Mid-West University
Faculty of Education
Surkhet, Karnali, Nepal

Bachelor of Education (B.Ed.)
(Four Years Program)

MATHEMATICS EDUCATION
Curriculum, 2021

BED in Mathematics

Bachelor in Education [BEd] is a four-year undergraduate program of Mid-Western Program. Mathematics is one of the areas of specialization of the program. Specialization in Mathematics in BES has mainly concern with the area of school mathematics. The main role of the graduates after achieving the degree is to work as teacher of Mathematics. The program aims to play lead role in mathematics instruction, curriculum development, exploring and widening the art of teaching, using different materials effectively for quality of school mathematics instruction.

Objectives of BED in Mathematics

A good mathematics teacher requires good command of mathematics as well as skills in generating and reflecting to own teachering. Creating and developing teachers to teach quality of school mathematics is the main motto the program. The main objectives of the program are given below.

a) To develop mathematical knowledge in teachers so that they can use the logic of higher mathematics in order to teach school mathematics.
b) To develop pedagogy for teaching/facilitating mathematics for effective instruction.
c) To use content based strategies in order to facilitate for quality of mathematics learning.
d) To develop different tools: work sheets, projects, cases, etc for teaching and learning process.
e) To apply strategies for future teacher's professional development especially focused on action research.
f) To develop and apply different tools suitable in assessment of/for learning.

Semesters Wise Courses

The four years BEd program is divided into eight semesters. There are two categories of courses common and specialization. The common courses are to be taken by all the students whatever they opt for the specialization. The specialization courses are to be taken by the students who desired to specialize in Mathematics. The following tablet shows eight semesters course list with credit hours.

Semester-wise Breakdown

Semester I	Semester II
1. COMP 411: English Language Proficiency I **2. COMP 412: Compulsory Nepali I** **3. EDU 413: Socio-Philosophical Foundations of Education** 4. MATH 414: Calculus for Teachers 5. MATH 415: Number Theories for Teachers	**6. COMP 421: English Language Proficiency II** **7. COMP: 422: Readings in Nepali Language** **8. EDU: 423: Emerging Theories of learning** 9. MATH 424:Matrix Algebra 10. MATH 425: Geometry for Teachers
Semester III	**Semester IV**
11. EDU 431: Educational Development in Nepal **12. EDU 432: Curriculum and Assessment** 13. MATH 433:Algebra for Teachers 14. MATH 434:Discrete Mathematics 15. MATH 435:Graph Theory	**16. EDU 441: Social Justice and Education** **17. EDU 442: Fundamentals of Research in Education** 18. MATH 443:Trigonometry for Teachers 19. MATH 444:Vector Analysis for Teachers 20. MATH 445: Logic for Teachers
Semester V	**Semester VI**
21. MATH 451: Fundamentals of Real Analysis 22. MATH 452: Analytical Solid Geometry 23. MATH 453: Basic Abstract Algebra 24. MATH 454: Projective Geometry 25. MATH 455: Mathematical Programs	26. MATH 461: Data Modeling 27. MATH 462: Principles of Real Analysis 28. MATH 463: Multi-variables Calculus 29. MATH 464: Differential Equation 30. MATH 465: Inferential Statistics
Semester VII	**Semester VIII**
31. MATH 471: Mathematical Modeling 32. MATH 472: Basics of Cryptography 33. MATH 473: Basic Topology 34. MATH 474: Operation Research 35. MATH 475: Theory of Mathematics Instruction	36. MATH 481: Action Research in Teaching Mathematics 37. MATH 482: Teaching Materials Development 38. MATH 483: Instructional Design in Mathematics 39. MATH 484: Student Teaching: on-campus 40. MATH 485: Student Teaching: off-campus

Semester I

Course Title: **Calculus for Teachers**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 414 Full Marks:
Level/Semester: B.Ed./First Pass Marks:

Introduction

This course is intended to explore basic skills of differentiation and integration including ε-δ approach to compute limit, continuity and derivatives. Proof of theorems of limits, continuing, derivatives and integrative and applying these rules in problem solving is the main essence of the course.

Objectives

By the end of the course, students are expected to demonstrate the following objectives.

a) To prove theorems of limits and apply in problem solving of limits including L' Hopital's rule.
b) To explain nature of curve by tangent and normal and solve related problems.
c) To state and prove Roll's theorem, Intermediate value theorem, Lagrange's mean value theorem, etc in order to enhance about the relation among limit, continuity and differentiability.
d) To use the concepts of continuity and differentiability of functions of several variables; partial differentiation and an appreciation of the difference between partial and ordinary differentiation in calculating.

Contents

Unit 1 Basic Concepts [5]

- Functions and their graphs
- Calculation of limits
- Continuity
- Discontinuity
- Test of continuity
- Properties of continuous function

Unit 2 Tangent and Normal [7]

- Tangent and normal of functions
- Calculation of sub-tangent and subnormal and their lengths
- Derivatives of arc length
- Polar equations of sub-tangent and subnormal
- Angle between radius vector and tangent
- Length of perpendicular from pole on tangent
- Pedal equation and angle between two curve

Unit 3 Higher order derivatives and Mean Value Theorem [10]

- Higher order derivatives
- Theorems with proof and their application
    - Rolle's theorem
    - Langrange's theorem
    - Cauchy Mean Value theorem
    - Maclaurin's theorem
    - Taylor's theorem.

Unit 4 Application of Derivatives [10]

- Indeterminate forms
- L' Hospital's rule
- Asymptotes
    - Classification
    - Asymptotes of algebraic curves,
- Rules of tracing curves
    - Standard curves and their tracing
    - Curvature and chord of curvature
    - Center and circle of curvature.

Unit 5 Partial derivatives and their use in optimization [8]

- Basic concepts of limits and continuity of functions (two and three variables)
- Partial derivatives and their geometrical interpretation
- Higher order partial derivatives
- Homogeneous functions
- Euler's theorems (two and three variables)
- Total differentials

Unit 6 Maximina and minimia of functions for two and three variables.

Instructional Techniques

- Class discussion
- Presentation
- Group work/pair work
- Project work
- Self-study

Evaluation Scheme

Internal – 40%
External – 60%

Internal evaluation will be based on the following criteria:

- Attendance and class Presentation 5%
- Project Work/Assignment/Essay I 10%
- Project Work/Assignment/Essay II 10%
- Mid-term Exam/Project 15%

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

References

Maskey, S. M. (2008). *Calculus*. Kathamandu: Ratna Pustak
Singh, R. & Bhatta M. (2010). *Engineering mathematics*. New Delhi, India:Tata McGraw Hill
Ramana, B.V. (2007). *Higher Engineering Mathematics.* New Delhi, India:Tata McGraw Hill

Course Title: **Number Thoeries for Teachers**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 415 Full Marks:
Level/Semester: B.Ed./First Pass Marks:

Introduction

Basic endeavor of human beings is counting and counting is based on the numbers. The use of numbers is basic for us. It is basic not only in day to day endeavor but also academic endeavor of mathematics teachers. The use of theory and practice of numbers is considered as the heart of developing thinking and learning skills as a tool and process. This course number theory not only serves as a pedagogical tool for teachers to teach mathematics but also helps to pursue algebra as pre-algebraic course.

Course Objectives

After completing the course, students are expected to achieve the following learning objectives.

a) To use continued fractions to develop arbitrarily accurate rational approximations to rational and irrational numbers.
b) To work with Diophantine equations, i.e. polynomial equations with integer solutions.
c) To validate and apply famous classical theorems and conjectures in number theory, such as Fermat's Last Theorem and Goldbach's Conjecture, and be aware of some of the tools used to investigate such problems.
d) To develop pedagogy for teaching different types of numbers, numbers patterns, numerical examples, models, etc in schools.

Course Contents

Unit 1 Algebraic numbers [3]

- Algebraic numbers and algebraic integers
- Quadratic irrationals
- Sums, products and quotients

Unit 2 Finite, Infinite, Periodic and Continued Fractions [4]

- Finite Continue Fraction
- The [ ] functions
- The convergent of a finite continued fraction
- Infinite continued fractions
- An example of infinite continued fraction
- The definition of infinite continued fraction
- Approximation by convergent
- Order of approximation
- Periodic and purely periodic continued fractions,
- Quadratic irrationals
- The main theorem.

Unit 3 Lagrange and Pell [3]

- Introduction
- The continued fraction for $\sqrt{n}$
- Sums of two squares
- The equations $x^2-ny^2 = \pm 1$

Unit 4 Divisibility [5]

- Review of Different types of numbers
- Division algorithm in **Z.**
- Greatest Common Divisor (GCD)
- Existence and Uniqueness of GCD
- Euclidean Algorithm
- Least Common Multiple (LCM)
- Relation of GCD and LCM

Unit 5 Diophantine Equation [3]

- Linear Diophantine equation ax + by = c
- Solve the Diophantine equation by different methods

Unit 6 Prime and Their Distribution [5]

- Fundamental theorem of arithmetic
- Canonical decomposition
- Sieve of Erastosthenes
- Euclid's theorem about prime
- Goldbach's Conjecture
- Infiniteness of primes
- Developing teaching modules in distribution of primes

Unit 7 The Theory of Congruence and Special Divisibility Test **[6]**

- Properties of congruence
- Complete set of residue in modulo n
- Base b representation
- Divisibility Test of 2 to 13 and 25
- Developing teaching module on divisibility test.

Unit 8 Linear Congruence **[5]**

- Test for solution of linear congruence $ax \equiv b \pmod{n}$
- Chinese Remainder theorem
- Solution of System of linear congruence

Unit 9 Wilson and Format Theorem **[6]**

- Wilson theorem and converse
- Quadratic congruence
- Format's factorization method
- Format's Little Theorem
- Pseudoprime and its properties

Unit 10 Euler's Theorem **[5]**

- Number-theoretic functions
- Euler's theorem
- Order, primitive root and index
- Quadratic congruence: residue and non-residue
- The Legendre Symbol and its properties
- Gauss' Lemma

Instructional Techniques

- Class discussion
- Presentation
- Group work/pair work
- Project work
- Self-study

Evaluation Scheme

Internal – 40%

External – 60%

Internal evaluation will be based on the following criteria:

- Attendance and class Presentation 5%
- Project Work/Assignment/Essay I 10%
- Project Work/Assignment/Essay II 10%
- Mid-term Exam/Project 15%

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

Text Books

1. Burton, D.M. (2000), *Elementary Number Theory*. Universal Book stall, New Delhi, India.
2. Pokhrel, T. R. (2005). *A fundamental of number theory with application*. Sunlight publication. Kathmandu. (for units 4 to 11)
3. A compendium will be developed for developing teaching modules of related units of school mathematics for units 1 to 3

References

1. Dickson, L.E., (1597). *Introduction to the theory of numbers*, Dover Edition, Dover Publications. Ine. New York.
2. Eves, H.W. (1996). *An Introduction to the History of Mathematics*, Fifth Edition, Holt, Rinehart and Winston, USA.
3. Koshy, T. (2005), *Elementry Number Theory with Application*. Academic press, An Imprint of Elsevier, san Diego, California.
4. Niven, Ivan, Zukerman, H.B. (2004), *An Introduction to the Theory of Numbers*, Fifth Ediction, Willey Easten Ltd, New Delhi, India.
5. Vasista, A.K. and Vasista A.R. (2002), *Modern Algebra*, Forty First Edition, Krishna Prakashan Media (P) Ltd. Meerut, India.
6. Wisner, R.J. (1970), *A Panorama of Numbers*, Scott, Fores man and company, USA.

Semester II

Course Title: **Matrix Algebra**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 424 Full Marks:
Level/Semester: B.Ed./Second Pass Marks:

Introduction

The main essence of the course is to understand properties of matrices and expand its horizon into different area. The construction of vector space associated with matrix and vice-versa is the center of the course. The evaluation of eigen-value and eigen-vector of a matrix is also done in the course. The importance of linearity in many areas of mathematics ranging from linear algebra through geometric applications to linear operators and special functions are expressed through the course.

Course Objectives

By the end of the course students are expected to achieve the following objectives.

- to familiar with the basics of linear algebra;
- to know the Gram-Schmidt orthogonalization and orthonormalization processes;
- to use different properties of matrices and determinant in solving different problems.
- to transform matrices in order to realize different forms of matrices.
- to calculate eigen-value and eigen-vector of a given matrix.

Course Contents

The following contents are kept in the course.

Unit 1 Matrix Algebra [6]

- Definition of a Matrix
- Operation on Matrices
- Symmetric
- Hermitian and Triangular Matrices
- Powers and trace of square Matrix
- Differentiation and integration of matrix
- Field and matrix over an arbitrary field

Unit 2 Determinants [3]

- Permutation and Inversion
- Determinant, Cofactor and minor
- Properties of determinants
- Evaluation of determinants

Unit 3 Inverses of a Matrix [3]

- Singular Matrix
- Adjoint and Inverse of a Matrix
- Important properties of Matrix Inversion
- Inverse of a matrix by partitioning

Unit 4 Rank and Equivalence [6]

- Submatrix and its rank
- Elementary transformations
- Equivalence and Normal form
- Inverse by step by step Reduction of [A; I],
- Inverse from elementary matrices

- Row equivalent and Column-equivalent canonical form
- Properties of rank, right inverse and left inverse of a matrix.

Unit 5 Vector space [9]

- Vector Space
- Linear dependent
- Basis and dimension
- Vector spaces as a direct sum of subspace
- Inner product spaces
- Orthonormal basis
- Gram-schmidt process of orthogonalization
- Linear combinations and subspaces spanned by a set of vectors
- Finite dimensional spaces

Unit 6 Linear Transformation and Matrices [9]

- Linear transformation
- Properties of linear transformation
- Matrix of a linear transformation
- Matrix of an identity and a zero transformation
- Matrix of the sum of two linear transformations and a scalar multiple of a linear transformation
- Matrix of an inverse transformation
- Matrix of an inverse transformation
- Change of basis
- Orthogonal and unitary transformations
- Linear functional-dual space
- Bi-dual space
- Adjoint of a linear transformation.

Unit 7 Eigenvalues, Eigenvectors and the Characteristic Equation [9]

- Eignevalues and eigenvectors of a linear transformation
- Properties of eigenvectors associated with distinct eigenvalue
- Matrix polynomial and lambda matrix
- Characteristic polynomial
- Annihilating polynomial and minimum polynomial
- Cayley – Hamilton theorem
- Minimum polynomial for a linear transformation
- Newton's formulae
- Method of Leverrier and Faddeev's algorithm
- Multiplicities of eigenvalues,
- Eignvalue problem for Hermitian matrices
- Congruent matrices

Instructional Techniques

- Class discussion
- Presentation
- Group work/pair work
- Project work
- Self-study

Evaluation Scheme

Internal – 40%

External – 60%

Internal evaluation will be based on the following criteria:

- Attendance and class Presentation 5%
- Project Work/Assignment/Essay I 10%
- Project Work/Assignment/Essay II 10%
- Mid-term Exam/Project 15%

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

References

1) DeFrantz,J.& Gagliardi D.(2008).*Introduction to linear Algebra.* New Delhi, India:Tata McGraw Hill
2) Lipschutz s.(2000). *Linear Algebra.* New Delhi, India:Tata McGraw Hill
3) Chakrabarti A. (2010)*A first course in linear algebra.* New Delhi, India:Tata McGraw Hill
4) Datta, K.B. (2002).*Matrix and linear algebra*.Newdelhi, India: Prentice-Hall

Course Title: **Geometry for Teachers**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 425 Full Marks:
Level/Semester: B.Ed./Second Pass Marks:

Introduction

There are two considerations for preparing to teach geometry at high school in teacher education program namely learn considerably more geometry than it covered in high school and acquire notion of modern geometric structures. The goal of this course is to provide a geometric experience that clarifies, extends, and unifies concepts that are generally discussed in traditional high school geometry courses and to present additional topics which assist in gaining a better understanding of elementary geometry. The intention of the main text is to use a metaphoric approach to understand geometry. The metaphoric pedagogy can also be explored through different projects.

General Objectives

a) To prepare the "Rules of the Road" with the properties of axiomatic systems and the application of the axiomatic method to investigation of these systems.
b) To generate idea about "Many Ways to Go." within a historical perspective, through plane geometry by investigating different axiomatic approaches to the study of Euclidean plane geometry.
c) To develop the notion of "Traveling Together," to investigate the content of Neutral Geometry.
d) To develop skills to move towards "One Way to Go" as a traveler through Euclidean Plane Geometry.
e) To develop the competency of having a "Side Trips" through analytical and transformational approaches to geometry.
f) To seek alternative in geometric tour as "Other Ways to Go" non-Euclidean Geometry.
g) To explore different pedagogic approaches in teaching geometry at high school.

Course Contents

Unit 1 Rules of the Road: Axiomatic Systems [6]

- Historical Background
- Axiomatic Systems and their Properties
- Finite Geometries
- Axioms for Incidence Geometry.

Unit 2 Many Ways to Go [6]

- Euclid's Geometry and Euclid's *Elements*
- An Introduction to Modern Euclidean Geometries
- Hilbert's Model for Euclidean Geometry
- Birkhoff's Model for Euclidean Geometry
- SMSG Postulates for Euclidean Geometry
- Non-Euclidean Geometries.

Unit 3 Traveling Together (Neutral Geometry) [6]

- Preliminary Notions
- Congruence Conditions
- The Place of Parallels
- The Saccheri-Legendre Theorem

- The Search for a Rectangle.

Unit 4 One Way to Go (Euclidean Geometry of the Plane) [6]

- The Parallel Postulate and Some Implications
- Congruence and Area
- Similarity
- Euclidean Results Concerning Circles
- Some Euclidean Results Concerning Triangles
- More Euclidean Results Concerning Triangles
- The Nine-Point Circle
- Euclidean Constructions

Unit 5 Side Trips (Analytic and Transformational Geometry) [9]

- Analytic Geometry
- Transformational Geometry
- Analytic Transformations
- Inversion

Unit 6. Other Ways to Go (Non-Euclidean Geometries) [12]

- A Return to Neutral Geometry: The Angle of Parallelism
- The Hyperbolic Parallel Postulate
- Hyperbolic Results Concerning Polygons
- Area in Hyperbolic Geometry
- Showing Consistency: A Model for Hyperbolic Geometry
- Classifying Theorems.
- Elliptic Geometry: A Geometry with No Parallels? Geometry in the Real World

Instructional Techniques

- Class discussion
- Presentation
- Group work/pair work
- Project work
- Self-study

Evaluation Scheme

Internal – 40%
External – 60%

Internal evaluation will be based on the following criteria:

- Attendance and class Presentation 5%
- Project Work/Assignment/Essay I 10%
- Project Work/Assignment/Essay II 10%
- Mid-term Exam/Project 15%

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

References

a) E.C. Wallace S.F. West June (2003). *Roads to geometry*. Pearson
b) Eves, H. (1995). *College geometry*. Narosa
c) A compendium for teaching geometry will be developed.

Semester III

Course Title: **Algebra for Teachers**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 433 Full Marks:
Level/Semester: B.Ed./Third Pass Marks:

Introduction

This course is designed to introduce students to the ideas, methods and techniques which are related to learning and teaching algebra. It aims to extend and enhance their skills in algebraic insight. The overall aim of the course is to introduce students to structure system: group theory, ring and field which are o the most important of the areas of abstract algebra.

Course Objectives

By the end of the course students are expected to achieve the following objectives.

- To understand basic concepts, such as groups, subgroups, homomorphisms, normal subgroups, quotient groups, conjugation, ring, subring, ideal, field, subfield, etc.
- To understand statements and proofs of the theorems and to be able to reproduce them.
- To construct original proofs of simple facts about groups.
- To use concrete examples of groups to illustrate abstract theorems and to provide counter-examples to incorrect conjectures.
- To use the above knowledge in problem solving.

Course Contents

Unit 1 Algebraic System [3]

A) Nature of Mathematics and Algebra
B) Set Theory and Logical System
C) Methods to Explore Algebraic Relations

Unit 2 Study of Relation and Function [6]

- Exploring Day to Days Relations and Function
- Emergence of Modeling functions
- Relations and Functions to Study Abstract Algebra
- Application of into different field

Unit 3 Number System [3]

- Number Theory as Bridging Pedagogy in Algebra
- Development of Algebra with Number Theory
- Some useful Number theoretic Relations

Unit 4 Algebraic System [12]

- Binary Operation and its teaching
- Properties of Binary operation
- Different Algebraic Systems
- Activities in Learning Algebraic System

Unit 5 Polynomials and Theory of Equations [12]

- Polynomial over an integral domain
- Division algorithm and division by x-c
- Zero of polynomial and Rolle's theorem
- Properties of equations
- Descartes' Rule of signs
- Relations between roots and coefficients
- Transformations of equations

- Multiple roots
- Sums of powers of roots
- Cubic and biquadratic equations
- Numerical solution of equations
- Teaching and learning activities in polynomial and theory of equation

Unit 6 Teaching of Matrices and Determinant [3]

- Matrices and its use
- Different types of matrices in our work
- Minor and cofactor
- Use of double suffix
- Symmetric and skew-symmetric determinants

Unit 7 Teaching System of equations [3]

- Equivalent systems
- Linear equations in two unknowns and line with infinity
- Linear equations in three unknowns
- Equation to a plane and plane at infinity

Unit 8 Teaching of Indices, Surds and theory of irrationals [3]

- Teaching laws of indices
- Teaching surds
- Teaching equations involving indices and surds
- Principles in equalities and inequalities

Instructional Techniques

- Class discussion
- Presentation
- Group work/pair work
- Project work
- Self-study

Evaluation Scheme

Internal – 40%
External – 60%

Internal evaluation will be based on the following criteria:

- Attendance and class Presentation 5%
- Project Work/Assignment/Essay I 10%
- Project Work/Assignment/Essay II 10%
- Mid-term Exam/Project 15%

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

References

Fraleigh, J. B. (1999). *A first course in abstract algebra* (5^{th} ed.). England: Addison-Wisley Longman, Inc.

Shrestha, R. M. & Bajracharya, S. (2001 [2059BS]). *Elementary linear algebra: Groups, Rings and Theory of equations*. Kathmandu, Nepal: Sukunda Pustak Bhawan.

Barnard, S. and Child, J. M. (….). *Higher algebra*. London: Macmillan and Co LTD

Course Title: **Discrete Mathematics**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 434 Full Marks:
Level/Semester: B.Ed./Third Pass Marks:

Introduction

In the age science and technology, recent years the discrete mathematics, finite structures, has gained great importance. This course covers a selection of topics from discrete mathematics. Fundamentals of mathematics of finite structures like counting principles, finite state machine, etc are dealt in the course.

Course Objectives

The following objectives are set for the course and you are expected to achieve these objectives after the completion of the course.

a) To prove and apply fundamental principles of counting in different area of mathematics like permutation, combination.
b) To use mathematical induction in further problems and proving related theorems.
c) To apply the recursive process in solving related problems.
d) To use the notion of relation and function in carrying algorithmic problems.
e) To demonstrate finite state machines in solving problems.
f) To establish first and second order recursive relations of linear and non-linear types.
g) To apply principles of inclusion and exclusion in developing rook polynomials.
h) To realize the use of generating function in developing partition.

Course Contents

Unit 1 Fundamental Principles of Counting [3]

- The rule of sum and product
- Permutation, combination and binomial theorem
- Combinations with repetition

Unit 2 Review on Set Theory and Logic [6]

- Set and Subsets
- Set operations and Laws of Set Theory
- Counting and Venn Diagram
- Basic Connectives and truth table
- Logical equivalence and logical implications
- The use of quantifiers

Unit 3 Properties of Integers: Mathematical Induction [3]

- The well ordering principle: Mathematical induction
- Recursive definitions

Unit 4 Relations and Functions [6]

- Cartesian Products and relations
- Functions: Plain and one-to-one
- Onto functions: Stirling Numbers of the second kind
- Special functions
- The Pigeonhole principle

- Function composition and inverse function
- Computational complexity
- Analysis of Algorithms

Unit 5 Languages: Finite State Machines [9]

- Language: The set theory of Strings
- Finite state machines
- Computer recognition: Zero-one Matrices and directed graphs
- Partial orders: Hasse diagram
- Equivalence relations and partitions
- Finite state machine: The minimization process

Unit 6 The Principle of Inclusion and Exclusion [6]

- The principle of inclusion and exclusion
- Generalizations of the principle
- Derangements: nothing is in its right place
- Rook polynomials
- Arrangements with forbidden positions

Unit 7 Generating Functions [6]

- Introductory Examples
- Definition and Examples: Calculational techniques
- Partitions of Integers
- The exponential generating functions
- The summation operator

Unit 8 Recurrence Relations [6]

- The first-order linear recurrence relation
- The second-order linear homogeneous recurrence relation with constant coefficients
- The Nonhomogeneous recurrence relation
- The method of generating functions
- A special kind of Nonlinear recurrence relation
- Divide-and-conquer algorithms

Instructional Techniques

- Class discussion
- Presentation
- Group work/pair work
- Project work
- Self-study

Evaluation Scheme

Internal – 40%
External – 60%

Internal evaluation will be based on the following criteria:

- Attendance and class Presentation 5%
- Project Work/Assignment/Essay I 10%
- Project Work/Assignment/Essay II 10%
- Mid-term Exam/Project 15%

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

References

Grimaldi, R. P. (2003). *Discrete and combinatorial mathematics*. Pearson Education.

Rosen, K. H. (2012). *Discrete mathematics and its applications* (7th ed). The McGraw-Hill Companies.

Course Title: **Graph Thoery**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 435 Full Marks:
Level/Semester: B.Ed./Third Pass Marks:

Introduction

The present education should provide student not only with ancient wisdom and historical knowledge, but also modern topics and a solid grasp of recent progress. The fundamentals of graph theory are accessible to students. The curriculum presented below includes ready-made activities that develop problem-solving skills while addressing some key ideas in graph theory through excursion and exploration. This is an elementary course on the graph theory.

Course Objectives

After the completion of the course, the respective students are expected to achieve the following objectives.

a) To classify graphs based on different modes
b) To use the role of the degree of vertex, edge, and sequence in describing the graphs
c) To distinguish isomorphic and non-isomorphic graphs
d) To use the notion of trees and bridges in solving spanning tree problems.
e) To apply different results of connectivity and traversability in different types of graphs
f) To use the concept of diagraph and planarity in embedding problems.
g) To explore the use of Ramsey number of graphs in different problems.

Course Contents

Unit 1 Introduction [4]

- Graph and graph models
- Connected graphs
- Common classes of graphs
- Multigraphs and diagraphs

Unit 2 Degrees [4]

- The degree of a vertex
- Regular graphs
- Degree sequences
- Excursion: Graphs and matrices
- Exploration: Irregular graphs

Unit 3 Isomorphic Graphs [4]

- The definition of isomorphism
- Isomorphism as a relation
- Excursion: Graphs and groups

Unit 4 Trees [4]

- Bridges
- Trees
- The minimum spanning tree problem
- Excursion: The number of spanning trees

Unit 5 Connectivity [4]

- Cut-vertices
- Blocks
- Connectivity

- Menger's theorem
- Exploration: Powers and edge labeling

Unit 6 Travesability [5]

- Eulerian graph
- Hamiltonian Graph
- Exploration: Hamiltonian walks

Unit 7 Diagraphs [5]

- Strong diagraphs
- Tournaments
- Excursion: Decision making
- Exploration: Wine bottle problems

Unit 8 Planarity [5]

- Planar graphs
- Embedding graphs on surfaces
- Excursion: Graph minors
- Exploration: Embedding graphs on graphs

Unit 9 Coloring Graphs [5]

- The four color problem
- Vertex coloring
- Edge Coloring
- Excursion: The Heawood map coloring theorem
- Exploration: Modular coloring

Unit 10 Ramsey Numbers [5]

- The Ramsey number of graphs
- Turan's theorem
- Exploration: Modified Ramsey numbers
- Excursion: Erdos numbers

Instructional Techniques

- Class discussion
- Presentation
- Group work/pair work
- Project work
- Self-study
-

Evaluation Scheme

Internal – 40%
External – 60%

Internal evaluation will be based on the following criteria:

- Attendance and class Presentation 5%
- Project Work/Assignment/Essay I 10%
- Project Work/Assignment/Essay II 10%
- Mid-term Exam/Project 15%

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

References

Chartrand, G. and Zhang, P. (2012). *A first course in graph theory.* The Dover Edition.
http://www.mathcove.net/petersen/lessons/get-lesson
http://www.maths.lse.ac.uk/Courses/LTCC_Graph/#des
http://www.math.gatech.edu/~thomas/TEACH/601
Douglas B. West, Introduction to Graph Theory, Prentice-Hall of India Pvt. Ltd. 1999
Maharjan, H.B & Sharma L.N.(2012). *An introduction to Graph Theory*.Bagbazar, Kathmandu:Paluwa Prakashan
Johan M. Harris, Jeffry L. Hirst, Michel J. Mossinghoff, Combinatorics and Graph Theory, Springier, 2000
Maskey S. M.(2002). *First Course on Graph Theory.* R. P. Bhandar, Kathmandu,

Semester IV

Course Title: **Trignometry for Teachers**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 443 Full Marks:
Level/Semester: B.Ed./Fourth Pass Marks:

Introduction
Teaching trigonometry requires knowledge and skills on same and higher level contents as well as sound understanding on how to teach trigonometric relations. This course tries to enhance both the skills for teachers. The teaching contents are reviewed with the view to develop modern teaching techniques and other contents are for enhancing related higher level of content knowledge.

Course Objectives
After the completion of the course, students are expected to achieve the following objectives.

a) Develop suitable teaching modules on teaching trigonometrical ratios, identities, height and distance, equations and genera; values.
b) To develop contextual teaching materials in teaching trigonometry.
c) To develop teaching and learning materials suitable for the present era on general values, inverse circular functions, properties of triangles.
d) To develop content knowledge on properties of quadrilateral, De Moivre's theorem, etc to express trigonometrical ratios into exponential form.
e) To use Gregory's Series to evaluate $\prod$
f) To find the sum and expand different trigonometric functions.

Course Contents

Unit 1 Teaching trigonometrical ratios, identities and Height and Distance [6]
Unit 2 Teaching trigonometical equations and general values [6]
Unit 3 Teaching Inverse Circular Functions [6]
Unit 4 Teaching properties of triangles and quadrilateral [6]
Unit 5 Teaching De Moivre's theorem and complex no. in Trigonometrical form [6]
Unit 6 Gregory's Series, evalution of $\prod$.and Summation of Trigonometrical series [6]
Unit 7 Hyperbolic Functions and Expansion of $\cos^n\theta$, $\sin^n\theta$, $\cos n\theta$ and $\sin n\theta$ [6]
Unit 8 Resolution into factors and Miscellaneous theorems and examples [6]

Instructional Techniques

- Class discussion
- Presentation
- Group work/pair work
- Project work
- Self-study

Evaluation Scheme
Internal – 40%
External – 60%

Internal evaluation will be based on the following criteria:

- Attendance and class Presentation 5%
- Project Work/Assignment/Essay I 10%
- Project Work/Assignment/Essay II 10%
- Mid-term Exam/Project 15%

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

References

A compendium for teaching trigonometry will be developed.
Das, B. C. and Mukharjee, B. N. (…) *Higher trigonometry*.
Larson, R. E; & Hostetler, R. P. (1990). Precalculus. Massachusetts: DC Heath and Company

Course Title: **Vector Analysis for Teachers**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 444 Full Marks:
Level/Semester: B.Ed./Fourth Pass Marks:

Introduction
The use of vectors in higher mathematics is found to be most significant. The course is designed with a view to impart knowledge and skills of vector analysis to the teachers and develop several teaching and learning modules. This course tries to present vectors as tools to study mathematics especially geometry. The main concern of the course is to make a bridge of teaching of school vector and study of related higher mathematics.

Course Objectives
After the completion of the course, the students are expected to achieve the following objectives.

a) To develop teaching and learning modules on basic concepts of vector.
b) To design activities for teaching and learning of product of two vectors.
c) To use different modern techniques in teaching vector geometry.
d) To develop different projects suitable for learning vector product.
e) To solve problems of product of more than two vectors and use in solving problems.

Course Contents

Unit 1 Teaching basic concepts of vectors and scalar [6]
- Scalar and vector quantities
- Different types of vectors
- Free vectors and line vectors
- Scalar multiplication of a vector
- Addition and subtraction of vectors
- Different theorems and its teaching

Unit 2 Designing activities for teaching scalar and vector product of two vectors [9]
- Scalar product of two vectors
- Geometrical interpretation and application
- Vector product of two vectors
- Geometrical meaning and application
- Related problems

Unit 3 Teaching of Vector Geometry (plane) [9]
- Vector equation of a straight line
- Proof of different properties of triangle and quadrilateral
- Proof of different properties of regular polygon

Unit 4 Product of more than two vectors [9]
- Scalar triple product
- Vector triple product
- Scalar product of four vectors
- Vector product of four vectors

Unit 5 Projects on vector Product [6]
- Develop students' learning project
- Assign to students and review

- Refine based on the review

Unitt 6 Vector Functions and Their Derivatives [6]

- Derivatives of vector function
- Tangent vectors
- Velocity and acceleration
- Arc length for space curves
- The unit tangent vector
- Curvature and normal vectors and components
- Derivatives of vector products
- Functional equations
- Functions of bounded variations
- Vector-valued function

Instructional Techniques

- Class discussion
- Presentation
- Group work/pair work
- Project work
- Self-study

Evaluation Scheme

Internal – 40%
External – 60%

Internal evaluation will be based on the following criteria:

- Attendance and class Presentation 5%
- Project Work/Assignment/Essay I 10%
- Project Work/Assignment/Essay II 10%
- Mid-term Exam/Project 15%

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

References

Teach yourself Vector analysis
A compendium will be developed for teaching module and project method

Course Title: **Logic for Teacher**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 445 Full Marks:
Level/Semester: B.Ed./Fourth Pass Marks:

Introduction
The main intend of the course is to develop ability and skills in logical reasoning by familiarizing them with the principles and methods of correct reasoning. The course also intends to enable the participants to test and evaluate good/ bad arguments, and reach to defensible conclusions. Some of the principles of the course are used in further study and some are used in teaching mathematics in school students.

Course Objectives
After the completion of the course, students are expected to achieve the following objectives.

a) To acquire the basic conceptions of logic and use in the professional life.
b) To use language in argument and counter-argument process.
c) To apply definitional and dispute approach to develop the logical reasoning.
d) To aware of fallacies in the logical system and avoid fallacies in reasoning process.
e) To use deduction and induction approach in deriving valid arguments.
f) To understand and apply the hypothetical approach in scientific reasoning.

Course Contents
Unit 1 Basic Logical Concepts [6]

- Introduction
- Propositions and Sentences
- Arguments, Premises, and Conclusions
- Analyzing Arguments
- Recognizing Arguments
- Arguments and Explanations
- Deduction and Validity
- Induction and Probability
- Validity and Truth
- Complex Argumentative Passages
- Reasoning.

Unit 2 The Uses of Language [5]

- Basic Functions of Language
- Discourse Serving Multiple Functions
- The Forms of Discourse
- Emotive Words
- Kinds of Agreement and Disagreement.

Unit 3 Definition [5]

- Disputes: Verbal Disputes and Definitions
- Kinds of Definition and the Resolution of Disputes
- Extension and Intension
- Extensional and Intensional Definitions

Unit 4 Fallacies [5]

- Introduction
- Fallacies of Relevance
- Fallacies of Presumption
- Fallacies of Ambiguity

Unit 5 Deduction [12]

- Theory of Deduction
- Categorical Propositions and Classes
- Quality, Quantity, and Distribution
- Traditional Square of Opposition
- Categorical Syllogisms
- Formal Nature of Syllogistic Argument
- Venn Diagram Technique for Testing Syllogisms
- Syllogistic Rules and Syllogistic Fallacies
- Syllogistic Arguments in Ordinary Language
- Symbolic Language of Modern Logic
- Symbols for Conjunction, Negation, and Disjunction, Conditional Statements and Material Implication,
- Argument Forms and Arguments
- Statement Forms and Material Equivalence
- Logical Equivalence
- Methods of Deduction
- Proving Validity and Invalidity using Quantification Theory

Unit 6 Induction [6]

- Argument by Analogy
- Appraising Analogical Arguments
- Refutation by Logical Analogy
- Casual Connection: Cause and Effect
- Mill's Methods, Critique of Mill's Methods

Unit 7 Science and Hypothesis [6]

- Value of Science
- Explanations: Scientific and Unscientific
- Evaluating Scientific Explanations,
- Stages of Scientific Investigation
- Pattern of Scientific Investigation
- Crucial Experiments and Ad Hoc Hypotheses.

Instructional Techniques

- Class discussion
- Presentation
- Group work/pair work
- Project work
- Self-study

Evaluation Scheme

Internal – 40%

External – 60%

Internal evaluation will be based on the following criteria:

- Attendance and class Presentation 5%
- Project Work/Assignment/Essay I 10%
- Project Work/Assignment/Essay II 10%
- Mid-term Exam/Project 15%

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

References

Copi, M. I.(2012). *Introduction to logic* (14th). Delhi : Pearson

Semester V

Course Title: **Fundamentals of Real Analysis**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 451 Full Marks:
Level/Semester: B.Ed./ Fifth Pass Marks:

1. Course Introduction
This course is about the properties of real numbers, sets, and sequences. The nature of a set based on the point(s) on it or near it is the heart of the course. The argumentative approach based on certain axioms is the core of abstract mathematics. The study of the real numbers begins from axiomatic understanding of real number, different subsets of real numbers,several properties of real numbers and functions on real numbers.

2. Course Objectives
On the completion of this course, the students are expected;

a) to establish different properties of real number system and realize real numbers as the complete order field.
b) to use the properties of different types of sets in establishing logical relations.
c) to distinguish between real sequences and series and carry different test for the nature of series.
d) to establish different relations on limit, continuity and derivative of a single valued real function.
e) to use different relations of functions in solving related problems.

3.Course Contents
Unit One: Real Numbers
1.1 Field structure and order structure
1.2 Bounded and unbounded sets
1.3 Supremum and infimum
1.4 Completeness in the set of **R**
1.5 Absolute value of a real number

Unit Two: Open Sets, Closed Sets and Countable Sets
2.1 Open interval, open sets
2.2 Limit points of a set
2.3 Closed sets: Closure of a set
2.4 Countable and Uncountable Sets

Unit Three: Real Sequences
3.1 Sequences
3.2 Limit points of a sequence
3.3 Limit superior and inferior
3.4 Convergent and non-convergent sequences
3.5 Algebra of sequences
3.6 Monotonic sequences

Unit Four: Infinite Series
4.1 Introduction of infinite series
4.2 Positive term series
4.3 Comparison tests for positive term series
4.4 Cauchy's root test
4.5 D'Alembert's ratio test
4.6 Raabe's test
4.7 Logarithmic test
4.8 Integral test
4.9 Gauss's test
4.10 Series with arbitrary terms
4.11 Rearrangement of terms

Unit Five: Limit and Continuity of a Single Variable Functions
5.1 Limits
5.2 Continuous function
5.3 Continuous on closed intervals
5.4 Uniform continuity

Unit Six: Derivative of a Single Variable Functions
6.1 The derivatives
6.2 Increasing and decreasing functions
6.3 Darboux's theorem
6.4Rolle's theorem
6.5 Lagrange's mean value theorem
6.6 Cauchy mean value theorem
6.7 Higher order derivatives

Unit Seven: Applications of Tayler's Theorem
7.1 Extreme values
7.2 Indeterminate forms

Unit Eight: Functions
8.1 Power series
8.2 Exponential functions
8.3 Logarithmic functions
8.4 Trigonometric functions
8.5 Functional equations
8.6 Functions of bounded variations
8.7 Vector-valued function

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

1. Attendance = 5 points
2. Assignments 3 x 5 points = 15 points
3. Class Test 3 x 5 points = 15 points
4. Presentation = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Gupta, S. L. and Rani, N. (2000). *Fundamental real analysis.* New Delhi: Vikas Publishing house Pvt ltd.
b) Malik, S. C. and Arora, S. (1998). *Mathematical analysis*. New Delhi: New Age International (P) Limited, Publishers. (Latest publication)
c) Maskey, S. M. (2001). *Principles of real analysis*. Kathmandu: Bhundipuran Prakashan.
d) Narayan, S. and Raisinghania, M. D. (2007). *Elements of real analysis.* New Delhi: S Chand and Company Ltd.

Course Title: **Analytical Solid Geometry**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 452 Full Marks:
Level/Semester: B.Ed./ Fifth Pass Marks:

1. Course Introduction

The analytical geometry of two-dimension is familiar to the school students. There is a need to extend two dimensional approaches into three-dimensions. This course consists of three dimensional coordinates system of planes, straight lines, surface, cones and cylinder, central conicoid, etc. There are several extensions of two-dimensional analytical geometry. The course is intended to impart an extension of analytical approach into three dimensions with a view to study solid objects of the environment.

2. Course Objectives

Onthe completion of the course, the students are expected;

a) to extend understanding of distance formula, section formula, direction of lines, etc from two to three dimensions.
b) to derive equation of plane and find angle between planes.
c) to solve systems of planes and find the volume of the tetrahedron.
d) to find the length of perpendicular from a given point to a plane.
e) to find the orthogonal projection of the plane and volume of tetrahedron
f) to derive the equation of straight lines in space.
g) to demonstrate the condition of lines to be in plane and coplanar lines.
h) to interpret the equation of curve, surface, locus of intersecting lines, skew lines in a simplified form.
i) to derive equation of sphere and solve related problems.
j) to find the equations of cones and cylinders and solve related problems.
k) to derive equation of central conicoid and derive different conditions of it.
l) to illustrate different properties of central conicoid.

3.Course Contents

Unit One: Review of 3-dimensional Coordinate System

1.1 Coordinates in 3-D space
1.2 Change of origin
1.3 Distance between two points
1.4 Tetrahedron
1.5 Section formulae
1.6 Angle between two lines
1.7 Direction cosines and ratios of a line
1.8 Projection on a given line.

Unit Two: Plane

2.1 General equation of the first degree representing a plane
2.2 Equation of plane in intercept form and normal form
2.3 Equation of planes through three points

2.4 Angle between two planes
2.5 Systems of planes
2.6 Two sides of a plane
2.7 Length of the perpendicular from a given point to a given plane
2.8 Joint equation of two planes
2.9 Orthogonal projection on a plane
2.10 Volume of a tetrahedron in terms of the coordinates of its vertices

Unit Three: Straight lines

3.1 Equation of a line in terms of direction cosines and the coordinates of a point on it.
3.2 Equation of straight line through two points
3.3 Symmetrical and unsymmetrical form of a line
3.4 Transformation of the equations of a line to the symmetrical form
3.5 Angle between a line and a plane
3.6 Condition of a line to lie in a plane
3.7 Condition of coplanar of two lines
3.8 The shortest distance between two lines
3.9 Length and equation of the line of the shortest distance between two straight lines
3.10 Length of the perpendicular from a given point to a given line
3.11 Intersection of three planes: triangular prism.

Unit Four: Interpretation of Equation

4.1 The equation to the surface
4.2 The equation to the curve
4.3 Surface generated by a straight lines
4.4 Locus of a straight line intersecting three given lines
4.5 Equations of two skew lines in a simplified form

Unit Five: The Sphere

5.1 Equation of sphere
5.2 Sphere through four given points
5.3 Plane section of a sphere
5.4 Intersection of two spheres
5.5 Sphere through a given circle
5.6 Intersection of a sphere and a line
5.7 Tangent plane and polar plane
5.8 Angle of intersection of two spheres
5.9 Radical plane
5.10 Coaxal system of spheres
5.11 Simplified form of the equation of two spheres

Unit Six: Cones and Cylinder

6.1 Definitions of a cone, vertex, guiding curve and generators
6.2 Equation of a cone with a given vertex and guiding curve
6.3 Enveloping cone of a sphere
6.4 Conditions of the equation of a cone

6.5 Intersection of a line and a quadratic cone
6.6 Reciprocal cones
6.7 Intersection of two cones with a common vertex
6.8 Right circular cone and its equation
6.9 Definition and equation of cylinder
6.10 Equation of two cylinders whose generators intersect a given conic and are parallel to a given line
6.11 Enveloping cylinder of a sphere
6.12 Right circular cylinder and its equation

Unit Seven: Central Conicoid

7.1 Conicoids and central conicoids
7.2 Standard equation of central conicoid
7.3 Intersection of a line with a conicoid
7.4 Tangent and tangent plane
7.5 Condition of tangency
7.6 Director sphere
7.7 Equation of the normal cubic curve through the feet of the six feet of the normals
7.8 Polar plane and plane of contact
7.9 Enveloping cone of the central conicoid
7.10 Section of a conicoid
7.11 Diametral plane, conjugate diameters and diametral planes of an ellipsoid
7.12 Properties of a conjugate semi diameter

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation should be based on the following criteria

1. Attendance = 5 points
2. Assignments 3 x 5 points = 15 points
3. Presentation 1 x 5 points = 5 points
4. Project using Micro-software 1 x 15 points = 15 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Staphit, Y. R and Bajracharya, B. C. (2005). *Three dimensional geometry*. Kathmandu: Sukunda Pustak Bhawan.

b) Narayan S. (1987). *Analytical solid geometry*. New Delhi: S. Chanda and Company Pvt Ltd.

Course Title: **Basic Abstract Algebra**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 453 Full Marks:
Level/Semester: B.Ed./ Fifth Pass Marks:

1. Course Introduction
This course on basic abstract algebra is about the preliminary algebraic structure of group, ring and field. The basic structures and substructures are discussed in the course. The course consists of simple algebraic sub-structures and their properties. Examples based theoretical discussion is the main concern of the course.

2. Course Objectives
On the completion of the course, the students are expected;

a) to define with examples group, subgroup and normal subgroup and prove their properties.
b) to define with examples ring, subring and ideal and prove their properties.
c) to distinguish integral domain, skew field and field with logic.
d) to establish varies properties of integral domain and field.
e) to show isomorphic relations among the algebraic structures.

3.Course Contents
Unit One: Basic to Algebraic Structure
1.1 Set, relation and function
1.2 Binary operation and its properties

Unit Two: Group, Subgroup and Normal Subgroup
2.1 Definition, examples and properties of groups.
2.2 Definition, examples and subgroup tests
2.3 Coset and Lagrange's theorem
2.4 Definitions and examples and properties of normal subgroups
2.5 Quotient group and its properties

Unit Three: Group Homomorphism
3.1 Homomorphism, kernel and images with examples
3.2 Isomorphism theorems

Unit Four: Ring, Subring and Ideals
4.1 Definition, examples and properties of ring
4.2 Definition, examples and subring tests
4.3 Ideal and Quotient ring.

Unit Five: Ring homomorphism
5.1 Kernel and Images of ring homomorphism
5.2 Isomorphic rings
5.3 Isomorphism theorems

Unit Six: Integral Domain and Field

6.1 Definition with examples of Ring with zero divisors, Integral domain, and field
6.2 Different properties of Integra domain and field.

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

1. Attendance = 5 points
2. Assignments 3 x 5 points = 15 points
3. Class Test 3 x 5 points = 15 points
4. Presentation = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Fraleigh, J. B. (1999). *A first course in abstract algebra* (5th ed.). England: Addison-Wisley Longman, Inc.
b) Shrestha, R. M. & Bajracharya, S. (2001 [2059BS]). *Elementary linear algebra: Groups, Rings and Theory of equations*. Kathmandu, Nepal: Sukunda Pustak Bhawan.
c) Vasishtha, A. R. & Vasishtha, A. K. (2002). *Modern algebra* (41st ed.). Meerut, India: Krishna Prakashan media (P) Ltd.
d) A compendium will be developed

Course Title: **Projective Geometry**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 454 Full Marks:
Level/Semester: B.Ed./ Fifth Pass Marks:

1. Course Introduction
In the course, the students are required to study basic geometrical properties in such a way that exhibits its thorough understanding. Furthermore, the projective geometry offers them a vision on Projective Geometry with a vision that there are different types of geometries. Relevant software (e.g. AUTOCAD) will be used for Projective Geometry. Apart from the prescribed contents, there will be projects from Euclidean and non- Euclidean Geometry and some from Projective Geometry too.

2. Course Objectives
On the completion of this course, the students are expected;

a) to demonstrate sound understanding of different properties and forms of projective geometry.
b) to apply suitable strategies to solve the related problems and different properties for further reading.
c) to appreciate the structure of projective geometry and its flexible properties and the possibility to develop a geometry having no circle, no distance, no angle, no betweenness and no parallelism.

3.Course Contents
Unit One; Affine and Projective Planes

1.1 Incidence structure with examples
1.2 Definition and examples of plane
1.3 Affine plane and its properties
1.4 Projective plane and its properties
1.5 Algebraic examples

Unit Two: Configuration

2.1 Definition and examples: triangle, complete four point,
2.2 Pappian and Desargues configurations and their incidence table
2.3Tactical configuration
2.4 Projective plane and tactical configuration

Unit Three: Desarguesian Plane

3.1 Definition of Desarguesian plane, Couple and axial
3.2 Desargues's triangle theorem
3.3 Properties of Desarguesian plane.

Unit Four: Pappian Plane

4.1 The theorem of Pappus
4.2 Properties of projectivities of Pappian plane.

Unit Five: Pascal's Theorem and Application

5.1 Pascal Theorem

5.2 Converse of Pascal Theorem

Unit Six: Metric Projective Geometry in $\prod_C$.

6.1 Distance and angle in $\prod_C$.

6.2 Triangle in $\prod_C$.

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

1. Attendance = 5 points
2. Assignments 3 x 5 points = 15 points
3. Slide Presentation 2 x 5 points = 10 points
4. Project Work = 10 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Garner, E. G. (1987). *An Outline of Projective Geometry*. New York: _____

b) Eves, H. (1995). *College Geometry*. New Delhi: Narosa Publishing House

c) Courant, R. & Robbins, H. (1996). *What is Mathematics?* New York: Oxford University Press.

d) Hessenberg's Work on Projective Geometry from **http://www.univ-nancy2.fr/pioncare/colloques/hgmc2005/Reich_ Karin.pdf**

e) Projective and Affine Plane from http://designthery.org/library/encyc/topics/pap.pdf

f) A Generalization of the Spieker circle & nagel lines from http://mysite.mweb.co.za/residents/profmd/spiekernagel.pdf

Course Title: **Mathematical Programs**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 455 Full Marks:
Level/Semester: B.Ed./ Fifth Pass Marks:

1.Course Introduction
This course intends to prepare the students to play a leadership role in school curricular and co-curricular activities. How to prepare and conduct different programs on mathematics and refine it based on the feedback is the main concern of this course.

2. Course Objectives
On the completion of the course, the students are expected;

a) to critically review school level mathematics curriculum and develop a model curriculum.
b) to prepare and conduct different inter-school and intra-school mathematics programs
c) to organize different activities by forming mathematics club in the school.
d) to play leadership role in conducting school mathematics program.

3. Course Contents
Unit One: Review of School Mathematics Curriculum

1.1 Review on Scope and sequence
1.2 Review on relevancy
1.3 Developing a model curriculum

Unit Two: Inter-School and Intra School Mathematics Programs

2.1 Mathematics lab activities
2.2 Periodic questions
2.3 Mathematics material exhibition
2.4 Math quiz and Olympiad

Unit Three: Mathematics Clubs

3.1 Publications in Mathematics
3.2 Seminar and Workshops in Mathematics

Unit Four: Leadership in Mathematics program

4.1 Leadership practices
4.2 Review meeting
4.3 Reflecting and re-planning
4.4 Monitoring and evaluating program

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based upon the following criteria

1. Attendance = 5 points
2. Overview of any Textbook = 15 points
3. Conduction of any Math Program = 5 points
4. Seminar and Workshop = 10 points
5. Reporting = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 ‘or’ questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 ‘or’ question	2 x 10 marks	20 Marks

6. Prescribed Texts

A program guide will be prepared

Semester VI

Course Title: **Data Modeling**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 461 Full Marks:
Level/Semester: B.Ed./ Sixth Pass Marks:

1. Course Introduction

Generating quantitative data and making trends based on those data, assessing and predicting based on those data, etc. requires quantitative techniques. The scope of social and physical science is not limited to one or two areas but is widened and thereis a need that every aspects to be quantified. The course is about the quantification of different phenomena in the environment.

2. Course Objectives

On the completion of the course, the students are expected;

a) to apply quantitative approach to decision making.
b) to forecast based on the trends and situations with quantitative approaches.
c) to use simple regression and correlation to decide whether the given variables are associated or not.
d) to interpret different educational indicators and calculate them
e) to calculate and develop model based on demographic data.
f) to use index number and time series in analyzing the trends.
g) to use statistical techniques for quality control.

3. Course Contents

Unit One: Simple Regression and Correlation

1.1 Introduction
1.2 Co-relation analysis
1.3 Estimation using regression Line
1.4 Limitations and errors.

Unit Two: Demography

2.1 Age-Sex component: Evaluation of age and sex data, Errors in age reporting, UN's age – sex accuracy index, Whipples's index, population pyramid and age dependent ratio
2.2 Measurement of mortality: Crude death rate and age specific death rate, standardized death rate, comparative mortality index, complete life-its functions and relation between its various functions
2.3 Measurement of fertility: Crude birth rate, general fertility rate, age-specific birth rate, total fertility rate and child-woman ratio, standardized birth rate, UN's age-sex adjusted birth rate
2.4 Population Growth model: Simple linear model, compound interest model, simple exponential model, polynomial model up to third degree, logistic models, use of these model in population projection, population projection by component method

Unit Three: Educational Statistics

3.1 Enrolment of different educational level
3.2 Literacy rate by sex and development region

3.3 Teacher student ratio, Gross Enrolment Rate (GER) and Net Enrolment Rate (NER) by
3.4 Level, Gender Parity Index (GPI)
3.5 Survival Rate and Internal Efficiency Rate, Promotion, Repetition and Dropout Rates
3.6 Trend of Regular SLC Results
3.7 Reliability and validity of questions, item analysis, calculation of teacher's pension

Unit Four: Statistical quality control

4.1 Importance of statistical methods in industrial research and practices
4.2 Specification of items and lot qualities, types of inspection
4.3 Determination of tolerance limits, general theory of control charts, causes of variation in quality control limits, summary of out of control criteria
4.5 Charts of attributes- W-chart, P-chart, C-chart, U-chart, charts for variables- X- bar and R charts.

Unit Five: Index Numbers

5.1 Introduction, Un-weighted aggregates index, Weighted aggregates index: Laspeyers method, Paasche method, Fixed-weight aggregate method, Average of relative method
5.2 Quantity and value indices, Issues in constructing and using index numbers.

Unit Six: Time Series

6.1 Introduction, Variations in time series
6.2 Trend analysis, Cyclic variation, Seasonal variation, Irregular variation
6.3 Time series analysis in forecasting, moving average and exponential smoothing.

Unit Seven: Forecasting

7.1 Introduction, Judgmental forecasting, Time-series patterns, Evaluating forecasting accuracy, Moving averages, Simple exponential smoothing
7.2 Time-series regression, Smoothing linear trends, Smoothing non-linear trends, Decomposition of seasonal data.

Unit Eight: Decision Making

8.1 Introduction to decision making, Steps in decision making, Different environments in which decisions are made
8.2 Criteria for decision making under uncertainty, Decision making under conditions of risk: Discrete random variables, using the expected value criterion with continuously distributed random variables
8.3 Decision trees: Graphic displays of the decision-making process, Decision making with an active opponent.

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

- Attendance = 5 points
- Assignments 3 x 5 points = 15 points
- Class Test 3 x 5 points = 15 points
- Presentation = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Barclay, G.(2010). *Demographic techniques*. New York: John Wiley and Sons
b) Levine, D.M, Krehbiel, C. Timothy, Bereson,M.L, and Viswanathan, P.K.(2011). *Business statistics*. New Delhi: Pearson
c) Milton.(2012).*Probability & statistics.* McGrawHill
d) Render, Stair & Hanna (2012). *Quantitative analysis for management*. New Delhi: Pearson education
e) Singh, M.L.& Sayami, S.B. (2008). *Introduction to mathematical demography*. Kathmandu
f) Vohra, N.D. (2012). *Quantitative techniques in management*. New Delhi: McGraw Hill education

Course Title: **Principle of Real Analysis**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 462 Full Marks:
Level/Semester: B.Ed./ Sixth Pass Marks:

1. Course Introduction

This course consists of the axiomatic foundations of real numbers. The point set topology is the first point for generalization of various results in **R**. The notion of Euclidean space and metric space is the main concern of the course. The course also discuss as the functions of bounded variations of real variables. The target of the course is to make familiar with Reimann-Stieltjes integration. The structures of point and set are seen in different spaces like Euclidean space, metric space, etc.

2. Course Objectives

On the completion of this course, the students are expected;

a) to establish different relations of open and closed sets in the Euclidean space and metric space.
b) to establish the relation of point and set in $\mathbf{R}^n$ and metric space.
c) to use the notion of covering in understanding compactness of a set and proving different theorems of compactness.
d) to understand the total and continuous functions of bounded variations.
e) to use the properties of functions of bounded variations in different area of the field.
f) to establish different properties of Riemann-Stieltjes integrals and use it in different types of integration.

3.Course Contents

Unit One: Review of Real Number System

1.1 Field structure and order structure
1.2 Bounded and unbounded sets
1.3 Supremum and infimum
1.4 Completeness in the set of **R**
1.5 Absolute value of a real number
1.6 Equivalent sets
1.7 Finite and infinite sets
1.8 Denumerable, countable and uncountable sets

Unit Two: Elements of Point Set Topology

2.1 Euclidean space $\mathbf{R}^n$ and basic algebraic operations
2.2 Open ball and open sets in $\mathbf{R}^n$
2.3 Closed sets, closure and derived sets
2.4 Bolzano-Weierstrass theorem
2.5 Cantor Intersection theorem

Unit Three: Metric Space

3.1 Point set topology in metric space
3.2 Construction of open and closed sets

3.3 Adherent points and accumulation points in metric space

Unit Four: Compactness

4.1 Covering and open covering
4.2 Lindelof covering theorem
4.3 Heine Borel-Covering theorem
4.4 Compactness in R^n
4.5 Compact subset of a metric space

Unit Five: Functions of Bounded Variations

5.1 Monotonic function and function of bounded variation
5.2 Total variation and additive property
5.3 Total variation function on [a, x] as a function of x
5.4 Function of bounded variation as the difference of two increasing functions
5.5 Continuous functions of bounded variations

Unit Six: Riemann Stieltjes (R-S) Integrals

6.1 Definition and existence of R-S integrals
6.2 Bilinearity of the R-S integral
6.3 Formula for integration by parts
6.4 Change of variable in a R-S integral
6.5 Step functions as integrators
6.6 Reduction of a R-S integral to a finite sum
6.7 Euler's Summation formula
6.8 Monotonic increasing integrator, upper and lower integrals
6.9 Additive and linearity of upper and lower integrals
6.10 Riemann's condition of R-S integral
6.11 Comparison theorems
6.12 Integrators of bounded variation
6.13 Necessary and sufficient conditions for existence of R-S integrals
6.14 Mean value theorem for R-S integrals
6.15 Integral as a function of Interval
6.16 Second fundamental theorem of integral calculus
6.17 Change of variable in a Riemann integral
6.18 Second mean value theorem for Riemann integral
6.19 Riemann-Stieltjes integrals depending on a parameter
6.20 Differentiation under the integral sign
6.21 Interchanging the order of integration

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

- Attendance = 5 points
- Assignments 3 x 5 points = 15 points
- Class Test 3 x 5 points = 15 points
- Presentation = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Apostal, T. M. (2000). *Mathematical analysis.* New Delhi: Narosa Publishing house.

7. References

a) Malik, S. C. and Arora, S. (1998). *Mathematical analysis*. New Delhi: New Age International (P) Limited, Publishers. (Latest publication)
b) Pahari, N. P. (2006). *A textbook of mathematical analysis*. Kathmandu: Sukunda Pustak Bhawan.

Course Title: **Multivariable Calculus**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 463 Full Marks:
Level/Semester: B.Ed./ Sixth Pass Marks:

1. Course Introduction
Working with a function of a single variable is not sufficient in all time. So the need of multivariable calculus is realized to fulfill the necessary of using different variables. The result on calculus subtleties, applications, and beauty of limits, continuity, differentiation, and integration will focus mostly on 2 and 3 dimensional spaces, but will also generalize to n dimensions as necessary. Multivariable calculus is the branch of calculus that studies functions of more than one variable. Some of the aspects are addressed in this course. A derivative of a multivariate function in which all but one of the variables is held fixed during the differentiation a vector pointing the direction of the tangent line to the graph of a function

2. Course Objectives
On the completion of the course, the students are expected;

a) to evaluate the limit, continuity and derivative of a function of several variables.
b) to use the techniques of Jacobians in different cases of functions.
c) to establish and apply elementary properties of Beta and Gamma functions.
d) to use the double and triple integrals in evaluating the integration.
e) to carry out differentiation and integration of vectors quantities.
f) to use the notation and manipulate the use of gradient, divergent and curl in problem solving.
g) to prove Green's, Gauss's and Stroke's theorems and apply in related problems.

3. Course Contents
Unit One: Functions of Several Variables

1.1 Continuity of functions of two variables
1.2 Partial derivatives
1.3 Interchange of the order of differentiation
1.4 Differentiability of two variables
1.5 Composite functions
1.6 Linear transformations
1.7 Matrices
1.8 Partial differentiations
1.9 The inverse and implicit function theorems

Unit Two: Jacobians

2.1 Definition and examples
2.2 Case of function of functions
2.3 Jacobian of implicit functions
2.4 Necessary and sufficient condition for Jacobian to vanish
2.5Convariants and Invariants

Unit Three: Beta and Gamma Functions

3.1 Principal and general values of an improper integral
3.2 Infinite limits
3.3 To find the value of different related integrals
3.4 Method of integration and differentiation under integration sign
3.5 Eular's integral- Beta and Gamma functions
3.6 Elementary properties of Gamma functions
3.7 Transformations of Gamma functions
3.8 Relation between Beta and Gamma functions
3.9 Other transformations

Unit Four: Double and Triple Integrals

4.1 Double Integrals
4.2 Second order elements in polar curves
4.3 Multiple integrals
4.4 Area of the surface
4.5 Dirichlet's theorem
4.6 Liouville's extension of Dirichlet's theorem
4.7 Change of order of integration
4.8 Transformation of multiple integrals
4.9Transformation of implicit functions
4.10Transformation for elements of surface
4.11 Volume and surface
4.12 Polar coordinates

Unit Five: Differentiation and Integration of Vectors

5.1 Vector functions
5.2 Limits and continuity of vector functions
5.3 Derivative of a vector function with respect to a scalar
5.4 Curve in space
5.5 Velocity and acceleration
5.6 Integration of vector function

Unit Six: Gradient, Divergent and Curl

6.1 Partial derivatives of vectors
6.2 The vector differential operator Del
6.3 Gradient of a scalar field
6.4 Level surfaces
6.5 Directional derivatives of a scalar point function
6.6 Tangent plane and normal to a level surface
6.7 Divergence of a vector point function
6.8 Curl of a vector point function
6.9 The Laplacian operator
6.10 Important vector identities
6.11 Invariance

Unit Seven: Green's Gauss's and Stoke's Theorem

7.1 Line integrals
7.2 Circulation
7.3 Surface and volume integrals
7.4 Green's theorem in the plane
7.5 The divergence theorem of Gauss
7.6 Green's theorem
7.7 Stroke's theorem
7.8 Line integrals independent of path
7.9 Physical interpretation of divergent and curl

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

- Attendance = 5 points
- Assignments 3 x 5 points = 15 points
- Class Test 3 x 5 points = 15 points
- Presentation = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Sharma, J. N. and Vasistha, A. R. (1998). *Mathematical analysis II.* Meerut: Krishna Prakashan Media (P) Ltd.
b) Thomas G. B. & Finney R. L.(2010). *Calculus and Analytic Geometry*, Narosa Publishing House
c) Kreyszig E. (2010).*Advanced engineering Mathematics*, Wiley Eastern Ltd.

Course Title: **Differential Equations**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 464 Full Marks:
Level/Semester: B.Ed./ Sixth Pass Marks:

1. Course Introduction
This course is about differential equations: ordinary and partial. Differential equations are the tools for providing mathematical meaning of the nature. This course gives an idea about the use of the differential equation apart from how to solve these equations.

2. Course Objectives
On the completion of this course, the students are expected;

a) to solve first and second order differential equation with constant coefficients
b) to use different series and equations for solving differential equations of higher order.
c) to apply Laplace transform solution for polynomial coefficients.
d) to impart an increased understanding of partial differential equations as well as foundation knowledge of complex variables.
e) to classify Partial Differential equations given in any of the standard coordinate system
f) to apply the method of separation of variables.
g) to construct a Green's function.
h) to determine the existence of a solution and if an analytic solution can be obtained, select the appropriate technique for constructing the solution.

3. Course Contents
Unit One: First Order Differential Equations

1.1 Introduction
1.2 Separable equations and Exact differential equations
1.3 Integrating factors and Bernoulli's equations
1.4 Linear first order differential equations with some physical applications

Unit Two: Linear Second Order Differential Equations

2.1 Introduction,
2.2 The fundamental theorem,
2.3 Wronskians and general solution
2.4 Homogeneous second order linear equations with constant coefficients,
2.5 Damped and undamped motions,
2.6 Non-homogeneous second order equations.

Unit Three:Total Differential Equations

3.1 Introduction
3.2 Condition for intregrability of Pdx + Qdy + Rdz = 0
3.3 Methods for solving Pdx + Qdy + Rdz = 0,
3.4 Methods of solving $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$

Unit Four: Series Solutions of Differential Equations

1.1 Introduction
1.2 Power series solution of differential equations
1.3 Legendre's equation, Legendre's polynomials and functions
1.4 Bessel's equations and functions

Unit Five: Laplace Transforms

a. Introduction
b. Definitions of Laplace transform,
c. Laplace transform of derivatives and integrals,
d. Derivatives and integral of Laplace transforms,
e. Inverse Laplace transforms and Laplace transform of periodic functions
f. Partial fractions, Convolutions
g. Laplace transform solutions of differential equations with polynomial coefficients.

Unit Six: Partial Differential Equations

a. Introduction
b. Derivation of the wave and heat equations
c. Fourier Series solutions, Laplace's equation,
d. Gravitational potential,
e. The D'Alembert solutions, Separation of variables,
f. Fourier series solution of boundary value problems,
g. Fourier- Bessel and Fourier - Legendre solution of boundary value problems, Laplace transform and Fourier transform solution of boundary value problems.

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

- Attendance = 5 points
- Assignments 3 x 5 points = 15 points
- Class Test 3 x 5 points = 15 points
- Presentation = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 ‘or’ questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 ‘or’ question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Kreyszig,E. (2005). *Advanced Engineering Mathematics*, Wisley Eastern Ltd.
b) Potter, M. C. &Goldberg, J. (2001).*Mathematical Methods*.(2nd Edition), TMH

Course Title: **Inferential Statistics**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 465 Full Marks:
Level/Semester: B.Ed./ Sixth Pass Marks:

1. Course Introduction

The generalization of population based on the properties of sample study is the main concern of the course. How can we make inference from the sample to the universe is the main issue of today's inferential statistics. The use of database software like SPSS is found to be better for tedious calculation and is preferred to use.

2. Course Objectives

On the completion of the course, the students are expected;

a) to use multiple regression analysis and models to make suitable interpretation.
b) to understand the role of estimation theory in inferential statistics.
c) to select appropriate test for hypothesis testing and apply the procedure for hypothesis testing.
d) to apply procedures for hypothesis testing in both parametric and non-parametric tests.

3. Course Contents

Unit One: Multiple Regression and Modeling

1.1 Multiple regression equation (with 2 independent variables)
1.2 Coefficient of multiple determination
1.3 Standard error of estimate
1.4 Multiple regression with dummy variable,
1.5 Multiple correlation, Interpretation of Regression and correlation.

Unit Two: Estimation

2.1 Introduction of Point estimates and Interval estimates
2.2 Interval estimates and confidence intervals
2.3 Interval estimates of the mean and proportion from large samples
2.4 Interval estimates using the t-distribution, Sample size in estimation.

Unit Three: Testing Hypotheses: One Sample Tests

3.1 Introduction and concepts basic to hypothesis testing procedure
3.2 Testing hypothesis
3.3 Hypothesis testing of means when the population standard deviation is known
3.4 The power of a hypothesis test
3.5 Hypothesis testing of proportion and means of large samplesmeans when the population standard deviation is not known.

Unit Four: Testing Hypotheses: Two Sample Tests

4.1 Hypothesis testing for differences between means and proportions
4.2 Tests for differences between means: Large sample sizes
4.3 Tests for differences between means: Small sample sizes
4.4.Testing differences between means with dependent samples
4.5 Tests for differences between proportions:Large sample sizes

Unit Five: Chi-Square and Analysis of Variance

5.1 Introduction of Chi-square as a test of independence
5.2 Chi-square as a test of goodness of fit
5.3 Analysis of variance
5.4 Inferences about a population variance.

Unit Six: Non Parametric test

6.1 Advantages and disadvantages of non-parametric tests over parametric tests, Run test, Sign test, Wileoxon signed rank test, Mann Whitney U test, Median test.

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

- Attendance = 5 points
- Assignments 3 x 5 points = 15 points
- Class Test 3 x 5 points = 15 points
- Presentation = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Freund, J. E (2001). *Mathematical statistics.*New Delhi: Prentice-Hall of India Pvt Ltd.
b) Levine, D.M, Krehbiel, C. Timothy, Bereson,M.L, and Viswanathan, P.K.(2011). *Business statistics.* New Delhi: Pearson
c) Levin R. I. & David, S.R.(2010). *Statistics for management*. India: Pearson edition
d) Upadhyay, H. P. & Dhakal, B. P. (2064). *Mathematical statistics*. Kathmandu: Sunlight Publication.

Semester VII

Course Title: **Mathematical Modeling**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 471 Full Marks:
Level/Semester: B.Ed./ Seventh Pass Marks:

1. Course Introduction

This course consists of two parts namely differential equation and mathematical modeling. Mathematical modeling consists of analytical model, numerical models and observational models. The main aim of differential equation is to acquaint the student with differential equation as a tool in mathematical modeling. Ordinary and Partial Differential Equations are considered as some of the most important tools in studying and developing mathematical models, so its study is found important in sequel. This course deals with different areas like algebra, geometry, calculus, and other field within mathematics such as Graph theory , Optimization, population dynamics, Linear Algebra, Integral Transform, Fourier Series.

2. Course Objectives

On the completion of this course, the students are expected;

a) to solve and apply ordinary and partial differential equations in modeling
b) to explain and analyze different types of models
c) to describe and delimit the modeling procedure
d) to enhance competencies in developing different types of model
e) to analyze different system and develop mathematical models

3. Course Contents

Unit One: Introduction to Mathematical Modeling

1.1 Modeling and Mathematical modeling
1.2 Procedural steps in developing mathematical model
1.3 Description of different types of models
1.3.1 Specific Vs general models
1.3.2 Numerical Vs analytical models
1.3.3 Deterministic Vs Stochastic models
1.3.4 Discrete Vs Continuous models
1.3.5 Qualitative Vs Quantitative models

Unit Two: System Analysis and Model Synthesis

2.1 Threefold nature of universe
2.2 Entropy: agent of change
2.3 Hierarchical Analysis
2.4 Macro to micro (Mtm) Analysis
2.5 Analytical Approaches

Unit Three: System Modeling Principles

3.1 Knowledge Based Modeling
3.2 Circumscription Principle
3.3 Conservation Principle
3.4 Correspondence Principle

3.5 Classification of Model Variables
3.6 Linear Relationship and Time Series
3.7 Calibration Principles
3.8 Building Block Principle
3.9 Exogeneous and Endogeneous Dynamic Forms
3.10 Information Feedback and Distortion Reduction

Unit Four: Analytical Models

4.1 Ordinary Differential and Difference Equations
4.2 Partial Differential Equations
4.3 Variational Principles
4.4 Random systems

Unit Five: Numerical Models

5.1 Finite difference: Ordinary and partial differential equations
5.2 Finite elements

Unit Six: Observational Models

6.1 Function fitting
6.2 Transforms
6.3 Architectures

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

- Attendance = 5 points
- Assignments 3 x 5 points = 15 points
- Class Test 3 x 5 points = 15 points
- Presentation = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 ‘or’ questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 ‘or’ question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Boyd, D. W. (2001). *System Analysis and Modeling.* New Delhi: Harcourt India Private Limited.
b) Gershenfeld, N. (1999). *The nature of Mathematical Modeling.* Cambridge: Cambridge University Press.
c) Gelfand, I. M and Formin (1963). *Calculus of Variations*. New York: Dover Publications, INC
d) Potter, M. C. and Goldberg, J. (2000). *Mathematical Methods.* New Delhi: Prentice Hall of India private limited.

Course Title: **Basic Topology**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 472 Full Marks:
Level/Semester: B.Ed./ Seventh Pass Marks:

1. Course Introduction
In the course, students have to study basic topological properties in such a way that exhibits thorough understanding. The basic topological structures: basis and sub-basis of topological spaces, different properties of continuity, connectedness, compactness, etc are dealt with in the course. The notion of net and filter is also introduced in the course.

2. Course Objectives
On the completion of the course, students are expected;

a) to demonstrate sound understanding of topological spaces and topological properties.
b) to apply suitable strategies to solve the related problems and study different properties for further reading.
c) to appreciate structure of topological spaces and topological properties.

3.Course Contents
Unit One: Topology and Topological Space
1.1 Definitions and examples of topology and topological space
1.2 Different types of topologies
1.3 Comparable and non-comparable topologies.

Unit Two: Point Set in Topological Space
2.1 Limit point and Derived set in the space
2.2 Interior, closure and boundary in the space
2.3 Dense and separable spaces

Unit Three: Basis and Sub-basis
3.1 Definition and examples of basis and local basis
3.2 First and second countable spaces
3.3 Equivalent bases
3.4 Definition and examples of sub-basis.

Unit Four: Continuity
4.1 Various definitions of continuity and their equivalence
4.2 Composition of continuous functions in the space
4.3 Semi continuous and characteristic functions
4.4 Construction of continuous function
4.5 Open and closed mapping

Unit Five: Topological Equivalent
5.1 Topological equivalent of the spaces
5.2 Topological property
5.3 Separability - First countability - Second countability

Unit Six: Connectedness

6.1 Definition and examples
6.2 Connectedness as a topological property
6.3 Different properties of connectedness and disconnectedness
6.4 Connected subsets of real line
6.5 Applications of connectedness

Unit Seven: Compactness

7.1 Definition and examples
7.2 Finite intersection property and compactness
7.3 Closed and compact subsets of the space
7.4 Properties related to compactness

Unit Eight: Product Spaces

8.1 Topology for X□Y.
8.2 Projection mapping
8.3 Properties of product spaces
8.4 Topology for Cartesian product of a finite collection of topological spaces
8.5 Topology for Cartesian product of any collection of topological spaces

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

- Attendance = 5 points
- Assignments 3 x 5 points = 15 points
- Class Test 3 x 5 points = 15 points
- Presentation = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 ‘or’ questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 ‘or’ question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Croom, F. H. (1999). *Principles of topology*

b) Garner, E. G. (2006). *An Outline of projective geometry*. New York: _____

c) Khanna, M. L.(1998). *Topology*. Meerut: Jai Prakash Nath & Co.

d) Munkers, J. E. (1994). *Topology a first course.* New Delhi: Prentice- Hall of India

e) Simmons, G. F. (2004). *Introduction to topology and modern analysis*. New Delhi: Tata McGraw-Hill Publishing Company Limited

Course Title: **Complex Analysis**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 473 Full Marks:
Level/Semester: B.Ed./ Seventh Pass Marks:

1. Course Introduction
This is an advanced undergraduate course dealing with calculus in one complex variable with geometric emphasis. This course covers complex numbers and complex functions, differentiation and the Cauchy-Riemann equations, Cauchy's theorem and the Cauchy integral formula, etc. The course is design with a view to foster on thinking ability in a complex variable.

2. Course Objectives
On completion of the course, the students are expected;

a) to be familiar with the properties of complex numbers.
b) to evaluate limit, continuity, differentiability of a complex valued function.
c) to test whether a function is an analytic or not.
d) to derive and use Cauchy- Riemann equations in solving problems
e) to explore different properties of linear and bilinear mappings.
f) to expand analytic function in form of the power series
g) to use the notion of zeros and singularities in evaluating analytic functions.
h) to carry out the complex integration of a complex valued function.

3.Course Contents
Unit One: Properties of Complex Numbers

1.1 Definition and operations of complex numbers
1.2 Modulus and Conjugate of a complex number
1.3 Different form of a complex number: modulus-argument, polar-standard form, trigonometric form
1.4 More important results about complex number
1.5 Integral and rational power of a complex number

Unit Two: Analytic Function

2.1 Curve in Argand plane
2.2 Function of a complex variable
2.3 Neighborhood of a point
2.4 Limit and continuity
2.5 Differentiability
2.6 Analytic function
2.7 Cauchy Riemann Equations
2.8 Harmonic function

Unit Three: Conformal Mappings

3.1 Jacobian of a transformation
3.2 Necessary and sufficient condition of conformal mapping
3.3 Superficial Magnification

3.4 The inverse point with respect to a circle
3.5 Some elementary transformations
3.6 Linear transformation
3.7 Bilinear transformation and its different properties

Unit Four: Power Series and Elementary Functions

4.1Sequence
4.2 Infinite series
4.3 Sequence and series of functions
4.4 Principal of Uniform convergence of a sequence
4.5 Cauchy's criteria for series
4.6 Power Series

Unit Five: Complex Integration

5.1 Rectifiable arc
5.2 Function of bounded variation
5.3 Evaluation of some integrals: ab-initio
5.4 Reduction off complex integrals to real integrals
5.5 Elementary properties of complex integrals
5.6 Upper bound of a complex integral
5.7 Line integrals as functions of arcs
5.8 Cauchy's fundamental theorem
5.9 Cauchy Goursat theorem
5.10 Cauchy Integral formula
5.11 Derivative of analytic function

Unit Six: Expansion of Analytic Function as Power Series

6.1 Taylor's theorem
6.2 Laurent's theorem
6.3 Uniqueness theorem
6.4 The zero of an analytic function

Unit Seven: Zeros and Singularities of analytic functions

7.1 Zero of order m
7.2 Isolated and non-isolated singularities
7.3 Polynomials and rational functions
7.4 Theorems on poles and other singularities
7.5 Maximum modulus principle
7.6 Rouche's theorem
7.7 Schwarz Lemma
7.8 Inverse function Theorem
7.9 Fundamental theorem of algebra

4. Instructional Techniques

- Seminar
- Presentation

- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

- Attendance = 5 points
- Assignments 3 x 5 points = 15 points
- Class Test 3 x 5 points = 15 points
- Presentation = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Churchil, R. V. (1995). The Complex Variable
b) Pandey, U. N. (2012). *Functions of a complex variable*. Kathmandu: Subhakamana Prakasan Pvt Ltd.
c) Vasistha, A. R. (2000). *Complex analysis.* Meerut: Krishna Prakashan Media.

Course Title: **Operation Research**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 474 Full Marks:
Level/Semester: B.Ed./ Seventh Pass Marks:

1. Course Introduction

Operation research is relatively recent field in the field of business.The development of started from the Word War. There are certain optimization strategies in the field of not only business but also in the other field. Linear programming, Markov chain, theory of games, Queuing models, Dynamic programming, etc are some examples of area of operation research.

2. Course Objectives

On the completion of the course, the students are expected;

a) to use linear programming approach for optimization problems.
b) to solve transportation and assignment problems.
c) to use networks for solving related problems.
d) to solve the problems of the theory of the game.
e) to use simulation techniques, dynamical programming, inventory techniques and network to make decision and solve related problems.

3. Course Contents

Unit One: Linear Programming

1.1 Introduction to Operation research
1.2 Introduction and Applications of linear programming
1.3 Graphical method to solve linear programs
1.4 Simplex method, Solution of maximization and Minimization model
1.5 Slack, Surplus and Unrestricted variables, Degeneracy
1.6 Alternative optima, Unboundness, infeasible solution

Unit Two: Transportation and Assignment Problems

2.1 Transportation problem (demand equals supply)
2.2 Transportation problems (demand does not equal supply),
2.3 Degeneracy, Initial solutions by the Greedy method and by Vogel's method,
2.4 The assignment problem
2.5 Solving maximization problems with Transportation and Assignment methods.

Unit Three:Theory of Game

3.1 Introduction, game model, two-person zero sum games and their solution
3.2 Saddle point, condition for no saddle point exists
3.3 Dominance rule, solution of 2 × n and m × 2 games
3.4 Limitations of the game theory, Application of game theory

Unit Four:Markov Chains

4.1 Introduction, band switching example
4.2 Markov process, assumption of Markov analysis
4.3 Markov analysis input and output process, specific state probabilities
4.4 Steady state probabilities, absorbing chain, application of Markov chains

Unit Five:Queuing Models

5.1 Introduction.

5.2 General description of Queue

5.3 Characteristic to be studied

5.4 Kendall's notation for representation

5.5 Queuing models. Classification of Queuing models, Solution of queuing models.

Unit Six:Inventory Techniques

6.1 Introduction, types of inventory, inventory decisions
6.2 Inventory cost, inventory systems, fixed order quantity system(FOQ)
6.3 Classical EOQ model, EOQ with price breaks
6.4 EOQ model for production runs
6.5 Inventory model with planned shortages
6.6 Periodic review system, Approaches to inventory control

Unit Seven:Dynamic programming

7.1 Introduction, dynamic programming versus linear programming
7.2 Dynamic programming: a network example, terminology of dynamic programming: stages, payoff, decision process
7.3 Principle of optimality, recursive relationship, deterministic dynamic programming, probabilistic dynamic programming and application of dynamic programming

Unit Eight:Simulation

8.1 Introduction. Definitions of Simulation
8.2 Types of Simulation. Why to use simulation
8.3 Generator of Random numbers, Monte –Carlo simulation
8.4 Advantage and disadvantage of simulation
8.5 Applications of simulation techniques of various problems

Unit Nine: Networks

9.1 Applications of Network-Models
9.2 PERT (program evaluation and review technique),
9.3 CPM (critical path method), Pert/Cost, Network scheduling with Resource limitations
9.4 Maximal-flow problem, Minimal-spanning –Tree problem, Shortest-route problem.

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

- Attendance = 5 points
- Assignments 3 x 5 points = 15 points
- Class Test 3 x 5 points = 15 points
- Presentation = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Gupta, P.K. & Hira, D. S. (2000). *Operation research.* New Delhi: India. S. Chand.
b) Vohra, N.D.(2012).*Quantitative techniques in management*. New Delhi: India. McGraw Hill

7. References

a) J. C. *Turner*, Modern Applied Mathematics (Probability-Statics-Operation Research), 1981. The English Language Book Society and Hodder and Stoughton.
b) Jit S. Chandan, Dr. Mohan P. Kawatra, Dr. Ki Ho Kim, Essentials of Linear Programming, 1994, Viking Publishing House Pvt. Ltd. India.
c) P.K. Gupta, Manmohan, Linear Programming and theory of games, 1991, Sultan Chand and Sons.
d) S.D.Sharma, Operation Research, 1991-1992, Kedar Ram Nath and company, Meerut, India.

Course Title: **Theory of Mathematics Instruction**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 475 Full Marks:
Level/Semester: B.Ed./ Seventh Pass Marks:

1. Course Introduction
How to teach mathematics is based on how do students best learn it. There are several theories of mathematics learning and teaching. There are several theories of learning generally classified as behaviorism, cognitivism, constructivism and humanism. Among these schools of learning schools some of the theories are selected here with a view to generate idea for mathematics instruction.

2. Course Objectives
On the completion the course, students are expected;
a) to design sample activities according to behaviorist leaning theory.
b) to use cognitivist learning approaches in the classroom selecting suitable topic.
c) to apply constructivist learning design to appropriate contents and environment.
d) to be humanistic in teaching mathematics.
e) to select appropriate learning theory for a given content and create environment.

3.Course Contents
Unit One: Learning according to Behaviorism
1.1 Learning math according to Behaviorism
1.2 Sample activities
1.3 Designing classroom learning activities

Unit Two: Jean Piaget: Cognitive Learning Theory
2.1 Developmental stages
2.2 Schema theory
2.3 Implication in teaching Mathematics

Unit Three: Burner's Learning Theory
3.1 Leaning theory
3.2 Developing mathematics learning strategies

Unit Four: Garner's Multiple Intelligences
4.1 Intelligence according to Garner
4.2 Designing lesson for each intelligence

Unit Five: Skemp's Learning Theory
5.1 Phase of learning
5.2 Designing activities

Unit Six: Van Hieale's Learning
6.1 Key stages of Van Heale's learning
6.2 Designing lesson for each stage

Unit Seven: Vygotskey's Social Constructivism

7.1 Theory of social constructivism
7.2 Developing learning strategies

Unit Eight: Humanism in teaching Mathematics

8.1 Humanistic approach of teaching
8.2 Approach of critical mathematics education

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

1. Attendance = 5 points
2. Assignments 3 x 5 points = 15 points
3. Presentation of comparative chart of different schools of thought = 10 points
4. Conduction of Debate Program = 10 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Upadhyay, H. P.; Upadhyay, M. P. & Luitel, S. (2067). *Teaching of mathematics* (in Neplai). Kathmandu: Balbalika Educational Publication.
b) Bell, H. F. (1978). *Teaching and learning mathematics.* Wmc brown Company Publisher
c) Skemp, R. (19..). *The psychology of learning mathematics*. Peinguin Books.
d) Kennedy, l. M., & Tipps, S. (2000). *Guiding children's learning of mathematics.* Australia: Wadsworth: Thomson Learning.
e) Maharjan, H. B., Upadhyaya, H. N., & Poudel, L. N. (1997(2054 BS)). *Teaching mathematics in secondary schools.* Kathmandu, Nepal: Ratna Pustak Bhandar.
f) Simpson, A. (2003). *Teaching and assessing skills in matheamtics* . The Edinburgh Building, Cambridge, UK: Cambrigde University Press.
g) Zevenbergen, R., Dole, S., & Wright, R. J. (2005). *Teaching mathematics in primary school.* Alexander Street, Australia: Allen & Unwin.

Semester VIII

Course Title: **Action Research in Teaching Mathematics**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 481 Full Marks:
Level/Semester: B.Ed./ Eighth Pass Marks:

1. Course Introduction
Teachers' professional development through action research, a self-initiative approach is important for mathematics teachers. This course is intended to familiarize students with the real world classroom problems and the ways to solve such problems. The students are required to work in real classrooms, identify a problem, propose an action plan, implement it and reflect on the experience. This experience is aimed at bridging the gap between the theories and the practice by way of theorizing from the practice and practicing the theories.

2. Course Objectives
On the completion of the course, students are expected to achieve the following objectives:

a) To distinguish action research from other research.
b) To identify the problem for the action research and phases and cycles in action research.
c) To update yourself in the field of action research from literature.
d) To design and implement action research in mathematics teaching
e) To develop and use necessary tools for action research
f) To reflect upon the action and continue in the professional life.
g) To report the activities and implications in a proper format
h) To realize action research as a problem solving and pedagogical tool
i) To develop habit valuing others' research and make the sharing culture.
j) Carry out action research independently and continue in professional life.

3.Course Contents
Unit One: Introducing Action Research

1.1 Meaning of research and action research
1.2 Who does action Research?
1.3 What is not an action research?
1.4 Significance of action research

Unit Two: Action Research Problem

2.1 Nature of problems selected for action research
2.2 Problem justification
2.3 Making problem statement
2.4 Writing objectives in the problem

Unit Three: Review of similar work done

3.1 Why to review in literature?
3.2 How to review?
3.3 Is it necessary?

Unit Four: Action Research Plan

4.1 Selection of Participants
4.2 Determination of tools to be used
4.3 Phases and cycles in action research
4.4 Preparation of schedule for action

Unit Five: Action Research Proposal

5.1 What is it?
5.2 Components in the proposal
5.3 Preparation of an action Research proposal

Unit Six: Tools for Action Research

6.1 Tools in action research
6.2 Development of tools
6.3 Process validation in action research
6.4 Finalizing the tools and process

Unit Seven: Implementation of the Plan

7.1 Data collection and during each cycle
7.2 Data analysis
7.3 Self-reflection in the implication

Unit Eight: Action Research Report

8.1 Why to make report?
8.2 Components of action research report.
8.3 Formats of Action research reports

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based upon the following criteria

During the semester students will have to select a problem and carry out an action research in their professional life and report to the tutor. This will be the main criteria for the course. Final grade will depend upon the following criteria:

a) Participation in discussion: 10%
b) Review of action researches: 15%
c) Proposal writing for Action Research 15%

The action research report will be evaluated on the basis of the rubrics.

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 ‘or’ questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 ‘or’ question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) A compendium will be developed
b) Greenwood, D. J. and Levin, M. (1998). *Introduction to action research.* New Delhi: Sage Publication.

Course Title: **Teaching Material Development**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 482 Full Marks:
Level/Semester: B.Ed./ Eighth Pass Marks:

1. Course Introduction

This course intends to develop practical skills ofprospective mathematics teachers to plan, acquire and construct low cost and no cost teaching materials. Teaching materials are very important factor for meaningful teaching and learning of mathematics so it plays a significant role to construct ideas and real understanding of mathematical phenomena through the use of real materials such as charts, models, relias, etc. Teachers will gain ideas, skill and insight of materials development in mathematics teaching that will help them for meaningful teaching and learning in the classroom.

2.Course Objectives

On the completion of this course, the students are expected;

(a) to introduce the importance of teaching materials in mathematics teaching
(b) to develop low cost and no cost teaching materials using paper, wood and other locally available materials
(c) to ensure/ promote effective use of audio-visual aids in mathematics teaching.

3.Course Contents

Unit One: Puzzles and Games in Teaching Mathematics

1.1 Tangram Puzzle
1.2 Circle Puzzle
1.3 Coordinate Game
1.4 Salute Game
1.5 Frango

Unit Two: Development and Use of Charts and Posters

2.1 Charts of formulae
2.2 Charts of illustrations
2.3 Charts of Relations: Venn
2.4 Posters of Activities flow-up
2.5 Posters related to real life problems

Unit Three: Paper Works: Cutting and Folding

3.1 Folding to make point, lines and angles
3.2 Folding for parallel lines and their relations
3.3 Folding for regular polygon
3.4 Folding to triangle and Quadrilateral
3.5 Folding for sum of series

Unit Four: Demonstrative Materials

4.1 Factorization kits
4.2 Polynomial kits

4.3 Patterns of formula
4.4 Model of shop, house, garden, etc

Unit Five: Nets, Skeletons and Solids
5.1 Prisms, pyramids and cones
5.2 Combined solids
5.3 Regular polyhedral

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Criteria for Internal Evaluation

2. Collection of Game & Puzzles = 5 points
3. Construction of 2-D charts and Posters = 5points
4. Paper folding Model = 5 points
5. Manipulative and Demonstrative Materials = 10 points
6. Presentation = 5 points
7. Attendance = 5 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Upadhyaya, H. N. and Maharjan, H. B. (2005). *Material development in secondary mathematics teaching* (in Nepali). Kathmandu: Paluwa Prakashan
b) A compendium will be developed.

Course Title: **Instructional Design in Mathematics**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: MATH 483 Full Marks:
Level/Semester: B.Ed./ Eighth Pass Marks:

1. Course Introduction

The course is about the summary of teaching methods, teaching techniques, pedagogical planning and developing and implementing assessment tools used in teaching mathematics. This course intends to impart theoretical as well as practical aspects of the knowledge, skills and attitude required by mathematics teachers.

2. Course Objectives

On the completion of the course, students are expected;

a) to design and apply appropriate teaching method in the specific content and context.
b) to integrate teaching techniques along with teaching methods in order to optimize the learning.
c) to design and implement different types of leaning approaches so that students enjoy in the learning process.
d) to develop annual, terminal, unit and daily plans and implement them in the professional life.
e) to develop tools for assessment of/for students mathematics learning and incorporate every students in learning process.

3.Course Contents

Unit One: Teaching Methods

1.1 Expository method
1.2 Laboratory method
1.3 Discussion method
1.4 Inductive and deductive methods
1.5 Analytic and synthetic methods
1.6 Discovery method

Unit Two: Teaching Techniques

2.1 Oral questions
2.2 Thinking time
2.3 Classroom arrangement
2.4 Students motivation
2.5 Drill and practice
2.6 Practical works
2.7 Use of ICT

Unit Three: Learning Design

3.1 Cooperative leaning designs
3.2 Constructive learning designs
3.3 Project based learning designs
3.4 Problem based learning designs

Unit Four: Pedagogical Planning

4.1 Annual plan, Term plan, and Unit plan
4.2 Lesson plan

Unit Five: Assessment of/for learning

5.1 Developing and refining assessment tools
5.2 Diagnostic test and remedial instruction
5.3 Assessment of/for learning

4. Instructional techniques

- Seminar
- Presentation
- Group work/ pair work
- Group discussion
- Assignment

5. Evaluation Scheme

- Internal: 40%
- External: 60%

Internal Evaluation will be based on the following criteria

1. Attendance = 5 points
2. Preparation of LP as required by 5 different Methods = 15 points
3. Presentation of any one LP = 5 points
4. Preparation of Diagnostic Test = 15 points

External Evaluation will be based on the following criteria:

Nature of questions	Total questions to be asked	Number of questions to be answered	Weightage
Multiple choice items	10	10 marks	10 Marks
Short answer questions	6 with 2 'or' questions	6 x 5 marks	30 Marks
Long answer questions	2 with 1 'or' question	2 x 10 marks	20 Marks

6. Prescribed Texts

a) Upadhyay, H. P.; Upadhyay, M. P. & Luitel, S. (2067). *Teaching of Mathematics* (in Neplai). Kathmandu: Balbalika Educational Publication.
b) Upadhyay, H. P. (2062).*MathematicsMethods* (in Neplai). Kathmandu: Vidyarthi Publication Pvt. Kamalpokhari.
c) A compendium will be developed
d) Roh, K. H. (2003). Problem-based learning in Mathematics. Retrieved from www.ericse.org
e) Kennedy, L.M. and Tipps, S. (2000). *Guiding Children's learning of mathematics* (9th ed). Australia: Wadsworth.
f) Kochhar, S. K. (1985). *Methods and techniques of teaching.*New Delhi, India: Sterling Publishers Private Limited.
g) Sidhu, K. S. (1995). *The teaching of mathematics.*New Delhi, India: Sterling Publishers Private Limited.
h) Zevenbergen, R., Dole, S. and Wright, R.(2005). *Teaching mathematics in primary schools.*Alexander Street, Australia: Allen and Unwin.
i) Wheatley, G. H. (1993). the role of mathematics learning . In K. Tobin*the practice of constructivism in science education* (pp. 121-133). New Jersey: Lawrence Erlbaum associate, publisher.

Course Title: **Student Teaching: On-campus**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: ENG 484 Full Marks:
Level/Semester: B.Ed./Eighth Pass Marks:

1. Course Introduction
This is a course designed to provide students an opportunity to get prepared for their practice teaching towards the end of the semester. The students will learn to make lesson plans and prepare the teaching learning materials during the course work. In addition to this they will also do the micro-teaching and observe some of the classes in the schools and bring their comments on them. Finally, the students will go to the school and teach the assigned course.

2. Course Objectives
The objectives of the course are:

a) to give students practical experience of preparing lesson plans

b) to expose students to micro-teaching experience as a preparation to the real teaching in schools

c) to provide students an opportunity to prepare teaching learning materials for real teaching

d) to develop in students class observation skills.

e) to give them real teaching experience in schools.

3. Course Contents
The objective of the on-campus activities is to prepare students with the required skills for their real classroom teaching in schools. On-campus activities will have four major components viz. field observation and class seminars; preparation of lesson plans; preparation of teaching learning materials; and supervised micro-teaching. The details of each component are given below:

1. Field Observation and Class Seminars

Each student will be assigned a school and the internal supervisor at the beginning of the eighth semester. The student will visit the school, build a rapport with the English teacher, discuss the ELT issues in the classroom and observe some of the lessons in class. The observation will focus on the key areas of ELT pedagogy, classroom management, lesson sequence, activities, students' engagement patterns of classroom interaction etc. Prior to the school visit, the supervisor and the students will prepare an observation form and the students will be given due orientation at the campus on what to observe, how to observe and how to keep the record of what was observed in class. Each student will observe at least five lessons in certain interval and prepare a report for class seminar. The seminar will discuss the issues observed in schools and the students will draw implicative lessons from the discussion for their practice teaching. After the class seminar the students will submit an individual report of their observation along with their critical reflections in about 1000-1500 words.

2. Preparation of Lesson Plans

The students will prepare 20 lesson plans from different areas of English language teaching. The supervisor will review the lesson plans and provide his/her feedback for their improvement before the students submit them for final grading. The grading of the lesson plan will be made based on the criteria such as the format of the lesson, learning goals, activities and lesson sequence.

3. Preparation of Teaching and Learning Materials

A weeklong materials preparation workshop will be organized on-campus and the students will prepare all the required materials for their real classroom teaching. Flash cards, posters, work-sheets, activities, audio recording, collection of pictures, drawing etc. will be prepared during the workshop. The supervisor will review the materials and sign them.

4. Supervised Micro-teaching

Students will teach five to ten micro-lessons during their supervised micro-teaching. All the micro-teaching sessions will be observed by the supervisor and necessary feedback will be provided to the students. After the micro-teaching post observation seminar will be organized in order to share the reflection of the students and the feedback of the supervisor and peers. Some of the classes will be videotaped and the students will be asked to make comments on their own lessons.

5. Evaluation Scheme

Field observation and class seminar	20marks
Preparation of lesson plan	20marks
Preparation of teaching learning materials	20marks
Supervised Micro-teaching	40marks

6. Prescribed Texts

a) Cohen, L., Manion, L. and Morrison, K. (2008). *A guide to teaching practice*. Oxon. Routledge.

b) Richards, J. C. and Farrell, T. S. C. (2011). *Practice teaching; a reflective approach*. Cambridge. Cambridge University Press.

Course Title: **Student Teaching: Off-campus**
Nature of the Course: Theory/Practical Credit Hours: 3
Course No: ENG 485 Full Marks:
Level/Semester: B.Ed./Eighth Pass Marks:

1. Course Introduction
This is a course that is designated to the real teaching of students in the schools. The students will go to the assigned schools and work with the regular teachers. They plan the lessons in consultation with the regular teacher and deliver the lessons in class. The school teacher will be requested to observe the student-teacher's class and provide their feedback.

2. Course Objectives
The objectives of the course are:

a) to give students real teaching experience in schools

b) to expose students to the school environment so that they learn the school culture

c) to train them in real teaching and other extra-curricular activities.

3. Course Contents

Off Campus Activities:
The students will go to the schools and start their real teaching. In addition to teaching, students will also learn other school activities such as test item construction, organizing and managing extra-curricular activities, case studies and so on. Major activities that the students will be engaged during this teaching are as follows:

a) Actual Teaching

Each student will be required to teach minimum of 30 lessons not exceeding one lesson per day. The students will prepare daily lesson plan and all the necessary teaching learning materials along with the work sheet in close coordination with the school teacher and campus supervisor in advance and deliver the lesson in school. Out of thirty, at least five lessons will be observed by the campus supervisor in different time intervals.

b) Case Study

The student will identify a particular case for a detailed study. The case could be a student with a unique learning style, a teacher who has been well recognized for his/her English lessons, a group of students with a different linguistic needs, a group of students with an indigenous linguistic community or a student with a different linguistic ability. The case should be studied in detail and a report of about 2000 words should be produced and submitted to the campus supervisor.

c) Teaching Logbook and Test Item Construction

Students will be required to maintain a log book of their teaching every day. The logbook should record the class, the subject they teach and the main activities they carried out. Similarly, students will also prepare test items from the course they teach in the school. The test items will include at least 20 objective questions and ten subjective questions of various types.

d) Extra-curricular Activities

Students should organize at least one extra-curricular event in the school and a report of the event should be submitted to the campus supervisor.

5. Evaluation Scheme

Classroom teaching	50 marks
Case study	10 marks
Logbook record	10 marks
Test items construction	20 marks
Extra-curricular activities event report	10 marks

6. Prescribed Texts

a) Cohen, L., Manion, L. and Morrison, K. (2008). *A guide to teaching practice*. Oxon. Routledge.

b) Richards, J. C. and Farrell, T. S. C. (2011). *Practice teaching; a reflective approach*. Cambridge. Cambridge University Press.