Course Title: Algebra **Full marks:** 60
Course number: Math. Ed. 485 (Minor) **Pass marks:** 30
Nature of course: Theory **Credit Hour:** 3
Level: B.Ed. **Total Period:** 48
Semester: Fourth

1. Course Description

This course is designed for prospective secondary level ICT teachers to provide a deeper and broader understanding of modern algebra. This course deals with axiomatic foundation for further study of mathematics consisting abstract algebra and linear algebra. The abstract algebraic structures deals in this course are groups, rings and fields. Moreover, the linear algebra consist matrices and determinants, vector spaces and linear transformation.

2. General Objectives

The general objectives of this course are as follows:

- To make the students familiar with group theory, group homomorphism, isomorphism theorems, ring theory, field, matrices and determinants, vector spaces and linear transformation.
- To develop capabilities among the students in proving theorems and problem solving techniques in algebra.
- To help them in developing positive attitude towards modern algebra.

3. Specific Objectives and Contents

S. N.	Specific Objectives	Contents
1	• To define various type of matrices. • Discuss operation of matrices. • Find the determinant of square matrices & state and apply the properties of determinants. • Find inverse of square matrix. • Find the rank of matrix. • Solve the system of linear equations of two or three variables by matrix method and Cramer's rule.	Unit I: Matrices and Determinants (8) 1.1 Definition of matrices, 1.2 Some Basic Matrices 1.3 Algebra of Matrices 1.4 Determinants and its properties 1.5 Inverse matrix 1.6 Rank of matrix 1.7 System of Linear Equations

	• Test the consistency of system of linear equations	
2	• Define binary operation and explain algebraic structure. • Construct Cayley's table for operation on a set. • Prove the properties of binary operation. • Decompose a set into equivalence classes. • Discuss the congruence modulo with example. • Define groups and give example of groups. • Verify the laws of exponents in the product of integral power of elements of group. • Define cyclic group and permutation group with examples • Define subgroups, cosets of subgroup, normal subgroups and quotient group with examples. • Prove Lagrange's theorem. • Prove the properties of subgroup and normal subgroup and quotient group.	Unit II: Group Theory (12) 2.1 Algebraic system, Binary operation and its properties 2.2 Cayley's tables 2.3 Equivalence relation, congruence modulo 2.4 Group and its properties 2.5 Integral power of elements of a group 2.6 Cyclic groups and permutation group 2.7 Elementary properties of groups, cyclic groups and permutation group 2.8 Subgroup and its properties 2.9 Cosets of a sub-group 2.10 Lagrange's theorem 2.11 Normal subgroups 2.12 Quotient group
3	• Define homomorphism and prove the simple properties of homomorphism. • Define isomorphism, endomorphism and automorphism. • Prove isomorphism theorems •	Unit III: Group Homomorphism (5) 3.1 Homomorphisms, Endomorphism, Automorphism and Isomorphism 3.2 Isomorphism theorems: fundamental theorem, diamond and quotient isomorphism theorems, correspondence theorem
4	• Define and explain rings and give examples of rings • Discuss the special types rings with suitable examples • Prove the properties of rings	Unit IV: Ring Theory (8) 4.1 Definition of Rings and its special classes with examples 4.2 Elementary properties of Rings 4.3 Subrings, Ideals and Quotient rings with

	• Define subrings, ideals, quotient rings and homomorphism of rings • Prove the properties of subrings, ideals and homomorphism. • Define ID, PID, ED and UFD with examples.	their properties 4.4 Homomorphism of Rings 4. 5 Integral Domain (ID), Principal Ideal Domain (PID), Euclidean Domain (ED), Unique Factorization Domain (UFD)
5	• Define vector spaces and subspaces with suitable examples. • Explain and prove some properties of vector spaces and subspaces. • Define linear independence and dependence and give their suitable examples. • Define basis and dimension of vector space with example.	Unit V: Vector Spaces (5) 5.1 Definition and examples of vector spaces 5.2 Subspaces 5.3 Linear combination: linear independence and linear dependence 5.4 Basis and dimension of a vector space
6	• Define linear transformation and give examples of linear transformations. • State and prove the properties of linear transformation. • Define kernel and image of linear transformation and prove the related properties. • Explain and prove the algebraic properties of linear transformation. • Find the eigen values and eigen vectors of the matrix	Unit VI: Linear Transformation (5) 6.1 Definition and examples of linear transformations 6.2 Kernel and image of linear transformation 6.3 Algebra of linear transformation 6.4 Matrix representation of linear transformation 6.5 Eigen values and Eigen vectors
7	• Define field, subfield and prime field with suitable examples. • Define the extension of fields and degree of field extension with examples • Prove the theorems of extension of field.	Unit VII: Field Theory (5) 7.1 Introduction 7.2 Subfield 7.3 Prime field 7.4 Field extension and degree of field extension 7.5 Algebraic and transcendental elements

	• Define algebraic and transcendental elements with examples	

4. Instructional Strategies

Because of theoretical nature of course, the student centered approach will be used in teaching learning process. As teachers are free to follow the methods suitable for them and the students, they may adopt the following teaching learning strategies.

4.1 General Instructional Techniques

Lecture and illustration
Discussion
Demonstration

4.2 Specific Instructional Techniques

Inquiry and question answer
Individual and group work, project work
Classroom presentation

5. Evaluation

5.1 Internal Evaluation **40%**

Internal evaluation will be conducted by subject teacher based on the following aspects:

Attendance	4 marks
Participation in learning activities	6 marks
First assignment	10 marks
Second assignment	10 marks
Third assignment	10 marks
Total	40 marks

5.2 External Evaluation **(60%)**

The examination section Dean Office, Faculty of Education will conduct final examination at the end of the fourth semester .The type of questions and marks allocated for each question will be as follows :

Types of questions	**Total questions**	**Number of questions & their marks**	**Total marks**
Group A: Multiple choice questions	10 questions	1 marks × 10	10
Group B: Short answer questions	6 questions with two OR	5 marks × 6	30
Group C: Long answer question	2 questions with one OR	10 marks × 2	20

6. Recommended Books

7. References

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Bhattarai, B.N. (2019). *A Text book on Linear Algebra and Vector Analysis* (Revised Edition) Kathmandu: Cambridge Publication Pvt. Ltd.

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Shrestha, R. M. and Bajracharya, S. (2066). Elementary linear algebra (Revised ed.). Kathmandu: Sukunda Pustak Bhawan.

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