Course Title: Mathematics II **Nature of Course: Theory**

Level: BICTE **Teaching Hours: 48**

Code Number: Math Ed. 426 **Full Marks: 100**

Semester: Second **Credit Hours: 3**

1. Course Introduction

The course Math II is an integrated course of different branches of mathematics for the students at bachelor's degree students of Information and Communication Technology (BICTE). This course deals the different concepts of mathematics which are applicable in the study of information and communication technology. The course comprised six units from different areas of mathematics. Complex numbers, calculus, basics of number theory, analytic geometry, fundamental concepts of graph theory and algebra are six chapters. These chapters are primarily designed to provide the foundational concepts of mathematics which are crucial in the field of study.

2. General Objectives

The general objectives of this course are as follows:

- To visualize the concept of complex numbers and their properties.
- To familiarize the concept of limit, continuity, derivative and integration.
- To introduce the concept of numbers and number theory.
- To explain the concept of coordinates in plane and space.
- To visualize the concept and graph theory and connect this concept with technology.
- To familiarize the basic concept of group and ring theories.

3. Specific Objectives and Contents

Specific objectives to each unit and corresponding contents are described below:

• Define complex number and visualize the complex number in Argand diagram. • Find the conjugate and absolute value of complex number • Find the square roots of complex number • Explain the relation of sets and subsets • Convert the complex number from cartesian form to polar and exponential form and vice-versa. • Find the nth roots of given complex numbers using DeMoivre's Theorem.	**Unit I Complex Number [6]** 1.1 Definition of complex number and Geometrical representation. 1.2 Conjugate and absolute value of complex number 1.3 Square roots of complex number 1.4 Polar and Exponential forms of complex numbers 1.5 n^{th} roots of complex numbers using DeMoivre's Theorem
• Define limit of the function using the $\varepsilon - \delta$. • Discuss the existence of limit of function. • Test the continuity of the function. • Discuss the types of discontinuity of the function • Define derivative with example • Derive the formula to find the derivatives of the function using definition • Find the derivatives of functions • Define extreme values of a function • Find the maxima and minima of function • Differentiate the definite and indefinite integrals • Evaluate standard indefinite integrals • Define the fundamental theorem of calculus. • Evaluate the area of plane regions using definite integrals.	**Unit II: Fundamentals of Calculus [12]** **2.1 Limits and continuity of a function** 2.1.1 $\varepsilon - \delta$ definition of limit and continuity. 2.1.2 Evaluate the limit of the function 2.1.3 Continuity of the function **2.2 Derivatives of function** 2.2.1 Definition and Geometrical interpretation 2.2.2 Derivatives of the functions (Algebraic only) 2.2.3 Maxima and minima of functions **2.3 Indefinite and Definite Integral** 2.3.1 Meanings of Integrals 2.3.2 Some Standard Integrals 2.3.3 Meaning of $\int_a^b f(x)dx$ 2.3.4 Problems on finding definite integral 2.3.5 Area of plane regions

3. Discuss the odd, even and divisibility relationship of number 4. Derive the divisibility rule for positive integers 5. Define division algorithm 6. Solve the problems related to division algorithm 7. Discuss the properties of GCD and solve the problems related to GCD 8. Discuss the different forms of Euclidean Algorithm 9. Execute the operations on different base number system. 10. Discuss the concept of modular arithmetic.	**Unit III Basics of Number Theory [6]** 3.1 Odd, Even and Divisibility Relationships 3.2 The Divisibility Rules 3.3 The Division Algorithm 3.4 The Greatest Common Divisor (GCD) and Euclidean Algorithm 3.5 Different Base Number System 3.6 Modular Arithmetic
• Derive the equation of straight line in different form • Find the length of perpendicular distance from any point to a straight line • Derive the angle between two lines • Define a concept of coordinate of a point in a space • Solve the problems involving dcs., drs., and projection • Derive the equation of planes • Find the angle between two points • Derive the equation of plane passing through any three points	**Unit IV Analytic Geometry [8]** **4.1 Straight Lines** 4.1.1 Equation of straight lines 4.1.2 Perpendicular distance of a line 4.1.3 Angle between lines **4.2 Conic Section [Definitions and equations on Standard forms with examples]** 4.2.1 Circle 4.2.2 Parabola 4.2.3 Ellipse 4.2.4 Hyperbola **4.3 Coordinate in space** 4.3.1 Coordinates of a point in space 4.3.2 Distance between two points 4.3.3 Directions Cosines and Ratios 4.3.4 Projection

• Discuss the concept of graph and different types of graphs • Define walks, paths and cycles of graphs with example • Find the vertex and edge of graphs • Define and solve the problems related to Eulerian and Hamiltonian graphs • Discuss the concepts of trees and forest with illustrative example.	**Unit V: Fundamental Concepts of Graph Theory [6]** 5.1 Introduction of graph 5.2 Different types of Graphs 5.3 Vertex and edges of graphs 5.4 Walks, paths and cycles of Graphs 5.5 Eulerian and Hamiltonian graphs concept and examples only 5.6 Trees and Forest concept with examples.
• Define binary operation with examples • Discuss the properties of algebraic structure with examples • Define group with example and non-example • Discuss the properties of group • Define sub-group, cyclic group and permutation group with examples. • Define ring with examples. • Explain the concept of subring, ideal and quotient rings with examples • Derive the relation between integral domain and field	**Unit VI: Algebra [10]** **6.1 Group Theory** 6.1.1 Binary operation 6.1.2 Algebraic Structure and its properties 6.1.3 Group and its properties 6.1.4 Sub-groups, Cyclic groups and Permutation groups **6.2 Ring and Field** 6.2.1 Definition of rings and its properties 6.2.2 Subring definition with examples. 6.2.3 Field definition and examples.

4. Instructional Techniques

4.1 General Instructional Techniques: There are various techniques of teaching and learning so as to grasp the knowledge of mathematics. Although the methods of teaching and learning may differ, the techniques to be used are lecture, discussion, problem solving, inquiry, question answer, demonstration, collaborative teaching approach and problem-solving method.

4.2 Specific Instructional Techniques

The specific teaching and learning techniques (unit - wise) are listed below:

Units	Activities and Instructional Techniques	Teaching Hours (48)
I	Discussion and presentation	6
II	Problems solving and Project work in group and group presentation.	5
III	Problem solving and discussion	7
IV	Question answer and discussion in group	6
V	Assignment and Group discussion	10
VI	Project work in group and individual and problem solving	9
VII	Discussion and Questions answer	5

5. Evaluation

5.1 Internal Evaluation: (40%)

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

- Attendance 5 marks
- Participation in learning activities 5 marks
- First assignment 10 marks
- Second assignment 10 marks
- Third assignment 10 marks

Total 40 marks

5.2 External Evaluation (60%)

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

- Objective questions (multiple choice) 10 x 1 mark = 10 marks
- Short answer questions (with two or) 6 x 5 marks = 30 marks
- Long answer questions (with 1 or) 2 x 10 marks = 20 marks

Total = 60 marks

6. Reference Books

Burton, D.M. (2011). *Elementary number theory*. The McGraw-Hill Companies, Inc. (Chapter III)

Bhattarai, B.N. (2017). *A Text book on Modern Algebra*. Kathmandu: Cambridge Publication Pvt. Ltd.

Goyal, J. K & Gupta, K. P. (2006). *Advance course in modern algebra (11th ed.).* Meerut: Pragati Prakashan Educational Publisher.

Mittal P. K. (2007). *Analytical geometry*, Delhi: Vrinda Publication (P)LTD.

Maskey, S. M. (2002). *First Course in Graph Theory*. Kathmandu: Ratna Pustak Bhandar.

Bell, H.F. (1978). *Teaching and learning mathematics*. WMC Brown Company.

Das, B. C. & Mukharjee, B. (1984). *Differential Calculus*. Calcutta: U N Dhur and Sons Pvt Ltd.

Sharma, J. N. (1991). *Functions of a complex variable*. Krishna Prakashan Media.