

Tribhuvan University



Institute of Science and Technology
SCHOOL OF MATHEMATICAL SCIENCES

Syllabus

Bachelor in Mathematical Sciences (B.Math.Sc.)
(with Major Actuarial Science) - **SECOND SEMESTER**

Course Structure

| Semester | Papers | Credit |
|----------|--|--------|
| Second | MSMT 151 Calculus with Analytic Geometry II | 3 |
| | MSMT 152 Linear Algebra with application I | 3 |
| | MSST 151 Statistics & Data Analysis II | 3 |
| | MSCS151 Introduction to Programming I | 3 |
| | MSEN 151 Communication skill II | 3 |
| Total | | 15 |

Code No.: MSMT 151

Paper: Calculus with Analytic Geometry II

Nature: Theory and Lab. work

Full Mark: 75

Pass Mark: 30

Credit: 3

Course Description:

This course begins with Applications of integration, Techniques of integration, Parametric Equations and Polar Coordinates, and is followed by a comprehensive treatment of Infinite sequence and series.

Learning Objectives:

After successful completion of this course the student will be able to

- Find Areas Between Curves, Volumes, Volumes by Cylindrical Shells, Work, Average Value of a Function
- Integrate by Parts,
- Find trigonometric Integrals,
- Do Trigonometric Substitution,
- Integrate Rational Functions by Partial Fractions,
- Strategy for Integration,
- Integration Using Tables and Computer Algebra Systems,
- Approximate Integration,
- find Improper Integrals
- Use integration to find Arc Length, Area of a Surface of Revolution,
- Apply integration to Physics and Engineering, Economics and Biology, Probability.
- Define Curves in Parametric form,
- Use Calculus with Parametric Curves,
- Acquire knowledge of Polar Coordinates,
- Find Areas and Lengths in Polar Coordinates,
- Acquire knowledge of Conic Sections,
- Express in Conic Sections in Polar Coordinates
- Acquire knowledge of Sequences and Series,
- Use The Integral Test to Estimate of Sums,
- Do The Comparison Tests,
- Acquire knowledge of Alternating Series, Absolute Convergence
- Do the Ratio and Root Tests,
- Acquire knowledge of Power Series,
- Represente Functions as Power Series,
- Acquire knowledge of Taylor and Maclaurin Series,
- Apply Taylor Polynomials.

Mode of Delivery:

The course will be taught by lecture (48 hrs), and problem solving and class discussion (24 hrs). In some topics the use of software MATLAB for problem solving will be encouraged. Students will be encouraged to utilize the computer whenever possible and wherever applicable.

Contents:

- Unit 1 Applications of integration** **8 hrs**
Areas Between Curves, Volumes, Volumes by Cylindrical Shells, Work, Average Value of a Function.
- Unit 2 Techniques of integration** **9 hrs**
Integration by Parts, Trigonometric Integrals, Trigonometric Substitution, Integration of Rational Functions by Partial Fractions, Strategy for Integration, Integration Using Tables and Computer Algebra Systems, Approximate Integration, Improper Integrals.
- Unit 3 Further Applications of integration** **8 hrs**
Arc Length, Area of a Surface of Revolution, Applications to Physics and Engineering, Applications to Economics and Biology, Probability
- Unit 4 Parametric Equations and Polar Coordinates** **10 hrs**
Curves Defined by Parametric Equations, Calculus with Parametric Curves, Polar Coordinates, Areas and Lengths in Polar Coordinates, Conic Sections, Conic Sections in Polar Coordinates.
- Unit 5 Infinite sequence and series** **13 hr**
Sequences, Series, The Integral Test and Estimates of Sums, The Comparison Tests, Alternating Series, Absolute Convergence and the Ratio and Root Tests, Strategy for Testing Series, Power Series, Representations of Functions as Power Series, Taylor and Maclaurin Series, Applications of Taylor Polynomials

Text Book:

1. *Calculus – Early Transcendental Functions*, 7th edition, J. Stewart, Thomson Brooks/Cole

Reference Books:

1. *Calculus: Early Transcendental Functions*, Larson, et al, Houghton Mifflin, 2011
2. *Calculus : a complete course*, Robert A. Adams, Christopher Essex. Pearson, 2010

Course No.: MSMT 152

Full Marks: 75

Course Title: Linear Algebra with Applications I

Pass Marks: 30

Nature of the Course: Theory

Credit: 3

Course Description:

This course develops fundamental algebraic tools involving matrices and vectors to study linear systems of equations and Gaussian elimination, linear transformations, determinants, eigenvalues and eigenvectors and their applications.

Objectives

On completion of this module, students will be able to

- Understand the concepts and methods of linear algebra
- Solve problems using linear algebra.
- Connect linear algebra to other fields both within and without mathematics
- Use the concepts and algorithms of linear algebra in an interactive computer environment
- Use computational tools for important applications of linear algebra

Mode of Delivery:

The course will be taught by lecture (48 hrs), and problem solving and class discussion (24 hrs). The use of software (MATLAB) will be encouraged.

Course Contents:

| | |
|---|---------------|
| Unit 1 Matrices | 12 hrs |
| The geometry of linear equations, Elimination with matrices, Matrix and Matrix operations, Triangular Factors and Row Exchanges, Inverses and Transposes | |
| Unit 2 Vector Spaces | 14 hrs |
| Vector Spaces and Subspaces, Solving $Ax = 0$ and $Ax = b$, Linear Independence, Basis, and Dimension, The Four Fundamental Subspaces, Graphs and Networks, Linear Transformations | |
| Unit 3 Orthogonality | 14 hrs |
| Orthogonal Vectors and Subspaces, Cosines and Projections onto Lines, Projections and Least Squares, Orthogonal Bases and Gram-Schmidt, The Fast Fourier Transform | |
| Unit 4 Determinants | 8 hrs |
| Determinants, Properties of the Determinant, Formulas for the Determinant, Applications of Determinants | |

Textbooks

1. Gilbert Strang, *Introduction to Linear Algebra*, 4th Edition, Wellesley- Cambridge Press.

Reference Books

1. David C. Lay, *Linear Algebra and its applications*, Pearson Education, 2012,
2. Howard Anton, Chris Rorres, *Elementary Linear Algebra: Applications Version*, Wiley, 2014.

Code No.: MSST 151
Paper: **Statistics and Data Analysis II**
Nature: Theory

Full Mark: 75
Pass Mark: 30
Credit: 3

Course Description:

This course begins with Applications of integration, Techniques of integration, Parametric Equations and Polar Coordinates, and is followed by a comprehensive treatment of Infinite sequence and series.

Learning Objectives:

The main objective of the course is to familiarize students with continued basic Statistics and methods of data analysis techniques including correlation and regression.

Mode of Delivery:

The course will be taught by lecture (48 hrs), and problem solving and class discussion (24 hrs). The use of spread sheet software for problem solving will be encouraged.

Contents:

Unit 1 Data Modeling

20 hrs

Correlation analysis: correlation and its types (bivariate data and frequency distribution, correlation between two variables, positive correlation, negative correlation, zero correlation, perfect correlation) scatter covariance between two variables, Karl Pearson's coefficient of Correlation of ranked data: Spearman rank correlation and Kendall rank correlation.

Regression analysis: Regression and its types, simple and multiple regression linear and curvilinear; total and partial, difference between correlation and regression, lines of regression, fitting of lines of regression by the method of least squares, interpretation of slope and intercept, concept of linearity, simple and multiple linear regression models, fitting a simple/multiple linear regression models to a data set and interpret the output, uses majors of model fit to select an appropriate set of explanatory variables .

Unit 2 Analysis of Categorical Data

8hrs

Class frequencies, relation between class frequencies, consistence of data, condition for consistency of data, independence and association of attributes, Yule's method and coefficient of contingency, Yule's coefficient of colligation, Pearson's coefficient of contingency and their interpretation.

Unit 3 Index Numbers

15 hrs

Index numbers kinds of index numbers: price index, value index, quantity index, cost of living index, construction of index numbers, methods of computing price index, simple and weighted index numbers: Laspeyre's, Passche's and Fisher's index numbers, time and factor reversal test, cost of living index number, purchasing power of money, real wages, base shifting, inflation and deflation: chain indices and splicing two index numbers.

Unit 4 Analysis of Time Series

Time series, components of time series. Measurement of trend: Semi-average, moving average. Method of least squares: measurement of seasonal variation: Method of simple average and Ratio to Moving average ,application of time series .

Unit 5 Introduction to Probability

10 hrs

Concepts in probability: deterministic and random experiments; Definitions of terms: trial and event, outcome, sample space, equally likely, mutually exclusive, exhaustive and favorable cases, sure and impossible events, independent and dependent events; Definitions of probability: mathematical (classical), statistical (relative frequency) and subjective with their merits and demerits; Combinatorial analysis and combinatorial probability examples, algebra of events and probability; Properties of probability and basic theorems: Additive and multiplicative theorems, Boole's inequality; Axiomatic definition of probability, conditional probability, pair-wise and mutual independence, Bayes theorem, prior and posterior probabilities

References

1. Gupta, S. C. & Kapoor, V. K. *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi India, 2001.
2. Kapoor, J. N. & Saxena, H. C. *Mathematical Statistics*, S. Chand & Company Ltd., New Delhi, India, 2001.
3. Gupta, S. C. & Kapoor V. K. *Fundamentals of Applied Statistics*, Sultan Chand and Sons, India, 1994.
4. Bajracharya P.M. et.all , a text book of statistics second edition, sukunda books publication, Kathmandu Nepal.

Code No.: MSCS 151

Paper: Introduction to Programming I

Nature: Theory + Lab

Full Mark: 75

Pass Mark: 30

Credit: 3

Course description:

This course covers the concepts of C programming including data types, operators, control statements, arrays, functions, pointers, structures, unions, and data files.

Course objectives:

The main objective of this course is to provide students knowledge of different concepts C programming so that they will be able to develop small to medium size computer programs using C programming language.

Mode of Delivery:

The course will be taught by lecture (48 hrs), and lab work (24 hrs). The students are encouraged to develop computer programs related to the concepts of the C language after completion of each chapter.

Course content:

Unit 1 Programming Preliminaries

3 hrs

Introduction to Program and Programming Language; Compiler and Interpreter; Algorithm, Flow Chart, and Pseudocode; ASCII; Software Development

Unit 2 C Fundamentals

5 hrs

Introduction; Basic Structure; Writing a Simple C Program; The C Character Set; Identifiers and Keywords; Data Types; Variables and Constants; Writing Comments; Operators; Expressions and Statements

Unit 3 Data Input and Output

5 hrs

Preliminaries; Single Character Input – The Getchar Function; Single Character Output – The Puchar Function; Entering Input Data – The Scanf Function; More About Scanf Function; Writing Output Data – The Printf Function; More About Printf Function; The Gets and Puts Functions

Unit 4 Control Statements

9 hrs

Preliminaries; Branching Statements – If and Switch Statements; Looping Statements – For, While, and Do While Statements; Nested Control Statements; Break and Continue

Unit 5 Functions

5 hrs

Introduction; Function Prototype; Function Definition; Function Call; Advantages of Using Function; Types of Functions – Library Function and User Defined Function; Recursive Function; Storage Classes; The Preprocessor - #include and #define

Unit 6 Arrays

4 hrs

Introduction; Array declaration and Initialization; Searching and sorting; Multidimensional arrays; Strings

Unit 7 Pointers**5 hrs**

Fundamentals; Pointer Declarations; Passing Pointers to a Functions; Pointers and One-dimensional Arrays; Dynamic Memory Allocation; Operations on Pointers; Pointers and Multi-dimensional Arrays; Arrays of Pointers

Unit 8 Structures and Unions**7 hrs**

Defining a Structure; Processing a Structure; User Defined Data Types (typedef); Structures and Pointers; Passing Structures to Functions; Self-referential Structures; Unions

Unit 9 Data Files**5 hrs**

Why Files; Opening and Closing a Data File; Reading and Writing a Data File; Processing a Data File; Unformatted Data Files; Concept of Binary Files

Laboratory Work:

After completing this course, students should have practical knowledge on data types, operators, control statements, arrays, functions, pointers, structures, unions, and data files. Students should be able to develop a small mini project on their interested field.

Recommended Books:

1. Programming with C, Byron S Gottried
2. A Book on C, Programming in C, Al Kelley and Ira Pohl, Pearson Education

Code No.: MSEN 151

Full Mark: 75

Paper: Communication skill II

Pass Mark: 30

Nature of the course: Theory

Credit: 3

Course Description:

This course is a continuation of Communication skill I and aims to further strengthen students' ability to use English language for professional purpose through a study of essays, short-stories, and short-plays of renowned authors, review of books and articles.

Learning Objectives:

After successful completion of this course the student will be able to

- gain wider understanding of intercultural contexts of the world
- enhance their own morale by envisioning the best for the society
- familiarize themselves with various styles and techniques of writing through reading the texts by renowned writers
- increase their critical thinking ability as per the analytical demand of the course

Mode of Delivery:

The course will be taught by lecture (48 hrs), and presentation, class discussion (24 hrs).

Course contents

Unit 1 Poems

7 hrs

The Loneliness of the Long Distance Runner, Metaphors, My Papa's Waltz, Eight O'clock, Ballad of the Landlord 3

Unit 2 Short Story

6 hrs

The Buddha, The Hitch-hiker, The Lottery

Unit 3 Short Dramas

4 hrs

Sorry, Wrong Number, Chandalika

Unit 4 Essay

8 hrs

A Most Forgiving Ape, Girlhood Among Ghosts, The Death of the Moth, We Are all Scientists

Unit 5 Technical Writing

14 hrs

Chapter – 5 – Memo, Chapter – 6 – Letters, Chapter – 7 – Job Search, Chapter - - Report Writing, Chapter - - Research

Unit 6 Daily English Newspapers

9 hrs

References

1. **Joys of Reading**, Compiled & edited by Shreedhar Lohani and R. Adhikari, M.K. Publishers and Distributors.
2. **Technical Writing**, Gerson and Gerson (Unit II and IV), Pearson Education Inc.
3. **Daily English Newspapers**
