



Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)

SCHEME OF INSTRUCTION & SYLLABI

Programme: **B. Tech. in Computer Science and Engineering – Data Science**

Scheme of Instructions: **B. Tech. Computer Science and Engineering – Data Science (As Per NEP 2020)**

Year – II/Semester- III



Sr. No	Sem	Type	BoS/ Dept	Sub Code	Subject	T/ P	Contact Hours			Credits	% Weightage			ESE Duration	Total Marks
							L	P	Hrs		CT/IA	CA	ESE		
1	III	PCC	DS	BDS42301	Data Structures and Algorithms	T	3	-	3	3	30	10	60	3 Hrs	100
2		PCC	DS	BDS42302	Data Structures and Algorithms Lab	P	-	2	2	1	-	25	25	2 Hrs	50
3		PCC	DS	BDS42303	Database Management Systems	T	3	-	3	3	30	10	60	3 Hrs	100
4		PCC	DS	BDS42304	Database Management Systems Lab	P	-	2	2	1	-	25	25	2 Hrs	50
5		PCC	DS	BDS42305	Basics of Data Analytics	T	2	-	2	2	14	6	30	2 Hrs	50
6		PCC	DS	BDS42306	Basics of Data Analytics Lab	P	-	2	2	1	-	25	25	2 Hrs	50
7		MDM	DS	BSH42304	Numerical and Statistical Methods	T	2	-	2	2	14	6	30	2 Hrs	50
8		OE	DS	BDS42307	OE-I: Object Oriented Programming with C++	T	4	-	4	4	30	10	60	3 Hrs	100
9		VEC	DS	BDS42308	Ethics in Engineering Practices	T	2	-	2	2	14	6	30	2 Hrs	50
10		CEP	DS	BDS42309	Community Engineering Project	P	-	4	4	2	-	50	50	-	100
11		AEC	DS	BDS42310	Liberal Learning Modules - 3	P	-	2	2	1	50	-	-	2 Hrs	50
Total							16	12	28	22	182	173	395		750

Course Category	BSC/ ESC (Basic Science Course/ Engineering Science Course.)	PCC/PEC (Programme Core courses)	VSEC (Skill Course)	Multidisciplinary Courses		Humanities Social Science & Management				Experiential Learning Courses				CC (Co-Curricular Courses)
				MDM (Multidisciplinary minor)	OE(Open Elective)	AEC (Ability Enhancement Course)	IKS(Indian Knowledge System)	VEC(Value education Course)	Management Course	Research Methodology	CEP	Project	Internship /OJT	
Credits	-	11	-	02	04	01	-	02	-	-	02	-	-	-
Cumulative Sum	16 / 13	13	04	02	04	03	02	02	-	-	02	-	-	04

PROGRESSIVE TOTAL CREDITS: 43+22=65

				June, 2026	1.00	Applicable for AY 2026-27 Onwards
Chairperson	Vice-Principal/ Director Academics	Director Administration	Principal	Date of Release	Version	



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SCHEME OF INSTRUCTION & SYLLABI

Programme: B. Tech. in Computer Science and Engineering – Data Science





Scheme of Instructions: B. Tech. Computer Science and Engineering – Data Science (As Per NEP 2020)



Program: B. Tech Computer Science and Engineering (Data Science)

List of **Open Electives** offered by Computer Science and Engineering (Data Science)

Open Elective-I	Open Elective-II	Open Elective-III
Semester-III	Semester-IV	Semester-V
BDS32307 – Object Oriented Programming with C++	BDS32407 – Introduction to Data Science	BDS33510 – Software Engineering and Quality Assurance

			 Dr. P. Premanand Naktode	June, 2026	1.00	Applicable for AY 2026-27 Onwards
Chairperson	Vice-Principal/ Director Academics	Director Administration	Principal	Date of Release	Version	

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**Wardha Road, Nagpur-441108
NAAC Accredited with A+ Grade

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**Program: B.Tech Second Year (CSE- Data Science)**

Semester		Course Code		Course Name	
III		BDS42301		Data Structure and Algorithm	
Teaching Scheme		Examination Scheme (Th)		Examination Scheme (P)	
Theory (Th)	3Hrs/week	CT-I	15	-	-
Practical (P)	0	CT-II	15	-	-
Total Credits	3	CA	10	-	-
Duration of ESE: 3 Hrs		ESE	60	-	-
		Total Marks	100	-	-

Pre-Requisites:**Course Outcomes:**

CO1	Categorize essential data structures and understand when it is appropriate to use.
CO2	Analyze use of Abstract data types & ways in which ADTs can be stored, accessed and manipulated
CO3	Implement the linear Data Structure such as stack and queue.
CO4	Analyze the Binary tree with their operations based on applications
CO5	Evaluate with analysis of efficiency and proofs of correctness of Graphs as a data structure.

Course Content

Unit I	Introduction: Common operations on data structures, Types of data structures, Data structures & Programming, Program Design, Complexities, Time Complexity: Big Oh, theta and omega notation. Order of Growth, Asymptotic Notation. Analysis of Algorithm. Abstract Data structure, Array as ADT: Introduction, Linear Arrays, Representation of one-dimension Arrays, Arrays as ADT, Representation of Linear array in Memory, Traversing Linear Arrays, Inserting and deleting elements of Array
Unit II	Sorting and Searching: Introduction, Sorting, Insertion Sort, Selection Sort, Merging, Merge-Sort, Radix Sort, searching; Linear Search, Binary Search: Linked List Introduction, Linked Lists, Representation of Linked Lists in Memory, traversing a Linked List, Searching a Linked List, Memory Allocation; Garbage Collection, Insertion into a Linked List, Deletion from a Linked List, Header Linked List, Circularly Linked Lists, Two-Way Lists (or Doubly Linked Lists).
Unit III	Stacks, Queue and Recursion-Introduction, Stacks, Array Representation of Stacks, Linked Representation of Stacks, Stack as ADT, Arithmetic Expression; Polish Notation, Application of Stacks, Recursion, Towers of Hanoi, Implementation of Recursive Procedures by Stacks, Queue, Linked Representation of Queues, Queues as ADT, Circular Queues, Deques, Priority Queues, Applications of Queues
Unit IV	Trees and Binary Trees -Binary Trees: Representation, Operations: Insert, Delete, Traversal: Preorder, Inorder, Postorder, Traversal Algorithms Using Stacks, Header Nodes; Threads, Threaded Binary Trees, Binary Search Trees, Searching and Inserting in Binary Search Trees, deleting in a Binary Search Tree, Balanced Binary Trees, AVL Search Trees, Insertion in an AVL Search Tree, Deletion in an AVL Search Tree, B-way Search Trees, Searching, Insertion and Deletion in an m-way Search tree, B-Trees, Searching, Insertion and Deletion in a Btree, B+-Trees Graph Algorithms

Unit V	Graphs and their Applications: Introduction, Graph Theory terminology, Sequential Representation of Graphs, Adjacency Matrix; Path Matrix, Linked Representation of a Graph, Operations on Graphs, traversing a Graph, Posets; Topological Sorting, Spanning Trees
Text Books	
1	A V Aho, J Hopcroft, J D Ullman, Data Structures and Algorithms, Addison- Wesley, 1983.
2	T HCormen, CF Leiserson, R L Rivest, C Algorithms, 3rd Ed., MIT Press, 2009.
Reference Books	
1	Data Structures & Algorithms, 1e, Alfred V.Aho, Jeffery D. Ullman , Person.
2	MT Goodrich, R Tamassia, DM Mount, Data Structures and Algorithms in Java, 5th Ed., Wiley, 2010. (Equivalent book in C also exists.)
Useful Links	
1	Data Structures And Algorithms: https://nptel.ac.in/courses/106102064
2	Programming and data structure: https://archive.nptel.ac.in/courses/106/106/106106130/



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Program: B.Tech Second Year (CSE- Data Science)

Semester		Course Code		Course Name	
III		BDS42302		Data Structure and Algorithm-Lab	
Teaching Scheme		Examination Scheme (Th)		Examination Scheme (P)	
Theory (Th)	-	CT-I	-	-	-
Practical (P)	2 Hrs/week	CT-II	-	-	-
Total Credits	1	CA	-	CA	25 Marks
Duration of ESE:		ESE	-	ESE	25 Marks
		Total Marks	-	Total Marks	50 Marks

Pre-Requisites:

Course Outcomes:

CO1	Categorize essential data structures and understand when it is appropriate to use.
CO2	Analyze use of Abstract data types & ways in which ADTs can be stored, accessed and manipulated
CO3	Implement the linear Data Structure such as stack and queue.
CO4	Analyze the Binary tree with their operations based on applications
CO5	Evaluate with analysis of efficiency and proofs of correctness of Graphs as a data structure.

Sr.no	List of Experiments	COs
1	Write a program that implements the following sorting i) Bubble sort ii) Selection sort iii) Quick sort.	CO1
2	Write a program that implements the following. i) Insertion sort ii) Merge sort iii) Heap sort.	CO1
3	Write a program that uses functions to perform the following operations on singly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.	CO2
4	Write a program that uses functions to perform the following operations on doubly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.	CO2
5	Write a program that uses functions to perform the following operations on circular linked List i) Creation ii) Insertion iii) Deletion iv) Traversal.	CO3
6	Write a program that implement stack (its operations) using i) Arrays ii) Linked list (Pointers).	CO3
7	Write a program that implement Queue (its operations) using i) Arrays ii) Linked list (Pointers).	CO4
8	Write a program that uses both recursive and non-recursive functions to perform the following searching operations for a Key value in a given list of integers: a) Linear search b) Binary search.	CO4
9	Write a program to implement all the functions of a dictionary (ADT) using Linked List.	CO5
10	Write a program to perform the following operations: Insert an element in to a binary search tree. Delete an element from a binary search tree. Search for a key element in a binary search tree.	CO5

Text Books

1	A V Aho, J Hopcroft, J D Ullman, Data Structures and Algorithms, Addison- Wesley, 1983.
2	T HCormen, CF Leiserson, R L Rivest, C Algorithms, 3rd Ed., MIT Press, 2009.

Reference Books

1	Data Structures & Algorithms, 1e, Alfred V.Aho, Jeffery D. Ullman , Person.
2	MT Goodrich, R Tamassia, DM Mount, Data Structures and Algorithms in Java, 5th Ed., Wiley, 2010. (Equivalent book in C also exists.)

Useful Links

1	Data Structures And Algorithms: https://nptel.ac.in/courses/106102064
2	Programming and data structure: https://archive.nptel.ac.in/courses/106/106/106106130/



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Program: B.Tech Second Year (CSE- Data Science)

Semester		Course Code		Course Name	
III		BDS42303		Database Management System	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	3Hrs/week	CT-I	15	-	-
Practical(P)	0	CT-II	15	-	-
Total Credits	3	CA	10	-	-
Duration of ESE: 3 Hrs		ESE	60	-	-
		Total Marks	100	-	-

Pre-Requisites:

Course Outcomes:

CO1	Analyze data storage problem and derive a data model expressed in the form of an entity relationship or relational model.
CO2	Implement relational database design and normalization methods of database tables.
CO3	Evaluate query processing technique and its strategies.
CO4	Apply the concepts of transaction management, scheduling, recovery while working in a database environment
CO5	Illustrate the issues and concepts of NoSQL databases.

Course Content

Unit I	Introduction to Management Systems: Significance and advantages, Types of Databases, DBMS Architecture, Functions of DBMS Relational Model: Entity Relationship Model, Development of ER Diagrams, Extended Entity Relationship Model. Relational model, Database Schema, Relational query languages, Relational algebra, Tuple and Domain Calculus.
Unit II	Relational Database Design: Dependency theory- functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's minimal covers. Normalization of Database Tables: 1NF, 2NF, 3NF, BCNF, Non-loss Decomposition & Dependency preservation, Multi-valued dependencies and 4NF, Join dependencies and definition of 5NF.
Unit III	Query Processing & Optimization: Query processing, Evaluation of relational algebra expressions, Algorithms for SELECT and JOIN operations, Query optimization using Heuristics and Cost Estimation, Materialized Views. Storage Structure & strategies : RAID, Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing
Unit IV	Transaction Management: Transaction concepts, properties of transactions, serializability of transactions, Two- Phase Commit protocol, Deadlock, two-phase locking protocol. Database Recovery : Failures and their classification, recovery and atomicity, recovery algorithms
Unit V	NoSQL Database: Concepts and evolution, Characteristics and significance, Key-value database, Graph Databases, Document Databases, CRUD Operation.

Text Books

1	Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, 6th Edition, McGraw Hill (SIE), 2013.
2	Carlos Coronel, Steven Morris and Peter Rob, Database Principles – Fundamentals of Design, Implementation and Management, 9th Edition, Cengage Learning, 2013.

3	Big Data: Principles and Paradigms Amir Wahid Dastjerdi, Rajkumar Buyya, Rodrigo N. Calheiros, Elsevier Science
4	NoSQL for Mere Mortals. Dan Sullivan, Addison-Wesley Professional
Reference Books	
1	Alexis Leon and Mathews Leon, Database Management Systems, Vikas Publishing, 2008.
2	An Introduction to Database Systems(8e Pearson) by Date, Kannan, Swamynathan
Useful Links	
1	Database Management System: https://onlinecourses.nptel.ac.in/noc22_cs91/preview
2	Database Management System: https://www.youtube.com/watch?v=8fyy2a5Nqns



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Semester		Course Code		Course Name	
III		BDS42304		Database Management System-Lab	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	-	CT-I	-	-	-
Practical(P)	2 Hrs/week	CT-II	-	-	-
Total Credits	1	CA	-	CA	25 Marks
Duration of ESE:		ESE	-	ESE	25 Marks
		Total Marks	-	Total Marks	50 Marks

Pre-Requisites:

Course Outcomes:

CO1	Categorize essential data structures and understand when it is appropriate to use.
CO2	Analyze use of Abstract data types & ways in which ADTs can be stored, accessed and manipulated
CO3	Implement the linear Data Structure such as stack and queue.
CO4	Analyze the Binary tree with their operations based on applications
CO5	Evaluate with analysis of efficiency and proofs of correctness of Graphs as a data structure.

Sr.no	List of Experiments	COs
1	Introduction to MySQL and MySQL Workbench IDE.	CO1
2	To study and execute the DDL commands of SQL: 1. Create 2. Alter 3. Rename 4. Drop	CO1
3	Create a database and implement DDL operations on a college database (with at least 3 tables).	CO2
4	To study and execute the DML commands of SQL 1. Insert 2. Select 3. Update 4. Delete	CO2
5	Write SQL queries to implement Keys constraints.	CO3
6	Develop a table with constraints (Primary Key, Foreign Key, Not Null, Unique, Check) and test DML operations.	CO3
7	Implementation of different types of Aggregate function with suitable examples	CO4
8	Implementation of different types of operators in SQL	CO4
9	Write queries using multiple aggregate functions with Grouping Sets or Rollup.	CO5
10	To perform queries based on Group By, Having, Order By clause.	CO5

Text Books

1	Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, 6th Edition, McGraw Hill (SIE), 2013.
2	Carlos Coronel, Steven Morris and Peter Rob, Database Principles – Fundamentals of Design, Implementation and Management, 9th Edition, Cengage Learning, 2013.
3	Big Data: Principles and Paradigms Amir Vahid Dastjerdi, Rajkumar Buyya, Rodrigo N. Calheiros, Elsevier Science
4	NoSQL for Mere Mortals. Dan Sullivan, Addison-Wesley Professional

Reference Books

1	Alexis Leon and Mathews Leon, Database Management Systems, Vikas Publishing, 2008.
2	An Introduction to Database Systems(8e Pearson) by Date, Kannan, Swamynathan

Useful Links

1	Database Management System: https://onlinecourses.nptel.ac.in/noc22_cs91/preview
2	Database Management System: https://www.youtube.com/watch?v=8fyy2a5Nqns



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Program: B.Tech Second Year (CSE- Data Science)

Semester		Course Code		Course Name	
III		BDS42305		Basics of Data Analytics	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	2Hrs/week	CT-I	7	-	-
Practical(P)	0	CT-II	7	-	-
Total Credits	2	CA	6	-	-
Duration of ESE: 2 Hrs		ESE	30	-	-
		Total Marks	50	-	-

Pre-Requisites:

Course Outcomes:

CO1 Understand Python fundamentals for data science applications.

CO2 Apply Python libraries for data handling, cleaning, and visualization.

CO3 Perform data analysis and implement basic machine learning models.

Course Content

Unit I	Python Fundamentals for Data Science: Introduction to Python and its applications in Data Science, Data types, variables, operators, Control structures (if, loops), Functions and modules, File handling and Jupyter Notebook
Unit II	Data Handling and Visualization: NumPy arrays and operations, Pandas (Series, DataFrame, data manipulation), Data cleaning and preprocessing, Data visualization using Matplotlib and Seaborn, Working with datasets (CSV, Excel)
Unit III	Data Analysis and Machine Learning Basics: Exploratory Data Analysis (EDA), Basic statistics for data analysis, Introduction to Scikit-learn, Basic ML algorithms (Regression, Classification), Model evaluation techniques

Text Books

- 1 Wes McKinney, Python for Data Analysis, 2nd Edition, O'Reilly Media, 2017.
- 2 Jake VanderPlas, Python Data Science Handbook, 1st Edition, O'Reilly Media, 2016.

Reference Books

- 1 John Paul Mueller and Luca Massaron, Python for Data Science For Dummies, 2nd Edition, Wiley, 2019.
- 2 Al Sweigart, Automate the Boring Stuff with Python, 2nd Edition, No Starch Press, 2019.
- 3 Chris Albon, Machine Learning with Python Cookbook, 1st Edition, O'Reilly Media, 2018.

Useful Links

- 1 <https://nptel.ac.in/courses/106106212>
- 2 https://onlinecourses.nptel.ac.in/noc22_cs32/preview



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Program: B.Tech Second Year (CSE- Data Science)

Semester		Course Code		Course Name	
III		BDS42306		Basics of Data Analytics - Lab	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	-	CT-I	-	-	-
Practical(P)	2 Hrs/week	CT-II	-	-	-
Total Credits	1	CA	-	CA	25 Marks
Duration of ESE:		ESE	-	ESE	25 Marks
		Total Marks	-	Total Marks	50 Marks

Pre-Requisites:

Course Outcomes:

CO1 Understand Python fundamentals for data science applications.

CO2 Apply Python libraries for data handling, cleaning, and visualization.

CO3 Perform data analysis and implement basic machine learning models.

Sr.no	List of Experiments	COs
1	Write programs to demonstrate basic syntax, variables, data types, and input/output operations.	CO1
2	Implement programs using conditional statements and loops (if-else, for, while).	CO1
3	Perform operations on lists, tuples, sets, and dictionaries.	CO1
4	Implement user-defined functions and perform file operations (read/write text files).	CO2
5	Create arrays and perform indexing, slicing, reshaping, and mathematical operations.	CO2
6	Compute mean, median, standard deviation, and perform random number generation.	CO2
7	Create Series and DataFrames, and perform basic operations.	CO3
8	Handle missing values, filtering, grouping, and merging datasets using Pandas.	CO3
9	Plot graphs such as line chart, bar chart, histogram, scatter plot, and boxplot.	CO3
10	Perform Exploratory Data Analysis (EDA) on a real-world dataset and present insights.	CO3

Text Books

- 1 Wes McKinney, Python for Data Analysis, 2nd Edition, O'Reilly Media, 2017.
- 2 Jake VanderPlas, Python Data Science Handbook, 1st Edition, O'Reilly Media, 2016.

Reference Books

- 1 John Paul Mueller and Luca Massaron, Python for Data Science For Dummies, 2nd Edition, Wiley, 2019.
- 2 Al Sweigart, Automate the Boring Stuff with Python, 2nd Edition, No Starch Press, 2019.
- 3 Chris Albon, Machine Learning with Python Cookbook, 1st Edition, O'Reilly Media, 2018.

Useful Links

- 1 <https://nptel.ac.in/courses/106106212>
- 2 https://onlinecourses.nptel.ac.in/noc22_cs32/preview



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Program: B.Tech Second Year (CSE- Data Science)

Semester		Course Code		Course Name	
III		BSH42304		Numerical and Statistical Methods	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	2 Hrs/week	CT-I	7	-	-
Practical(P)	0	CT-II	7	-	-
Total Credits	2	CA	6	-	-
Duration of ESE: 2 Hrs		ESE	30	-	-
		Total Marks	50	-	-

Pre-Requisites:

Course Outcomes:

CO1 Apply Statistical concepts to real world situation and problem solving.

CO2 Analyze the efficiency, accuracy and stability of numerical methods through theoretical analysis.

CO3 Analyze computational problems in graph theoretical framework.

Course Content

Unit I	Statistics: Mean Deviation and Standard Deviation, Multiple regression analysis, Regression equation of three variables, Residual MSE and MAE, Coefficient of determination, Root Mean Square error, Interquartile Range, Quartile, Decile & Percentile.
Unit II	Numerical Methods: Numerical Solution of Algebraic and Transcendental equations: Regula Falsi, Newton-Raphson (Successive Approximation Methods). Numerical Solutions of System of linear equations: Gauss elimination, and Gauss-Seidel Methods.
Unit III	Graph Theory: Basic concepts of graph theory, Digraphs, Basic definitions, Matrix representation of graphs, Subgraphs and quotient graphs, Paths and circuits, Reachability and connectedness, Node base, Euler's path & Hamilton's path, Tree, Binary tree, Undirected tree, Spanning tree, Weighted graphs (Only definitions and examples), Minimal spanning tree by Kruskal's algorithm, Representation of algebraic expressions by Venn diagram and binary tree.

Text Books

1	Higher Engineering Mathematics by B.S. Grewal, 40th Edition, Khanna Publication
2	Advanced Engineering Mathematics by Erwin Kreyszig, 8th Edition, Wiley India
3	Essential Math for Data Science for , by Thomas Nield
4	Probability, Statistics and Random Processes T. Veerarajan.
5	Fundamentals of Mathematical Statistics (Modern Approach) S.C. Gupta and V. K. Kapoor 10th Edition

Reference Books

1	A Text Book of applied Mathematics, Volume II, by P.N. Wartikar & J.N. Wartikar, Poona Vidyarthi Griha Prakashan
2	Introductory methods of Numerical Analysis, by S.S. Sastry, PHI
3	Probability, Statistics with Reliability, Queuing and Computer Science Application K.S. Trivedi.

Useful Links

1	Statistical Methods for Engineers: https://archive.nptel.ac.in/courses/111/105/111105077/
2	Numerical Methods: https://archive.nptel.ac.in/courses/111/107/111107105/



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Program: B.Tech Second Year (CSE- Data Science)

Semester		Course Code		Course Name	
III		BDS42307		Open Elective-I: Object Oriented Programming with C++	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	4 Hrs/week	CT-I	15	-	-
Practical(P)	0	CT-II	15	-	-
Total Credits	4	CA	10	-	-
Duration of ESE: 3 Hrs		ESE	60	-	-
		Total Marks	100	-	-

Pre-Requisites:

Course Outcomes:

CO1	Understand the basic concept of object-oriented Programming
CO2	Implement classes and objects to solve real-world problems
CO3	Implement abstract classes and interfaces.
CO4	Apply constructors, destructors, and copy constructors for proper resource management
CO5	Design code that can handle runtime errors using exception handling mechanisms.

Course Content

Unit I	Introduction to C++ and OOP: History and Evolution of C++, Overview of Object-Oriented Programming, Classes and Objects, Abstraction, Encapsulation, Inheritance, and Polymorphism, Basic C++ Syntax, Data Types, Variables, and Operators, Control Structures (if, switch, loops)
Unit II	Classes and Objects: Defining Classes and Creating Objects, Access Specifiers (public, private, protected), Member Functions and Data Members, Constructors and Destructors, Friend Functions and Friend Classes
Unit III	Inheritance and Polymorphism: Types of Inheritance (Single, Multiple, Multilevel, Hierarchical, Hybrid), Base and Derived Classes, Function Overriding, Virtual Functions and Pure Virtual Functions, Abstract Classes Operator Overloading and Templates: Operator Overloading, Overloading Unary and Binary Operators, Overloading with Friend Functions, Function Overloading, Templates, Function Templates, Class Templates, Template Specialization
Unit IV	Pointers and Dynamic Memory Management: Pointers Basics, Pointer Arithmetic, Pointers to Objects, Dynamic Memory Allocation and Deallocation (new and delete), Smart Pointers (unique_ptr, shared_ptr)
Unit V	Exception Handling: Basics of Exception Handling, try, catch, throw, Multiple Catch Blocks, Nested try Statements, Custom Exceptions, Exception Specifications

Text Books

1	Object Oriented Programming with C++, Second Edition. by Mahesh Bhawe, Sunil Patekar.
2	Object-Oriented Programming in C++, Fourth Edition. by Robert Lafore.

Reference Books

1	Deciphering Object-Oriented Programming with C++ by Dorothy R. Kirk.
2	"Effective C++: 55 Specific Ways to Improve Your Programs and Designs" by Scott Meyers

Useful Links

1	OOP with C++: https://onlinecourses.nptel.ac.in/noc21_cs02/preview
2	OOP : https://onlinecourses.nptel.ac.in/noc22_cs103/preview



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Program: B.Tech Second Year (CSE- Data Science)

Semester		Course Code		Course Name	
III		BSH2308		Ethics in Engineering Practices	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	2 Hrs/week	CT-I	7	-	-
Practical(P)	0	CT-II	7	-	-
Total Credits	2	CA	6	-	-
Duration of ESE: 2 Hrs		ESE	30	-	-
		Total Marks	50	-	-

Pre-Requisites: General Ethics, Social sciences.

Course Outcomes:

CO1	Describe Basic Human Values, Ethics & Importance of Engineering Ethics.
CO2	Illustrate the Basic Ethics for Engineers, Principles of Engineering Ethics & Fundamental Rights of individuals of society.
CO3	Discuss Ethics for Engineer Professionals, and their Safety, Responsibility & Rights.

Course Content

Unit I	Introduction to Engineer Ethics: Morals, Values, Integrity & Ethics, What is Engineering Ethics, Importance of Engineering Ethics, Code of Ethics, Potential Moral Problems of Engineering Ethics.
Unit II	Professional Practices in Engineering: Happiness, Prosperity & Harmony, Professional Ethics, Engineering Ethics, Principles of Engineering Ethics, Environmental Ethics, Public Interest Litigation (PIL), Intellectual property Rights (IPR).
Unit III	An Overview of Engineering Ethics: Ethics in Industry, Professional Practices in Engineering, Ethical behavior, Industry professional malpractices, Workplace Safety, Responsibility and Rights, Basics of business ethics - Corporate Social Responsibility – Issues of Management – Crisis Management

Text Books

1	A New Look into Social Science : Shabbir, Sheikh and Dwadashiwar, S. Chand Publisher
2	Constitution of India and Professional Ethics: Reddy, G.B. and Mohd. Suhaib, IK International Publishing House. 2006
3	Introduction to Engineering Ethics : Martin, Mik, Roland Schinzinger, 2 nd edition (16 February 2009) McGraw-Hill Education;

Reference Books

1	Human Resource Development and Management : A. M. Sheikh, 3 rd Revised Edition, S Chand & Co Ltd.
2	“A Gift of Fire: Social, Legal and Ethical Issues, for Computing and the Internet”: Sara Baase, 3 rd Edition PHI Publications.
3	“Case study in Information Technology Ethics” :Richard A. Spinello, 2 nd Edition PHI Publications.
4	“Internet Ethics”: Duncan Lanford, Macmillan Education UK.
5	“Computer and Ethics in the Cyber age”: D. Micah Hester and Paul J. Ford.

Useful Links

1	https://nptel.ac.in/courses/110/105/110105079/
2	https://nptel/courses/video/1101323279/L54.html
3	https://nptel/courses/video/110105079/L54.html



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Semester		Course Code		Course Name	
III		BDS42306		Community Engineering Project	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory (Th)	-	CT-I	-	-	-
Practical (P)	4 Hrs	CT-II	-	-	-
Total Credits	2	CA	50 Marks	-	-
		ESE	-	-	-
		Total Marks	50 Marks	-	-

Course Outcomes

CO1	Demonstrate the knowledge, skills and attitudes of a professional engineer.
CO2	Apply methodologies and professional way of documentation and communication
CO3	Analyze the key stages in development of the project.
CO4	Design engineering solutions to complex problems utilizing a systems approach.
CO5	Develop Software skills by learning various algorithms and methodology.

Course Content

Engaging Students in a multidisciplinary project that leverages computer science, data science, and information technology principles to design, develop, and implement smart technology solutions aimed at improving community living. The project will focus on real-world problems, ethical considerations, and the integration of advanced technologies.

Key Aspects of the Project:

1. Project Planning and Management	7. Data Analysis and Visualization
2. Problem Identification	8. User Experience and Feedback
3. Ethical Considerations	9. Deployment and Testing
4. System Design and Architecture	10. Evaluation and Impact Assessment
5. Data Collection and Management	11. Documentation and Reporting
6. Hardware Implementation	12. Final Presentation and Report



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Program: B.Tech Second Year (CSE- Data Science)

Semester		Course Code		Course Name	
III		BDS42310		Liberal Learning Module-3: Creative writing and Storytelling	
Teaching Scheme		Examination Scheme(Th)		Examination Scheme(P)	
Theory(Th)	-	-	-	-	-
Practical(P)	2Hrs/week	-	-	-	-
Total Credits	2 (P)	-	-	CA	25
Duration of ESE: 1Hrs		-	-	ESE	25
		-	-	Total Marks	50

Pre-Requisites:

Course Outcomes:

CO1 | **Develop** descriptive and expressive writing.

CO2 | **Develop** believable characters and settings.

CO3 | **Present** creative writing effectively.

Course Content

Unit I	Unit 1: Introduction to Creative Writing :Meaning and importance of creative writing, Elements of creative writing,Imagination and creativity in writing,Language, style, and vocabulary, Forms of creative writing (short stories, poetry, personal narrative)
	Activity: Picture-Based Story Writing :Students are given a picture or photograph.,They write a 150–200 word short story based on the image., Peer discussion and feedback.
Unit II	Unit 2:Elements of Storytelling: Story vs Plot, Characterization,Setting and atmosphere, Point of view (First person, Third person), Dialogue writing, Conflict and resolution
	Activity: Character Creation Workshop ∴ Students create a fictional character profile:Name,Background,personality traits.Goal and conflict.Write a short scene (200 words) featuring the character.
Unit III	Unit 3: Writing and Presenting Stories: Short story structure (Beginning – Middle – End), Narrative techniques, Editing and revising creative work, Peer review and feedback, Publishing or presenting stories
	Activity: Final Story Project :Students write a 500–800 word short story . Present or read their story in class. Peer evaluation and feedback.

Text Books

1	Burroway, Janet. Imaginative Writing: The Elements of Craft
2	King, Stephen. On Writing: A Memoir of the Craft

Reference Books

1	Strunk, William & White, E.B. The Elements of Style
2	Goldberg, Natalie. Writing Down the Bones

Useful Links

1	https://www.coursera.org/specializations/creative-writing
2	https://www.nownovel.com/

Sr.no	List of Experiments	COs
1	Transforming a Real-Life Incident into a Creative Narrative	CO1
2	Practice of Different Writing Styles (Narrative, Descriptive, Reflective)	CO1

3	Vocabulary Enhancement and Figurative Language Usage (Simile, Metaphor)	CO1
4	Writing a Short Creative Piece based on a Given Prompt	CO1
5	Identification and Analysis of Story Elements (Plot, Character, Setting)	CO2
6	Developing a Plot using Story Structure (Beginning, Middle, End)	CO2
7	Setting Creation and Atmosphere Building Exercise	CO2
8	Converting a Written Story into a Script for Presentation	CO3
9	Story Editing and Proofreading for Clarity and Impact	CO3
10	Peer Review and Feedback Analysis of Story Presentation	CO3