

Program	B. Tech CSE(CCML)						
Year	II		Semester	IV			
Course Name	Database Management Systems						
Code	NCS4401						
Course Type	PCC	L	T	P	Credit		
Pre-Requisite	Fundamentals of computer	3	1	0	4		
Course Objectives	1. To introduce the basics of Database Management System 2. Understanding the fundamental relational system, data model. 3. Understanding the fundamental of architecture, and manipulations. 4. To develop Understanding of Transaction Processing System, Concurrency control, and Recovery procedures in database.						
Course Outcomes							
CO1	Understand terms related to database design and management.						
CO2	Constructing conceptual data model.						
CO3	Understand the functional dependencies, normalization and using SQL						
CO4	Understand and applying issues of transaction processing and concurrency control						

Module	Course Contents	Contact Hrs.	Mapped CO
1	Database System Concepts, Database Users, and Architecture Introduction to Database System with example, Characteristics of the Database Approach, Users of Database System, Advantages and disadvantages of Using a DBMS, Implications of the Database Approach, Data Models, Schemas, and Instances, DBMS Architecture and Data Independence, Database Languages and Interfaces, The Components of Database System, Classification of Database Management Systems	30 Hours	CO1
2	Data Modelling & Relational Database Management System Data Modelling Using the Entity-Relationship Model, concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Entity Types, Entity Sets, and Attributes, Relationships, Relationship Types, Roles, and Structural Constraints, Strong vs Weak Entity Types, ER Diagrams, Naming Conventions, and Design Issues, Enhanced Entity-Relationship Modelling, Subclasses, Super classes, and Inheritance, Specialization and Generalization, Constraints and Characteristics of Specialization and Generalization, Modelling of UNION Types Using Categories, The Relational Data Model, Relational Constraints, and the Relational Algebra, Relational Model Concepts, Relational Constraints and Relational Database Schemas, Update Operations and Dealing with Constraint Violations, Basic Relational Algebra Operations, Additional Relational Operations, Examples of Queries in Relational Algebra	30 Hours	CO2
3	SQL and Database Design Theory and Methodology Structured Query Language- The Relational Database Standard, Data Definition, Constraints, and Schema	30 Hours	CO3

	Changes in SQL, Types of SQL Commands, SQL Operators and their Procedure, Insert, Delete, and Update Statements in SQL, Queries and Subqueries, Aggregate Functions, Joins, Unions, Intersection, Minus, Views (Virtual Tables) in SQL, Cursors, Triggers and PL/SQL, Functional Dependencies and Normalization for Relational Databases, Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form		
4	Transaction Processing, Concurrency Control and Database Recovery Transaction Processing Concepts, Introduction to Transaction Processing, Transaction states and State Diagram, Transaction and System Concepts, Desirable Properties of Transactions, Schedules and Recoverability, Serializability of Schedules, Concurrency Control Techniques, Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Multiversion Concurrency Control Techniques, Validation (Optimistic) Concurrency Control Techniques, Granularity of Data Items and Multiple Granularity Locking, Database Recovery Techniques, Recovery Concepts, Recovery Techniques Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, The ARIES Recovery Algorithm, Database Backup and Recovery from Catastrophic Failures	30 Hours	CO4

Suggested Readings

1. Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition.
 2. Fundamentals of Database Systems, Elmasri Navathe Pearson Education.
 3. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_cs51/preview
 2. <https://www.udemy.com/topic/database-management/>

Program	B. Tech CSE(CCML)								
Year	II	Semester		IV					
Course Name	Data Structure Using ‘C’								
Code	NCS4403								
Course Type	PCC	L	T	P	Credit				
Pre-Requisite	Fundamentals of computer knowledge	3	1	0	4				
Course Objectives	1. To introduce the basis and advanced data structures 2. To understand various data operations performed on in data structures 3. To understand various sorting and searching techniques in data structures 4. To analyse the performance of data structures algorithms								
Course Outcomes									
CO1	Understand the applications of data structures including the ability to implement algorithms for the creation, insertion, deletion, searching and sorting of each data structure.								
CO2	Apply knowledge of underlying data structures needed for solving problems and programming.								
CO3	Analyse the application of data structures for storage and retrieval of ordered and unordered data.								
CO4	Understanding the graph representation and traversal								

Module	Course Contents	Contact Hrs.	Mapped CO
1	Introduction Introduction: Basic Terminology, Data types and its classification, Algorithm complexity notations like big Oh, Time- Space trade-off. Abstract Data Type (ADT). Array: Array , Definition, Representation and Analysis of Arrays, Single and Multidimensional Arrays, Address calculation, Array as Parameters, Sparse Matrices, Recursion- definition and processes, simulating recursion, Backtracking, Recursive algorithms, Tail recursion, Removal of recursion, Tower of Hanoi.	30 Hours	CO1
2	Stack and Linked List Stack, Array Implementation of stack, Linked Representation of Stack, Application of stack: Conversion of Infix to Prefix and Postfix Expressions And Expression evaluation, Queue, Array and linked implementation of queues, Circular queues, D-queues and Priority Queues. Linked list, Implementation of Singly Linked List, Two-way Header List, Doubly linked list, Linked List in Array. Generalized linked list, Application: Garbage collection and compaction, Polynomial Arithmetic.	30 Hours	CO2
3	Tree, Searching, Sorting and Hashing Trees: Basic, terminology, Binary Trees, algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Binary Search Tree(BST), AVL Trees, B-trees. Application: Algebraic Expression, Huffman coding Algorithm. Internal and External sorting, Insertion Sort, Bubble Sort, selection	30 Hours	CO3

	sort, Quick Sort, Merge Sort, Heap Sort, Radix sort, Searching Hashing: Sequential search, binary search, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation. Symbol Table, Static tree table, Dynamic Tree table.		
4	Graphs Graphs: Terminology, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi-list, Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshall Algorithm and Dijksta Algorithm.	30 Hours	CO4

Suggested Readings

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, “Data Structures Using C and C++”, PHI, 2000.
 2. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publication, 1982.
 3. Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with Applications”, McGraw-Hill, 1984
 4. R. Kruse Et Al, “Data Structures and Program Design in C”, Pearson Education, 2006
 5. Lipschutz, “Data Structures”, Schaum’s Outline Series, TMH, 2014
 6. GAV Pai, “Data Structures and Algorithms”, TMH, 2009

Online Resources

1. <https://archive.nptel.ac.in/courses/106/102/106102064/>

Program	B. Tech. CSE(CCML)					
Year	II	Semester		IV		
Course Name	Big Data Analytics & Architecture					
Code	NCS4404					
Course Type	PCC	L	T	P	Credit	
Pre-Requisite	Java, HADOOP frameworks, Clustering techniques, large data sets, PIG and HIVE	3	0	0	3	
Course Objectives	<ol style="list-style-type: none"> Optimize business decisions and create competitive advantage with Big data analytics Understand several key big data technologies used for storage, analysis and manipulation of data. Recognize the key concepts of Hadoop framework, map reduce. To learn Basic methodologies of PIG and HIVE. 					
Course Outcomes						
CO1	Understand what Big Data, importance and various sources of data. Describe the elements of big data-volume, variety, velocity and veracity.					
CO2	Analyse the Big Data framework like Hadoop and NOSQL to efficiently store and process Big Data to generate analytics					
CO3	Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm					
CO4	Demonstrate and evaluate an ability to use frameworks like pig and hive to process Big Data and Analytics.					

Module	Course Contents	Contact Hrs.	Mapped CO
1	ESSENTIALS OF BIG DATA AND ANALYTICS: Data, Characteristics of data and Types of digital data, Sources of data, Working with unstructured data, Evolution and Definition of big data, Characteristics and Need of big data, Challenges of big data; Overview of business intelligence, Data science and Analytics, Meaning and Characteristics of big data analytics, Need of big data analytics, Classification of analytics, Challenges to big data analytics, Importance of big data analytics, Basic terminologies in big data environment.	30 Hours	CO1
2	HADOOP : Introducing Hadoop, Need of Hadoop, limitations of RDBMS, RDBMS versus Hadoop, Distributed computing challenges, History of Hadoop , Hadoop overview, Use case of Hadoop, Hadoop distributors, HDFS (Hadoop Distributed File System) , Processing data with Hadoop, Managing resources and applications with Hadoop YARN (Yet another Resource Negotiator), Interacting with Hadoop Ecosystem.	30 Hours	CO2

3	<p>MAPREDUCE PROGRAMMING:</p> <p>Introduction , Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression, Real time applications using MapReduce, Data serialization and Working with common serialization formats, Big data serialization formats.</p> <p>INTRODUCTION TO PIG and HIVE:</p> <p>Introducing Pig: Pig architecture, Benefits, Installing Pig, Properties of Pig, Running Pig, Getting started with Pig Latin, Working with operators in Pig, Working with functions in Pig. Introducing Hive: Getting started with Hive, Hive Services, Data types in Hive, Built-in functions in Hive, Hive DDL</p>	<p>30 Hours</p>	<p>CO3, CO4</p>
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Suggested Readings

1. Seema Acharya, Subhashini Chellappan, —Big Data and Analytics, Wiley Publications, 2 nd Edition, 2014DT Editorial Services, —Big Data, Dream Tech Press, 2 nd Edition, 2015.
 2. Tom White, —Hadoop: The Definitive Guide, O'Reilly, 3 rd Edition, 2012.
 3. Black Book Big Data, dreamtech publications , 1st Edition, 2017.

E-Text Books

1. <https://www.books.google.co.in/books?id=rkWPojgfeM8C&printsec=frontcover&dq=HIGH+PERFORMANCE+COMPUTING>.
 2. http://www.datameer.com/pdf/big-data-analytics-ebook.pdf?mkt_tok

Online Resources

1. <https://nptel.ac.in/courses/106104189>

Program	B. Tech.CSE(CCML)								
Year	II	Semester		IV					
Course Name	DevOps								
Code	NCCML4401								
Course Type	PCC	L	T	P	Credit				
Pre-Requisite	To basic knowledge of certain basic programming languages such as Java, Perl and Python as it ensures the DevOps engineer.	3	0	0	3				
Course Objectives	<ol style="list-style-type: none"> 1. Understand the blooming in the techniques used in DevOps and their benefits. 2. Understanding the lifecycle of a project, including alternative configurations and other project management models. 3. Understand the benefit of automation in different stages of a project. 4. Analyzing the philosophy and principles of DevOps. 								
Course Outcomes									
CO1	Understand the concepts of DevOps in real life scenarios to improve the process.								
CO2	Analyze the implemented for swift completion of the tasks and increase productivity.								
CO3	Evaluate the concepts of DevOps and Design Thinking which are being followed by MNCs around the globe.								
CO4	Apply the concepts of DevOps and Design Thinking which are being followed by MNCs around the globe.								

Module	Course Contents	Contact Hrs.	Mapped CO
1	<p>Design Thinking Methodology About Design Thinking Intro to Design Thinking, Importance of Design thinking, History of Design Thinking, IBM Design Thinking Framework.</p> <p>The Principles Guide Us Introduction, Focus on User Outcomes, Relentless Reinvention, Diverse Empowered Teams.</p> <p>The Loops Drive Us Introduction, Empathy Map, As-Is Scenario, Big Idea Vignettes, Prioritization Grid, Need Statements, Ideation Activity, Storyboards.</p>	30 Hours	CO1
2	<p>Agile Methodology Software Development Methodology Definition of Project; Project vs Operations; Relationship between Project; Program and Portfolio; Features of Project; Measuring Project Success Phases of a Project.</p> <p>Project Execution Methodologies Waterfall Model; How does Waterfall work advantages - Disadvantages of Waterfall Model; V-Model; How does V-Model work; Advantages and Disadvantages of V-Model; Advantages-Disadvantages of Agile</p> <p>Agile Deep Dive</p>	30 Hours	CO2

	Methodology Overview; Introduction to Agile Manifesto & Guiding Principles; Agile vs Waterfall; Agile Frameworks; Extreme Programming (XP); Rational Unified Process (RUP); Feature Driven Development (FDD); Test Driven Development (TDD); Scrum; Kanban		
3	<p>Scrum Deep Dive Foundation of Scrum; Scrum Team; Roles in Scrum Team; Sprints; Definition of Ready</p> <p>Scrum Artifacts Product backlog; Sprint Backlog; Sprint Burndown; Impediments list</p> <p>DevOps Devops Fundamentals Introduction to DevOps; Agile Vs DevOps; DevOps Principles; Introduction to CI/CD; Hands-on GIT; Build Automation; Configuration Management; Continuous Deployment - Docker;</p> <p>Devops Use Case Introduction of a Use Case for CI/CD Pipeline; DevOps in Mobile Application; DevOps in Web Application; DevOps in Internet of Things</p> <p>Introduction to Devops on Cloud Introduction to IBM Cloud; DevOps on Cloud; Cloud Services (Toolchain and DevOps)</p>	30 Hours	CO3,CO4

Suggested Readings

1. Agile Development and Methodologies – IBM Content
2. ‘Running Lean’ by Ash Maurya
3. Scrum: The Art of Doing Twice the Work in Half the Time’ by Jeff Sutherland
4. The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win’ by Gene Kim, Kevin Behr and George Spafford
5. ‘Essential Scrum: A Practical Guide to the Most Popular Agile Process’ by Kenneth Rubin
6. Hands-on Devops by Sricharan Yadapalli – 2017
7. Design Thinking Methodology by Emrah Yayici - 2016

Online Resources

- 1.<https://www.youtube.com/watch?v=GJQ36pIYbic&list=PL9ooVrP1hQOE5ZDJJsExZ2upwK7aTYiX>
- 2.<https://www.youtube.com/@nptel-speciallectureseries6651>

Course Articulation Matrix															
PO-PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	
CO1	2	2	2	1	3								2	2	2
CO2	3	2	3	3	2								3	2	2
CO3	2	3	3	3	2								3	3	2
CO4	2	3	3	3	2								2	2	1

Program	B. Tech CSE(CCML)								
Year	II	Semester		IV					
Course Name	Database Management Systems Lab								
Code	NCS4451								
Course Type	PCC	L	T	P	Credit				
Pre-Requisite	Fundamentals of computer knowledge	0	0	2	1				
Course Objectives	1. Students are able to designing, developing database. 2. Students are able to querying a database. 3. Students are able to take backup and rollback database 4. Students are able to write functions and procedure								
Course Outcomes									
CO1	Infer database language commands to create simple database								
CO2	Analyze the database using queries to retrieve records								
CO3	Applying PL/SQL for processing database								
CO4	Develop solutions using database concepts for TCL Commands								

S. No.	List of Experiments	Mapped CO
1	Write the queries for Data Definition and Data Manipulation Language.	CO1
2	Write SQL queries using logical operations (=, <,>, etc).	CO1
3	Write SQL queries using SQL operators.	CO2
4	Write SQL query using character, number, date and group functions.	CO1
5	Write SQL queries for extracting data from more than one table.	CO4
6	Write SQL queries for sub queries, nested queries.	CO2
7	Write programme by the use of PL/SQL.	CO3
8	Concepts for ROLL BACK, COMMIT.	CO4
9	Create VIEWS and understand its concept	CO3
10	Create CURSORS and understand its concept.	CO3

Online Resources

1. <http://vlabs.iitkgp.ernet.in/se/4/theory/>
2. <https://vsit.edu.in/vlab.html>

Program	B. Tech.CSE(CCML)					
Year	II	Semester		IV		
Course Name	DevOps Lab					
Code	NCCML4451					
Course Type	PCC	L	T	P		
Pre-Requisite	Basic Programming Language.	0	0	2		
Credit				1		
Course Objectives	1. Understand the blooming in the techniques used in DevOps and their benefits. 2. Understanding the lifecycle of a project, including alternative configurations and other project management models. 3. Understand the benefit of automation in different stages of a project. 4. Analyzing the philosophy and principles of DevOps.					
Course Outcomes						
CO1	Remember the importance of DevOps tools used in software development life cycle.					
CO2	Implemented the importance of Jenkins to Build, Deploy and Test Software Applications					
CO3	Perform the concepts of DevOps and Design Thinking which are being followed by MNCs around the globe.					
CO4	Analyze & Illustrate the Containerization of OS images and deployment of applications over Docker					

S. No.	List of Experiments	Mapped CO
1	Designing a better way for cab booking from start to finish. Create a List of Stakeholders, Empathy Map and As-is Scenario Map	CO1
2	In Above case discussed in practical I, create Big Idea Vignettes, Prioritization grid and Need statements.	CO1
3	For the same case create story board, Hills	CO1
4	Create a To-be Scenario for the case discussed in Practical I	CO2
5	Installing Docker and Creating Docker Image	CO2
6	Pull and Push of docker images to and from docker repository.	CO3
7	Installation of Ubuntu on a virtual machine.	CO3
8	Installation of GIT and Creating GIT Repository.	CO4
9	Testing Using Junit	CO4
10	Setting up DevOps on IBM Cloud	CO4
11	Project Statement Deployment of an application on IBM Cloud. The environment provisioning automation task executes and begins posting activity events describing the progress of the execution. The activity postings are gathered by the continuous delivery process and presented to the user in a manner that is consumable to the development team. The task can be completed using JIRA also.	CO2,3

Online Resources

1. <https://www.azuredevopslabs.com/>

Course Articulation Matrix

PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	2	2	2	2	2								3	2	3
CO2	2	1	2	2	3								3	3	2
CO3	2	2	2	2	3									2	2
CO4	2	2	2	1	2								2	3	2

Program	B.Tech CSE(CCML)					
Year	II	Semester		IV		
Course Name	Data Structure Lab					
Code	NCS44 53					
Course Type	PCC	L	T	P		
Pre-Requisite	Basic knowledge of C language	0	0	2		
Credit	1					
Course Objectives	1. Understand various data representation techniques in the real world. 2. Implement linear and non-linear data structures. 3. Analyze various algorithms based on their time and space complexity. 4. Develop real-time applications using suitable data structure.					
Course Outcomes						
CO1	Understand the concept of data structures and apply algorithm for solving problems like Sorting, searching, insertion and deletion of data.					
CO2	Understand linear data structures for processing of ordered or unordered data.					
CO3	Explore various operations on dynamic data structures like single linked list, circular linked list and doubly linked list					
CO4	Understand the binary search trees, hash function, and concepts of collision and its resolution methods					

S. No.	List of Experiments	Mapped CO
1	Implementation of List using Dynamic memory Allocation.	CO1
2	Implementation of Queue.	CO1
3	Implementation of Searching and Sorting Algorithms.	CO1
4	Array implementation of Stack.	CO2
5	Array implementation of Queue.	CO2
6	Array implementation of Circular Queue.	CO2
7	Array implementation of List	CO2
8	Implementation of Stack	CO3
9	Implementation of Circular Queue	CO3
10	Implementation of Tree Structures	CO4
11	Implementation of Binary Tree.	CO4
12	Implementation of Tree Traversal.	CO4
13	Implementation of Binary Search Tree.	CO4
14	Implementation of Insertion in BST.	CO4
15	Implementation of Deletion in BST.	CO4
16	Graph Implementation, BFS.	CO4
17	Graph Implementation, DFS.	CO4
18	Graph Implementation, Minimum cost spanning tree.	CO4
19	Graph Implementation, shortest path algorithm.	CO4

Online Resources

1. <https://cse01-iiith.vlabs.ac.in/>
 2. <https://cse.iitkgp.ac.in/~rkumar/pds-vlab/index1.html>

Program	B.TECH: CSE/CSE-AI/CSE-CCML/CSE-IOTBC								
Year	II	Semester		III/IV					
Course Name	INDIAN CONSSTITUTION								
Code	NVC4301/NVC4401								
Course Type	CQAC	L	T	P	Credit				
Pre-Requisite	The basic knowledge of Indian Constitutions	1	0	0	1				
Course Objectives	<ul style="list-style-type: none"> 1. To realise the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution. To Know the need and importance of protecting traditional 2. To identify the importance of fundamental rights as well as fundamental duties. 3. To understand the functioning of Union, State and Local Governments in Indian federal system 4. To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure. 								
Course Outcomes									
CO1	Understand the concept of Indian constitution.								
CO2	Identify the powers and functions of Supreme Court and High court.								
CO3	Analyse the role Governor and Chief Minister.								
CO4	Explain the district administration role and importance.								

Module	Course Contents	Contact Hrs.	Mapped CO
1	<p>Introduction to Indian Constitution Constitution meaning of the term - The making of the Indian Constitution - Sources and constitutional history – Philosophy of Constituent Assembly - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.</p> <p>Union Government and its Administration Structure: President and Vice President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions.</p>	30 Hours	CO1, CO2
2	<p>The States and The Union Territories State Government and its Administration: Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions – Relation between the Union and the States.</p> <p>Local Administration District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative – Pachayati Raj: Functions PRI: Zilla Panchayat, Elected officials and their roles - Block level Organizational Hierarchy, Village level - Role of Elected and Appointed officials - Importance of grass-root democracy</p>	30 Hours	CO3, CO4

Suggested Readings

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt.Ltd.. New Delhi
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th Edition, Universal Law Publication.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc20_lw03/preview

Course Articulation Matrix														
PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		2					2	3	1	2			3	1
CO2		3					1	2	3	2			1	2
CO3		1					2	2	2	1			2	1
CO4		2					1	3	2	2			2	2