

Dr. Babasaheb Ambedkar Technological University

(Established as University of Technology in the State of Maharashtra

(Under Maharashtra Act No. XXIX of 2014)

P.O. Lonere, Dist. Raigad, Pin 402 103, Maharashtra

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Under Graduate Programme

Bucket of Multi – Disciplinary Minor (MDM) Courses

In

Computer Engineering and Allied Branches

With effective from the academic year

2025 – 2026

(For Affiliated Institutes only)

Department of Computer Engineering

Dr. Babasaheb Ambedkar Technological University, Lonere

Course Structure for Multi-Disciplinary Minor (MDM) Bucket in Computer Engineering and Allied Branches (UG) w.e.f. 2025-26 as per NEP-2020 (For Affiliated Institutes Only)

Semester	Course Code	Course Name	Teaching Scheme		Evaluation Scheme			Credit
			T	P	CA	MTE	ESE	
III	25AF1245MD306A	Data Structures	3	-	20	20	60	3
	25AF1245MDL306A	Data Structures Laboratory	-	2	60	-	40	1
	25AF1245MD306B	Object-Oriented Programming	2	-	20	20	60	2
	25AF1245MDL306B	Object-Oriented Programming Laboratory	-	2	60	-	40	1
IV	25AF1245MD406A	Design and Analysis of Algorithms	3	2	20	20	60	4
	25AF1245MDL406A	Design and Analysis of Algorithms Laboratory	-	2	60	-	40	1
	25AF1245MDL406B	Python Programming	1	2	60	-	40	2
V	25AF1245MD506A	Operating Systems	3	-	20	20	60	3
	25AF1245MDL506A	Operating Systems Laboratory	-	2	60	-	40	1
	25AF1245MD506B	Database Management System	3	-	20	20	60	3
	25AF1245MDL506B	Database Management System Laboratory	-	2	60	-	40	1
	25AF1245MD506C	Theory of Computation	3	-	20	20	60	3
VI	25AF1245MD606A	Software Engineering	3	-	20	20	60	3
	25AF1245MD606B	Data Communication & Computer Networks	3	-	20	20	60	3
VII	25AF1245MD705	AI Ethics	2	-	20	20	60	2

A student wishing to pursue a Minor program in B.Tech. (Artificial Intelligence and Machine Learning) needs to complete at least 14 credits from the list of courses.

Second Year (Semester – III) Data Structures

25AF1245MD306A	Data Structures	MDM	3L-0T-2P	4 Credit
Teaching Scheme		Examination Scheme		
Lecture: 3 hrs./week		Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)		

COURSE CONTENT

Unit I Introduction: Data, Data types, Data structure, Abstract Data Type (ADT), representation of Information, characteristics of an algorithm, program, analysing programs. Arrays and Hash Tables: Concept of sequential organisation, linear and non-linear data structures, storage representation, array processing, sparse matrices, transpose of sparse matrices, Hash Tables, Direct address tables, Hash tables, Hash functions, Open addressing, Perfect hashing.

Unit II Stacks and Queues: Introduction, stack and queue as ADT, representation and implementation of stack and queue using sequential and linked allocation, Circular queue and its implementation, Application of stack for expression evaluation and expression conversion, recursion, priority queue.

Unit-III Linked Lists: Concept of linked organization, singly and doubly linked list, and dynamic storage management, circular linked list, operations such as insertion, deletion, concatenation, traversal of linked list, dynamic memory management, garbage collection.

Unit-IV Trees and Graphs: Basic terminology, binary trees and their representation, insertion and deletion of nodes in binary trees, binary search tree and its traversal, threaded binary tree, Heap, Balanced Trees, Terminology and representation of graphs using adjacency matrix, Warshall's algorithm.

Unit-V Searching and Sorting: Sequential, binary searching, skip lists – dictionaries, linear list representation, skip list representation, operations – insertion, deletion, and searching. Insertion sort, selection sort, radix sort, and File handling.

Reference Books:

1. Horowitz and Sahani, Fundamentals of Data Structures, Universities Press, 2nd Edition, 2008.

2. Thomas Cormen, Introduction to Algorithms, PHI Publication, 2nd Edition, 2002.
3. Venkatesan & Rose, Data Structures, Wiley Publication, 1st Edition, 2015.
4. Goodrich & Tamassia, Data Structures & Algorithms in C++, Wiley Publication, 2nd Edition, 2011.
5. R. G. Dromey, How to Solve it by Computer, 2nd Impression, Pearson Education.
6. Kyle Loudon, Mastering Algorithms with C: Useful Techniques from Sorting to Encryption, O'Reilly Media, 1st Edition, 1999.

Text Books:

1. Mark Allen Weiss, Data structures and algorithms analysis in C++, Pearson Education, 4th Edition, 2013.
2. S. Lipschutz, Data Structures, McGraw-Hill Publication, Revised 1st Edition, 2014.
3. Y. Langsm, M. Augenstin, A. Tanenbaum, Data Structure using C and C++, Prentice Hall India Learning Private Limited, 2nd Edition, 1998.
4. Trembley and Sorenson, Introduction to Data Structures, PHI Publication, 2nd Revised Edition, 1983.
5. Vishal Goyal, Lalit Goyal, A Simplified Approach To Data Structure, SPD Publication, 1st Edition, 2014.

Second Year (Semester – III) Object-Oriented Programming

25AF1245MD306B	Object-Oriented Programming	MDM	2L-0T-2P	3 Credit
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Teaching Scheme	Examination Scheme
Lecture: 2 hrs./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

COURSE CONTENT

Unit-1 Introduction to Classes and Objects (Java): Introduction, Java Class Libraries, Typical Java Development Environment, Memory Concepts, Arithmetic. Classes, Objects, Methods and Instance Variables, Declaring a Class with a Method and Instantiating an Object of a Class, Declaring a Method, Instance variables, set Methods and get Methods, Primitive Types vs. Reference type double Types, Initializing Objects with Constructors, floating point numbers. Contro Statements and Array

Unit-2 Modularization in Java: Java Package, importing packages, Methods: static methods, static Fields, scope of declaration, method overloading, and Java API packages.

Unit-3 Inheritance and Polymorphism in Java

Inheritance: Super classes and Subclasses, protected members, relationship between super classes and subclasses, constructors in subclasses, object class.

Polymorphism: Abstract classes and methods, final methods and classes, polymorphism examples, and Interfaces.

Unit-4 Exception-handling: Exception-handling overview, handling Arithmetic Exceptions and Input Mismatch Exceptions, when to use exception handling, Java exception hierarchy, finally block. Java Iterator Methods Parametrized Classes in Java.

Text Books:

1. Paul Deitel and Harvey Detail, Java: How to Program, Pearson's Publication, 9th Edition.

Reference Books:

1. Joel Murach and Michael Urban, Murach's Beginning Java with Eclipse, Murach's Publication, 1st Edition, 2016.
2. Doug Lowe, Java All-in-One For Dummies, Wiley Publication, 4th Edition, 2014.
3. Herbert Schildt, Java: The Complete Reference, McGraw-Hill Publication, 9th Edition.
4. Patrick Niemeyer, Daniel Leuck, Learning Java, O'Reilly Media, 4th Edition, 2013.
5. JavaScript: The Good Parts, Douglas Crockford, O'Reilly, ISBN: 9782744055973.

Second Year (Semester – IV)

Design and Analysis of Algorithms

25AF1245MD406A	Design and Analysis of Algorithms	MDM	3L-0T-2P	4 Credit
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

COURSE CONTENT

Unit-1 Introduction to Algorithms: Definition, Properties of Algorithms, Expressing Algorithm, Flowchart, Algorithm Design Techniques, Performance Analysis of Algorithms, Types of Algorithms Analysis, Order of Growth, Asymptotic Notations, Recursion, Recurrences Relation, Substitution Method, Iterative Method, Recursion Tree, Master Theorem, Changing Variable, Heap Sort.

Unit-2 Divide and Conquer: Introduction, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix Multiplication.

Unit-3 Backtracking: Backtracking Concept, N-Queens Problem, Four-Queens Problem, Eight-Queen Problem, Hamiltonian Cycle, Sum of Subsets Problem, Graph Coloring Problem, Branch and Bound: Introduction, Traveling Salesperson Problem, 15-Puzzle Problem, Comparisons between Backtracking and Branch and Bound.

Unit-4 Greedy Algorithms: Introduction to Greedy Technique, Greedy Method, Optimal Merge Patterns, Huffman Coding, Knapsack Problem, Activity Selection Problem, Job Sequencing with Deadline, Minimum Spanning Tree, Single-Source Shortest Path Algorithm.

Unit-5 Dynamic Programming: Introduction, Characteristics of Dynamic Programming, Component of Dynamic Programming, Comparison of Divide-and-Conquer and Dynamic Programming Techniques, Longest Common Subsequence, matrix multiplication, shortest paths: Bellman-Ford, Floyd Warshall, Application of Dynamic Programming.

NP Completeness: Introduction, the Complexity Class P, the Complexity Class NP, Polynomial-Time Reduction, the Complexity Class NP-Complete.

Text Books:

1. T. Cormen, Introduction to Algorithms, PHI Publication, 4th Edition, 2022.

Reference Books:

1. Aho, Ullman, Data Structure and Algorithms, Addison-Wesley Publication, 1st Edition, 1983.
2. Michel Goodrich, Roberto Tamassia, Algorithm Design – Foundation, Analysis & Internet Examples, Wiley Publication, 2nd Edition, 2006.
3. George T. Heineman, Gary Pollice, Stanley Selkow, Algorithms in a Nutshell, A Practical Guide, O'Reilly Media, 2nd Edition, 2016.
4. Sara Base, Computer algorithms: Introduction to Design and Analysis, Addison-Wesley Publication, 2nd Edition, 1988.

Second Year (Semester – IV) Python Programming

25AF1245MD406B	Python Programming	MDM	1L-0T-2P	2 Credit
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Teaching Scheme	Examination Scheme
Lecture: 1 hrs./week	Continuous Assessment: 60 Marks Mid Semester Exam: - End Semester Exam: 40 Marks

COURSE CONTENT

Unit-1: Informal introduction to programming, algorithms and data structures, downloading and installing Python, run a simple program on Python interpreter.

Unit-2: Variables, operations, control flow – assignments, conditionals, loops, functions: optional arguments, default values, passing functions as arguments, Statements, Expressions.

Strings: String processing. Exception handling, Basic input/output, handling files.

Unit-3: Class and Object, Data Structure: List, Tuple and Sequences, Set, Dictionaries.

Unit-4: Using Database and Structured Query Languages (SQL): SQLite manager, Spidering Twitter using a Database, Programming with multiple tables, JOIN to retrieve data.

Text/Reference Books:

1. Michael Urban and Joel Murach, Murach's Python Programming, Murach's Publication, 2016
2. Charles Severance, Python for Informatics: Exploring Information, University of Michigan, Version 2.7.0, 2014.
3. Dr. R. Nageswara Rao, Core Python Programming, Dreamtech Press, 1st Edition, 2016.
4. Mark Lutz, Learning Python, O'Reilly Media, 5th Edition, 2013.
5. Mark Pilgrim, Dive into Python 3, A press Publication, 2nd Edition, 2009.
6. Allen B. Downey, Think Python, O'Reilly Media, 2nd Edition, 2012.
7. Jon Kleinberg and Eva Tardos, Algorithm Design, Pearson Education, 1st Edition, 2006.