digit scheme, ISBN check digit

scheme, Creating Identification numbers, IBM scheme, Symmetry, Symmetry and Rigid motions, Verhoeff check digit scheme.

### Essential Readings

1. David C. Lay, Steven R. Lay and Judi J. McDonald (2016). Linear Algebra and Its Applications (5th ed.). Pearson.
2. Tucker, Alan (2012). Applied Combinatorics (6th ed.). John Wiley & Sons, Inc.
3. Kirtland, Joseph (2001). Identification Numbers and Check Digit Schemes. Mathematical Association of America.

### Suggestive Readings

- Andirilli, Stephen and Hecker, David (2016). Elementary Linear Algebra (5th ed.). Academic Press, Elsevier.
- Lidl, Rudolf and Pilz, Günter (1998). Applied Abstract Algebra (2nd ed.). Springer. Indian Reprint 2014.
- Strang, Gilbert (2016). Introduction to Linear Algebra (5th ed.). Wellesley-Cambridge.

## DISCIPLINE SPECIFIC ELECTIVE COURSE-4(ii): ELEMENTS OF PARTIAL DIFFERENTIAL EQUATIONS

### CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Elements of Partial Differential Equations	4	3	1	0	Class XII pass with Mathematics	Differential Equations

**Learning Objectives:** The main objective of this course is to introduce:

- Basic concepts of first and second-order linear/nonlinear partial differential equations.
- Methods to solve first-order nonlinear PDEs and determine integral surfaces.
- Linear PDEs with constant coefficients, and finding their solutions using complimentary functions and particular integral.
- Modeling of wave equation, diffusion equation, traffic flow and their solutions.

**Learning Outcomes:** The course will enable the students to learn:

- Charpit's and Jacobi's methods to solve first-order nonlinear partial differential equations in two and three independent variables, respectively.
- Monge's method for integrating PDE of type  $Rr + Ss + Tt = V$ .
- The Cauchy problem and solutions of one-dimensional wave equations with initial boundary-value problems, and vibration of finite string with fixed ends.
- The macroscopic modeling of the traffic flow, where the focus will be on modeling the density of cars and their flow, rather than modeling individual cars and their velocity.