UNIVERSITY OF PUNE
DEPARTMENT OF MATHEMATICS
SYLLABUS
M.Tech.
(Industrial Mathematics with Computer Application)

A three years duration course with total 150 credit points

FIRST YEAR

SEMESTER I
(All are compulsory and each course is of 5 credit points)

MIM 101 Linear Algebra
MIM 102 C-Programming
MIM 103 Operating Systems
MIM 104 Algebra
MIM 105 Numerical Analysis.

Total credits:25 points

SEMESTER II
(All are compulsory and each course is of 5 credit points)

MIM 201 Foundations of Analysis
MIM 202 Complex Analysis
MIM 203 Data Structures with C
MIM 204 Programming in C++
MIM 205 Differential Equations

Total credits: 25 points

SECOND YEAR

SEMESTER III
(All are compulsory and each course is of 5 credit points)

MIM 301 Web Programming
MIM 302 Discrete Mathematics
MIM 303 Theory of Computer Science
MIM 304 Design and Analysis of Algorithms
MIM 305 JAVA

Total credits: 25 points

SEMESTER IV
(Each course is of 5 credit points)

MIM 401 Field Theory / Optional Mathematics Course
MIM 402 Differential Geometry /Optional Mathematics Course
MIM 403 Data Base Management Systems I
MIM 404 MS.NET
MIM 405 Computer Networks.

Total credits: 25 points

THIRD YEAR

SEMESTER V
(Each course is of 5 credit points)

MIM 501 Coding Theory /Optional Mathematics Course
MIM 502 Probability Theory /Optional Mathematics Course
MIM 503 Data Base Management Systems II
MIM 504 Software Engineering
MIM 505 Advanced JAVA

Total credits: 25 points

SEMESTER VI

Industrial Training
Industrial Training has two projects:
(1) Minor project: During the vacation between 4 th semester and 5 th semester.
(5 credit points.)
(2) Major project: 6th semester.
(20 credit points.)

Total credits: 25 points.

MIM 101 : Linear Algebra

1. **Prerequisites:** Vector Spaces: Definition and Examples, Subspaces, Bases and Dimensions, Linear Transformations, Quotient Spaces, Direct Sum, The matrix of Linear Transformation, Duality.
2. **Canonical Forms:** Eigenvalues and Eigenvectors, The minimal Polynomial, Diagonalisability, Triangular sable Operators, Jordan Forms, The Rational Forms.
3. **Inner Product Spaces:** Inner Product Spaces, Orthogonally, The Adjoint of Linear Transformation, Unitary operators, Self Adjoint and Normal Operators, Polar and Singular Value Decomposition.
4. **Bilinear Forms:** Definition and Examples, The matrix of a Bilinear Form, Orthogonality, Classification of Bilinear Forms.
5. **Modules:** Definition and Examples, Further notions and Results.
6. **Free Modules:** Linear Independence, Bases of Free Modules, Matrices and Homeomorphisms.

Prescribed Books:

- **Luthar and Passi**, Modules (Narosa Publishing House).
- **Vivek Sahai and Vikas Bist,** Linear Algebra (Narosa Publishing House).

MIM 102 : C-Programming

1. **Introductory Concepts:** Introduction to computer, computer characteristics, types of programming languages,introduction to C.
2. **C Fundamentals:** The character set, identifier and keywords, data types, constants, variables and arrays, declarations, expressions, statements, symbolic constants.
3. **Operators and Expressions:** Arithmetic operators, unary operators, relational and logical operators, assignment operators, library functions.
4. **Data Input and Outputs:** Preliminaries, single character input-getchar() function, single character output-putchar() function, entering input data-scanf function, writing output data- printf function, formatted input-output, gets and puts functions.
5. **Preparing and Running a Program:** Planning and writing a C Program, compiling and executing the program.
6. **Control Statements:** Preliminaries, the while statement, the do- while statement, the for statement, nested loops, the if-else statement, the switch statement, the break statement, the continue statement, the comma operator, the goto statement.
7. **Functions:** A brief overview, defining a function, accessing a function, passing arguments to a function, specifying argument data types, function prototypes, recursion.
8. **Program Structures:** Storage classes, automatic variables, external variables, static variables, multifile programs, more about library functions.
9. **Arrays:** Defining an array, processing an array, passing arrays to a function, multidimensional arrays, arrays and strings.
10. **Pointers:** Fundamentals, pointer declarations, passing pointer to a function, pointer and one dimensional arrays, operations on pointers, pointers and multidimensional arrays, array of pointers, pointer to a function, passing functions to other functions, more about pointer declarations.
11. **Structures and Unions:** Defining a structure, processing a structure, user-defined data types (typedef), structures and pointers, passing structure to a function, self-referential structures, unions.
12. **Data Files:** Opening and closing a data file, creating a data file, processing a data file, unformatted data files.

Prescribed Books: 1. Byron S, Gottfried, *Programming with C*, Schaum's Outline series.

2. Yashwant Kanetkar, *Let us C*, BPB Publications.

Reference Book: Brian W, Kernighan, Dennis M, Ritchie, *The C Programming Language*, Prentice Hall Publication.

MIM 103 : Operating Systems

1. **Introduction to Operating Systems :** Batch System, Time sharing system, personal computer system, Parallel system, Distributed System, Real Time System
2. **File System :** File Systems, File Concepts, Allocation Methods, Access Methods, Directory Structure
3. **Threads :** Overview, Multithreading models, Threading Issues.
4. **CPU Scheduling :** Basics, Scheduling criteria, Scheduling Algorithms, Multiple Processor Scheduling.
5. **Disk and Drum Scheduling**
6. **Memory Management :** Background, Swapping, Contiguous allocation, Paging, Segmentation, Segmentation and paging- combined system, virtual memory concept, Demand paging, Paging replacement algorithms.
7. **Concurrent Processing and programming :** Review of process concepts, Hierarchy of processes, Problem and solution algorithm, Semaphores, Overview of Concurrent programming, Modularization, Synchronization in Windows 2000, Concurrent languages.
8. **Deadlocks :** System model, Deadlock characterization, methods of handling Deadlocks, Deadlock Prevention, Deadlock Avoidence, Deadlock Detection, Recovery from Deadlock.

Prescribed Book:

- **Silberschatz**, Operating System Concepts .

MIM 104 : Algebra

1. Prerequisites: Semigroups and groups, Homomorphisms, Subgroups and cosets. Rings, Examples of rings, types of rings, subrings and characteristic of a ring.
2. Cyclic groups, permutation groups, generators and relations.
3. Normal subgroups and quotient groups. Isomorphism theorems, automorphisms, conjugacy and G-sets.
4. Normal series, Solvable groups, Nilpotent groups.
5. Group Homomorphisms, First Isomorphism Theorem, Fundamental Theorem of Finite Abelian Groups.
6. Permutation Groups, Cyclic decomposition, Alternating group A_n, Simplicity of A_n.
7. Structure of groups, Direct products, Finitely Generated Abelian Groups, Invariants of a finite abelian group
8. Sylow Theorems, Groups of order p2, pq.
9. Ideals and homomorphisms, maximal and prime ideals, nilpotent and nil ideals, Zorn's lemma
10. . Unique Factorisation Domains, Principal Ideal Domains, Euclidean Domains. Polynomials over UFD.

Prescribed Book:

- **P. B. Bhattacharya, S. K. Jain and S. R. Nagpaul,** Basic Abstract Algebra (Second Ed.), Cambridge Univ. Press (Indian Ed. 1995).

Reference Book:

- **Joseph A. Gallian,**Contemporary Abstract Algebra (Fourth Ed.), Narosa, 1999.
- **I. S. Luthar and I. B. S. Passi,** Algebra-Vol. 1: Groups, Narosa, New Delhi, 1996.

MIM : 105 Numerical Analysis

1. **Iterative solutions of nonlinear equation:** bisection method. Fixed-point interation, Newton's method, secant method, acceleration of convergence, Newton's method for two non linear equations, polynomial equation methods.

2. **Polynomial interpolation:** interpolation polynomial, divided difference interpolation, Aitken's formula, finite difference formulas, Hermite's interpolation, double interpolation.

3. **Linear systems of Equations:** Gauss Elimination, Gauss-Jordan method, LU decomposition, iterative methods, and Gauss- Seidel iteration.

4. **Numerical Calculus :** Numerical differentiation, Errors in numerical differentiation, Numerical Integration, Trapezoidal rule, Simpson's 1/3 - rule, Simpson's 3/8 rule, error estimates for Trapezoidal rule and Simpson's rule.

5. **Numerical Solution of Ordinary differential Equations :** Solution by Taylor series, Picard Method of successive approximations, Euler's Method, Modified Eular Method, Runge- Kutta Methods, Predicator-Corrector Methods.

6. **Eigenvalue Problem :** Power method, Jacobi method, Householder method.

7. **Practicals with Scilab.**

Prescribed Book:

- **S. S. Sastry,** Introduction Methods of Numerical Analysis (4th Edition)(Prentice-Hall).

Refrence Book:

- **K .E. Atkinson,**: An Introduction to Numerical Analysis.
- **J. I. Buchaman and P. R. Turner,** Numerical Methods and Analysis..

SEMESTER II

MIM 201 : Foundations of Analysis

1. **A Taste of Topology:** Metric space concepts, Compactness, Connectedness, Coverings, Cantor sets.
2. **Functions of a Real Variable:** Differentiation, Reimann integration, Series.
3. **Function Spaces:** Uniform convergence and $C^0[a, b]$, Power series, Compactness and equicontinuity in C^0.
4. **Multivariate Calculus:** Derivatives, Higher derivatives, Smooothness classses, Implicit and inverse functions.
5. **Lebesgue Theory:** Outer measure, Measurability, Regularity, Lebesgue integrals.

Prescribed Book:

- **C. C. Pugh,** Real Mathematical Analysis, Springer, New Delhi, 2004. (Ch. 2: Sec 1 to 5; Ch. 3, Ch. 4: Sec 1 to 5; Ch. 5: Sec 2 to 5; Ch. 6: Sec 1 to 4.)

Reference Books:

- **N. L. Carothers,** Real analysis, Cambridge University Press India, 1999.
- **H. Royden,** Real Analysis, Third Edition, Prentice Hall of India, 1988.

MIM 202 : Complex Analysis

1. **Pre-requisites:**
   (a) **Topological and Analytical Preliminaries:** Point sets in the plane, sequences, compactness, stereographic projection, continuity.
   (b) **Elementary Functions:** Exponential functions, mapping properties, logarithmic function, complex exponents.
2. **Analytic Functions:** Cauchy-Riemann Equations, analyticity, harmonic functions.
3. **Power Series:** Sequences, uniform convergence, Maclaurin and Taylor series, operations on power series.
4. **Complex Integration and Cauchy's Theorem:** Curves, parameterizations, line integral, Cauchy's Theorem.
5. **Applications of Cauchy's Theorem:** Cauchy's integral formula, Cauchy's inequality and applications, maximum modulus theorem.
6. **Laurent Series and Residue Theorem:** Laurent series, classification of singularities, evaluation of real integrals, argument principle.
7. **Bilinear Transformations and Mappings:** Basic mappings, linear fractional transformations, other mappings.

Prescribed Book: S. Ponnuswamy and Herb Silverman, *Complex Variables with Applications*, Birkhäuser.
Reference Book: J. B. Convey, *Functions of one complex variables*, Narosa Publishing House.

MIM 203 : Data Structure with C

1. **Basic Concepts :** Overview,Pointers and Dynamic memory Allocation, Algorithm Specification, Data Abstraction, Performance Analysis.
2. **Arrays and Structures :** Arrays, Dynamically allocated arrays, Structures and Unions, Polynomials,Sparse Matrices, Representation of multidimensional arrays, Strings.
3. **Stack and Queues :** Stacks, Stacks using Dynamic Arrays, Queues, Circular Queues using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues.
4. **Linked Lists :** Singly Linked Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List Operations, Sparse Matrices, Doubly Linked Lists.
5. **Trees :** Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Threaded Binary Trees, Heaps, Binary Search Trees, Selection Trees, Forests, Counting Binary Trees.
6. **Graphs :** The Graph Abstract Data Type, Elementary Graph Operations, Minimum Cost Spanning Trees, Stortest Paths and Transitive Closure, Activity Networks.
7. **Sorting :** Motivation, Insertion Sort, Quick Sort, How fast we can sort?, Merge Sort, Heap Sort, List and Table Sorts.
8. **Hashing :** Introduction, Static Hashing, Dynamic Hashing, Bloom Filters.

Prescribed Book :

- **Horowitz, Sahni, Anderson-Freed,** Fundamentals of Data Structures in C, 2nd Edition (Universities Press)

Reference Books :

- **Donald E. Knuth,** The Art of Computer Programming, Volume 1, Third Edition (Pearson Education)
- **Seymour Lipschutz,** Data Structures (Tata McGrawHill).
- **Aaron M. Tenenbaum,** Data Structures Using C (Pearson Education).

MIM 204 : Progremming in C^{++}

1. **Introduction :** Declarations, const declartions, Namaespaces, cin and cout, Loops, Functions, references, Function Overloading, Function with default parameters, passing arguments with reference and pointers, new and delete operators.

2. **Classes :** Procedural and object-oriented programming, the class, public and private, implementing class member functions, inline functions, constructor and desructor, const memeber fuctions, static members, "'this"' pointer an array of objects, class scope.

3. **Working With Classes :** class in class, initialiser list, operator overloading, friend functions, automatic conversions, conversion fuctions, copy constructor, assignment operator, classes and dynamic memeory.

4. **Class Inheritance :** Beginning with simple base, inheritance is a relation, declaring derived classes, protected members, virtual funtions, pure virtual functions, abstract classes, public, protected and private inheritance, operators new and delete, virtual base, multiple inheritance.

5. **Templates :** Generic programming, template functions, defining a class template, using a template class, using template with family of classes, template versality, template specilization, inheritance.

6. **Exception Handling :** Exception, the exception mechanism, exception versality, multiple try blocks, exception and classes, exception and inheritance, the exception class.

7. **Files and Streams :** cin, cout cerr, clog streams, operators >> and <<, formating output, manipulators, reading string and single character, stream states, Files, ifstream, ofstream and fstream classes, file modes, text and binary files, overloading << and >> operators for user defined operators, user defined manipulators.

Prescribed Book:

- **Stephen Prata,** C++ Primer Plus (Tecmedia).

Reference Books:

- **Bruce-Eckele,** Thinking in C++ (vol-I and vol -II).
- **B. Stoustroup,** Programming Language C++ .

MIM 205 : Differential Equations

1. **Prerequisites:** Linear equations of the first order.

2. **Linear equations with constant coefficients :** Second order homogeneous equations, Initial value problems, Linear dependence and independence, Nonhomogeneous equations of n-th order, Algebra of constant coefficients.

3. **Linear equations with variable coefficients :** Initial value problems, Solutions of the homogeneous equation, Wronskian and linear independence, Reduction of order, Nonhomogeneous equations, Legendre equation.

4. **Linear Equations with regular singular points :** Euler equation, Second order equation with regular singular points, Exceptional cases, Bessel equation.

5. **Existence and uniqueness of solutions to first order equations:** Separation of variables, exact equations, Method of successive approximations, Lipschitz condition, Approximation to and uniqueness of solutions.

6. **Existence and uniqueness of solutions to systems and n-th order equations:** Complex n-dimensional space, Systems as vector equations, Existence and uniqueness of solutions to systems, Existence, Uniqueness for linear systems and equations of order n.

Prescribed Book:

- **E. A. Coddington,** An Introduction to Ordinary Differential Equations (Prentice- Hall).

Reference Book: G. F. Simmons and S. G. Krantz, Differential Equations (Tata McGraw-Hill).

SEMESTER III

MIM 301 : Web Programming

1. **Web Programming** HTML Programming CSS JavaScript DOM DHTML
2. **Extensible markup Language (XML)** The Purpose and Nature of XML XML Syntax and Structure Rules XML Document Type Declaration (DTD) XML Schema XSL Extensible Stylesheet Language XPath XQuery XML Parsers Java and XML
3. **AJAX** Introduction to Ajax Ajax Architecture XMLHttpRequest Ajax Framework and DOM Ajax using HTML,CSS,JavaScript

MIM 302 : Discrete Structures

1. **Order Relations and Structures:** Partially ordered set, Extremal Elements of Partially ordered sets,Lattices, Finite boolean algebras, Functions on boolean algebras, Circuit designs.

2. **Trees:** Trees,Labeled Trees, Tree Searching, Undirected Trees, Minimal Spanning Trees

3. **Topics in Graph Theory:** Graph, Euler Paths and Circuits, Hamiltonian Paths and Circuits, Tranport Networks, Matching Problems, Coloring Graphs,

4. **Combinatorics:** Combination, Permutation, Generating Functions, Odinary and Exponential Generating Functions, Recurrence Relation, Methods of Solution of Recurrence Relatiion , Substitution Method, Characteristic Method, Generating Function Method, Principle of Inclusion and Exclusion.

   Prescribed Book:

   - **Kolman, Busby, Ross**, Discrete Mathematical Structures,Fifth Edition (Pearson Education).
   - **Purna Chandra Biswal**, Discrete Mathematics and Graph Theory, Second Edition (PHI.).

   Reference Book: Alan Tucker, Applied Combinatorics, Forth Edition (John Willey).

MIM 303 : Theory of Computer Science

1. **Propositions and Predicates:** Propositions (or statements), Normal Forms of Well-formed Formulas, Rules of Inference for Propositional Calculus (Statement Calculus), Predicate Calculus, Rules of Inference for Predicate Calculus.

2. **Mathematical Preliminaries:** Sets. Relations and Functions, Graphs and Trees, String and Their Properties, Principal of Induction, Proof by Contradiction, Supplementary Examples.

3. **The Theory of Automata :** Definition of an Automaton, Description of a Finite Automaton, Transition Systems Properties of Transition Functions, Acceptability Systems, Nondeterministic Finite Stare Machines, The Equivalence of DFA and NDFA, Mealy and Moore Models, Minimization of Finite Automata, Supplementary Examples

4. **Formal Languages:**Basic Definition and Examples, Chomsky Classification of Language, Languages and Their Relation, Recursive and Recursively Enumerable Set, Operations on Language, Language and Automata, Supplementary Examples.

5. **Regular Sets and Regular Grammars:** Regular Expressions, Finite Automata and Regular Expressions, Pumping Lemma for Regular Set, Application of Pumping Lemma, Closure Properties of Regular Sets Regular Sets and Regular Grammars.

6. **Context Free Languages:** Context-free Languages and Derivation Tree, Ambiguity in Context-free Grammars Simplification of Context-free Grammars, Normal Forms for Context-free Grammars, Pumping Lemma for Context-free Languages, Decision Algorithms for Context-free Languages.

7. **Pushdown Automata:**Basic Definitions, Acceptance by pda, Pushdown Automata and Context-free Languages, Parsing and Pushdown Automata, Supplementary Examples.

8. **Turing Machines and Linear Bounded Automata:** Representation of Turing Machine, Language Acceptability by Turing Machines, Design of Turing Machines, Descriptions of Turing Machines.

Prescribed Book:

- **K. L. P. Mishra and N. Chandasekaran,** Theory of Computer Science (PHI Learning Private Ltd).

MIM 304 : Design and Analysis of Algorithms

1. **Mathematical Foundation:** Growth Functions, Summations, Recurrences Substitutions, Iterations, Master Methods, Counting and probability .
2. **Sorting :**Heap Sort, Quick Sort, Merge Sort, Sorting in linear Time, Medians and Order Statistics.
3. **Dynamic Programming :** Matrix chain Multiplication, longest common subsequence, optimal polygon triangularisation.
4. **Greedy Algorithm**.
5. **Graphs :** Traversals, Topological sort, Minimum spanning trees, single source shortest path, All pair shortest path, Maximum flow problems.
6. **Sorting Networks :** Comparision, bitonic sort and merge sort networks.
7. **Parallel Algorithms :** CRCW, EREW algorithms efficiency sorting linear system problem, Matrix Operations, Strassens Algorithm and matrix inversion.
8. **FFT :**Polynomials DFT, FFT.
9. **Number Theoretic Algorithm :** Rabin - Karp, KMP, Bower - Moore algorithms.
10. **Geometric Algorithms :** Finding convex hall, closes pair of points, linear programming problem.
11. **NP Completeness :** P and NP classes, NP completeness and reducibility.
12. **Approximation Algorithms :** Vertex cover problem, traveling salesman problem, set covering and subset sum problems.

Prescribed Book:

- **T. H Coreman, Leiserson, Rivest**, Introduction to Algorithms .

MIM 305 : JAVA PROGRAMMING

1. **Introduction to Java Programming** - Overview, Java Tools, Java Byte Code
2. **Elementary Programming Concepts :** Variables and Identifiers, Java keywords, Data Types, Operators, Expression, Constants, Statements, Arrays
3. **Classes and Packages** : Defining classes, Static Members, Using packages, Access Specifiers, Constructors, Finalisers referencing objects
4. **Inheritance, nested and inner class :** Extending classes, Abstract Class Interface, Super Keyword, Final classes, Constructors and Inheritance, Dynamic Binding, Overriding methods
5. **Exception and Input and Output :** Byte streams, Character streams, File i/o basics, Introduction to exception, Try and catch block and finally block, Inbuilt Exception.
6. **String Handling and Exploring Java.lang :** String Operations, Character Extractions, Data Conversions, Modifying strings.
7. **Applet and Event Handling and Controls**
8. **Input and Output package :** Object serialization, reader and writer
9. **Swings :** - Layout Manager Layout Manager swing Controls Components Organizers, Jlish, Jtree, Jtables, Dialogue, File chooser, color chooser.
10. **JDBC :** The design of JDBC, JDBC programming concepts making the connection, statement and result set class, Executing SQL commands, Executing Queries.
11. **Multithreading :** Running multiple threads, The runnable interface Threads priorities Daemon, Thread States, thread groups Synchronization and Interthread Communication Deadlocks. **Prescribed Book:**
    - **Herbert Schildt**, A Complete Reference Java 2.

MIM 401 : Field Theory

1. **Prerequisites:** Definitions and basic properties Rings and fields, Ideals and homomorphisms, Characteristic of fields, Euclidean domains, Unique factorization, Polynomials.

2. **Field Extensions:** The degree of an extension, Extensions and polynomials, Polynomials and extensions.

3. **Applications to Geometry:** Ruler and compass construction, An algebraic approach.

4. **Splitting Fields.**

5. **Finite Fields.**

6. **The Galois Group:** Monomorphisms between fields, Automorphisms, Groups and subfields, Normal extensions, Separable extensions, The Galois correspondence, The fundamental theorem, An example.

7. **Equations and Groups:** Solution by radicals of quadratics, cubics and quartics. Cyclotomic polynomials, cyclic extensions.

8. **Groups and Equations:** Insoluble quintics, General polynomials.

9. **Prescribed Book:**

   - J. M. Howie, Fields and Galois Theory, Springer Undergraduate Mathematics Series, 2006.
     (Chapters 1 to 8 and Chapter 10).

   Reference Books:

   - **M. Artin,** Algebra, Prentice-Hall, Englewood Cliffs, N.J., 1991.
   - **P. B. Bhattacharya, S. K. Jain and S. R. Nagpaul,** Basic Abstract Algebra, Second Ed., Cambridge University Press, Cambridge, 1995.

MIM 402 : Differential Geometry

1. **Graphs and Level Sets**
2. **Vector Fields**
3. **The Tangent Space**
4. **Surfaces**
5. **Vector Fields on Surfaces;Orientation**
6. **The Gauss Map**
7. **Geodesics**
8. **Parallel Transport**
9. **The Weingarten Map**
10. **Curvature of Plane Curves**
11. **Arc Length and Line Integrals**
12. **Curvature of Surfaces**
13. **Parametrized Surfaces**
14. **Local Equivalence of Surfaces and Parametrized Surfaces**
15. **Surface Area and Volume**
16. **The Exponential Map**
17. **The Gauss-Bonnet Theorem**

Prescribed Book:

- **J. A. Thorpe**, Elementary Topics in Differential Geometry, Springer, Second Edition
  (Chapters 1 to 12 and Chapter 14, 15, 17, 19, 22).

MIM 403 : Data Base Management Systems I

1. **Database Concepts**
2. **Relational Algebra**
3. **Database Design Concepts**
4. **ER Diagrams and Normalization SQL**

MIM 404 : MS.NET

1. **Introducing .NET Platform:** .NET and Windows DNA .NET Architecture

2. **Features of .NET Platform:** Multilanguage Support, Platform and Processor Independence, Memory Management, Versioning, Deployment, Interoperability with Unmanaged Code.

3. **.NET Architecture:** .NET Runtime, Managed/Unmanaged Code, Intermediate Language, Common Language Specification/Common Type System, .NET Base Class Library (BCL), Assemblies, Metadata, Assemblies and Modules, Assembly Cache, Reflection, Just In Time Compilation, Garbage Collection, Object Oriented in .NET.

4. **Introducing C** *hash* **Programming:** Data Types, Control Structures, Properties and Indexers, Delegates and Events, Exception Handling, Basics of Inheritance.

MIM 405 : Computer Networks

1. **Introduction to Networking** Hardware Architecture Topologies, Media, Devices Transmission Techniques Twisted Pair, Coaxial Cable, Fiber optics

2. **The OSI Reference Model** Protocol Layering, TCP/IP Model, OSI vs. TCP/IP

3. **Common Network Architecture** Connection oriented N/Ws Connectionless N/Ws Example of N/Ws-P2P, X, 25, ATM, Ethernet Wireless LANs - 802.11, 802.11x, Gigabit Wireless Transmission Switching Circuit Switching, Message Switching, Packet Switching

4. **Local Area Networks** Components and Technology, Transmission Protocol and Media

5. **IP Addressing Routing IP addresses** Network part and Host Part Network Masks, Network addresses and Broadcast addresses, Address Classes, Loop back address, IP routing concepts,Routing Tables, Stream and Packets TCP - a reliable pipe, TCP Connection IPV6: The next generation Protocol.

6. **Domain Network Services (DNS)** Domain Names, Authoritative Hosts, Delegating Authority, Resource Records, SOA records, DNS protocol, DHCP and Scope Resolution

7. **Network Applications** Http, MIME, SMTP, POP

8. **Network security** Packet filtering, Encryption, Virtual Private network, Digital signatures

- **Prescribed Book :**

- **Andrew S. Tanenbaum** , Computer Networks 4e, PHI, India.

Reference Books:

1. **Douglas E. Comer**, Computer Networks and Internets with Internet Applications , Pearson Education, forth Edition

2. **William R. Cheswick,**, Firewalls and Internet Security 2nd Edition Pearson Education.

SEMESTER V

MIM 501 : Coding Theory

1. **Error detection: correction and decoding:** Communication channels,Maximum likelihood decoding,Hamming distance,Nearest neighbour / minimum distance decoding, Distance of a code.

2. **Linear codes:** Vector spaces over finite fields, Linear codes, Hamming weight, Bases of linear codes, Generator matrix and parity check matrix, Equivalence of linear codes, Encoding with a linear code,Decoding of linear codes, Cosets, Nearest neighbour decoding for linear codes, Syndrom decoding.

3. **Cyclic codes:** Definitions, Generator polynomials, Generator and parity check matrices, Decoding of cyclic codes, Burst-error-correcting codes.

4. **Some special cyclic codes:** BCH codes, Definitions, Parameters of BCH codes, Decoding of BCH codes.

Reference Books:

1. **San Ling and Chaoing xing** , Coding Theory- A First Course .

2. **Lid and Pilz**, Applied Abstract Algebra - 2nd Edition

MIM 502 : Probability Theory

1. **Introduction to Discrete Probability :** Intuitive concepts: probability of an event as a measure between 0 and 1; random variable; probability distribution; frequency interpretation of probability; random numbers; coins, dice, and other games; simulations; odds; historical development of probability; random walks.

2. **Formal concepts:** sample space, outcomes, and events; random variable; discrete distribution functions and axioms of probability; unions, intersections, and complements; properties of probabilities, principle of inclusion and exclusion; tree diagrams; uniform distributions over finite sets, symmetry; infinite sample spaces with discrete probabilities.

3. **Introduction to Continuous Probability :** The intuitive problems with probabilities over space (line, plane, Rn in general). Monte Carlo simulations, Buffon's needle. Formal concepts: density function for a continuous random variable; integration; cumulative distribution functions; derivatives; exponential density function;

4. **Conditional Probability :** Intutive concept of conditional probability; formal definition of conditional probability; Bayes' formula for inverting conditional probabilities; independent events; joint distribution functions; independent random variables; independent trials. Conditional density functions for continuous distributions; the beta distribution

5. **Distributions and Densities :** Uniform continuous distributions; geometric distribution; Poisson distribution; exponential and gamma distributions; introduction to queueing theory; normal (Gaussian) distribution; Chi-squared distribution

6. **Expected Value and Variance :** Expected value for discrete random variables, expectation; linearity of expectation; expectation of independent random variables; conditional expectation; variance and standard deviation; variance of various distributions. Expectation and variance for continuous random variables.

7. **Sums of Random Variables :** Analysis of sums of independent random variables with identical distributions, that is, independent trials.

8. **Law of Large Numbers :** Chebychev inequality, law of averages, law of large numbers.

9. **The Central Limit Theorem :**The central limit theorem for Bernoulli trials, binomial distributions again, the normal distribution, the general central limit theorem.

Prescribed Book:

- **Charles M. Grinstead and J. Laurie Snell**, Introduction to Probability, the American Mathematical Society, 1997.
(Chapters 1 to 8 and Chapter 10).

MIM 503 : Advanced Data Base Management Systems II

1. **Advanced Database Concepts**
2. **Database Architecture**
3. **PL/SQL**

MIM 504 : Software Engineering

1. **Introduction To Software Engineering**
   Definition, System Concepts,
   Types of System, Element of System
   A generic view of Software Engineering
   Characteristics of software
   McCall's Quality Factors
   Software Process
   Challenges Facing Software Engineering

2. **Requirement Analysis**
   Definition of System Analysis
   Fact Finding Techniques
   Requirement Anticipation, Investigation
   Feasibility Study
   User Requirements
   System Requirement Specification
   Requirements Engineering
   Requirements Validation
   System Requirement Specifications (SRS)

3. **Analysis and Design Tools**
   Decision Tree and Decision Tables
   Data Flow Diagrams [Physical and Logical]
   Data Dictionary
   Input and Output Design
   (Case Study: Minimum two case studies on each of the above topic should be covered.)

4. **Software Development Methodologies**
   System Development Life Cycle. - Classical Model
   Waterfall Model
   Spiral Model
   Prototyping Approach
   Agile Methods
   Rapid Application Development

5. **System Testing**
   Testing and Debugging Definition.
   Verification and Validation
   Testing Objectives and Principles.

Testing Strategies
- Black Box Testing.
- White Box Testing
- Performance Testing
- User Acceptance Testing
- Stress Testing
Test Case Design
Report Test Result
Test Automation
(Case Study: Minimum two case studies on test case design should be covered.)

6. **System Maintenance**
   Importance of Maintenance
   Software Maintenance
   Types of Maintenance
   Maintenance Side Effects/Ripple Effects
   Re-engineering
   Reverse Engineering

Reference Books:

1. **Ian Sommerville** , Software Engineering , 7th/8th Edition [Pearson Education]
2. **Roger S. Pressman**, Software Engineering - A Practitioner's Approach 7th Edition - [McGraw Hill International Edition]
3. **James Senn**, Analysis of Information Systems
4. **Pathasarthy and Khalskar**, System Analysis and Design.

Ch 1, -:Reference Book 1,2
Ch 2 -:Reference Book 1,2
Ch 3 -:Reference Book 1,3 (case studies from Ref Book 3)
Ch 4 -:Reference Book 2
Ch 5 -:Reference Book 2
Ch 6 -:Reference Book 4

MIM 505 : Advanced JAVA

1. **JAVA Basic Reveiws**

   Java streaming - Networking - Event handling - Multithreading - Byte code Interpretation - Customizing application - Data Structures - Collection classes.

2. **Distributed Computing**

   Custom sockets - Remote Method Invocation - Activation - Object serialization -Distributed garbage collection - RMI - IIOP - Interface definition language - CORBA - JINI overview.

3. **JAVA Beans And Swing**

   Bean concepts - Events in bean box - Bean customization - Persistence - Application - deployment using swing - Advanced swing techniques - JAR file handling.

4. **JAVA Enterprise Applications**

   JNI - Servlets - Java Server Pages - JDBC - Session beans - Entity beans - Programming and deploying enterprise Java Beans - Java transactions.

5. **Related JAVA Techniques**

   Java Media Frame work - 3D graphics - Internationalization - Case study - Deploying n-tier application, E- commerce applications.

Reference Books:

1. **Deitel and Deitel** , Java How to program, Prentice Hall , 4 th Edition, 2000.

2. **Gary Cornell and Cay S. Horstmann**, Core Java Vol 1 and Vol 2 , Sun Microsystems Press, 1999.

3. **Stephen Asbury, Scott R. Weiner, Wiley**, Developing Java Enterprise Applications, 1998.

SEMESTER VI

Industrial Training