Second Semester:

Course Title: **Discrete Structure**
Course Code: COM **42**1
Semester: II
Class Load: 6 Hrs. per Week (Theory: 3Hrs+ Tutorials: 3Hrs)
Evaluation: External (60)+ Internal (20+20)

Course Objective:

This module aims to expose students to rigorous mathematical proof techniques of discrete mathematics.

Detailed Course

Unit 1. Relations and order Relations8 Hrs

1.1 Product sets, Binary relations, Domain and Range of binary relation.

1.1 Types of relation-Inverse relation, Identity relation, universe relations, void relation, complementary relation, ternary relation and n-ary relation.

1.2 Representation of relations-Table of relation, Arrow diagrams of relation, Graph of relation,Matix of relation, Directed graph of a relation on a set A.

1.3 Boolean Matrix.

1.4 Properties of relations- reflexive, irreflexive, symmetric, asymmetric, anti-symmetric and transitive raltions. Equivalence relation, Equivalence relation and partition, Equivalence classes and quotient set.

1.5 Composition of two relations, matrix of composition relations properties-

1.6 Partial order relation, Partial ordered set, Dual partial ordered set.

Unit 2. Function (Mapping) 7 Hrs

2.1 Concept of function, Domain and Range, image and pre-image, Graph of a function f: A→B, Equality of functions, Real valued function, constant function and Identity function.

2.2 Types of functions – onto function, one-to-one function, One-to-one correspondence between A and B, Inverse function.

2.3 The composition of two functions, Properties

2.4 Special functions-Floor function, ceiling functions, Exponential and Logarithmic functions, Integer valued function, Absolute value function, Remainder functions(mod. M functions), factorial function, characteristic function.

2.5 Sequence, finite sequence and infinite sequence length of finite sequence, string and bit string.

2.6 Cardinality – Cardinal set, Denumerable set, countable and uncountable set.
Induction and recursion, Examples of proofs by mathematical induction, Recursive definition and Recursively defined function.

Unit 3 Counting and Combinatory 8 Hrs

3.1 Basic counting principle. The sum rule and the product rule.

3.2 Permutation of n different objects. The number of r- permutations of n distinct objects when (a) repetition of objects are not allowed (b) repetition of objects are allowed.
Permutations of n objects when the things are not distinct, circular permutations.
Restricted permutations – The number of r-permutations of n different objects are always present.
Combination :- r-combinations of n different objects Restricted combinations, combinations with repetitions:

3.4 Binomial Theorem, Binomial coefficients and Pascal triangle Pascal's identity.

3.5 The pigeonhole principle and Inclusion and Exclusion principle.

Unit 4: Basic Concepts of Graphs **8 Hrs**

4.1 Simple graph, multiple graph and pseudo graph, order of a graph and size of a graph.

4.2 Adjacent vertices, Adjacent edge, degree of a vertex, Isolated vertex and Pendant vertex. Degree sequence of a graph.
Properties (with proofs):

a) The sum of the degree of the vertices of a graph is equal to twice the number of edges.
a) The number of odd vertices in a graph is always even.

4.3 Special types of graph- Isolated graph, complete graph, Regular graph, Path graph, Cycle graph, Wheel graph, Bipartite graph and complete bipartite graph, Graphs of regular Platonic Solids.

4.4 Connectivity – walk, trail and circuit, Path and Cycle, Connected graph, Cut-sets and Cut-vertices. Edges connectivity an vertex connectivity. Theorems (with proofs): a) Let G be a graph. Then every walk from any two verticals U n V contains a path from these vertices b)

4.5 Subgraphs – Subgraphs of a graph, Spanning subgraph, Induced subgraph, Subgraphs deleting a vertex of G(V,E), Subgraph deleting an edge of G(V,E), Connected graph and connected components, Components of a graph.

4.6 Representations of graph – Adjacency list, Adjacency matix, and Incidence matrix.

4.7 Isomorphism of Graphs, Isomorphic graphs, Isomorphic classes, Self Complementary.

Unit 5: Traversability
4 Hrs

5.1 Eulerian trail, Eulerain circuit, Eulerian graph, Konigsberg Bridge problem. Theorems (without proofs):-

a) A connected graph G is Eulerian if and only if each vertex has even degree.
a) A connected graph G has Eulerian trail if and only if it has exactly two odd vertices.

5.2 Hamitonian path, Hamiltonian cycle and Hamiltonian graph. Theorems (without proofs)

Unit 6. Trees **5 Hrs**

6.1 Label tree and non Label tree. Non-isomorphic trees. Leaf and branch node, Forest. Between any two vertices of G.

6.2 Properties of tree (with proofs).

6.3 Spanning tree, A theorem with proof – A graph G has a spanning tree if and only if G is connected, Methods of constructing a spanning tree from a graph by

a) Breadth – first search and

a) Depth – first search (Backtracking), Determination of all spanning tree in a simple connected graph, using 'Matrix tree theorem's (Kirchhoff's Theorem).

6.4 Minimum spanning tree- a) Kruskal algorithm b) Prim's algorithm. Edge constrained spanning tree.

Unit 7: Directed Graphs **5 Hrs**

7.1 Digraph, Simple digraph, Reflexive, Symmetric and Transitive digraph, Loop and Parallel arc (edge), Adjacent vertices and degree of vertices, Source vertex and Sink vertex. Theorem (with proof) – In a digraph, the sum of the in-degrees of vertices, the sum of the out-degrees of vertices and the number of edges are equal are equal to each other.

7.2 Connectivity of digraphs – underlying graph, directed walk, closed walk, directed path, directed cycle, spanning path. Weakly connected, Unilaterally connected and strongly connected theorems (without proofs)

7.3 Representation of diagraph – Adjacency list, Adjacency matrix and Incidence matrix.

7.4 Rooted tree, Pictorial representation of rooted tree. Definitions of some terms related to Parent and child sibling, Ancestors, Descendants.

7.5 Subtrees of a rooted tree – the subtree at a vertex v, the subtree of vertex v, ordered rooted tree, universal address system for the vertices of an ordered rooted trees, Lexicographical order.

7.6 Binary tree and m-any tree, properties of binary tree with proofs.

Text Book:

1. Kenth Rosen; ***Discrete Mathematical and its application***, McGraw-Hill

Recommended Book:

1. Kolma, Busby, Roos; ***Discrete Mathematical Structure***, Prentice-Hall of India.
2. R.Joshnsonbaugh; ***Discrete Mathematical***, Pearson Education Asia.
3. Seymour Lipschutz and Marc Lipson; ***Discrete Mathematics***,(Schaum's Outline).
4. S.M Maskey: ***First course in Graph Theory***, Published by RatnaPustakBhandar.

Course Title: **Microprocessor and Assembly Programming**
Course Code: COM **42**2
Semester: II
Class Load: **6** Hrs. per Week (Theory: 3 Hrs, **Practical: 3 Hrs**)
Evaluation: External(60) + Internal (20 + 20)

Course Objective: To be familiar with the operation, programming and application of 8 and 16 bit microprocessor.

1. Introduction **6 hours**

1.1 History of microprocessor
1.2 Calculator and stored program computer
1.3 Von Neumann and Harvard architecture
1.4 Simple stored program computer architecture
1.5 Microprocessor Architecture (8 and 16 bit)
1.6 Applications

2. Microprocessor Instructions (8bit Microprocessor) **8 hours**

2.1 Resister transfer language (RTL)
2.2 Instruction and machine cycle
2.3 Addressing modes: Direct, indirect, immediate, absolute, relative, indexed, register, stack and implied
2.4 RTL description of data transfer, arithmetic, logical, branch, miscellaneous instructions
2.5 Fetch and execution cycle, fetch execution overlap
2.6 Timing diagram for register move, indirect read, indirect write and out instructions

3. Assembly Language Programming (16 bit Microprocessor) **10 hours**

3.1 Assembler instructions format: Opcodes, memonics and operands
3.2 Assembler operations: Sample assembly language program and code generation, one pass and two pass assembly
3.3 Macro assemblers, linking assemblers and assembler directives

4. Bus Structure and Memory Devices **4 hours**

4.1 Bus Structure, synchronous and asynchronous data bus, address bus, bus timing
4.2 Static and Dynamic RAM, ROM
4.3 PROM, UVEPROM, EEPROM, PROM programmer and erasure
1.4 Address decoding, memory interface (8, 16, 32, 64 bit)

5. Input/Output Interfaces **7 hours**

5.1 Serial Communication
  5.1.1 Asynchronous interface: ASCII code, baud rate, start bit, stop bit, parity bit
  5.1.2 Synchronous interface

5.1.3 8255 Programmable Peripheral Interface (Block diagram and Modes only)
5.1.4 8251 Programmable Communication Interface (Block diagram and Modes only)
5.2 Parallel Communication
5.3 Data transfer wait interface
5.4 RS-232 and IEEE 488-1978 general purpose interface standard
5.5 8279 Keyboard and display controller (Block diagram and Modes only)

6. Interrupt (8, 16-bit) 5 hours

6.1 Introduction
6.2 Interrupt vector and descriptor table
6.3 Interrupt service routine requirements
6.4 Interrupt priority: Maskable and non-maskable interrupts, software interrupts, trap and execution (8 and 16 bit)
6.5 Vectored, chained and polled interrupt structures
6.6 Interrupts in parallel and serial interfaces
6.7 8259 Interrupt controller (Block diagram and Modes only)

7. DMA 3 hours

7.1 Introduction
7.2 Basic DMA operations
7.3 8237 DMA controller (Block diagram and Modes only)

8. Introduction to Advance Microprocessor Architecture 2 hours

Based on register size and Bus width from 8085 to Recent Microprocessor

Laboratory:

12 laboratory exercise using microprocessor trainer kit and assembler.

Text Books:

1 Ghosh, P. K., Sridhar P. R.,"*0000 to 8085: Introduction to Microprocessors for Engineers and Scientists*", Second Edition, Prentice Hall of India Private Limited, 1997.
1 Barry B. Berry,"*The Intel Microprocessors 8086,8088,80186, 80286, 80386, and 80486 (Architecture, Programming and Interface ,*", Prentice Hall of India Private Limited, 1997.
2 "Lance, A. Leventhal., "*Introduction to Microprocessors: Software, Hardware, and Programming*", Eastern Economy Edition, Prentice Hall of India Private Limited, 1995.
3 Yu Cheng Liu and Glenn A. Gibson, "*Microprocessors Systems: The 8086/8088 Family ,*", Prentice Hall of India Private Limited, 1998.
4 Douglas V. Hall, "*Microprocessors and Interfacing,*", Prentice Hall of India Private Limited, 1997.

Course Title: **Object Oriented Programming**
Course Code: COM **42**3
Semester: II
Class Load: **6** Hrs. per Week (Theory: 3 Hrs, Practical**: 3 Hrs**)
Evaluation: External (60) + Internal (20 + 20)

Course Objectives:

Object-oriented programming is an approach to thinking about computation and problem solving in Object Oriented Paradigms. This course lays out the principles of object-oriented programming in C++ Programming Language. The Course helps the target audience to discover the basic concepts of object-oriented programming in C++. The basic objective behind this course is:

- To introduce the fundamentals of C++ programming
- To present the defensive programming style required by the C/C++ programming language
- To explore the facilities offered by C++ for object-oriented programming.

Course Contents:

1. Introduction to Object Oriented Paradigm (12 Hrs.)

Object-Oriented Programming as a New Paradigm, A Way of Viewing the World-Agents, Computation as Simulation, Coping with Complexity: The Nonlinear Behavior of Complexity: Abstraction Mechanisms, reusable Software. Object-Oriented Design: Responsibility Implies Noninterference, Programming in the Small and Programming in the Large, Role of Behavior in OOP, Case Study: Responsibility-Driven Design, CRC Cards, Components and Behavior, Software Components, Formalize the Interface, Design the Representation for Components, Implementing Components, Integration of Components, Maintenance and Evolution

1. Classes, Methods and Messages (13 Hrs.)

Encapsulation, Varieties of Classes, Interface and Implementation, Classes and Methods in C++, Message-Passing Formalism, Message Passing Syntax in C++, Issues in Creation and Initialization; Stack Versus Heap Storage Allocation, Memory recovery, Pointers; Mechanisms for Creation and Initialization in C++, Case Study: The Eight Queen Puzzle in C++.

2. Inheritance and Software Reusability (10 Hrs.)

Introduction to Inheritance, Subclass, Subtype, and Substitutability; Forms of Inheritance, Inheritance in C++, Inheritance- Its merit and demerits, Inheritance and Substitutability, The *is-a* rule and the *has-a* rule, Composition and Inheritance, Software reusability

3. Polymorphism (10 Hrs.)

Polymorphism in Programming languages, Varieties of Polymorphism, Polymorphic Variables, Overloading, Overriding, Deferred Methods, Pure Polymorphism, Generic and Templates, Polymorphism in C++ and, Case Study: Container Classes and The Standard Template Library

Laboratory Work

There shall be 20 exercises in minimum, as decided by the faculty. The exercises shall encompass a broad spectrum of real-life and scientific problems, development of small program to the development of fairly complex subroutines, programs for engineering applications and problem solving situations. Laboratory assignments will be offered in groups of two to four for evaluation purpose. In general, the Laboratory Work must cover assignments and exercises from the following areas:

1. Data types – control structures, functions and scoping rules.
1. Composite data types, C++ strings, use of " Constant " keyword, pointers and references
2. Classes and data abstraction
3. Inheritance, abstract classes and multiple inheritance
4. Friend functions, friend classes and operator overloading.
5. Static class members
6. Polymorphism, early binding and late binding
7. C++ type conversion
8. Exception handling
9. Function templates, class templates and container classes.

Recommended Book:

1. R. Lafore, *Object Oriented Programming in Turbo C++*, Galgotia Publications Ltd. India, 1999
1. Budd, T., *An Introduction to Object Oriented Programming*, Second Edition, Addison-Wesley, Pearson Education Asia, ISBN: 81-7808-228-4.
2. Savitch, W, *Problem Solving with C++ - The Object of Programming*, 2nd Edition, Addison – Wesley, Pearson Education Asia (LPE), 2001, ISBN: 81-7808-173-3
3. Lippman, S.B., Lajoie. J., *C++ Primer*, 3rd Ed., Addison Wesley, 1998
4. Eckel, B., *Thinking in C++*, 2nd Edition, Prentice Hall, 2000

Course Objective:
Course Title: **Statistics**
Course Code: MAT **42**4
Semester: II
Class Load: 6 Hrs. per Week (Theory: 3Hrs + Tutorials 3 Hrs)

Evaluation: External (60) + Internal (20 + 20)

Course Objective:
This module aims to introduce students to the tools and techniques of statistics that can be used for managerial decision making.

Detailed Course
Unit 1: Introduction **2 Hrs**
Definition, scope, and limitations of statistics. Use of statistics in management.

Unit*2:* **Data Collection and** Classification **2 Hrs**
Objective of data collection. Types of data. Methods of collecting primary data. Method of collecting secondary data. Precaution in using secondary data. Problems of collecting primary and secondary data. Sampling - concepts and method.

Unit 3: Classification and Presentation **4 Hrs**
Need and meaning of classification. Types of classification Frequency distribution (including bivariate frequency). Graphic and diagrammatic presentation: Histogram, Frequency, polygon and 0 give curves, Percentage bar diagram and Pie diagram.
Note: Unit 1, 2, and 3 Revision only,

Unit 4: **Measures** of Central **Tendency** **6 Hrs**
Types of average (AM, GM, HM, Median, Mode), Choice of average

Unit 5: Measures of Dispersion **3 Hrs**
Objectives of relative and absolute measures of dispersion. Types ol measuring dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Loren; Curve. Coefficient of variation and its application

Unit 6: Measures of Skewness and Kurtosis **4 Hrs**
Objective of measuring Skewness Karl Pearson's and Bowley's coefficient of skewness. Obji'c.live of measures of Kurtosis. Measures of skewness and Kurtosis based on moments,

Unit 7: Correlation and Regression 5 Hrs

Correlation and *its* type Karl Pearsons correlation coefficient (including bivariate frequency distribution) Spearman's rank correlation coefficient Regression analysis and its application (simple and Including bivariate frequency distribution). Properties of correlation and regression coefficient.

Unit 8: Analysis of Time Series **8 Hrs**

Need and definition of time series. Components of time series. Methods of measuring trend - (a) Method of semi average (b) Method of moving average (c) Least square method Measurement of seasonal variation - Simple average method and Ratio to moving average using additive and multiplicative model.

Unit 9: Index Number **7 Hrs**

Definition and uses of index number. Types of index number Problems in constructing index number. Simple aggregative and simple averages of price relatives. Laspeyre's, Paasche's and Fisher's index numbers. Weighted average of price relatives (using A.M. and G M). Time reversal test and factor reversal test. Consumer's price index number Aggregative expenditure method. Family budget method. Base shifting and deflating.

Unit 10: Probability **4 Hrs**

Concept of objective and subjective probability. Permutations and combinations. Counting and random variable Marginal and joint probability. Addition and multiplication rule Conditional probability and Baye's theorem.

Recommended Book:

Statistics *for Management,* by Levin.
Gupla SC., *Fundamentals of Statistics,* Himalayan Publishing House, India.

Course Title: **Basic Mathematics** II
Course Code: MAT**42**5
Semester: II
Class Load: 6 Hrs. per Week (Theory: 3Hrs + Tutorials 3 Hrs.)

Evaluation: External (60)+ Internal (20 + 20)

Course Objectives

This course provides students with the knowledge of fundamental of linear algebra and the theory of matrices. On completion of this course the student will master the basic concepts and acquires skills in solving problems in linear algebra.

Course Contents:

Unit 1: Linear equations in linear Algebra **10 Hrs.**

1.1 Systems of linear equations
1.2 Row reduction and Echelon Forms
1.3 Vector equations
1.4 The matrix equations Ax = b
1.5 Solution sets of linear systems
1.6 Linear independence
1.7 Introduction Linear Transformations
1.8 The matrix of a Linear Transformations

Unit 2: Matrix Algebra **8 Hrs.**

2.1 Matrix operations
2.2 The inverse of a matrix
2.3 Characterization of invertible matrices
2.4 Partitioned Matrices
2.5 The Leontief Input-output model
2.6 Application to Computer graphics

Unit 3: Determinants **4 Hrs.**

3.1 Introduction to determinants
3.2 Properties of determinants
3.3 Cramer's rule value and linear transformations

Unit 4: Vector Spaces **8 Hrs.**

4.1 Vector spaces and sub polar
4.2 Null spaces, Column spaces and linear transformations
4.3 Linearly Independent Sets; Bases
4.4 Coordinate systems
4.5 The dimension of a vector space

4.6 Rank
4.7 Change of basis

Unit 5: Eigen values and Eigen vectors **7 Hrs.**

5.1 Eigen vectors and Eigen values
5.2 The characteristics equations
5.3 Diagonalization
5.4 Eigen vectors and Linear Transformations
5.5 Complex Eigen values
5.6 Discrete Dynamical System

Unit 6: Orthogonality and Least Squares **8 Hrs.**

6.1 Linear product, length and Orthogonality
6.2 Orthogonal sets
6.3 Orthogonal Projections
6.4 The Gram- Schmidt process
6.5 Least square problems
6.6 Applications to Linear models

Recommended Book:

1. David C. lay: Linear Algebra and its applications, 3rd edition, Pearson Education.
1. Kolman, Bernard; Introductory Linear Algebra with Application.7th edition. Pearson.
2. Gilbert Strang; Linear Algebra and its Application.3rd edition.
3. Kreszig, E. " Advanced Engineering Mathematics." 5th edition. Wiley