Statistics & Numerical Methods

Semester: II
Credit Hr: 4

Full Marks: 100
Internal: 20+20
Final Exam: 60

Course Objective: After completion of the subject, students are expected to be able to assemble data, analyze data, determine central tendency, solve non-linear equations, use interpolation, solve linear equations, integration and differentiation.

Course Contents:

1. Review of Measures of Location
Concept of Variables: Qualitative, Quantitative, Discrete and continuous variable; Frequency Distribution; Measures of Location: Mean, Median and Mode. **[2 hrs]**

2. Measures of Variation, Skewness and Kurtosis
Concept of absolute and relative measure of variation; Measures of Variation: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Variance, Coefficient of Variation; Five number summary; Measures of Skewness and Kurtosis based on moments. **[5 hrs]**

3. Correlation and Regression
Simple correlation: Scatter Diagram, Karl Pearson's correlation coefficient; Spearman's Rank correlation coefficient; Interpretation of correlation coefficient; Simple Linear Regression: Estimation of parameters using the Principle of Least Square Method, Regression Coefficients and their Properties. **[4 hrs]**

4. Probability
Basic Terminology in Probability: Sample Space, Events, Random Experiment, Trial, Mutually Exclusive and Not mutually Exclusive Events, Equally Likely Events, Exhaustive Events, Independent Events and Dependent Events; Approaches of Probability: Classical Approach of Probability, Statistical Approach of Probability; Laws of Probability: Additive law of probability, Multiplicative law of probability for independent events only. **[4 hrs]**

5. Random Variable and Probability Distributions
Discrete and Continuous Random variable; Mathematical Expectation of discrete random variable; Binomial Distribution: Probability Mass function; Chief characteristics of Binomial Distribution: Mean & variance; Calculation of Binomial probabilities; Fitting of Binomial Distribution; Poisson distribution: Probability Mass function; Chief characteristics of Poisson distribution: Mean & Variance; Calculation of Poisson probabilities; Fitting of Poisson distribution; Normal distribution: probability density function; Chief-characteristics: Mean & Variance; Calculation of standard normal probabilities. **[5 hrs]**

6. Sampling Distribution
Concept of Parameters and Statistics; Sampling Distribution of Mean of a sample from normal population; Standard Error of Mean. **[2 hrs]**

7. Estimation
Brief Introduction of Estimation; Criteria of a Good Estimator: Unbiasedness, Consistency, Efficiency & Sufficiency; Types of Estimates: Point Estimates & Interval Estimates. **[3 hrs]**

8. Testing of Hypothesis
Null Hypothesis and Alternative Hypothesis; Procedure in Hypothesis Testing; Types of Errors in Hypothesis Testing: Type I & Type II Error; Hypothesis test about a population Mean for Large Samples: z test; Hypothesis test about a population Mean for Small Samples: t-test. **[5 hrs]**

9. Introduction to Numerical Methods
Needs of numerical method; Errors: types and general formulas for errors; Rolle's and Intermediate value theorems. **[3 hrs]**

10. Solution of non-linear equations

Introduction; The Bisection method; The method of False Position; Newton-Raphson Method; Fixed-point iteration method. **[5 hrs]**

11. Interpolation

Introduction; Finite differences; Newton's formula for interpolation; Interpolation with unevenly spaced points: Lagrange's and Newton interpolation formula. **[5 hrs]**

12. System of Linear Equations

Consistency of linear system of equations; Solution of linear system: direct method, method of iteration; Direct method: Gauss-elimination method, method of factorization; Iterative method: Gauss-Jacobins and Gauss-Seidel method; Matrix Eigen values & Eigen vectors. **[7 hrs]**

13. Numerical Integration and Differentiation

Introduction; Numerical differentiation; Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rules; Romberg integration. Numerical double integration: **[5 hrs]**

14. Numerical solution of ordinary differential Equations

Euler's method; Modified Euler's method; Rungekutta methods (2^{nd} & 4^{th} order); Boundary-Value problem (Finite difference method). **[5 hrs]**

Reference Books:

1. Beri G. C., Statistics for Management, Tata McGraw Hill, New Delhi, 2003
2. Medhi J., Statistical Methods, New Age International, 1995
3. Johnson Richard A., Millers Fremund's, Probability & Statistics for Engineers, Pearson Education, 2001
4. Levin Rechard I., Rubin David S., Statistics for Management, Pearson Education, 2004
5. Chandan J. S., Singh Jagit, Khanna K. K., Business Statistics, Vikas Pub. House, 1999
6. S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall India

Object Oriented Programming in C++

Semester: II
Credit Hr: 3

Full Marks: 100
Internal: 20+20
Final Exam: 60

Course Objective: To provide the concepts of object oriented programming and develop the skills for implementing the concepts to solve real world problems using the object oriented paradigm.

Course Contents:

1. **Introduction:** **3 hrs**
   Comparing procedure oriented and object-oriented programming paradigm; Features of object-oriented programming languages; Application and benefits of OOP

2. **Introduction to C++:** **4 hrs**
   History of C++; Data types in C++; Keywords; Input output operations: cin, cout; Comments; new and delete operators; const; typecasting; manipulators

3. **Functions:** **2 hrs**
   Introduction; Function overloading; Inline function; Default arguments

4. **Classes and Objects:** **6 hrs**
   Introduction; Structure and classes; class declaration (public, protected and private modifiers); class objects; Accessing class members; Defining member functions: Member function inside the class body, member function outside the class body; this pointer; static data members and static member functions; passing objects to functions; returning objects from functions; Friend functions and friend classes

5. **Constructors and Destructors:** **3 hrs**
   Functions of constructors and destructors; Syntax of constructors and destructors; Types of constructors; Destructors

6. **Operator Overloading:** **6 hrs**
   Introduction; Operator overloading restrictions; overloading unary and binary operators; Operator overloading using a friend functions; Data conversion: conversion between basic types, conversion between user defined and basic types, conversion between user defined data types

7. **Inheritance:** **7 hrs**
   Introduction; Types of inheritance; Advantages of inheritance; Base classes and derived classes; Constructors and destructors in derived classes

8. **Virtual Functions and Run time Polymorphism:** **6 hrs**
   Introduction; Early binding vs Late binding; Virtual functions; Pure virtual functions, and Abstract base classes

9. **Templates:** **3 hrs**
   Introduction; Advantages of template; Functions template and Class template

10. **Stream in C++:** **5 hrs**
    Streams in C++; Input/output class hierarchy; File input and output

Reference Books:

1. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill Publishing Company Limited, India
2. Robert Lafore, "Object Oriented Programming in C++", Galgotia Publication, India
3. Deitel & Deitel, "C++ How to Program", 3/e, Prentice Hall
4. John Hubbard, "Schema's Outlines Programming with C++", McGraw Hill

System Analysis & Design

Semester: II
Credit Hr: 3

Full Marks: 100
Internal: 20
Final Exam: 80

Course Objective: To impart the knowledge of System and its life cycle in real world.

Course Contents:

1. Introduction **12 hrs**

1.1. System
1.2. Features of System
1.3. System Development Environment
    1.3.1. Different Roles in System Development
    1.3.2. Information and its types
    1.3.3. System Development Life Cycle

2. System Analysis **7 hrs**

2.1. Data Flow Diagram
2.2. E-R Diagram

3. System Design **9 hrs**

3.1. Introduction to Design
3.2. Design Specification
3.3. Traditional Method
3.4. Prototyping

4. Implementation **5 hrs**

4.1. Introduction to System Implementation
4.2. Testing and its types
4.3. Documentation

5. Object Oriented Analysis and Design **12 hrs**

5.1. Introduction
5.2. Features of OOAD
5.3. UML
    5.3.1. Use Case Diagram
    5.3.2. Class Diagram

Reference Book:

1. Modern System Analysis & Design, Third Edition, By: Jeffery A. Hoffer, Joey F. George, Joseph S. Valacich, Pearson Education.

Data Structure & Algorithm

Semester: II
Credit Hr: 3

Full Marks: 100
Internal: 20+20
Final Exam: 60

Course Objective: This course explores techniques for understanding, analyzing and selecting appropriate data structures to solve a given problem.

Course Contents:

1. Linear Data Structures: Array, Records or structures, Operations on Stack, Stack, Applications of Stack Implementation of Stacks (based on Array and linked list), Linked List, List (based on array and linked list), Queues, Operations on Queues, Circular Queues, Priority Queues, Implementation of Queues (Based on array and linked list) Doubly lists, Circularly Lists, operations on lists **15 Hrs**

2. The Analysis of Algorithms: Introduction to Algorithms, Efficiency, Asymptotic Analysis (Big O, omega and Theta Notations) **4 Hrs**

3. Hierarchical Data Structures: Trees, Binary Trees, Operations on Binary Trees, Linked list and array implementation of binary trees, Binary tree traversal, Binary Search Trees, Implementation of Insertion, Deletion and Search in Binary search trees, Indexed Search Trees, Heaps, Implementation of Heaps, Application of heaps. **15 Hrs**

4. Graph Data Structures: Graphs, Operations on Graphs, Adjacency Matrix and List representation, Transversal Algorithms (DFS, BFS), Minimum Spanning Trees, Krushkal's and Prim's, Shortest Path Algorithm (Dijkstra's Algorithm) **5 Hrs**

5. Sorting and Searching Algorithms: Selection sort, Insertion sort, Bubble sort, Binary Tree Sort, Quick sort, Merge Sort, Sequential Search, Binary Search **6 Hrs**

Reference Book:

Data Structures, Algorithms & Applications in Java, Sartaj Sahni, Tata McGraw Hill

Database System

Semester: II
Credit Hr: 3

Full Marks: 100
Internal: 20+20
Final Exam: 60

Course Contents:

1. Database systems **4 Hrs**

History and motivation for database systems, Components of database systems, DBMS functions,, Database architecture and data independence, Use of a database query language

2. Data modeling **4 Hrs**

Data modeling, Conceptual models (including entry-relationship and UML), Object-Oriented model, Relational data model

3. Relational Databases **5 Hrs**

Mapping conceptual schema to a relational schema, Entity and referential integrity, Relational algebra and relational calculus

4. Database query language **8 Hrs**

Overview of database languages, SQL (Data definition, query formulation, update, sub-language, constraints, integrity), Query optimization, QBE and 4th-generation, environments, Embedding non-procedural queries in a procedural language, Introduction to Object Query Language

5. Relational Database design **8 urs**

Database design, Functional dependency, Normal forms (1NF, 2NF, 3NF, BCNF), Multivalued dependency (4NF), Join dependency (PJNF, 5NF), and Representation theory

6. Transaction processing **5 Hrs**

Transactions, Failure and recovery, Concurrency control

7. Physical database design **6 Hrs**

Storage and file structure, Indexed files, Hashed files, Signature files, B-trees, Files with dense index, Files with variable length records, Database efficiency and tuning

8. Distributed data based **5 Hrs**

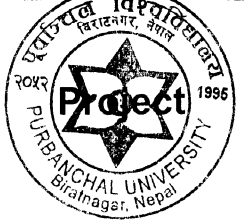
Distributed data storage, Distributed query processing, Distributed transaction model Concurrency control, Homogeneous and heterogeneous solutions, Client-server

Laboratory:

1. Installing database software (Oracle/MSQL/MYSQL)
2. Mapping conceptual schema to a relational schema along with following topics using any database:
   - SQL Statements (DML, DDL, DTL and DCL)
   - SQL Clauses (WHERE, ORDER BY, GROUP BY, HAVING)
   - SQL Operators (Logical Operators, Comparision Operators, LIKE, IN, IS NULL, BETWEEN....AND)
   - SQL Integrity Constraints (Primary/Foreign/Unique Key Constraint, Check/Not NULL Constraints)
   - Other SQL concepts (Aliases, Group Functions, JOINS, VIEWS, Subquery, Index, GRANT, REVOKE)
3. Practice for performance tuning (i.e. using indexes)
4. Query in distributed database environments using concept of link servers.

Reference Book:

R. Ramakrishnan, J. Gehrke, Database Management Systems, 3rd Edition, McGraw Hill



Semester: II
Credit Hr: 2

Full Marks: 100
Internal: 60
Final Exam: 40

Course Objective: To design and complete the software project in any high level language (C or C++). On the completion of the project, student will be able to develop small scale software in high level programming language.

Course Contents:

There should be a total of 45 hours covering important features of a high level programming language. A software development project will be assigned to students in a group (upto 4). A relevant topic shall be identified and instructed to each group. Students must develop the assigned software, submit written report, and give oral presentation.

General Procedure:

1. Topic Selection
2. Information Gathering
3. System Requirements and Specifications
4. Algorithms and Flowcharts
5. Coding
6. Implementation
7. Documentation

The project document shall include the following:

1. Technical description of the project
2. System aspect of the project
3. Project tasks and time-schedule
4. Project team members
5. Project supervisor
6. Implementation of the project