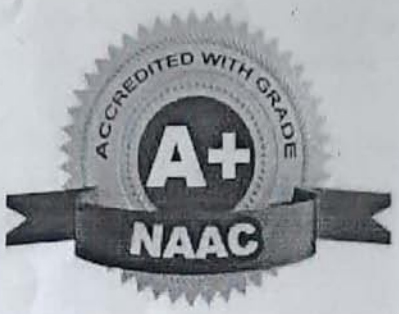
TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108



Bachelor of Technology

NEP - 2020 Scheme

2024

Department of Computer Science and Engineering (Data Science)

Vision of Institute:

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

Mission of Institute

[M1]. To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.

[M2]. To provide facilities and services to meet the challenges of Industry and Society.

[M3]. To facilitate socially responsive research, innovation and Entrepreneurship.

[M4]. To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

Vision of the Department

To achieve excellent standards of quality-education by creating Data Science Engineers who are empowered with latest tools and technologies to provide customer oriented innovations to industry towards serving the greater cause of society.

Mission of the Department

[M1]. To develop professionals who are skilled in the area of Data Science
[M2]. To undertake industry academic collaboration to enhance competency in graduates.
[M3]. To foster innovative ideas amongst students for becoming leaders.
[M4]. To create an environment of research culture.
[M5]. To impart social and ethical values for inculcating the culture of lifelong learning.

Program Education Objectives (PEO)

- Acquire fundamental knowledge of mathematics, science and engineering to analyze, design and implement solutions to the Data Science problems
- Understand emerging concepts and trends in Data Science.
- Apply Data Science tools to develop innovative computational systems.
- The students are encouraged to develop the habit of lifelong learning to face the challenges.
- The students will be embedded as a responsible individual having ethical and social values to lead the society and to nurture team spirit.

Program Outcomes (PO)

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and software tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

PSO-1: Visualize, curate, and prepare data for use with a variety of statistical/AI methods and models and recognize how the quality of the data and the means of data collection may affect conclusions.

PSO-2: Ability to use modern software packages and scalable computing infrastructure to formulate problems, identify and gather relevant existing data, and analyze the data to provide insights

PSO-3: Utilize contemporary computing technologies, such as machine learning, AI, parallel and distributed computing, to solve practical problems characterized by large-scale data

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SCHEME OF INSTRUCTION & SYLLABI

Programme:B. Tech CSE- Data Science

Scheme of Instructions: Second Year B.Tech. in CSE-Data Science(As Per NEP 2020)

Semester–III

SN	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	BDS32301	Data Structure and Algorithm	T	3	0	3	3	30	10	60	3 Hrs	100
2	III	PCC	DS	BDS32303	Database Management System	T	3	0	3	3	30	10	60	3 Hrs	100
3	III	MDM	SH	BSH32304	Numerical and Statistical Methods	T	2	0	2	2	14	6	30	2 Hrs	50
4	III	HSSM	DS	BDS32305	Principles & Morals of Data Science	T	2	0	2	2	14	6	30	2 Hrs	50
5	III	VEC	SH	BSH32308	Ethics in Engineering Practices	T	2	0	2	2	14	6	30	2 Hrs	50
6	III	OE		BSS323XX	OE - I	T	4	0	4	4	30	10	60	3 Hrs	100
7	III	PCC	DS	BDS32302	Data Structure and Algorithm - Lab	P	0	2	2	1	25	-	25	2 Hrs	50
8	III	PCC	DS	BDS32304	Database Management System - Lab	P	0	2	2	1	25	-	25	2 Hrs	50
9	III	CEP	DS	BDS32306	Community Engineering Project	P	0	4	4	2	-	50	-	-	50
						Total	16	08	24	20	182	98	320	19 Hrs	600

Course Category	BSC/ESC(Basic Science Course/ Engineering Science Course.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	Multidisciplinary courses	SEC(Skill Course)	Humanities Social Science & Management	Experiential Learning Courses	CC(Liberal Learning Courses
Credits	--	08	--	06	--	04	02	--
Cumulative Sum	16/13	11	--	06	04	08	02	04

PROGRESSIVE TOTAL CREDITS:43+20=63

Chairperson	Dean Academics	Vice Principal	Principal	June,2024	1.00	Applicable for AY 2024-25 Onwards
				Date of Release	Version	

Programme: B. Tech. CSE-Data Science

List of **Program Electives** offered By CSE- Data Science Department

Program Elective- I	Program Elective-II	Program Elective-III	Program Elective- IV	Program Elective- V
Semester V	**Semester VI**	**Semester VI**	**Semester VII**	**Semester VIII**
BDS33507: Cyber Security	**BDS33605:** Mobile and Adhoc Network	**BDS33609:** Cyber Law	**BDS34702:** Cyber Forensic	**BDS34803:** Evidence Acquisition and Recovery
BDS33508: Generative AI	**BDS33606:** Data Visualization Techniques	**BDS33610:** Natural Language Processing	**BDS34703:** IoT for Social Good	**BDS34804:** Industrial and Medical IoT
BDS33509: Cloud Computing	**BDS33607:** Mobile Computing	**BDS33611:** Distributed Computing	**BDS34704:** Big Data Computing	**BDS34805:** Reconfigurable Computing
BDS33510: R Programming	**BDS33608:** Client Side Scripting-Java Script	**BDS33612:** Server Side Scripting-PHP	**BDS34705:** Python for Data Science	**BDS34806:** NoSQL

Programme: B. Tech. CSE-Data Science

List of **Open Electives** offered By CSE- Data Science Department

Open Elective-I	Open Elective-II	Open Elective-III
Semester-III	**Semester-IV**	**Semester-V**
BDS32307 Object Oriented Programming with C++	**BDS32405** Introduction to Data Science	**BDS33511** Software Engineering and Quality Assurance

Course Category	BSC (Basic Science Course)	ESC (Engineering Science Course.)	PCC (Programme Core courses	PEC (Programme Elective courses)	Multidisciplinary courses	VSEC (Skill Course)	Humanities Social Science & Management	Experiential Learning Courses	CC(Liberal Learning Courses	Semester Wise Credits
Semester-I	08	05	02	--	--	02	02	--	02	22
Semester-II	08	08	--	--	--	02	02	--	02	21
Semester-III	--	--	08	--	02	--	04	02	--	20
Semester-IV	--	--	08	--	02	02	06	--	--	20
Semester-V	--	--	12	04	02	02	--	--	--	22
Semester-VI	--	--	10	08	02	02	--	--	--	22
Semester-VII	--	--	04	04	--	--	--	12	--	20
Semester-VIII	--	--	04	04	04	--	--	08	--	20
Cumulative Sum	**16**	**13**	**48**	**20**	**12**	**10**	14	**22**	**04**	167

				June,2024	1.00	Applicable for AY 2024-25 Onwards
Chairperson	Dean Academics	Vice Principal	Principal	Date of Release	Version	

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Semester	Course Code	Course Name
III	BDS32301	Data Structure and Algorithm

Teaching Scheme		Examination Scheme	
Lectures	3Hrs/week	CT-1	15 Marks
Tutorial	0	CT-2	15 Marks
Total Credit	3	CA	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 03Hrs 00Min.	

Course Objectives:

1	Introduce basic idea of data structure to make aware about methods and structure used to organize large amount of data.
2	Develop skill for implementing methods to solve specific problems using basic data structures like queue and stack
3	Develop proficiency in implementing algorithm for solving specific problems related to data.

Course Contents

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

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Text Books	
T.1	A V Aho, J Hopcroft, J D Ullman, Data Structures and Algorithms, Addison- Wesley, 1983.
T.2	T HCormen, CF Leiserson, R L Rivest, C Algorithms, 3rd Ed., MIT Press, 2009.
Reference Books	
R.1	Data Structures & Algorithms, 1e, Alfred V.Aho, Jeffery D. Ullman , Person.
R.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/

Course Outcomes		Cognitive Level
After the completion of this course, students will be able to-		
BDS32301.1	**Categorize** essential data structures and understand when it is appropriate to use.	4
BDS32301.2	**Analyze** use of Abstract data types & ways in which ADTs can be stored, accessed and manipulated	4
BDS32301.3	**Implement** the linear Data Structure such as stack and queue.	3
BDS32301.4	**Analyze** the Binary tree with their operations based on applications	4
BDS32301.5	**Evaluate** with analysis of efficiency and proofs of correctness of Graphs as a data structure.	5

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Semester	Course Code	Course Name
III	BDS32302	Data Structure and Algorithm-Lab

Teaching Scheme		Examination Scheme	
Lectures	-	CT-1	-
Tutorial	-	CT-2	-
Practical	2 Hrs/week	CA	25 Marks
Total Credit	1	ESE	25 Marks
		Total	50 Marks
		Duration of ESE: -	

Course Objectives:

1	Introduce basic idea of data structure to make aware about methods and structure used to organize large amount of data.
2	Develop skill for implementing methods to solve specific problems using basic data structures like queue and stack
3	Develop proficiency in implementing algorithm for solving specific problems related to data.

Sr. No.	List of Experiments
1	Write a program that implements the following sorting i)Bubble sort ii)Selection sort iii)Quick sort.
2	Write a program that implements the following i)Insertion sort ii)Merge sort iii)Heap sort.
3	Write a program that uses functions to perform the following operations on singly linked list i)Creation ii)Insertion iii)Deletion iv)Traversal.
4	Write a program that uses functions to perform the following operations on doubly linked list i)Creation ii)Insertion iii) Deletion iv)Traversal.
5	Write a program that uses functions to perform the following operations on circular linked List i)Creation ii)Insertion iii)Deletion iv)Traversal.
6	Write a program that implement stack (its operations) using i)Arrays ii)Linked list(Pointers).
7	Write a program that implement Queue(its operations)using i)Arrays ii)Linked list(Pointers).
8	Write a program that implement Circular Queue using arrays. 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.
9	Write a program to implement all the functions of a dictionary(ADT)using Linked List.
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.

Text Books

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

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Reference Books	
R.1	Data Structures & Algorithms, 1e, Alfred V.Aho, Jeffery D. Ullman , Person.
R.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/

Course Outcomes		Cognitive Level
After the completion of this course, students will be able to-		
BDS32302.1	**Categorize** essential data structures and understand when it is appropriate to use.	4
BDS32302.2	**Analyze** use of Abstract data types & ways in which ADTs can be stored, accessed and manipulated	4
BDS32302.3	**Implement** the linear Data Structure such as stack and queue.	3
BDS32302.4	**Analyze** the Binary tree with their operations based on applications	4
BDS32302.5	**Evaluate** with analysis of efficiency and proofs of correctness of Graphs as a data structure.	5

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Semester	Course Code	Course Name
III	BDS32303	Database Management System

Teaching Scheme		Examination Scheme	
Lectures	3Hrs/week	CT-1	15 Marks
Tutorial	0	CT-2	15 Marks
Total Credit	3	CA	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 03Hrs 00Min.	

Course Objectives:

1	Understand the fundamental concepts and principles of database systems.
2	Implement the architecture and components of a Database Management System
3	Understand encryption, authentication, authorization, and auditing in the context of database systems.

Course Contents

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

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

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Reference Books	
R.1	Alexis Leon and Mathews Leon, Database Management Systems, Vikas Publishing, 2008.
R.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

Course Outcomes		Cognitive Level
After the completion of this course, students will be able to-		
BDS32303.1	**Analyze** data storage problem and derive a data model expressed in the form of an entity relationship or relational model.	4
BDS32303.2	**Implement** relational database design and normalization methods of database tables.	4
BDS32303.3	**Evaluate** query processing technique and its strategies.	5
BDS32303.4	**Apply** the concepts of transaction management, scheduling, recovery while working in a database environment	3
BDS32303.5	**Illustrate** the issues and concepts of NoSQL databases.	4

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Semester	Course Code	Course Name
III	BDS32304	Database Management System-Lab

Teaching Scheme		Examination Scheme	
Lectures	-	CT-1	-
Tutorial	-	CT-2	-
Practical	2 Hrs/week	CA	25 Marks
Total Credit	1	ESE	25 Marks
		Total	50 Marks
		Duration of ESE: -	

Course Objectives:

1	Understand the fundamental concepts and principles of database systems.
2	Implement the architecture and components of a Database Management System
3	Understand encryption, authentication, authorization, and auditing in the context of database systems.

Sr. No.	List of Experiments
1	Introduction to SQL and DML query solving using SQL simulator sql-ex.ru
2	Design, develop, and implement the specified queries for the above design using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
3	Demonstration of Views, Procedures, Functions & Triggers.
4	To implement set operators and views on a database.
5	To perform queries based on Group By, Having, Order By clause.
6	Draw E-R diagram and convert entities and relationships to relation table for a given scenario. a. Two assignments shall be carried out i.e. consider two different scenarios (eg. bank, college, Employee, Hotel etc).
7	To study the various data language commands (DCL) and implements them on the database.
8	To perform nested Queries and joining Queries using DML command.
9	Demonstration of Views , Procedures, Functions & Triggers.
10	Mini project on case study using Database Connectivity with Front End Tools

Text Books

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

Reference Books

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

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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

Course Outcomes		Cognitive Level
After the completion of this course, students will be able to-		
BDS32304.1	**Analyze** data storage problem and derive a data model expressed in the form of an entity relationship or relational model.	4
BDS32304.2	**Implement** relational database design and normalization methods of database tables.	4
BDS32304.3	**Evaluate** query processing technique and its strategies.	5
BDS32304.4	**Apply** the concepts of transaction management, scheduling, recovery while working in a database environment	3
BDS32304.5	**Illustrate** the issues and concepts of NoSQL databases.	4

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Semester	Course Code	Course Name
III	BSH32304	Numerical and Statistical Methods

Teaching Scheme	
Lectures	2Hrs/week
Tutorial	0
Total Credit	2

Examination Scheme	
CT-1	7 Marks
CT-2	7 Marks
CA	6 Marks
ESE	30 Marks
Total	50 Marks
Duration of ESE: 02Hrs 00Min.	

Course Objectives:

1	Provide the knowledge of the various statistical methods in the field of Data Science Engineering
2	Implements the numerical solution of the problems to solve critical problems in data science.
3	Understand the basic definitions and concepts in graph theory in solving problems such as connectivity, cycle detection, and path finding.

Course Contents

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: RegulaFalsi, 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

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

Reference Books

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

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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/

Course Outcomes		Cognitive Level
After the completion of this course, students will be able to-		
BSH32304.1	**Apply** Statistical concepts to real world situation and problem solving.	3
BSH32304.2	**Analyze** the efficiency, accuracy and stability of numerical methods through theoretically analysis.	4
BSH32304.3	**Analyze** computational problems in graph theoretical framework.	4

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Semester		**Course Code**	**Course Name**
III		BDS32305	Principles & Morals of Data Science
Teaching Scheme			**Examination Scheme**
Lectures	2 Hrs/week		**CT-1** 7 Marks
Tutorial	0		**CT-2** 7 Marks
Total Credit	2		**CA** 6 Marks
			ESE 30 Marks
			Total 50 Marks
			Duration of ESE: 02 Hrs 00Min.

Course Objectives:	
1	Provide the insights of data science in real world.
2	Implement various aspects of the data privacy and security.
3	Provide the knowledge about the professional responsibility of the data scientist.

Course Contents	
Unit I	Introduction to Ethics in Data Science: Overview of ethical considerations in data science, Importance of ethics in data collection, analysis, and interpretation, Ethical Theories and Frameworks: Utilitarianism, deontology, virtue ethics, and their application in data science, Ethical decision-making frameworks
Unit II	Data Privacy and Security, The basics of data privacy and security. Legal and ethical consequences of data breaches and leaks, Transparency and Accountability, The role of transparency in the data science process, Accountability in data analysis and decision-making
Unit III	Professional Responsibility: Responsibilities of data scientists and analysts, Ethical standards Social and Ethical Implications of Data Science: Impact of data science on society, including ethical considerations, Ethical Issues in AI and Machine Learning: Ethics of AI decision-making, Ethical challenges in the development and deployment of AI systems

Text Books	
T.1	Ethics and Data Science Kindle Edition by Mike Loukides , Hilary Mason, DJ Patil
T.2	Principles of Data Science: Mathematical techniques and theory to succeed in data-driven industries December 2016 by Sinan Ozdemir
T.3	"Ethics of Big Data: Balancing Risk and Innovation" by Kord Davis and Doug Patterson
T.4	"Responsible Data Science" by Peter Christen, Kristian Lum, and Edmon Begoli

Reference Books	
R.1	Deborah G. Johnson, "Computer ethics", 3ePrearson Eduction
R.2	Richard A Spinello, " case study in Information Technology Ethics" Second edition PHI Publications
R.3	"Data Ethics: The New Competitive Advantage" by Gry Hasselbalch and Pernille Tranberg

Useful Links	
1	Data Science for Engineers: https://onlinecourses.nptel.ac.in/noc21_cs69/preview
2	Probability Theory for Data Science: https://onlinecourses.nptel.ac.in/noc24_ma64/preview

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Course Outcomes		Cognitive Level
After the completion of this course, students will be able to-		
BDS32305.1	Understand the overview of ethical and professional behavior.	2
BDS32305.2	Appraise various data privacy techniques.	5
BDS32305.3	Implement the concept of strategic management to take decisions.	5

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Semester		**Course Code**	**Course Name**
III		BSH32308	Ethics in Engineering Practices
Teaching Scheme			**Examination Scheme**
Lectures	2 Hrs/week		**CT-1** 7 Marks
Tutorial	0		**CT-2** 7 Marks
Total Credit	2		**CA** 6 Marks
			ESE 30 Marks
			Total 50 Marks
			Duration of ESE: 2 Hrs 00Min.

Pre-Requisites: General Ethics, Social sciences.

Course Objectives:

1	Understand the Human Values, Ethics and Engineering Ethics.
2	Understand Professional practices in Engineering for Engineers.
3	Understand types of ethical violations and consequence of their influence on business practice, economy and society in general.

Course Contents

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

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

Reference Books

R.1	Human Resource Development and Management : A. M. Sheikh, 3rd Revised Edition, S Chand & Co Ltd.
R.2	"A Gift of Fire: Social, Legal and Ethical Issues, for Computing and the Internet": Sara Baase, 3rd Edition PHI Publications.
R.3	"Case study in Information Technology Ethics" :Richard A. Spinello, 2nd Edition PHI Publications.
R.4	"Internet Ethics": Duncan Lanford, Macmillan Education UK.

R.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

Course Outcomes		**Cognitive Level**
After the completion of this course, students will be able to-		
BSH2308.1	**Describe** Basic Human Values, Ethics & Importance of Engineering Ethics.	2
BSH2308.2	**Illustrate the** Basic Ethics for Engineers, Principles of Engineering Ethics & Fundamental Rights of individuals of society.	4
BSH2308.3	**Discuss** Ethics for Engineer Professionals, and their Safety, Responsibility & Rights.	2

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Semester		Course Code		Course Name	
III		BDS32306		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 Objectives:

1	Application of techniques & principles of data science in specific applications with respect to social needs.
2	Ability to implement effective trouble-shooting for project.
3	Development of effective communication skill.

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

Course Outcomes		Cognitive Level
After the completion of this course, students will be able to-		
BDS32306.1	**Demonstrate** the knowledge, skills and attitudes of a professional engineer.	3
BDS32306.2	**Apply** methodologies and professional way of documentation and communication	3
BDS32306.3	**Analyze** the key stages in development of the project.	4
BDS32306.4	**Design** engineering solutions to complex problems utilizing a systems approach.	6
BDS32306.5	**Develop** Software skills by learning various algorithms and methodology.	6

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Semester	Course Code	Course Name
III	BDS32307	Open Elective-I: Object Oriented Programming with C++

Teaching Scheme	
Lectures	4 Hrs/week
Tutorial	0
Total Credit	4

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 04Hrs 00Min.	

Course Objectives:

1	Understand basic fundamentals of object oriented programming.
2	Implement the inheritance and polymorphism techniques for constructing classes in programming.
3	Understand the principles of exception handling for robust error management in programming.

Course Contents

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

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

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Reference Books	
R.1	Deciphering Object-Oriented Programming with C++ by Dorothy R. Kirk.
R.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

Course Outcomes		Cognitive Level
After the completion of this course, students will be able to-		
BSS323XX.1	Understand the basic concept of object oriented Programming	2
BSS323XX.2	Implement classes and objects to solve real-world problems	5
BSS323XX.3	Implement abstract classes and interfaces.	5
BSS323XX.4	Apply constructors, destructors, and copy constructors for proper resource management	3
BSS323XX.5	Design code that can handle runtime errors using exception handling mechanisms.	6

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Dr. Pragati Patil
Vice-Principal
Tulsiramji Gaikwad Patil College of Engineering & Technology, Nagpur

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