# COURSE STRUCTURE

## First Semester

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Title of the Paper</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MST101</td>
<td>Real Analysis</td>
<td>100</td>
</tr>
<tr>
<td>MST102</td>
<td>Differential Equations and Applications</td>
<td>100</td>
</tr>
<tr>
<td>MST103</td>
<td>Discrete Mathematical Structures</td>
<td>100</td>
</tr>
<tr>
<td>MST104</td>
<td>Computing Fundamentals &amp; Programming</td>
<td>100</td>
</tr>
<tr>
<td>MST105</td>
<td>Computer Based Numerical Methods</td>
<td>100</td>
</tr>
<tr>
<td><strong>Practicals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab-I</td>
<td>Programming in C</td>
<td>50</td>
</tr>
<tr>
<td>Lab-II</td>
<td>Numerical Methods</td>
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<td><strong>Total</strong></td>
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## Second Semester

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<tbody>
<tr>
<td>MST201</td>
<td>Linear Algebra</td>
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</tr>
<tr>
<td>MST202</td>
<td>Curves, Surfaces &amp; Applications</td>
<td>100</td>
</tr>
<tr>
<td>MST203</td>
<td>Operating Systems</td>
<td>100</td>
</tr>
<tr>
<td>MST204</td>
<td>Computer Organization &amp; Architecture</td>
<td>100</td>
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<tr>
<td>MST205</td>
<td>Data Structures</td>
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<td><strong>Practicals</strong></td>
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<tr>
<td>Lab-III</td>
<td>Data Structures using C</td>
<td>50</td>
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<tr>
<td>Lab-IV</td>
<td>UNIX / LINUX Shell Programming</td>
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<td>MST301</td>
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<td>MST302</td>
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<td>MST303</td>
<td>Database Management Systems</td>
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<td>MST304</td>
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<td>MST305</td>
<td>Soft Skills</td>
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<tr>
<td>Lab-V</td>
<td>Programming in Java</td>
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<tr>
<td>Lab-VI</td>
<td>Oracle</td>
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<tr>
<td>MST402</td>
<td>Complex Analysis</td>
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<td>MST403</td>
<td>Formal Language &amp; Automata Theory</td>
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<tr>
<td>MST404</td>
<td>Software Engineering</td>
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<td>MST405</td>
<td>Internet Technologies</td>
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<tr>
<td>LAB-VII</td>
<td>Programming using J2EE</td>
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<tr>
<td>LAB-VIII</td>
<td>Minor Project</td>
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<tr>
<td>MST501</td>
<td>Operations Research</td>
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<tr>
<td>MST502</td>
<td>Analysis &amp; Design of Algorithm</td>
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<td>MST503</td>
<td>Data Mining</td>
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<td>MST504</td>
<td>Artificial Intelligence</td>
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<td>MST505</td>
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<td>LAB-IX</td>
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<td>LAB-X</td>
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<tr>
<td>MST601</td>
<td>Project / Dissertation + Viva Voce</td>
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**Grand Total** 3200
DETAILED SYLLABUS

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Lecture</th>
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<tbody>
<tr>
<td>MST101</td>
<td>Real Analysis</td>
<td>4</td>
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**Unit 1.** Countability of sets. Outer and inner Lebesgue measure, Lebesgue measurable sets, Properties of measurable sets, Borel sets and their measurability, Non-measurable sets, Cantor’s ternary sets and their properties.

**Unit 2.** Measurable function, Characteristic function, Step function, Continuous function, Set of measure zero, Borel measurable function, The structure of measurable function.


**Unit 4.** Point wise convergence, Convergence almost everywhere, Uniform convergence almost everywhere, Convergence in measure, F. Reisz’s theorem on convergence a.e., D.F. Egoroff’s theorem, Lebesgue bounded convergence theorem, Lebesgue domainated convergence theorem, Fatou’s lemma, Monotone convergence theorem.

L^p-space, Properties of L^p-space, Holder’s inequality, Minkowski’s inequality and Schwartz’s inequality, Convergence in the mean, Riesz-Fischer theorem.

**References**

1. Royden, H.L.,
   Real Analysis (2nd ed.)
   The Macmillan Co., new York (1968)

2. Jain, P.K. & Gupta V.P.,
   Lebesgue measure and Integration
   Willey Eastern Ltd., New Age Int. Ltd., New Delhi, (1994)

3. Inder K. Rana,
   An Introduction to measure and integration, Narosa Publishing House, Delhi, (1997)

4. D.Somasundaran
   A Second Course in Mathematical Analysis
<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>MST102</td>
<td>Differential Equations and Applications</td>
<td>4</td>
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</table>

**Unit 1.** Existence & uniqueness theorem, General theory of Homogenous and nonhomogeneous equations with constant coefficients, Theory of equations with variable coefficients, Method of variation parameter and the formula for particular integral in terms of Wronskian.

**Unit 2.** Series Solution of second order linear differential equations near ordinary point, Singularity and the solution in the neighborhood of regular singular point, Euler equation and Frobenious method, Solution of Legendre, Bessel, Hypergeometric, Hermite and Lagurre differential equations.

**Unit 3.** Formulation of heat conduction equation and its solution by variable separation method, Steadystate condition and the solution of heat conduction problem with non-zero end conditions, Formation of wave equation and the solution of wave equation.

**Unit 4.** Linear homogeneous boundary value problems, Eigen values and Eigen functions, Sturm Liouville boundary value problems, Non-homogeneous boundary value problems, Green’s functions and the solution of boundary value problems in terms of Green’s functions.

**References**

1. Earl A. Coddington,  
   An Introduction to Ordinary Differential Equation.

2. Boyce and Diprime.,  
   Elementary Differential Equations and Boundary Value Problems.

3. E. Weinberger,  
   A first course in partial differential equations
Unit 1. Relations and Functions, Equivalence Relations, Partial Order, Recurrence Relations, Solutions of Linear homogeneous Recurrence Relations, Introduction to Mathematical Logic, Propositional Calculus.

Unit 2. Lattices and Boolean algebra, Boolean Functions, Connonical Form (Disjunctive Normal Form) of a Boolean function, Karnaugh Maps.


Unit 4. Linear codes, Hamming Code, Generator and parity check matrix, Hamming distance standard array and Syndrome decoding, introduction to cyclic codes.

References

1. Discrete Mathematics
   K.A. Ross, Charles R.W. Wright,
   Prentice Hall Inc.

2. Discrete Mathematical Structure for Computer Sciences
   Bernard Kolman / Robert C. Busby
   Prentice Hall of India.

3. Theory of Error Correcting Codes
   F.J. Mac. Williams / N.J.A.Sloane,

4. Graph Theory with Applications to Engineering and Computer Science
   Narsingh Deo,
   Prentice Hall of India.
<table>
<thead>
<tr>
<th>Code</th>
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<th>Lecture</th>
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<tr>
<td>MST104</td>
<td>Computing Fundamentals &amp; Programming</td>
<td>4</td>
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</table>


**Functions:** Introduction, Need for User-Defined Function, A Multi-function Program, Definition of Function, Arguments & local variables, Returning and Calling Function by reference & Call by value, Passing Arrays & Strings to Function, Returning Multiple Values, Recursion, Recursive Functions, Storage Class & Scope.


**Reference:**

**Unit-1 (6+6):**


**Unit-2 (10)**

Least square approximation : Weighted least square approximation. Method of least square for continuous functions, orthogonal polynomials, Gram-Schmidt orthogonalization process and approximation of functions using Chebyshev polynomials.

**Unit-3 (6+6)**


**Unit-4 (10)**


**Reference:**

1. S.D. Conte & Carl D. Boor, Elementary Numerical Analysis
2. Iyengar and Jain: Numerical methods for Scientific and Engineering Computations
3. G.D. Smith, Numerical Solution of Partial Differential Equations
5. Naseem Ahmad, Fundamentals Numerical Analysis with error estimation
<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Lecture</th>
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<tbody>
<tr>
<td>MST201</td>
<td>Linear Algebra</td>
<td>4</td>
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</table>

**Unit-I**

Vector Space, Subspaces and properties, Quotient Space, Basis and Dimension, Linear Transformation, Rank And Nullity of a Linear Transformation, Sylvester’s Law of Nullity.

**Unit-II**

Algebra of Linear Transformations, Hom(u,v), L(u) Dual Space, Bidual, Direct sum of subspaces, Independent Subspaces.

**Unit-III**

Matrix of Linear Transformations, Change of Basis, Equivalent and Similar Matrices, Relationship between Hom(u,v) and Mm,n(F). Minimal Polynomials, of a Linear Transformations and its properties, Eigen Values, Eigen Vectors.

**Unit-IV**

Inner-Product Space, Orthogonality and Orthonormality, Schwartz inequality, Gram-Schmidt Orthogonalization process, Unitary, Adjoint, Hermitation, Skew Hermition, Normal Linear transformation and their properties.

**References**

- I. N. Herstein, Topics in Algebra.
- P. R. Halmos, Linear Algebra with Problems.
- Hoffman & Kunze, Linear Algebra.
- Surjeet Singh & Q Zameeruddin, Modern Algebra.
<table>
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<tr>
<th>Code</th>
<th>Name</th>
<th>Lecture</th>
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<tbody>
<tr>
<td>MST202</td>
<td>Curves, Surfaces &amp; Applications</td>
<td>4</td>
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</table>

**Unit-1:** Curves in $\mathbb{R}^3$, unit speed curves, tangent to a curve, principal vectors, binormal vector, curvature and torsion, Serret-Frenet formula, Helix, Offset curves, Bertrand Curves.

**Unit-2:** Surface in $\mathbb{R}^3$, Smooth surface, Tangent, normal and orientibilty, first fundamental form, Conformal mapping of a surface, second fundamental form, normal curvature, geodesic, curvature of curves on a surface.

**Unit-3:** Principal curvature, Meusnier’s theorem, Euler’s theorem, Umbilical surface, Gaussian and mean curvature, geodesic, geodesic equation, Guass equations, Codazzi-Mainardi equations.

**Unit-4:** Bezier curves, Properties of Bezier curves, Join of two Bezier curves, subdivision of Bezier curves, Linear, quadratic and cubic Bezier curves, Derivative of Bezier curve, B-spline curves, Derivatives and properties of B-spline curves, B-spline surfaces.

**References**

5. Introduction to Differential geometry, t. G. Willmore, Oxford University Press.


**Memory Management:** Classical Memory Management Techniques, Paging, Segmentation, Virtual Memory - Demand Paging, Page Replacement Policies, Allocation of Frames, Thrashing.


**References**

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<tr>
<th>Code</th>
<th>Name</th>
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<tbody>
<tr>
<td>MST204</td>
<td>Computer Organization &amp; Architecture</td>
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</table>

**Unit-I**

**Information Representation**: Number Systems, Binary Arithmetic, Fixed-point and Floating-point representation of numbers, Codes, Complements, Error detecting and correcting codes, Character Representation – ASCII, EBCDIC. Boolean Algebra: Basic Definitions, Axiomatic definition of Boolean Algebra, Basic theorems and Properties of Boolean Algebra, Boolean functions, Canonical and Standard Forms.

**Unit -II**


**Unit-III**

**Sequential Logic**: Flip-Flops, Clocked RS, D type, JK, T type, State table, state diagram and state equations. Flip-flop excitation tables. Design Procedure, Design of sequential circuit and Counters, Shift registers, Synchronous Counters. Primary Memory, Secondary memory, Cache memory, Memory Hierarchy

**Unit-IV**

**Architecture**: Basic architecture of computer, Bus structures, Von Neumann Concept. Zero address, one address, two address and three address machine, Addressing modes, Microprogramming, Micro engine ,Micro instruction , Pipelining, Array processing, vector processing, Synchronous and Asynchronous Data transfer, DMA data transfer.

**References**

3. Nicholas Carter, Schaum’s Outlines Computer Architecture, Tata MH.
10. Donald e Givone, Digital principles and Design, TMH (Unit II and V)
**Introduction to Data Structure**: Definition of Data Structure, Types & Characteristics of Data Structures, Abstract Data Type (ADT), Algorithms: Algorithm Concepts, Definition of Algorithm, Objectives of Algorithms, Quality of an Algorithm, Space Complexity and Time Complexity of an Algorithm.

**Arrays, Stacks and Queues**: Characteristics & of an Array, Row and Column Major Implementations of 1-D, 2-D, 3-D Arrays. Operations on Stack, Stack Implementation using Array and Linked List, Applications of Stack - Polish and Reverse Polish Notations, Recursion, Buddy Systems, Garbage Collection. Operations on Queues, Types of Queues: Linear Queue, Circular Queue, Priority Queue, Double Ended Queue, Queue Implementation.


**Sorting and Searching**: Bubble Sort, Sequential Sort, Shell Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort, Topology Sort. Linear Search and Binary Search

**References**:

- Classic Data Structures by D. Samanta, PHI
- Data Structures by S. Lipshutz, Schaum outline series, Tata Mc-graw Hill
- Data Structures Using C & C++ by Tananbaum
- Introduction to Algorithms Cormen, Leiserson, Rivest.
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<th>Code</th>
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<th>Lecture</th>
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<tr>
<td>MST301</td>
<td>Topology</td>
<td>4</td>
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**Unit – 1:**


**Unit – 2:**

First and Second countable spaces, Separable spaces, Second countability and Separability, Separation Axioms, $T_i (i = 0,1,2)$ spaces and their characterizations and basic properties, Regular and Normal Spaces, Urysohn’s lemma, Tietze extension theorem.

**Unit – 3:**

Open covering and Compact spaces, Continuous functions and Compact sets, Finite intersection property, Locally compact spaces, Countable compactness and Sequential compactness, Bolzano Weierstrass property, Lebesgue covering lemma, Total boundedness, Equivalence of compactness.

**Unit – 4:**

Separation of a space, Connected spaces, Connected sets in the real line, Totally disconnected spaces, Intermediate value theorem, Path connected, Components, Local connectedness, Locally path connected spaces, Continuous functions and connected sets.

**Books Recommended**

1. J.R. Munkres: Topology (Relevant portions only)
2. Benjamin T. Sims:
   Fundamentals of Topology (Relevant portions only)
   Macmillan Publishing Co. Inc. N.Y.

**Help Books**

1. Colin Adams and Robert Franzosa:
   Introduction to Topology Pure and Applied

2. G.F. Simmons:
   Introduction to Topology and Modern Analysis

3. B.K. Tyagi:
   Metric Spaces
   Cambridge University Press India Pvt. Ltd., 2010
**Introduction to Computer Networks and its uses:** Network categorization and Hardware: Broadcast and point-to-point networks, Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Networks (WAN), Inter Networks, Network Software: Protocols, Services, Network Architecture, design issues, OSI Reference Model, TCP/IP Reference Model, review of different layer services, comparison of OSI and TCP/IP model.

**Physical Layer and Connectivity devices:**
The Physical Layer: different transmission media, guided transmission media- twisted pair cable, coaxial cable, fiber-optics, wireless transmission- radio waves, micro waves, infrared waves; satellite communication, network topologies and architecture, Connectivity devices: Introduction to modems, switch, hub, repeater, gateways, routers, network adopter card, data communication model, digital to analog data and signals, bit rate baud, band width.

**Date Link Layer and Medium Access Sub Layer:**
Date Link Layer: error detection and correction, error control, flow control, data link protocol, stop and wait protocol, sliding window protocol: A one-bit sliding window protocol, A protocol using go back-N, A protocol using selective repeat, examples of data link protocols: HDLC (High Level Data Link Control), FCS (Frame Check Sequence); Medium Access Sub Layer: channel allocation, ALOHA- pure ALOHA, slotted ALOHA, Medium Access Control, Carrier Sense Multiple Access, CSMA with Collision Detection, wireless LAN protocol, IEEE standards 802 for LANs.

**Network Layer, Transport Layer and Application Layer:**
Network Layer: services provided to the transport layer, routing algorithms, shortest path routing, flooding algorithms, IP protocol, IP address; Transport Layer: design issues, transport protocols: Inter transport protocol- Transmission Control Protocol (TCP), User Datagram Protocol (UDP); Application Layer: application layer services and protocols- Domain Name System (DNS), electronic mail, file transfer protocol, hypertext transfer protocol, Introduction to Network Security and Cryptography (DES, RSA algorithms), Communication Security(Firewalls).

**References:**


**Functional Dependency and Normalisation**: Design Guidelines for Relational Schemas, Functional Dependency, Normal Forms Based on Primary Keys. Definition of First Normal Form, Second Normal Form, Third Normal Form and BCNF.


**SQL**: Table Creation, Deletion and Modification in SQL, Defining Constraints, Basic Structure of SQL for Data Extraction from Database, Insert, Delete & Update Statements in SQL, Views in SQL, Aggregate Functions , Nested Queries, Introduction of QBE.

**PL/SQL**: Introduction of PL/SQL, Programming Constructs, Procedures, Functions, Exception handling, Cursors, Triggers and Packages.

**References**
- "Database system concepts", Henry F Korth, Abraham Silberschatz, S. Sudurshan, McGraw-Hill.
- "An Introduction to Database Systems", C.J.Date, Pearson Education.
- "Data Base System", Michael kifer and et all, Pearson Education..
- "Database Management Systems", Ramakrishna, Gehrke;Mcgraw-Hill.
- The Database Book –Principle and Practice" By Narain Gehani, University Press.
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<tr>
<td>MST304</td>
<td>Object Oriented Programming</td>
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**Packages, Interface and Exception Handling:** Java API Package, Using System Packages, Naming Conventions, Creating Packages, Accessing a Package, Using a Package, Adding a Class to a Package. Interface – Defining an Interface, Implementing Interface, Applying Interface, Accession of Interface Variable, Interface and Abstract Class. Exception Handling - Exception Types, Handling of Exception using try-catch, Catching Multiple Exceptions, Nested try Statements, Use of throw, throws and finally Clause, Java Built-in Exception, Creating Exception Subclasses.

**Multithreading, I/O and String Handling:** Thread Models, Main Thread, Creating Threads, Thread Priorities, Life Cycle of Thread, Synchronization in Java, Thread Exceptions, Inter-Thread Communications. I/O Basics, Byte Stream and Character Stream Classes, Reading from and Writing to Console, Reading and Writing Files, Transient and Volatile Modifiers, Stream Tokenizer, Serialization. String – Fundamental of Characters and Strings, String Class, String Operations, String Buffer Class and Methods.

**Applet Programming and Advance java Concepts:** Applet Basics, Applet Architecture, Applet Initialization and Termination, Writing Applets, HTML Applet Tags, Passing Parameters to Applets, AudioClip Interface, and AppletStub interface. Java Database Connectivity – Different Types of Drivers, Establishing a Connection, Transactions with Database. Overview of Event Handling, AWT Controls, Layout Managers, Menus and Swing.

**References**

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<tr>
<td>MST305</td>
<td>Soft Skills</td>
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**Self Development and Assessment:** Self-Assessment, Self-Awareness, Perception and Attitudes, Values and Belief System, Personal Goal Setting, Career Planning, Self-Esteem, Building of Self-Confidence.

**Communication Skill:** Components of Communication, Principles of Communication, Barriers, Listening Skills. Verbal Communication - Planning, Preparation, Delivery, Feedback and Assessment of Activities Like Public Speaking, Group Discussion, Presentation Skills, Perfect Interview, Listening and observation Skills, Body language.


**Ethics, Etiquettes and Other Skills:** Business Ethics, Etiquettes in social as well as Office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics and ethics as an IT professional, Civic Sense, Managing time, Improving Personal Memory, Study Skills that Include Rapid Reading, Notes Taking, Complex Problem Solving, Creativity.

**References:**

2. 7 Habits of Highly effective people – Stephen Covey
3. Business Communication - M. Balasubramanyam
4. Business Communication - M. Balasubramanyam
5. John Collin, “Perfect Presentation”, Video Arts MARSHAL
6. Jenny Rogers “Effective Interviews”, Video Arts MARSHAL
7. Raman Sharma, “Technical Communications”, OXFORD
11. Tim Hindle, “Reducing Stress”, Essential Manager Series Dk Publishing
12. Sheila Cameron, “Business Student
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<tr>
<td>MST401</td>
<td>Functional Analysis</td>
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**Unit 1. Normed Spaces, Banach Spaces and Bounded Linear Operators:**

Definition and examples, subspaces, some concrete examples of Banach spaces, bounded linear operators, spaces of bounded linear operators, equivalent norms, open mapping and closed graph theorems and their consequences, uniform boundedness principle.

**Unit 2. Bounded Linear Functionals:**

Examples and basic properties, Forms of dual spaces, Hahn-Banach theorem and its consequences, embedding and reflexivity, adjoint of bounded linear operators, weak convergence.

**Unit 3. Inner Product and Hilbert Spaces:**

Definitions and examples, orthogonality of vectors, orthogonal complements and projection theorem, orthonormal sets, complete orthonormal sets.

**Unit 4. Functionals and Operators on Hilbert Spaces:**

Bounded linear functionals, Riesz-Frechet theorem, Hilbert-adjoint operators, self-adjoint operators, normal operators and unitary operators.

**Books Recommended:**

1. Introductory Functional Analysis and Applications
   E. Kreyszig,
   John-Wiley & Sons.

2. Introduction to Functional Analysis with Applications
   A.H.Siddiqi, Khalil Ahmad and P. Manchanda,
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<tr>
<td>MST402</td>
<td>Complex Analysis</td>
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**Unit-I**

Representation of Complex Numbers, Analytic Function, Cauchy Riemann Equations, Power Series, Some Elementary Functions, Harmonic Functions.

**Unit-II**

Properties of Line Integrals, Zeros of an Analytic Function, Cauchy’s Theorem, Morera’s Theorem, Cauchy’s Integral Formula, Cauchy’s Inequality, Fundamental Theorem of Algebra, Poisson’s Formula, Liouville’s Theorem, Rouche’s Theorem, The Argument Principle.

**Unit-III**

Zeros and Poles, Classification of Isolated Singularities, Taylor’s and Laurent’s Series, Winding Numbers and Residues, Cauchy Residue Theorem and Application in Evaluation of Improper Real Integrals and Evaluation of Sum.

**Unit-IV**

Conformal Mapping Properties, Schwarg Lemma, Riemann Mapping Theorem (Without Proof), Maximum Modulus Theorem, Analytical Continuation.

**References**

- Rudin, Real and Complex Analysis
- J. B. Conway, Complex Analysis.
- Alfors, Complex Analysis.
- E. C. Titchmarsh, Complex Analysis.
- B. Choudhary, Complex Analysis.
- Anant R. Shastri – Complex analysis
- Zill Dennis G. & Shanahan Patrick D. – A first course in Complex Analysis with Applications.
- Fundamentals of Complex Analysis with Applications to Engineering and Science, E-B Saff and A-D Snider.
Unit-I: Definitions: - Alphabets, Strings, Languages, Grammar, automata and other related definitions, various operation on languages :- union, concatenation, negation, reverse, kleen star , intersection etc. Applications of automata in various fields of Computer Science, Engineering and Application. Formal languages and grammars, Construction of grammar for a given language, finding language for a given grammar. Leftmost derivation, rightmost derivations, sentential forms, derivation tree/ parse tree, Ambiguous grammar and languages ,Chomsky Classification of grammar and languages, unrestricted grammar, context sensitive grammar, Context free grammar, Regular Grammar , Right Linear grammar, left linear grammar hierarchy and machines corresponding to formal languages. Problems based on these concepts.

Unit-II: Definition:- DFA, NFA, Moore machine, Mealy machine, Regular Expression. Acceptance of a language by DFA and NFA , configuration of DFA NFA, Constructing DFA for a given language, finding language for a given DFA. Constructing NDFA for a given language, finding language for a given NFA. Converting NFA to DFA, Minimization of DFA, Finding a DFA/NFA from a given Regular Expression, identities on regular expression, Arden’s theorem, Finding regular expression from a given DFA/NFA. Epsilon closure, Finding NFA with epsilon move from Regular expression, finding DFA from NFA with epsilon move. Methods to decide whether a given language is regular or not, Kleen’s theorem. Closure properties of regular languages. Pumping lemma for regular languages and its applications. Conversion from Mealy to moore machine and vice- versa. Algorithms based on FA. Problems based on these concepts.

Unit-III: Simplification of Context free grammar, elimination of useless symbols,epsilon production and unit production, Normal forms of CFG:- CNF, GNF , converting a given grammar to CNF, converting a given grammar to GNF. Application of CFG, parsing and ambiguity, removing ambiguity from grammar. PDA:- definition and construction. Acceptance by a PDA, Constructing PDA for a given language/grammar, Constructing language/grammar from a given PDA, Closure properties of Context free Languages. Pumping lemma for Context free languages and its application. Algorithms based on PDA .Problems based on these concepts.

Unit-IV: Turing Machine: - definition, construction and its applications, equivalence between TM and unrestricted grammar. TM as language acceptor, language decider and function computer, constructing TM for accepting/deciding a given language, constructing TM for computing a given function, Turing computable Functions, Combining TMs, Copying machine, shifting machine, TM for addition , multiplication, subtraction, division etc. Problems based on these concepts , Universal Turing Machine, halting problem, PCP problem ,Context sensitive language and LBA.

References


**Software Requirement Analysis and Specifications:** Problem Analysis, Functional & Non-Functional Requirements, User & System Requirements, Requirements Engineering Process, Requirements Elicitation & Analysis Techniques, Requirements Validation, Requirements Management, Metrics for Analysis Model, Data Flow Diagrams, Data Dictionaries, Decision Table, Decision Tree, Software Requirement and Specifications.


**References**

- Prof. K.K. Aggarwal & Yogesh Singh: SOFTWARE ENGG;
- Pressman”Priciples of Software Engg” TMC, 5th Ed. 2005
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<tr>
<td>MST405</td>
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**Internet Basics:** Overview of Internet, History, Web System Architecture, Internet vs. Intranet, Uniform Resource Locator, Protocol used in Internet – TCP/IP, SMTP, PPP, HTTP, Services on the Internet - E-mail, Usenet, FTP, Search Engines, Web Browsers.

**An Overview of Java:** Data Types, Variable and Arrays, Classes and Objects, Constructors, Method Overloading, Inheritance and Polymorphism, Method Overriding, Abstract Class, Interfaces, Packages, Exception Handling, Multithreading.

**Database Connection and XML:** Java Database Connectivity – Different Types of Drivers, JDBC API’s, Establishing a Connection, Statements & its Type, Record Sets, Transactions with Database. Overview of XML, XML Development Goal, Structure of XML Document, XML Parser.

**Servlet Programming:** Servlet API Overview, Servlet Life Cycle, Servlet Implementation, Servlet Configuration, Servlet Exception, Requests & Responses, Servlets & JDBC, Servlet Sessions, Context and Collaboration.


**References**

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**Unit I**
Linear programming: applications and model formulation, Theory of Simplex method, Two Phase Method, Big-M method.

**Unit II**
Duality in LP, Dual Simplex method, Sensitivity analysis, Integer Programming, Branch and Bound Technique, Dynamic programming, Bellman’s Principle of Optimality

**Unit III**
Queuing Theory, Model-I (M/M/1):(∞/FCFS), Model-II (M/M/1):(N/FCFS), Network analysis, Critical Path Method (CPM), Project Evaluation and Review Technique (PERT), Project Planning with CPM/PERT

**Unit IV**

**References:**

### Introduction:

### Sorting and Searching Techniques:
Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Linear Time Sorting: Bucket Sort, Radix Sort and Counting Sort, Searching Techniques: Sequential Search, Binary Search, Multiplication of Large Integers and Strassen’s Matrix Multiplication.

### Advanced Data Structures:

### Algorithm Design Strategies:

### Dynamic Programming:

### NP - Completeness:
O/1 Knapsack Problem, Travelling Sales Person Problem, Polynomial Time, Polynomial Time Verification, NP Hard and NP-Complete Problems, Simple NP-Hard Problems.

### References
- Cormen Leiserson, Rivest and Stein, Introduction to Algorithms, PHI
- Aho, Hopcroft. & Ullman, Design and analysis of algorithms, Pearson Education.
- Horowitz, Sahni, Analysis and Design of Algorithms
- Sar Baase, Gelder, Computer Algorithms, Pearson Education.
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**Data Warehouse and OLAP Technology:** Introduction to Data Warehouse; Features of Data Warehouse; Operational Database Systems vs. Data Warehouses; Difference Between OLTP and OLAP; Multidimensional Data Models: Data cubes, Star Schema, Snowflake Schema; Concept Hierarchies; OLAP Operations: Roll-up, Drill-down, Slice, Dice, and Pivot; Three-Tier Data Warehouse Architecture; Types of OLAP Servers: ROLAP, MOLAP, and HOLAP.

**Introduction to Data Mining:** KDD (Knowledge Discover from Databases) Process and Data Mining; KDD Steps; Types of Data for Data Mining, Data Mining Functionalities, Classification of Data Mining Systems; Data Mining Task Primitives; Major Issues in Data Mining.

**Data Preprocessing:** Introduction to Data Preprocessing; Descriptive Data Summarization: Measuring and Central Tendency and Dispersion of Data; Visualization of Descriptive Data Summaries; Data Cleaning: Handling Missing Values, Filtering Noisy Data – Binning Method; Data Integration; Data Transformation: Smoothing, Aggregation, Generalization, Normalization and Feature Selection; Data Reduction; Data Discretization and Concept Hierarchy Generation.

**Association Rule Mining:** Market basket Analysis; Frequent Itemsets, Closed Itemsets, and Association Rules; Support and Confidence; Apriori Algorithm for Mining Frequent Itemsets Using Candidate Generation; Generating Association Rules from Frequent Itemsets; Improving the Efficiency of Apriori Algorithm; FP-Growth Algorithm for Mining Frequent Itemsets without Candidate Generation; Mining Closed Frequent Itemsets; Correlation Analysis.
**Classification Rule Mining**: Introduction to Classification and Prediction; Classification by Decision Induction; Attribute Selection Measures: Information Gain, Gain Ratio, and Gini Index; Tree Pruning; Bayesian Classification: Bayes’ Theorem, Naïve Bayesian Classification, Bayesian Belief Networks; Classifier Accuracy Measures: Sensitivity, Specificity, Precision, and Accuracy; Predictor Error Measures; Accuracy Evaluation Methods: Holdout, Random Subsampling, Cross-validation, and Bootstrap; Accuracy Enhancement Methods: Bagging and Boosting.

**Cluster Analysis**: Introduction to Cluster and Clustering; Features Required for Clustering Algorithms; Data Types and Dissimilarity Measures in Cluster Analysis; Categorization of Clustering Methods; Partitioning-Based Clustering: k-means Algorithms, k-medoids algorithms (PAM, CLARA, CLARANS); Hierarchical Clustering: Agglomerative and Divisive Methods (AGNES, DIANA, BIRCH); Density-Based Clustering: DBSCAN.

**References**:

- J. Han & M. Kamber: Data Mining Concepts and Techniques, 2nd Ed., Morgan Kaufman
- Michael Berry & Gordon Linoff: Data Mining Techniques , Revised Ed.


**Knowledge Representation & Reasons Logical Agents:** Knowledge – Based Agents, the Wumpus World, Logic, Propositional Logic, Resolution Patterns in Propositional Logic, Resolution, Forward & Backward. Chaining. First Order Logic. Inference in First Order Logic, Propositional Vs. First Order Inference, Unification & Lifts Forward Chaining, Backward Chaining, Resolution.


**Learning:** Forms of Learning, Induction Learning, Learning Decision Tree, Statistical Learning Methods, Learning With Complex Data, Learning With Hidden Variables – The EM Algorithm, Instance Based Learning, Neural Networks.

**References**

- Introduction to Artificial Intelligence – Rajendra Akerkar, PHI.
- Artificial Intelligence and Expert Systems – Patterson PHI
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**Overview of Graphics Systems:** Overview of Computer Graphics; Video Display Devices; Raster Scan Display; Random Scan Display; Cathode Rays Tube (CRT) Display Device; Direct View Storage Tube (DVST) Display Device; Flat Panel display: Plasma Panel Display, Thin Film Electroluminescent Display, Light Emitted Diode (LED) Display Device, Liquid Crystal Display Device; Color CRT Display Devices: Beam-Penetration Method, Shadow-Mask Method.

**Line, Curves and Surfaces:** Line Drawing Algorithm, DDA Algorithm, Bresenham’s Line Drawing Algorithm, Bresenham’s Circle Drawing Algorithm, Mid-Point Circle and Ellipse Drawing Algorithm, Bezier Curves, 4 point and 5 point Bezier Curves using Bernstein Polynomials, B-Spline Curves, Computing control points given end slopes for a specified curve segment, Scan-Line Polygon Fill Algorithms, Boundary Fill and Flood-Fill Algorithms.

**Two Dimensional Geometric Transformation, Viewing and Clipping:** Basic Transformations: Translation, Rotation, Scaling; Other Transformations: Reflection and Shearing Operations; Transformation between Cartesian Coordinate Systems; Viewing: The viewing Pipeline, Viewing Coordinate Reference Frame, Window to Viewport Coordinate Transformation; Clipping: Point clipping; Line Clipping; Cohen-Sutherland Line Clipping Algorithm, Liang-Barsky Line Clipping Algorithm, Liang-Barsky Line Clipping Algorithm to Clip a Line Against Non-Rectangular Convex Polygon, Polygon Clipping: Sutherland-Hodgeman Polygon Clipping, Weiler-Atherton Polygon Clipping; Text clipping.

**Three Dimensional Geometric Transformations and Clipping:** Basic Transformations: Translation, Rotation, Rotation with Rotation Axis Parallel to one of the Principal Axis, General Rotation, Scaling; Other Transformations: Reflections, Shears; Three Dimensional Line Clipping: Mid-Point Subdivision Line Clipping Algorithm, Liang-Barsky Line Clipping Algorithms.

**Projection, Fractal Generation, Shading and Surface Rendering:** Projection: Types of Projections, Perspective Projection Transformation with Center at Origin, Perspective Projection Transformations with center at $C_0(a, b, c)$, Orthographic Projection Transformation with Projection Plane as one of the Standard Plane, Orthographic Projection Transformation with Projection Plane Passes Through $R_0(x_0, y_0, z_0)$ and Normal Vector is $N=n_1i+n_2j+n_3k$, Isometric Projection Transformation; Fractal Geometric: Fractal Generation Procedure, Classification of Fractal, Fractal Dimension, Fractal Construction Methods; Shading: Shading Algorithms, Shading Model, Illumination Model; Hidden Surface Detection: Z-Buffer Method, A-Buffer Method, Scan Line Method.
References

- Rogars and Adams “Mathematical elements of computer graphics” Mc Graw Hill
- Woo, Open GL Programming, Pearson Education