



**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                          |                       |                   |
|--------------------------------|--------------------------|-----------------------|-------------------|
| <b>Name of Program</b>         | M. Tech.                 | <b>Semester</b> First | <b>Year</b> First |
| <b>Name of Course</b>          | Advanced Data Structures |                       |                   |
| <b>Course Code</b>             | AC-102                   |                       |                   |
| <b>Core / Elective / Other</b> | CORE                     |                       |                   |

**Prerequisite:**

1. Data Structures and Algorithms
2. C/C++ Programming

**Course Outcomes:**

1. Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.
2. Master a variety of advanced abstract data type (ADT) and data structures and their implementations.
3. Master different algorithm design techniques
4. Ability to apply and implement learned algorithm design techniques and data structures to solve problems.

**Description of Contents in brief:**

Review of algorithm analysis, Optimal Binary search trees, Balanced binary search trees, Binary heaps, Advanced heap structures, Binomial heaps, Fibonacci heaps. Amortized analysis, Splay trees. Dictionaries, Disjoint set structures. Data Structures for External Memory, External sorting, String matching. Introduction to Randomized Data structures and algorithms

**List of Text Books:**

1. Introduction to algorithms Cormen and Rivest
2. Randomized algorithms R.Motwani and P. Raghavan
3. Data Structures, Algorithms and Applications in C++ by Sartaj Sahni. University Press

**List of Reference Books:**

1. Handbook of Data Structures and Applications by Dinesh P. Mehta, Sartaj Sahni
2. Advanced Data Structures by Peter Brass

**URLs:**

1. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-851-advanced-data-structures-spring-2012/>
2. <https://courses.csail.mit.edu/6.851/>



**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

IA-64 Architecture and Itanium Processor; Conclusions.

**List of Text Books:**

1. John L. Hennessy and David A. Patterson, “Computer Architecture: A quantitative approach”, 5th edition, Morgan Kaufmann Elsevier, 2013

**List of Reference Books:**

1. Advanced Computer Architecture Parallelism, Scalability – Kai Hwang:, Programmability, Tata Mc Grawhill, 2003.
2. Kai Hwang and Faye Briggs, “Computer Architecture and Parallel Processing”, Mc Graw-Hill International Edition, 2000.
3. Parallel Computer Architecture, A Hardware / Software Approach – David E. Culler, Jaswinder Pal Singh, Anoop Gupta:, Morgan Kaufman, 1999
4. Kai Hwang and Naresh Jotwani, “Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability”, McGraw Hill Education 3/e. 2015
5. Sima D, Fountain T and Kacsuk P, “Advanced Computer Architectures: A Design Space Approach”, Addison Wesley, 2000.

**URLs:**

2. NPTEL Course: <https://nptel.ac.in/courses/106/103/106103206/>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                |                   |              |
|--------------------------------|----------------|-------------------|--------------|
| <b>Name of Program</b>         | M. Tech        | <b>Semester I</b> | <b>Year1</b> |
| <b>Name of Course</b>          | Soft Computing |                   |              |
| <b>Course Code</b>             | AC-104         |                   |              |
| <b>Core / Elective / Other</b> | Core           |                   |              |

**Course Outcomes:**

1. To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations
2. Understand learning rules for each of the architectures and learn several neural network paradigms and its applications
3. Know how to apply Neural Networks and Genetic Algorithms to different problem areas
4. Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic
5. Evaluate and compare solutions by various soft computing approaches for a given problem

**Description of Contents in brief:**

Introduction to neural networks, Working of an artificial neuron, Perceptron, Back propagation algorithm, Adalines and Madalines. Supervised and unsupervised learning, Counter-propagation networks, Adaptive Resonance Theory, Kohonen's Self Organizing Maps, Neocognitron, Associative memory, Bidirectional Associative Memory.

Introduction to fuzzy logic and fuzzy sets, fuzzy relations, fuzzy graphs, fuzzy arithmetic and fuzzy if-then rules, Process control using fuzzy logic, Decision-making fuzzy systems, Applications of fuzzy logic, Hybrid systems like neuro-fuzzy systems.

Evolutionary Computation: Population-based Search: genetic algorithms and evolutionary computation, Swarm optimization, Ant colony optimization. Search techniques like Simulated Annealing, Tabu search etc.

**List of Text Books:**

1. Soft Computing and Intelligent Systems Design by F.O.Karray and C.De Silva, Pearson Publication
2. Neural Networks, Fuzzy Logic and Genetic Algorithms by Rajsekaran and Pai, PHI Publication.

**URLs:**

1. NOC:Introduction to Soft Computing <https://nptel.ac.in/courses/106105173/>
2. Introduction to Soft Computing [https://swayam.gov.in/nd1\\_noc20\\_cs17/preview](https://swayam.gov.in/nd1_noc20_cs17/preview)

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                              |                 |       |             |       |
|--------------------------------|------------------------------|-----------------|-------|-------------|-------|
| <b>Name of Program</b>         | M. Tech.                     | <b>Semester</b> | FIRST | <b>Year</b> | FIRST |
| <b>Name of Course</b>          | Advanced Data Structures Lab |                 |       |             |       |
| <b>Course Code</b>             | AC -105                      |                 |       |             |       |
| <b>Core / Elective / Other</b> | LAB                          |                 |       |             |       |

**Prerequisite:**

1. C/C++ Programming
2. Java Programming

**Course Outcomes:**

1. Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.
2. Master a variety of advanced abstract data type (ADT) and data structures and their implementations.
3. Master different algorithm design techniques
4. Ability to apply and implement learned algorithm design techniques and data structures to solve problems.

**Description of Contents in brief:**

Lab Experiments include implementation and amortized analysis of Optimal Binary search trees, Balanced binary search trees like Red-Black trees, Splay trees for dictionary operations. Binary heaps, Advanced heap structures like Leftist Heaps, Binomial heaps, Fibonacci heaps. Disjoint set structures, B-Tree, B+ Tree, External sorting, String matching, Randomized Data structures and algorithms such as Skip list, treaps etc.

**List of Text Books:**

1. Introduction to algorithms Cormen and Rivest
2. Randomized algorithms R.Motwani and P. Raghavan

**List of Reference Books:**

1. Handbook of Data Structures and Applications by Dinesh P. Mehta, Sartaj Sahni
2. Advanced Data Structures by Peter Brass

**URLs:**

1. <https://www.cs.usfca.edu/~galles/visualization/Algorithms.html>
2. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-851-advanced-data-structures-spring-2012/>
3. <https://courses.csail.mit.edu/6.851/>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                            |                    |               |
|--------------------------------|----------------------------|--------------------|---------------|
| <b>Name of Program</b>         | <b>M.Tech</b>              | <b>Semester II</b> | <b>Year I</b> |
| <b>Name of Course</b>          | High Performance Computing |                    |               |
| <b>Course Code</b>             | AC -201                    |                    |               |
| <b>Core / Elective / Other</b> | Core                       |                    |               |

**Prerequisite:**

Parallel and distributed algorithms

**Course Outcomes:**

1. Learning about different parallel programming techniques.
2. Learning about the programming languages for parallel computation

**Description of Contents in brief:**

Overview of parallel system organization; Introduction to message passing and MPI programming; Embarrassingly parallel problems; Problem decomposition, graph partitioning, and load balancing; Introduction to shared memory and OpenMP programming; Examples of scientific computing; Parallel Languages.

**List of Reference Books:**

1. Parallel Programming for Multicore and Cluster Systems by Thomas Rauber and GudulaRunger.
2. Scientific Parallel Computing by Scott, Clark, and Bagheri.
3. Using OpenMP: Portable Shared Memory Parallel Programming by Chapman, Jost, and van der Pas.

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                           |                    |               |
|--------------------------------|---------------------------|--------------------|---------------|
| <b>Name of Program</b>         | <b>M.Tech</b>             | <b>Semester II</b> | <b>Year I</b> |
| <b>Name of Course</b>          | Graph Theory & Algorithms |                    |               |
| <b>Course Code</b>             | AC-202                    |                    |               |
| <b>Core / Elective / Other</b> | Core                      |                    |               |

**Prerequisite:**

Discrete Mathematics

**Course Outcomes:**

1. Graph theory is the core content of Discrete Mathematics, and Discrete Mathematics is the theoretical basis of computer science and network information science
2. This course introduces in an elementary way some basic knowledge and the primary methods in Graph Theory
3. How to represent the real problems into the computer and solve using graph theory
4. Various representation of graph and represent the various problems in the form of graph
5. Will learn how to solve shortest path problem using various algorithms

**Description of Contents in brief:**

1. This course will cover all elementary concepts such as coloring, Hamilton path
2. Planarity: Plane and planar graphs, outer-planar graphs, maximal planar graphs
3. Eulerian digraphs, connectivity and strongly connected digraphs; directed acyclic graphs (DAG), topological sorting
4. Matching and covering: Maximum matching, Berge's theorem
5. Network flows: Flows and matching; max-flow min-cut theorem

**List of Text Books:**

1. Discrete and Combinatorial Mathematics: An Applied Introduction by R.P.Grimaldi, 4th edition, Addison Wesley
2. Introduction to Graph Theory by Gary Chartrand and Ping Zhang, Mc Graw Hill International edition
3. Graph Theory by R. Diestel

**List of Reference Books:**

1. Graph Theory Applications by C. R. Foulds, Narosa Publishing House
2. Graph Theory by Harary. F. Addison Wesley

**URLs:**

1. <https://nptel.ac.in/courses/111106102/>
2. <https://nptel.ac.in/courses/111106050/>



3. <https://www.coursera.org/learn/graphs>

**Lecture Plan (about 30-40 Lectures):**

**Lecture No. Topic**

1. Introduction to graphs, its definitions and applications
2. Degree, operations, sub graphs, paths and cycles
3. connected graph, complete graph and applications
4. Graph Theorems and their proof
5. Walk, Trail, Paths, Degree of a vertex, isomorphic graphs
6. Connected Graph, distance, Cut vertex, Cut edge, bridge, block
7. Self complementary graphs, distance in graphs
8. Graph representations: Adjacency matrix, incidence, cycle and cut set matrices
9. Trees, definitions and properties, rooted trees, trees and sorting
10. Contd. Trees, definitions and properties, rooted trees, trees and sorting
11. Weighted trees and prefix codes
12. Biconnected components and articulation points.
13. Graph Traversal: Euler tours and circuit
14. Planar and non planar graphs
15. Euler formula, platonic bodies
16. Kuratowski's theorem
17. Hamiltonian path, circuit and cycle in graph
18. Graph colouring
19. Chromatic polynomials equations
20. Warshall's Algorithm
21. Depth-First and Breadth-First Searches
22. Contd. Depth-First and Breadth-First Searches problems
23. Dijkstra's Algorithm
24. Kruskal's Algorithm
25. Prim's Algorithm
26. Floyd's Algorithm
27. Network Flows: Max flow – Min cut Theorem
28. Travelling Salesman's Problem
29. K-shortest Path Algorithms
30. Maximum Matching in Bipartite Graphs: The Hungarian Algorithm
31. Maximum Flow in a Transport Network
32. Contd. Maximum Flow in a Transport Network
33. The Ford–Fulkerson Algorithm

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                         |                    |               |
|--------------------------------|-------------------------|--------------------|---------------|
| <b>Name of Program</b>         | <b>M. TECH</b>          | <b>Semester II</b> | <b>Year I</b> |
| <b>Name of Course</b>          | Optimization Techniques |                    |               |
| <b>Course Code</b>             | AC-203                  |                    |               |
| <b>Core / Elective / Other</b> | Core                    |                    |               |

**Course Outcomes:**

1. To enable students to develop mathematical models.
2. To teach how to formulate optimization Problem.
3. To teach standard techniques of optimization.
4. A student with capabilities needed to become a better researcher

**Description of Contents in brief:**

- 1 Unconstrained Optimization, Convex Optimization, Optimization Using Calculus
- 2 Graphical Optimization, Linear Programming
- 3 Quadratic Programming.
- 4 Optimization Problem Formulation of machine learning algorithms like SVM and its variants, ELM and its variant etc..
- 5 Study of evolutionary optimization techniques like PSO, Artificial Bee Colony Algorithm, Genetic Algorithm, Ant Colony Optimization, Simulated Annealing, Neadler Mead Algorithm etc.
- 6 Integer Programming
- 7 Dynamic Programming
- 8 Error Functions and their minimization techniques

**List of Text Books:**

1. Practical Optimization Algorithms and Engineering applications, Andreas Antoniou, Lu, Wu-Sheng, Springer Publication
2. AnIntroductiontoOptimization, Edwin KP. Chong& Stanislaw H. Zak, Wiley Publication

**List of Reference Books:**

1. Operations Research : An Introduction by Hamdy A Taha, Pearson

**URLs:**

1. <https://nptel.ac.in/courses/105/108/105108127/>
2. <https://nptel.ac.in/courses/112/105/112105235/>
3. <https://nptel.ac.in/courses/111/105/111105100/>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                                |                    |               |
|--------------------------------|--------------------------------|--------------------|---------------|
| <b>Name of Program</b>         | <b>M.Tech</b>                  | <b>Semester II</b> | <b>Year I</b> |
| <b>Name of Course</b>          | High Performance Computing Lab |                    |               |
| <b>Course Code</b>             | AC-204                         |                    |               |
| <b>Core / Elective / Other</b> | Lab-II                         |                    |               |

**Prerequisite:**

Basic Programming

**Course Outcomes:**

Learning about different parallel programming languages.

**Description of Contents in brief:**

1. MPI programming
2. OpenMP programming

**List of Reference Books:**

1. Using MPI, Third Edition  
Portable Parallel Programming with the Message-Passing Interface By William Gropp,  
Ewing Lusk and Anthony Skjellum
2. Using OpenMP  
Portable Shared Memory Parallel Programming, By Barbara Chapman, Gabriele Jost and  
Ruud van der Pas

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                                  |
|--------------------------------|----------------------------------|
| <b>Name of Program</b>         | <b>M.Tech</b>                    |
| <b>Name of Course</b>          | <b>Data Mining</b>               |
| <b>Course Code</b>             | <b>AC-501</b>                    |
| <b>Core / Elective / Other</b> | <b>Group A Program Electives</b> |

**Prerequisite:**

1. Knowledge of basic probability theory and algorithms,
2. Programming Languages Java/C++/XML/R/Matlab

**Course Outcomes:**

1. To introduce students to the basic concepts and techniques of Data Mining.
2. To develop skills of using recent data mining techniques to practical problems.
3. To apply data mining techniques to realistic data.

**Description of Contents in brief:**

1. Introduction to Data warehousing, needs for developing data Warehouse, Data warehouse systems and its Components, Design of Data Warehouse, Dimension and Measures, Conceptual Modeling of Data Warehouses, Multidimensional Data Model & Aggregates.
2. Introduction to Data Mining, Knowledge Discovery, Data Mining Functionalities, Data Mining System categorization and its Issues. Data Preprocessing: - Data Cleaning, Data Integration and Transformation. Data Reduction. Guidelines for Successful Data Mining. OLAP, Characteristics of OLAP System, Guidelines for OLAP Implementation.
3. Introduction to Logistic Regression, Logistic function, Logistic Regression with more than two classes. Principal components analysis, dimensionality reduction. Application and Challenges of Data Mining, Introduction of Web Structure Mining, Web Usage Mining, Spatial Mining, Text Mining, Security Issue, Privacy Issue, Ethical Issue.
4. Association Rule Mining, Single Dimensional Boolean Association Rules, Multi-Level Association Rule, Apriori Algorithm, FP Growth Algorithm, Time series mining association rules, latest trends in association rules mining.
5. Classification and Clustering, Classification and Clustering Distance Measures, Types of Clustering, K-Means Algorithm, Decision Tree Induction, Bayesian Classification, Association Rule Based Other Classification Methods, Prediction, Classifier Accuracy, Categorization of methods, Partitioning methods.

**List of Textbooks:**

1. Data mining: Concepts and Techniques, by Jiawei Han and Micheline Kamber, Morgan Kaufmann.
2. Principles of Data Mining, by David Hand, Heikki Mannila, Padhraic Smyth, The MIT Press .
3. Introduction to Data Mining, by Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, Pearson/Addison Wesley.

**List of Reference Books:**

1. T. Mitchell. Machine Learning. New York, NY: McGraw-Hill, 1997.
2. Berry and Linoff. Mastering Data Mining. New York, NY: Wiley, 2000. ISBN: 0471331236
3. Wang, H. (2010). Managing and mining graph data (Vol. 40). C. C. Aggarwal (Ed.). New York:

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

Springer

**URLs:**

1. What is happening in the world of data mining ; <https://www.kdnuggets.com/>
2. Data Mining: [https://link.springer.com/referenceworkentry/10.1007%2F978-0-387-39940-9\\_104](https://link.springer.com/referenceworkentry/10.1007%2F978-0-387-39940-9_104)
3. <https://nptel.ac.in/courses/106105174/>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY,  
BHOPAL - 462003**

**Name of Program**      **M.Tech**

**Name of Course**                      **OPERATING SYSTEM & DESIGN**

**Course Code**                              **AC -502**

**Core / Elective / Other**              **Group A Program Electives**

**Prerequisite:**

1. Computer Architecture
2. Operating Systems

**Course Outcomes:**

1. Basics concepts of advance operating system design issues
2. Understand and analyse theory and implementation of: processes, resource control (concurrency etc.)
3. Physical and virtual memory management schemes
4. Multiprocessor operating systems architecture
5. Distributed Operating system: architecture

**Description of Contents in brief:**

1. Basic structure of Operating System, Processes, Storage
2. CPU scheduling policy and Process synchronization mechanism
3. Main memory management and segmentation schemes
4. Disk and file structure and their executing by the operating system, disk scheduling
5. Distributed operating system design issues and process scheduling and synchronization mechanism
6. Multiprocessor operating systems design issues and process scheduling and synchronization mechanism

**List of Text Books:**

1. Operating Systems: A Concept-Based Approach” by D M Dhamdhare
2. Advanced Concepts in Operating Systems: Distributed, Database, and Multiprocessor Operating Systems by Mukesh Singhal and Niranjan G. Shivaratri
3. Operating System Concepts by Avi Silberschatz and Peter Galvin
4. Distributed Operating Systems: Concepts and Design by Pradeep K. Sinha

**List of Reference Books:**

1. Modern Operating Systems by Andrew S Tanenbaum
2. Operating Systems: Internals and Design Principles by William Stallings
3. Operating System: A Design-oriented Approach by Charles Crowley

**URLs:**

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY,  
BHOPAL - 462003**

1. <https://www.udacity.com/course/advanced-operating-systems--ud189>
2. <http://web.stanford.edu/~ouster/cgi-bin/cs140-spring20/index.php>
3. <https://www.cse.iitb.ac.in/~mythili/os/>
4. <https://nptel.ac.in/courses/106/106/106106168/>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                                    |
|--------------------------------|------------------------------------|
| <b>Name of Program</b>         | <b>M. Tech.</b>                    |
| <b>Name of Course</b>          | Web Search & Information Retrieval |
| <b>Course Code</b>             | AC-503                             |
| <b>Core / Elective / Other</b> | <b>Group A Program Electives</b>   |

**Prerequisite:**

1. Data Mining
2. Basic probability and statistics

**Course Outcomes:**

1. Ability to develop web crawling techniques
2. Ability to explore knowledge of data structures in indexing methods of information retrieval Systems
3. Ability to develop clustering and searching techniques
4. Ability to understand parallel and distributed information retrieval system

**Description of Contents in brief:**

1. Information retrieval model, Basic Information Retrieval model (Boolean and vector-space retrieval models; ranked retrieval; text-similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity.)
2. Document Representation, Simple tokenizing, stop-word removal, stemming.
3. Performance metrics: recall, precision, and F-measure; Evaluations on benchmark text collections.
4. Query expansion, Query languages and query operation,
5. Web Search, Web crawling, Link analysis, Ontology, domain specific search
6. Text Categorization & Clustering: Categorization algorithms: Rocchio, nearest neighbor, and naive Bayes. Applications to information filtering and organization. Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Applications to information filtering; organization; and relevance feedback.
7. Collaborative filtering and content-based recommendation of documents and products.
8. Parallel and distributed information retrieval, Text and multimedia languages, Social networks.

**List of Text Books:**

1. Introduction to Information Retrieval, Cambridge University Press by C. D. Manning, P. Raghavan and H. Schütze
2. Mining the web Discovering knowledge from hypertext data by S Chakrabarti

**List of Reference Books:**

1. Search Engines: Information Retrieval in Practice, Addison-Wesley by B. Croft, D. Metzler and T. Strohman
2. Modern Information Retrieval, AddisonWesley by R. Baeza-Yates and B. Ribeiro-Neto



**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                                  |
|--------------------------------|----------------------------------|
| <b>Name of Program</b>         | <b>M.Tech</b>                    |
| <b>Name of Course</b>          | Digital Image Processing         |
| <b>Course Code</b>             | AC-504                           |
| <b>Core / Elective / Other</b> | <b>Group A Program Electives</b> |

**Prerequisite:**

1. Mathematics (including engineering mathematics).
2. linear Algebra  
Differential Equations  
Probability and Statistics  
Calculus
3. A good programming skill(for platform like matlab, python)

**Course Outcomes:**

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
3. Categorize various compression techniques.
4. Interpret Image compression standards.
5. Interpret image segmentation and representation techniques.
6. To study the image fundamentals and mathematical transforms necessary for image processing.
7. To study the image enhancement techniques
8. To study image restoration procedures.
9. To study the image compression procedures.

**Description of Contents in brief:**

1. **Introduction and Fundamentals:** motivation and Perspective, Applications, Components of Image processing System, A simple image model, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.
2. **Image Enhancement in Frequency Domain:** Fourier transform, Filters low pass, High pass, correspondence between filtering in spatial & frequency domain, Smoothing Frequency Domain Filters – Gaussian Low-pass Filters; Sharpening Frequency Domain Filters – Gaussian High-pass Filters; Homomorphic Filtering.
3. **Image Enhancement in Spatial Domain:**Introduction; Basic Gray Level Functions Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

Arithmetic/Logic Operations Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening The Laplacian.

4. **Image Restoration :** A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering Band-pass Filters; Minimum Mean-square Error Restoration.
5. **Morphological Image Processing:** Introduction, Logic Operations involving Binary Images, Dilation and Erosion Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected, Components, Convex Hull, Thinning, Thickening
6. **Image Segmentation:**  
Multi-level Thresh holding, Local Thresh holding, Region-based Approach, Detection of discontinuation by point detection, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresh holding Edge Detector Performance, Line Detection, Corner Detection
- 7 **Introduction of Image Transformation:**  
Discrete image transform. Wavelet transformation. Image Compression.

**List of Text Books:**

Jayaraman, S., Esakkirajan, S., & Veerakumar, T. (2009). Digital image processing tmh publication. Year of Publication.  
Digital Image Processing Second Edition (English, Paperback, S. Sridhar)

**List of Reference Books:**

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.
2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY.
3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ.

**URLs:**

1. <https://www.tutorialspoint.com/dip/index.htm>
2. [https://en.wikipedia.org/wiki/Digital\\_image\\_processing](https://en.wikipedia.org/wiki/Digital_image_processing)
3. <https://www.geeksforgeeks.org/digital-image-processing-basics/>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

**Name of Program**      **M. Tech**

**Name of Course**              Embedded System

**Course Code**                  AC - 505

**Core / Elective / Other**      **Group A Program Electives**

**Course Outcomes:**

1. The course will cover the process of design, develop, and test the embedded system.
2. Covers the classification of the real-time operating systems.
3. Case studies of designing embedded system.

**Description of Contents in brief:**

1. Introduction to Embedded System, Challenges & Design Matrices, Classification of Embedded System
2. Design and Specification of Embedded System, Design of General-Purpose Microprocessor, Assembly Language Programming
3. 8051 Microcontroller, ARM Controller and PIC Microcontroller
4. Peripheral device, Timers, Counters, Watchdog timers, and other controllers
5. Memory, Interfacing, and Protocols, Finite State machine for capturing behaviour
6. Implementation of project from start to finish (Digital Camera Example and others)
7. Real Time OS, Embedded Control Applications, Network Based Embedded Applications

**List of Text Books:**

1. Embedded System Design: A Unified Hardware/Software Introduction by Frank Vahid, Tony D. Givargis
2. Computers as Components :Principles of Embedded Computing System Design by Marilyn Wolf

**URLs:**

1. <https://nptel.ac.in/courses/108102045/> by Dr. Santanu Chaudhury, Department of Electrical Engineering, IIT Delhi.
2. <https://nptel.ac.in/courses/106105159/> by Prof. Anupam Basu, IIT Kharagpur.
3. <https://nptel.ac.in/courses/106/103/106103182/> by Dr. Arnab Sarkar, CSE, IIT Guwahati.

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                                  |
|--------------------------------|----------------------------------|
| <b>Name of Program</b>         | <b>M.Tech.</b>                   |
| <b>Name of Course</b>          | Distributed System               |
| <b>Course Code</b>             | AC-506                           |
| <b>Core / Elective / Other</b> | <b>Group A Program Electives</b> |

**Prerequisite:**

1. Computer Networks
2. Basic Programming

**Course Outcomes:**

1. To knowledge of various architectures used to design distributed systems
2. To able to build distributed systems using various inter-process communication techniques.
3. To attain the knowledge of different distributed algorithms.

**Description of Contents in brief:**

Distributed Computing: Introduction, Types, and Various system models. Communication and Processes: RPC, RMI and others, Client and Server threads. Clock Synchronization: Types of clock and their synchronization, Introduction to distributed mutual exclusion, Election of a process, Consensus and related problems; Consistency: Various types of consistency, Consistency protocols, Fault tolerance: Introduction to fault tolerance, Process resilience; Protection and security in distributed systems: Various types of security techniques, Cryptography; Examples of distributed systems: Distributed file systems, Distributed shared memory and others.

**List of Text Books:**

Distributed Systems Principles and paradigms Andrew S. Tanenbaum and Maarten

**List of Reference Books:**

Distributed systems, concepts and design, George Colouris, Jean Dollimore and Tim Kindberg.

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                                  |
|--------------------------------|----------------------------------|
| <b>Name of Program</b>         | <b>M.Tech</b>                    |
| <b>Name of Course</b>          | Cluster & Grid Computing         |
| <b>Course Code</b>             | AC-507                           |
| <b>Core / Elective / Other</b> | <b>Group A Program Electives</b> |

**Prerequisite:**

Parallel Algorithms

**Course Outcomes:**

1. It Gives Knowledge of distributed computing fundamentals, grid computing middleware, and high performance applications.
2. Learn how to interconnect standalone heterogeneous systems cooperatively working together as a single, integrated computing resource.

**Description of Contents in brief:**

Basic concepts in Distributed Systems, Notion of time, Distributed Mutual exclusion, Consensus, Failure models, Paradigms for process interaction in distributed programs. Cluster Computing: Introduction, Hardware for cluster computing, Software architectures for cluster computing based on shared memory (OpenMP) and messagepassing (MPI/PVM) models, Performance evaluation tools, Configuring and Tuning Clusters. Grid Computing: The Evolution Grid Technologies, Grid applications, Grid architecture, Grid relationship to other Distributed Technologies, Computational and Data Grids, Semantic grids. Peer-to-Peer (P2P) Concepts in Grids: Introduction to P2P systems, Overlays, Unstructured P2P systems (Gnutella, Freenet), Structured P2P systems (Distributed Hash Tables - Chord, Pastry), Integrating unstructured and structured, P2P systems, Introduction to P2P security - Sybil attacks Grid Management systems: Security, Grid-Enabling software and Grid enabling network services, Virtualization Services for Data Grids.

**List of Text Books:**

1. R. Buyya, High Performance Cluster Computing, Prentice Hall, USA, 1999.
2. Parallel Programming with MPI by Peter Pacheco, Morgan Kaufmann, 1998
3. I. Foster and C. Kesselman, The Grid : Blueprint for a New Computing

**List of Reference Books:**

1. Infrastructure, Morgan Kaufmann Publishers , 1999.
2. Grid Computing, D. Janakiram, Tata Mcgrahill, 2005.

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                                  |
|--------------------------------|----------------------------------|
| <b>Name of Program</b>         | <b>M.Tech</b>                    |
| <b>Name of Course</b>          | Software Engineering             |
| <b>Course Code</b>             | AC -508                          |
| <b>Core / Elective / Other</b> | <b>Group A Program Electives</b> |

**Prerequisite:**

1. The basic knowledge about the principles of software engineering.
2. The software lifecycle.
3. Sufficient programming skills for the team development project.

**Course Outcomes:**

1. an ability to use the techniques, skills, and modern engineering tools and processes necessary for software engineering practice.
2. an ability to apply software engineering perspective through software design and construction, requirements analysis, verification, and validation, to develop solutions to modern problems such as security, data science, and systems engineering.
3. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

**Description of Contents in brief:**

1. A recapitulation of software engineering process models.
2. A recapitulation of the basic techniques for requirements engineering and design
3. Project management
4. Process and project metrics 5. Estimation for software projects
5. Project scheduling
6. Risk management , Maintenance and reengineering
7. Dependability of systems ,Reliability engineering , Safety engineering
8. Security engineering , Resilience engineering

**List of Text Books:**

1. Software Engineering: A Practitioner's Approach by Roger S. Pressman, McGraw-Hill International edition.
2. Software Engineering by Ian Sommerville, Addison-Wesley.

**List of Reference Books:**

1. An Integrated Approach to Software Engineering, by Pankaj Jalote, Narosa Publishing House.
2. Software Engineering by K.K. Agarwal.
3. Fundamentals of Software Engineering by Rajib Mall, PHI

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                                  |
|--------------------------------|----------------------------------|
| <b>Name of Program</b>         | <b>M.Tech.</b>                   |
| <b>Name of Course</b>          | Distributed Databases            |
| <b>Course Code</b>             | AC-509                           |
| <b>Core / Elective / Other</b> | <b>Group A Program Electives</b> |

**Prerequisite:**

1. Database Management System
2. Distributed System

**Course Outcomes:**

1. The issues and challenges faced while designing distributed database systems.
2. Understand the fundamental principles and architecture of distributed database systems.
3. Familiar with the different methods and techniques distributed query processing.

**Description of Contents in brief:**

Introduction: Distributed Data processing, Distributed database system (DDBMSS), Promises of DDBMSs, Complicating factors and Problem areas in DDBMSs, Overview Of Relational DBMS Relational Database concepts, Normalization, Integrity rules, Relational Data Languages, Relational DBMS. Distributed DBMS Architecture: DBMS Standardization, Architectural models for Distributed DBMS, Distributed DBMS Architecture. Distributed Database Design: Alternative design Strategies, Distribution design issues, Fragmentation, Allocation. Semantic Data Control: View Management, Data security, Semantic Integrity Control. Overview of Query Processing: Query processing problem, Objectives of Query Processing, Complexity of Relational Algebra operations, characterization of Query processors, Layers of Query Processing.

Introduction to Transaction Management: Definition of Transaction, Properties of transaction, types of transaction. Distributed Concurrency Control: Serializability theory, Taxonomy of concurrency control mechanisms, locking based concurrency control algorithms. Parallel Database Systems: Database servers, Parallel architecture, Parallel DBMS techniques, Parallel execution problems, Parallel execution for hierarchical architecture. Distributed Object Database Management systems: Fundamental Object concepts and Object models, Object distribution design. Architectural issues, Object management, Distributed object storage, Object query processing. Transaction management. Database Interoperability: Database Integration, Query processing.

**List of Text Books:**

Distributed Databases principles and systems, Stefano Ceri, Giuseppe Pelagatti, Tata McGraw Hill

**List of Reference Books:**

M. Tamer Özsu, Patrick Valduriez, "Principles of Distributed Database Systems", Second Edition.

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

**Name of Program**      **M. Tech**

**Name of Course**              Semantic Web

**Course Code**                  AC -510

**Core / Elective / Other**      **Group A Program Electives**

**Prerequisite:**

1. Basic knowledge of web technologies.
2. Basic understanding of web development.
3. Basic knowledge and understanding of markup language (HTML).

**Course Outcomes:** On successful completion of the module students should be able to:

1. Understand the rationale behind Semantic Web
2. Design RDF Schemas for ontologies.
3. Model and design ontologies using Web Ontology Language (OWL).
4. Describe web resources
5. Understand and reflect on the principles of Ontology Engineering.

**Description of Contents in brief:**

1. Semantic Web Vision: Today's web, Examples of semantic web from today's web, Semantic web technologies, layered approach
2. Structured web documents in XML: The XML language, Structuring, Namespaces, Querying and Addressing XML documents, Processing
3. Describing Web Resources: Introduction, RDF, RDF Schema syntax and language, Direct Inference System, Querying RQL
4. Web Ontology Language: Introduction, OWL language, Examples, OWL in OWL, Future extensions
5. Logic and Inference: Rules: Introduction, Monotonic Rules syntax, semantics & examples, Nonmonotonic rules – syntax & examples, Encoding in XML
6. Applications: Introduction, Horizontal Information Products at Elsevier, Data Integration at Audi, Skill Finding at Swiss Life, Think Tank portal at EnerSearch, e-Learning, Web Services, Other Scenarios
7. Ontology Engineering: Introduction, Manual construction of Ontology, Reusing existing ontology, using Semi-automatic methods, Knowledge semantic web architecture

**List of Text Books:**

1. Grigoris Antoniou and Frank van Harmelen, A Semantic Web Primer, 1st Edition, MIT Press, 2004.

**List of Reference Books:**

1. John Hebel, Matthew Fisher, Ryan Blace and Andrew Perez-Lopez, Semantic Web Programming, 1st Edition, Wiley, 2009.
2. Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph, Foundations of Semantic Web Technologies, CRC Press, 2009.
3. Dean Allemang, James Hendler, Semantic Web for the Working Ontologist: Effective



**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

Modeling in RDFS andOWL, Morgan Kauffmann, ISBN-10: 0-12-373556-4.

**URLs:**

1. [https://www.w3schools.com/xml/xml\\_rdf.asp](https://www.w3schools.com/xml/xml_rdf.asp)
2. <https://www.w3.org/TR/rdf-syntax-grammar/>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

**Name of Program** M. Tech.  
**Name of Course** Parallel Algorithms  
**Course Code** AC-511  
**Core / Elective / Other** Group A Program Electives

**Prerequisite:**

1. Data Structure
2. Analysis and Design of Algorithms
3. Operating systems
4. Computer Architecture

**Course Outcomes:**

1. Understand the parallel architecture and different parallel algorithm
2. Design and implement parallel algorithms for any given problem
3. Calculate the speed-up, cost and efficiency of parallel algorithm

**Description of Contents in brief:**

1. Understand the parallel architecture and different parallel algorithm
2. Processor arrays, multiprocessors, multicomputers, Flynn's taxonomy, serial and parallel computation, PRAM algorithms, parallel complexity.
3. Elementary Parallel Algorithms, Matrix Multiplication.
4. Searching algorithms, sorting algorithms, dictionary operation, graph algorithms, combinatorial search.
5. Parallel programming languages, mapping and scheduling.

**List of Text Books:**

1. Parallel algorithms Michael. J. Quinn
2. Michael J Quinn, Parallel Computing, TMH
3. Joseph Jaja, An Introduction to Parallel Algorithms, Addison Wesley

**List of Reference Books:**

1. Implicit Parallel Programming in PH
2. Guy Blelloch, Prefix Sums and Their Applications, in *Synthesis of Parallel Algorithms*, edited by John H Reif, Morgan Kaufmann, 1991.
3. Alan Gibbons and Wojciech Rytter, *Efficient Parallel Algorithms*, Cambridge University Press, 1989.
4. Mark Harris, Shubhabrata Sengupta, and John Owens, Parallel Prefix Sum (Scan) with CUDA, in *GPU Gems 3*, edited by Hubert Nguyen, 2007.

**URLs:**

1. <http://www.toves.org/books/distalg/>
2. <https://www.comp.nus.edu.sg/~rahul/allfiles/cs6234-16-pds.pdf>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

**Name of Program**      **M.Tech**

**Name of Course**              **Image Analysis**

**Course Code**                  **AC-512**

**Core / Elective / Other**      **Group A Program Electives**

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                                  |
|--------------------------------|----------------------------------|
| <b>Name of Program</b>         | <b>M.Tech</b>                    |
| <b>Name of Course</b>          | <b>Big data Analytics</b>        |
| <b>Course Code</b>             | <b>AC-513</b>                    |
| <b>Core / Elective / Other</b> | <b>Group A Program Electives</b> |

**Prerequisite:**

1. A strong mathematical background in Probability and Statistics.
2. Proficiency with algorithms.
3. Programming skills in C, Python, R, Core Java, etc.

**Course Outcomes:**

1. Find a meaningful pattern in data
2. Handle large scale analytics projects from various domains
3. Develop intelligent decision support systems

**Description of Contents in brief:**

1. Insight into data analytics and statistical analysis of various formats of data.
2. Outlines various frameworks to handle big data.
3. Apache Hadoop Framework for batch , Apache Spark for stream data processing
4. Apache storm and Kafka briefing.

**List of Reference Books:**

1. Tom White, "HADOOP: The definitive Guide", O Reilly.
2. Learning Spark: Lightning-Fast Big Data Analysis Paperback by Holden Karau
3. Boris lublinsky, Kevin t. Smith, AlexeyYakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.

**URLs:**

1. [https://mitxpro.mit.edu/courses/course-v1:MITxPRO+DSx+2T2019/about?utm\\_medium=website&utm\\_source=stats&utm\\_campaign=ds-su19&utm\\_content=event-calendar](https://mitxpro.mit.edu/courses/course-v1:MITxPRO+DSx+2T2019/about?utm_medium=website&utm_source=stats&utm_campaign=ds-su19&utm_content=event-calendar)
2. <https://nptel.ac.in/courses/106104189/>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

**Name of Program**      **M.Tech**

**Name of Course**              **Data Mining**

**Course Code**                      **AC-601**

**Core / Elective / Other**      **Group B Department Electives**

**Prerequisite:**

1. Knowledge of basic probability theory and algorithms,
2. Programming Languages Java/C++/XML/R/Matlab

**Course Outcomes:**

1. To introduce students to the basic concepts and techniques of Data Mining.
2. To develop skills of using recent data mining techniques to practical problems.
3. To apply data mining techniques to realistic data.

**Description of Contents in brief:**

1. Introduction to Data warehousing, needs for developing data Warehouse, Data warehouse systems and its Components, Design of Data Warehouse, Dimension and Measures, Conceptual Modeling of Data Warehouses, Multidimensional Data Model & Aggregates.
2. Introduction to Data Mining, Knowledge Discovery, Data Mining Functionalities, Data Mining System categorization and its Issues. Data Preprocessing: - Data Cleaning, Data Integration and Transformation. Data Reduction. Guidelines for Successful Data Mining. OLAP, Characteristics of OLAP System, Guidelines for OLAP Implementation.
3. Introduction to Logistic Regression, Logistic function, Logistic Regression with more than two classes. Principal components analysis, dimensionality reduction. Application and Challenges of Data Mining, Introduction of Web Structure Mining, Web Usage Mining, Spatial Mining, Text Mining, Security Issue, Privacy Issue, Ethical Issue.
4. Association Rule Mining, Single Dimensional Boolean Association Rules, Multi-Level Association Rule, Apriori Algorithm, FP Growth Algorithm, Time series mining association rules, latest trends in association rules mining.
5. Classification and Clustering, Classification and Clustering Distance Measures, Types of Clustering, K-Means Algorithm, Decision Tree Induction, Bayesian Classification, Association Rule Based Other Classification Methods, Prediction, Classifier Accuracy, Categorization of methods, Partitioning methods.

**List of Textbooks:**

1. Data mining: Concepts and Techniques, by Jiawei Han and Micheline Kamber, Morgan Kaufmann.
2. Principles of Data Mining, by David Hand, Heikki Mannila, Padhraic Smyth, The MIT Press .
3. Introduction to Data Mining, by Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, Pearson/Addison Wesley.

**List of Reference Books:**

1. T. Mitchell. Machine Learning. New York, NY: McGraw-Hill, 1997.
2. Berry and Linoff. Mastering Data Mining. New York, NY: Wiley, 2000. ISBN: 0471331236
3. Wang, H. (2010). Managing and mining graph data (Vol. 40). C. C. Aggarwal (Ed.). New York:

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

Springer

**URLs:**

1. What is happening in the world of data mining ; <https://www.kdnuggets.com/>
2. Data Mining: [https://link.springer.com/referenceworkentry/10.1007%2F978-0-387-39940-9\\_104](https://link.springer.com/referenceworkentry/10.1007%2F978-0-387-39940-9_104)
3. <https://nptel.ac.in/courses/106105174/>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                                     |
|--------------------------------|-------------------------------------|
| <b>Name of Program</b>         | <b>M. Tech.</b>                     |
| <b>Name of Course</b>          | Web Search & Information Retrieval  |
| <b>Course Code</b>             | AC-602                              |
| <b>Core / Elective / Other</b> | <b>Group B Department Electives</b> |

**Prerequisite:**

1. Data Mining
2. Basic probability and statistics

**Course Outcomes:**

1. Ability to develop web crawling techniques
2. Ability to explore knowledge of data structures in indexing methods of information retrieval Systems
3. Ability to develop clustering and searching techniques
4. Ability to understand parallel and distributed information retrieval system

**Description of Contents in brief:**

1. Information retrieval model, Basic Information Retrieval model (Boolean and vector-space retrieval models; ranked retrieval; text-similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity.)
2. Document Representation, Simple tokenizing, stop-word removal, stemming.
3. Performance metrics: recall, precision, and F-measure; Evaluations on benchmark text collections.
4. Query expansion, Query languages and query operation,
5. Web Search, Web crawling, Link analysis, Ontology, domain specific search
6. Text Categorization & Clustering: Categorization algorithms: Rocchio, nearest neighbor, and naive Bayes. Applications to information filtering and organization. Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Applications to information filtering; organization; and relevance feedback.
7. Collaborative filtering and content-based recommendation of documents and products.
8. Parallel and distributed information retrieval, Text and multimedia languages, Social networks.

**List of Text Books:**

1. Introduction to Information Retrieval, Cambridge University Press by C. D. Manning, P. Raghavan and H. Schütze
2. Mining the web Discovering knowledge from hypertext data by S Chakrabarti

**List of Reference Books:**

1. Search Engines: Information Retrieval in Practice, Addison-Wesley by B. Croft, D. Metzler and T. Strohman
2. Modern Information Retrieval, AddisonWesley by R. Baeza-Yates and B. Ribeiro-Neto

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                          |
|--------------------------------|--------------------------|
| <b>Name of Program</b>         | <b>M.Tech</b>            |
| <b>Name of Course</b>          | Digital Image Processing |
| <b>Course Code</b>             | AC-603                   |
| <b>Core / Elective / Other</b> | Elective                 |

**Prerequisite:**

1. Mathematics (including engineering mathematics).
2. linear Algebra  
Differential Equations  
Probability and Statistics  
Calculus
3. A good programming skill(for platform like matlab, python)

**Course Outcomes:**

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
3. Categorize various compression techniques.
4. Interpret Image compression standards.
5. Interpret image segmentation and representation techniques.
6. To study the image fundamentals and mathematical transforms necessary for image processing.
7. To study the image enhancement techniques
8. To study image restoration procedures.
9. To study the image compression procedures.

**Description of Contents in brief:**

1. **Introduction and Fundamentals:** motivation and Perspective, Applications, Components of Image processing System, A simple image model, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.
2. **Image Enhancement in Frequency Domain:** Fourier transform, Filters low pass, High pass, correspondence between filtering in spatial & frequency domain, Smoothing Frequency Domain Filters – Gaussian Low-pass Filters; Sharpening Frequency Domain Filters – Gaussian High-pass Filters; Homomorphic Filtering.
3. **Image Enhancement in Spatial Domain:** Introduction; Basic Gray Level Functions Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations Image Subtraction, Image Averaging; Basics of Spatial



**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening The Laplacian.

4. **Image Restoration** : A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering Band-pass Filters; Minimum Mean-square Error Restoration.
5. **Morphological Image Processing**: Introduction, Logic Operations involving Binary Images, Dilation and Erosion Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected, Components, Convex Hull, Thinning, Thickening
6. **Image Segmentation**: Multi-level Thresh holding, Local Thresh holding, Region-based Approach, Detection of discontinuation by point detection, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresh holding Edge Detector Performance, Line Detection, Corner Detection
- 7 **Introduction of Image Transformation**: Discrete image transform. Wavelet transformation. Image Compression.

**List of Text Books:**

1. Jayaraman, S., Esakkirajan, S., & Veerakumar, T. (2009). Digital image processing tmh publication. Year of Publication.
2. Digital Image Processing Second Edition (English, Paperback, S. Sridhar)

**List of Reference Books:**

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.
2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY.
3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ.

**URLs:**

1. <https://www.tutorialspoint.com/dip/index.htm>
2. [https://en.wikipedia.org/wiki/Digital\\_image\\_processing](https://en.wikipedia.org/wiki/Digital_image_processing)
3. <https://www.geeksforgeeks.org/digital-image-processing-basics/>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

**Name of Program** M. Tech.  
**Name of Course** Parallel Algorithms  
**Course Code** AC-604  
**Core / Elective / Other** Group B Department Electives

**Prerequisite:**

1. Data Structure
2. Analysis and Design of Algorithms
3. Operating systems
4. Computer Architecture

**Course Outcomes:**

1. Understand the parallel architecture and different parallel algorithm
2. Design and implement parallel algorithms for any given problem
3. Calculate the speed-up, cost and efficiency of parallel algorithm

**Description of Contents in brief:**

1. Understand the parallel architecture and different parallel algorithm
2. Processor arrays, multiprocessors, multicomputers, Flynn's taxonomy, serial and parallel computation, PRAM algorithms, parallel complexity.
3. Elementary Parallel Algorithms, Matrix Multiplication.
4. Searching algorithms, sorting algorithms, dictionary operation, graph algorithms, combinatorial search.
5. Parallel programming languages, mapping and scheduling.

**List of Text Books:**

1. Parallel algorithms Michael. J. Quinn
2. Michael J Quinn, Parallel Computing, TMH
3. Joseph Jaja, An Introduction to Parallel Algorithms, Addison Wesley

**List of Reference Books:**

1. Implicit Parallel Programming in PH
2. Guy Blelloch, Prefix Sums and Their Applications, in *Synthesis of Parallel Algorithms*, edited by John H Reif, Morgan Kaufmann, 1991.
3. Alan Gibbons and Wojciech Rytter, *Efficient Parallel Algorithms*, Cambridge University Press, 1989.
4. Mark Harris, Shubhabrata Sengupta, and John Owens, Parallel Prefix Sum (Scan) with CUDA, in *GPU Gems 3*, edited by Hubert Nguyen, 2007.

**URLs:**

1. <http://www.toves.org/books/distalg/>
2. <https://www.comp.nus.edu.sg/~rahul/allfiles/cs6234-16-pds.pdf>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

**Name of Program**      **M.Tech**

**Name of Course**              **Big data Analytics**

**Course Code**                  **AC-605**

**Core / Elective / Other**        **Group B Department Electives**

**Prerequisite:**

1. A strong mathematical background in Probability and Statistics.
2. Proficiency with algorithms.
3. Programming skills in C, Python, R, Core Java, etc.

**Course Outcomes:**

1. Find a meaningful pattern in data
2. Handle large scale analytics projects from various domains
3. Develop intelligent decision support systems

**Description of Contents in brief:**

1. Insight into data analytics and statistical analysis of various formats of data.
2. Outlines various frameworks to handle big data.
3. Apache Hadoop Framework for batch , Apache Spark for stream data processing
4. Apache storm and Kafka briefing.

**List of Reference Books:**

1. Tom White, “HADOOP: The definitive Guide”, O Reilly.
2. Learning Spark: Lightning-Fast Big Data Analysis Paperback by Holden Karau
3. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.

**URLs:**

1. [https://mitxpro.mit.edu/courses/course-v1:MITxPRO+DSx+2T2019/about?utm\\_medium=website&utm\\_source=stats&utm\\_campaign=ds-su19&utm\\_content=event-calendar](https://mitxpro.mit.edu/courses/course-v1:MITxPRO+DSx+2T2019/about?utm_medium=website&utm_source=stats&utm_campaign=ds-su19&utm_content=event-calendar)
2. <https://nptel.ac.in/courses/106104189/>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                          |
|--------------------------------|--------------------------|
| <b>Name of Program</b>         | <b>M.Tech</b>            |
| <b>Name of Course</b>          | Digital Image Processing |
| <b>Course Code</b>             | AC-701                   |
| <b>Core / Elective / Other</b> | <b>Group C-IE</b>        |

**Prerequisite:**

1. Mathematics (including engineering mathematics).
2. linear Algebra  
Differential Equations  
Probability and Statistics  
Calculus
3. A good programming skill(for platform like matlab, python)

**Course Outcomes:**

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
3. Categorize various compression techniques.
4. Interpret Image compression standards.
5. Interpret image segmentation and representation techniques.
6. To study the image fundamentals and mathematical transforms necessary for image processing.
7. To study the image enhancement techniques
8. To study image restoration procedures.
9. To study the image compression procedures.

**Description of Contents in brief:**

1. **Introduction and Fundamentals:** motivation and Perspective, Applications, Components of Image processing System, A simple image model, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.
2. **Image Enhancement in Frequency Domain:** Fourier transform, Filters low pass, High pass, correspondence between filtering in spatial & frequency domain, Smoothing Frequency Domain Filters – Gaussian Low-pass Filters; Sharpening Frequency Domain Filters – Gaussian High-pass Filters; Homomorphic Filtering.
3. **Image Enhancement in Spatial Domain:**Introduction; Basic Gray Level Functions Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

Arithmetic/Logic Operations Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening The Laplacian.

4. **Image Restoration :** A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering Band-pass Filters; Minimum Mean-square Error Restoration.
5. **Morphological Image Processing:** Introduction, Logic Operations involving Binary Images, Dilation and Erosion Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected, Components, Convex Hull, Thinning, Thickening
6. **Image Segmentation:**  
Multi-level Thresh holding, Local Thresh holding, Region-based Approach, Detection of discontinuation by point detection, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresh holding Edge Detector Performance, Line Detection, Corner Detection
- 7 **Introduction of Image Transformation:**  
Discrete image transform. Wavelet transformation. Image Compression.

**List of Text Books:**

Jayaraman, S., Esakkirajan, S., & Veerakumar, T. (2009). Digital image processing tmh publication. Year of Publication.  
Digital Image Processing Second Edition (English, Paperback, S. Sridhar)

**List of Reference Books:**

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.
2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY.
3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ.

**URLs:**

1. <https://www.tutorialspoint.com/dip/index.htm>
2. [https://en.wikipedia.org/wiki/Digital\\_image\\_processing](https://en.wikipedia.org/wiki/Digital_image_processing)
3. <https://www.geeksforgeeks.org/digital-image-processing-basics/>

**MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY  
BHOPAL - 462003**

|                                |                           |
|--------------------------------|---------------------------|
| <b>Name of Program</b>         | <b>M.Tech</b>             |
| <b>Name of Course</b>          | <b>Big data Analytics</b> |
| <b>Course Code</b>             | <b>AC-702</b>             |
| <b>Core / Elective / Other</b> | <b>Group C-IE</b>         |

**Prerequisite:**

1. A strong mathematical background in Probability and Statistics.
2. Proficiency with algorithms.
3. Programming skills in C, Python, R, Core Java, etc.

**Course Outcomes:**

1. Find a meaningful pattern in data
2. Handle large scale analytics projects from various domains
3. Develop intelligent decision support systems

**Description of Contents in brief:**

1. Insight into data analytics and statistical analysis of various formats of data.
2. Outlines various frameworks to handle big data.
3. Apache Hadoop Framework for batch , Apache Spark for stream data processing
4. Apache storm and Kafka briefing.

**List of Reference Books:**

1. Tom White, "HADOOP: The definitive Guide", O Reilly.
2. Learning Spark: Lightning-Fast Big Data Analysis Paperback by Holden Karau
3. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.

**URLs:**

1. [https://mitxpro.mit.edu/courses/course-v1:MITxPRO+DSx+2T2019/about?utm\\_medium=website&utm\\_source=stats&utm\\_campaign=ds-su19&utm\\_content=event-calendar](https://mitxpro.mit.edu/courses/course-v1:MITxPRO+DSx+2T2019/about?utm_medium=website&utm_source=stats&utm_campaign=ds-su19&utm_content=event-calendar)
2. <https://nptel.ac.in/courses/106104189/>