LINGAYA'S VIDYAPEETH

Department of Computer Science & Engineering

Scheme & Syllabus

Of

M.Tech(CSE)

Batch: 2024-2026

VISION

To be a school, committed to education, research & innovation and develop globally competent professionals in the area of Computer Science, Information Technology and Computer Applications who are responsible citizens and have respect for life and sensitivity towards environment.

MISSION

1. To develop professionals and leaders in Computer Science, IT and allied areas who have right attitude and aptitude to serve the society.

2. To develop and maintain state-of-the-art infrastructure and research facilities to enable create, apply and disseminate knowledge.

3. To foster linkages with all stakeholders for continuous improvement in academics in Computer Science, IT and Computer Applications.

4. To develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge who have deep respect for human life and values.

5. To undertake disciplinary and inter-disciplinary collaborative research and innovation which offer opportunities for long term interaction with academia and industry and develop technologies relevant to the society.

PROGRAM OUTCOMES:

PO1- Engineering Knowledge: Apply the knowledge of mathematics, science, engineering and Application fundamentals, and an engineering and Application specialization to the solution of complex engineering problems.

PO2- Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3-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.

PO4- 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.

PO5- Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6- 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.

PO7- 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.

PO8- Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9- Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10- 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.

PO11- 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.

PO12- Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES:

PSO1: To equip the students with theoretical and implementation knowledgebase in all the latest areas of Computer Science & Engineering for a successful career in software industries, pursuing higher studies, or entrepreneurial establishments.

PSO2: To nurture the students with the critical thinking abilities for better decision making by offering them a socially acceptable solutions to real life problems through computing paradigm.

PSO3: To nurture the students with the comprehensive analytical and design abilities by offering them techno-commercially feasible solutions of real business problems through computing.

LINGAYA'S VIDYAPEETH

SCHEME OF STUDIES
SESSION: 2024-25

School: School of Engineering & Technology	Batch:2024-2026
Department: CSE	Year:1st
Course: M.Tech	Semester: I

SN	Category	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PEC	CS-501E	Big Data Analytics	3	0	0	3	15	25	60	-	-	100
2	PCC	CS-503E	Object Oriented Design and Analysis	3	0	0	3	15	25	60	-	-	100
3	PCC	CS-505E	Object Data Structure & Algorithm	3	0	0	3	15	25	60	-	-	100
4	PCC	AM-501E	Advanced Engineering Mathematics	3	0	0	3	15	25	60	-	-	100
5	PCC	CS-507E	Advanced Database Management System	3	0	0	3	15	25	60	-	-	100
6	PCC	RM-501E	Research Process & Methodology	3	0	0	3	15	25	60	-	-	100
7	PCC	CS-555E	Advanced Data Structure Lab	0	0	4	2	-	-	-	60	40	100
8	PCC	CS-557E	Advanced Database Management System Lab	0	0	4	2	-	-	-	60	40	100
			Total---->	**18**	**0**	**8**	**22**						

LINGAYA'S VIDYAPEETH
SCHEME OF STUDIES
SESSION: 2024-25

School: School of Engineering & Technology	**Batch: 2024-2026**
Department: CSE	**Year:1st**
Course: M.Tech	**Semester: II**

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PEC	CS-502E	Trends in AI & Soft Computing	3	0	0	3	15	25	60	-	-	100
2	PCC	CS-504E	Data Mining & Data Warehousing	3	0	0	3	15	25	60	-	-	100
3	PEC		**Elective - I**	3	0	0	3	15	25	60	-	-	100
4	PEC	CS-552E	Soft Computing & Artificial Intelligence Lab	0	0	4	2	-	-	-	60	40	100
5	PCC	CS-554E	Data Mining& Data Warehousing Lab	0	0	4	2	-	-	-	60	40	100
6	PROJ	CS-592E	Project with Seminar	0	0	8	4	-	-	-	-	100	100
7	PEC	PEC(CS)-502E	MOOC Course - I (NPTEL)	0	0	0	3	-	-	-	-	-	100
			Total---->	**9**	**0**	**16**	**20**						

LINGAYA'S VIDYAPEETH
SCHEME OF STUDIES
SESSION: 2025-26

School: School of Engineering & Technology	**Batch: 2024-2026**
Department: CSE	**Year: 2nd**
Course: M.Tech	**Semester: III**

SN	Category	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PCC	CS-601E	Digital Image Processing	3	0	0	3	15	25	60	-	-	100
2	PCC	CS-603E	Data Science using python	3	0	0	3	15	25	60	-	-	100
3	PCC	CS-605E	Machine Learning	3	0	0	3	15	25	60	-	-	100
4	PEC	RD-601E	Introduction to Blockchain Technology	3	0	0	3	15	25	60	-	-	100
5	PCC	RD-603E	Research paper writing & IPR	2	0	0	2						100
6	PEC		**Elective - II**	3	0	0	3	15	25	60	-	-	100
7	PCC	CS-653E	Data Science using python lab	0	0	4	2	-	-	-	60	40	100
8	PCC	CS-691E	Dissertation Preliminary	0	0	4	2	-	-	-	-	100	100
9	PEC	PEC(CS)-601E	MOOC Course-II (NPTEL)	0	0	0	3						100
10	PCC	CS-693E	Seminar I	0	0	4	2	-	-	-	-	100	100
			Total---->	**17**	**0**	**12**	**23**						

LINGAYA'S VIDYAPEETH
SCHEME OF STUDIES
SESSION: 2025-26

School: School of Engineering & Technology	**Batch: 2024-2026**
Department: CSE	**Year: 2nd**
Course: M.Tech	**Semester: IV**

SN	Category	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PCC	CS-692E	Dissertation	0	0	32	16	-	-	-	-	300	300
2	PCC	CS-694E	Seminar II	0	0	8	4	-	-	-	-	100	100
			Total---->	**0**	**0**	**40**	**20**						

LINGAYA'S VIDYAPEETH
SCHEME OF STUDIES

Elective I Courses		
S.No	**Course Code**	**Course Name**
1	CSE-502E	**Cloud Computing**
2	CSE-504E	**Network Security Management**
3	CSE-506E	**Information Retrieval**
Elective II Courses		
S.No	**Course Code**	**Course Name**
1	CSE-601E	**Natural Language Processing**
2	CSE-603E	**Cryptography and Cyber Security**
3	CSE-605E	**Agile Technology**

Syllabus

of

M.Tech(CSE)

1st Year

(1st Semester& 2nd Semester)

LINGAYA'S VIDYAPEETH

SCHEME OF STUDIES
SESSION: 2024-25

School: School of Engineering & Technology	Batch:2024-2026
Department: CSE	Year:1st
Course: M.Tech	Semester: I

SN	Category	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PEC	CS-501E	Big Data Analytics	3	0	0	3	15	25	60	-	-	100
2	PCC	CS-503E	Object Oriented Design and Analysis	3	0	0	3	15	25	60	-	-	100
3	PCC	CS-505E	Object Data Structure & Algorithm	3	0	0	3	15	25	60	-	-	100
4	PCC	AM-501E	Advanced Engineering Mathematics	3	0	0	3	15	25	60	-	-	100
5	PCC	CS-507E	Advanced Database Management System	3	0	0	3	15	25	60	-	-	100
6	PCC	RM-501E	Research Process & Methodology	3	0	0	3	15	25	60	-	-	100
7	PCC	CS-555E	Advanced Data Structure Lab	0	0	4	2	-	-	-	60	40	100
8	PCC	CS-557E	Advanced Database Management System Lab	0	0	4	2	-	-	-	60	40	100
			Total---->	**18**	**0**	**8**	**22**						

LINGAYA'S VIDYAPEETH
SCHEME OF STUDIES
SESSION: 2024-25

School: School of Engineering & Technology	**Batch: 2024-2026**
Department: CSE	**Year:1st**
Course: M.Tech	**Semester: II**

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PEC	CS-502E	Trends in AI & Soft Computing	3	0	0	3	15	25	60	-	-	100
2	PCC	CS-504E	Data Mining & Data Warehousing	3	0	0	3	15	25	60	-	-	100
3	PEC		**Elective - I**	3	0	0	3	15	25	60	-	-	100
4	PEC	CS-552E	Soft Computing & Artificial Intelligence Lab	0	0	4	2	-	-	-	60	40	100
5	PCC	CS-554E	Data Mining& Data Warehousing Lab	0	0	4	2	-	-	-	60	40	100
6	PROJ	CS-592E	Project with Seminar	0	0	8	4	-	-	-	-	100	100
7	PEC	PEC(CS)-502E	MOOC Course - I (NPTEL)	0	0	0	3	-	-	-	-	-	100
			Total---->	**9**	**0**	**16**	**20**						

CS-501E	BIG DATA ANALYTICS	L-T-P	Cr
		3-0-0	3

OBJECTIVES

This course brings together several key big data technologies used for storage, analysis and manipulation of data and recognize the key concepts of Hadoop framework, MapReduce, Pig, Hive, and No-SQL and a sample project in Hadoop API.

COURSE OUTCOMES

The students undergoing this course will be able to:

CO1: Learn the basic concepts of big data

CO2: Handle the big data as well as get familiar with the Hadoop

CO3: Get deeper knowledge of Hadoop as well as map reduce

CO4: Know about the architecture for real time applications

CO5: Learn about the Pig

UNIT I

Big Data and its Importance – Four V's of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications, Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data – Crowd Sourcing Analytics – Inter- and Trans-Firewall Analytics - Information Management.

UNIT-II

Integrating disparate data stores - Mapping data to the programming framework - Connecting and extracting data from storage - Transforming data for processing - Subdividing data in preparation for Hadoop Map Reduce, Hadoop Map Reduce - Creating the components of Hadoop

UNIT-III

Map Reduce jobs - Distributing data processing across server farms -Executing Hadoop Map Reduce jobs - Monitoring the progress of job flows - The Building Blocks of Hadoop Map Reduce - Distinguishing Hadoop daemons - Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

UNIT-IV

Real-Time Architecture – Orchestration and Synthesis Using Analytics Engines – Discovery using Data at Rest – Implementation of Big Data Analytics – Big Data Convergence – Analytics Business Maturity Model,

UNIT V

Installing and Running Pig – Comparison with Databases – Pig Latin – UserDefine Functions – Data Processing Operators – Installing and Running Hive – Hive QL – Tables – Querying Data – User-Defined Functions – Oracle Big Data.

TEXT BOOK

Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.

REFERENCE BOOKS

1. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", 1st Edition, IBM Corporation, 2012.
2. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", 1st Edition, Wiley and SAS Business Series, 2012.
3. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012

CS-503E	OBJECT ORIENTED DESIGN AND ANALYSIS	L-T-P	Cr
		3-0-0	3

OBJECTIVES

This course brings together several key features of object oriented related to design and analysis.

COURSE OBJECTIVES

After undergoing this course, the students will be able to:

CO1: Know about the fundamentals of object oriented design
CO2: Analyze the object oriented key features like behavior, design etc
CO3: Learn the basic concepts of UML
CO4: Learn about the USE-CASES, their designs as well as their implementation
CO5: Know about the testing and coding for design of object-oriented

UNIT I

OBJECT ORIENTED DESIGN FUNDAMENTALS: The object model - Classes and Objects, Complexity ,Classification, Notation, Process - Pragmatics - Binary and entity relationship, Object types - Object state, OOSD life cycle, Frameworks and design patterns, design for reusability, advanced object-oriented programming techniques, design using object-oriented databases and distributed object architectures, design of software agents.

UNIT II

OVERVIEW OF OBJECT ORIENTED ANALYSIS: Shaler/Mellor, Coad/Yourdon, Rumbagh, Booch's Approach towards the analysis, UML ,Usecase, Conceptual model, Behaviour ,Class, Analysis patterns, Overview, Diagrams, Aggregation.

UNIT III

UNIFIED MODELING LANGUAGE: UML –static view, Dynamic view, Model Management View, UML Diagrams, Collaboration - Sequence - Class - Design patterns and frameworks - Comparison with other Design methods

UNIT IV

USE CASE DRIVEN, ARCHITECTURE CENTRIC, ITERATIVE, AND INCREMENTAL THE FOUR PS: people, project, product, and process Use case driven process: why use case, capturing use cases, analysis, design, and implementation to realize the use cases, testing the use cases Architecture-centric process: architecture in brief, why we need architecture, use cases and architecture, the steps to architecture, an architecture description.

UNIT V

MANAGING OBJECT ORIENTED DEVELOPMENT MANAGING ANALYSIS AND DESIGN - Evaluation testing - Coding - Maintenance Metrics, case Studies In Object Oriented Development Design of foundation class libraries - Object Oriented databases - Client/Server computing - Middleware.

TEXT BOOKS

1. Craig Larmen, Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development, Prentice Hall (2004)
2. Booch G., Rambaugh J., Jacobson Ivar, The Unified Modeling Language User Guide, Pearson Education (2003)
3. The Unified Modeling Language User Guide, Grady Booch, James Rumbaugh, Ivar Jacobson 2nd Edition, Pearson Education.
4. UML 2 Toolkit by Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado WILEYDreamtech India Pvt. Ltd.
5. The Unified Software Development Process by Ivar Jacobson, Grady Booch, James Rumbaugh, Pearson Education

REFERENCE BOOKS

Yogesh Singh, Ruchika Malhotra, Object oriented software engineering, PHI 2012

CS-505E	OBJECT DATA STRUCTURE AND ALGORITHMS	L T P	Cr
		3 0 0	3

OBJECTIVES

To learn about the time complexity of algorithms and understand the representations used in heap data structures, different types of search structures and various algorithm design techniques. Understand the advanced data structures.

COURSE OUTCOMES

The students undergoing this course will be able to:

CO1: Know about the data types as well as measures of complexity of algorithms
CO2: Get knowledge about heaps and its different types
CO3: Get familiar with the BST and its types
CO4: learn about the dynamic programming
CO5: learn about the approaches used for parallel algorithms

UNIT I

ABSTRACT DATA TYPES - Time and Space Analysis of Algorithms - Big Oh and Theta Notations - Average, best and worst case analysis - Simple recurrence relations – Mappings.

UNIT II

MIN-MAX HEAPS - Heaps - Leftist heaps -Binomial heaps - Fibonacci heaps - Skew heaps - Lazybinomial heaps.

UNIT III

BINARY SEARCH TREES - AVL trees - 2-3 trees - 2-3-4 trees - Red-black trees - B-trees - splay trees - Tries.

UNIT IV

DIVIDE AND CONQUER AND GREEDY: Quicksort - Strassen's matrix multiplication - Convex hull - Treevertex splitting - Job sequencing with deadlines - Optimal storage on tapes Dynamic Programming and Backtracking: Multistage graphs - 0/1 knapsack - 8- queens problem - graph coloring.

UNIT V

PARALLEL ALGORITHMS: Basic Techniques- Work & Efficiency - Distributed Computation - Heuristic & Approximation Approaches.

TEXT BOOKS

Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Third Edition, Pearson Education, Asia.2007.

REFERENCE BOOKS

1. E. Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data structures in C++, University Press, 2009.
2. E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms/C++, Second Edition, University Press, 2007.

3. Jean-Paul Tremblay, Paul .G. Sorenson, "An Introduction to Data Structures with Applications", Tata McGraw Hill second edition , 1991.
4. Thomas H.Coremen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein , "Introduction to algorithms", Third edition, MIT press.

AM-501E	ADVANCED ENGINEERING MATHEMATICS	L- T- P	Cr
		3- 1 - 0	4

COURSE OUTCOMES

The undergoing this course will be able to:

CO1: Know about integration as well as differential equations
CO2: Learn about the Laplace transform, its inverse as well as applications
CO3: State different statistical methods like interpolation, extrapolation etc.
CO4: Learn about the different numerical methods for integration
CO5: Key aspects used in differential equations

UNIT I

Integration in series, ordinary and singular points, power series, frobenius method to find the general solution of higher order linear ordinary differential equation with constant variable coefficients, Legendre and Bassels equation, Legendre polynomials, Bessel functions, Boundary value, Strum-Liouville problem, Orthogonal eigen function expansions.

UNIT II

Laplace Transform, Laplace Inverse Transform, Application of Laplace Transform and Inverse Laplace Transform in the particular solution of integral equation and integro- differential equations, Infinite Fourier sine and cosine transforms and its applications, Fourier-Legendre series, Fourier-Bessel series.

UNIT III

Interpolation, Extrapolation, Lagrangs method, Missing-terms problems, Hermite interpolation, Spline interpolation, Cubic spline, Fitting of a curve in given sub-interval using cubic spline interpolation, Representation of a tabulated function in power of (x-a) using Newtons divided difference formula.

UNIT IV

Numerical integration using Romberg method, Gauss-Legendre and Lobatto methods, Gaussian integration and numerical; double integration, Numerical solution of a system of non-linear equations using Newton Raphson method, Solution of system of linear equations in four variables using Gauss-Jordan and Crout's methods.

UNIT V

Partial Differential Equations, Modeling, Vibrating String, Wave Equations. Product solutions o1'Laplaceequations, heat conduction equations, wave equations, Poisson'sequations by the method of separation of valiables and its applications in boundary value problems, Conversiou of a differeirtial equation into integral equation and vice versa, Solutions of Fredholur and Volterra integral equations of first and second kind.

TEXT BOOKS

Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers

REFERENCE BOOKS

1. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern-lndia.
2. Numerical Methods for Scientific and Engineering Computation, M. K. Jain, S. R. K. Iyengar and R.K..Jain, New Age International (P) Ltd.

3. **E-Resources:** **https://nptel.ac.in/courses/111/105/111105035/**
4. **Latest Journals:** **https://www.springer.com/journal/10665**
5. **Ethical Things:** **https://soaneemrana.org/onewebmedia/ADVANCED%20ENGINEERING%20MATHEMATICS%20BY%20ERWIN%20ERESZIG1.pdf**
6. **Latest Things:** **https://www.wolfram.com/books/profile.cgi?id=8784**

CS-507E	ADVANCE DATABASE MANAGEMENT SYSTEM	L-T-P	Cr
		3-0-0	3

OBJECTIVE

To provide knowledge about various organizations and management information systems,keeping in view the aspects of shareability, availability, evolvability and integrity.

COURSE OUTCOMES

The students undergoing this course will be able:

CO1: Recap to use DBMS features and be familiar with advanced SQL usage

CO2: Understanding of Query Processing and Query Optimization

CO3: Be proficient with Transactions, Concurrency Control and Recovery Systems

CO4: Be exposed to parallel, distributed and deductive databases and object database systems

CO5: To learn about the Database System Architectures.

UNIT I

Coping with System Failures: Introduction to ADBMS, ACID properties, Issues and Models for Resilient Operation, Undo Logging, Redo Logging, Undo/Redo Logging, Logging Rules, Recovery using different Logging methods, Protecting against Media Failures, Non-quiescent Archiving, Recovery using an Archive and Log, Transactions in SQL Serializability, Atomicity, Formal review of relational database and FDs Implication, Closure, its correctness

UNIT II

Concurrency Control: Serial and Serializable Schedules, Conflict-Serializability, Precedence Graphs and a Test for Conflict-Serializability, Enforcing Serializability by Locks, The Locking Scheduler, Two-Phase Locking (2PL), Locking Systems with several Lock Modes: shared and Exclusive Locks, The Lock Table, Managing Hierarchies of Database Elements: Locks with Multiple Granularity, The Tree Protocol, 3NF and BCNF, Decomposition and synthesis approaches, Review of SQL99, Basics of query processing, external sorting, file scans

UNIT III

Advanced Transaction Management: Serializability and Recoverability, Recoverable Schedules, ACR, Logical Logging, Recovery from Logical Logs, View Serializability, Polygraphs and the Test for View-Serializability, Resolving Deadlocks, Deadlock Prevention by Ordering Elements and Timestamps, Distributed Databases: Distributed Commit, Two-phase Commit (2PC), Distributed Locking, Processing of joins, materialized vs. pipelined processing, query transformation rules, DB transactions, ACID properties, interleaved executions, schedules, serializability

UNIT IV

The Query Compiler: Parsing, Estimating the cost of operations, Query optimization, Completing the Physical-Query-Plan and Query Execution; Storage management. Correctness of interleaved execution, Locking and management of locks, 2PL, deadlocks, multiple level granularity, CC on B+ trees, Optimistic CC

UNIT V

Database System Architectures: Object Definition Language (ODL), Object-relational Model,

XML and its Data Model, Object-orientation in Query Languages, Logical Query Languages, Centralized and Client-Server Architectures, Parallel Databases, Spatial and Geographic Databases, Multimedia Databases, Mobility and Personal Databases, T/O based techniques, Multiversion approaches, Comparison of CC methods, dynamic databases, Failure classification, recovery algorithm, XML and relational databases

TEXT BOOK

1. Silberschatz A., Korth H. F. and Sudarshan S., "Database System Concepts", 3rdedition, McGraw-Hill, International Edition, 1997.

RM-501E	RESEARCH PROCESS AND METHODOLOGY	L- T- P	Cr
		3- 1 - 0	4

COURSE OBJECTIVES

The students undergoing this course will be able to:

CO1: Know about the research problem, its objectives and approaches of research
CO2: Learn about plagiarism and ethics of research
CO3: How to create a good research proposal
CO4: Learn about the patents as well as copyrights
CO5: Know about the patents deeply

UNIT I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II

Effective literature studies approaches, analysis Plagiarism, Research ethics,

UNIT III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT IV

NATURE OF INTELLECTUAL PROPERTY: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V

PATENT RIGHTS: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

TEXT BOOKS

1. "Research Methodology: An Introduction" by Ranjit Kumar, 2nd Edition,
2. "Research Methodology: A Step by Step Guide for beginners & engineering students" by Wayne Goddard and Stuart Melville.

REFERENCE BOOKS

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science.
2. "Resisting Intellectual Property", Taylor & Francis Ltd .
3. E-Resources: https://nptel.ac.in/courses/121/106/121106007/
4. Latest Journals: https://ijrm.humanjournals.com/
5. Ethical Things: https://bmcmedresmethodol.biomedcentral.com/articles/10.1186/1471-2288-14-127

CS-555E	ADVANCED DATA STRUCTURE LAB	L T P	Cr
		0 0 4	2

OBJECTIVES

Implement advanced data structures and advanced algorithm concepts. Calculate the time complexity of algorithms and express it using appropriate notations and implement different algorithm design techniques.

COURSE OUTCOMES

CO1 Be able to design and analyze the time and space efficiency of the data structure
CO2 Be capable to identity the appropriate data structure for given problem
CO3 Have practical knowledge on the applications of data structures

LIST OF EXPERIMENTS

1. Implement min - max heap and calculate the efficiency of the algorithms.
2. Implement Heap data structure.
3. Implement splay trees.
4. Implement the insertion of AVL trees with rotations.
5. Implement B-Tree.
6. Implement vertex cover problem using approximate algorithms.
7. Implement and calculate the time complexity of quick sort
8. Implement Convex hull
9. Implement 0/1 Knapsack using Dynamic Programming
10. Implement Graph coloring using backtracking

CS-557E	ADVANCED DATABASE MANAGEMENT LAB	L-T-P	Cr
		0-0-2	1

OBJECTIVE

To provide knowledge about implementation of practical aspects of database i.e. creation oftables and applying queries using SQL queries

COURSE OUTCOMES

The students undergoing this course will be able:
CO1: To know the basics of structured query language
CO2: To aware about applying different queries on database structured in the form of tables
CO3: To learn about the different SQL queries performed using operators as well asconstraints
CO4: To create views from created table to further organize the data
CO5: To learn about the basic operations of relational algebra

LIST OF EXPERIMENTS

1. Implement complex SQL queries involving subqueries, joins, and group functions.
2. Create and execute PL/SQL triggers and stored procedures for automation.
3. Demonstrate ACID properties by managing transactions and concurrency control.
4. Optimize query performance by creating indexes and partitioning data.
5. Perform normalization and denormalization on a given database schema.
6. Design a data warehouse schema and create OLAP cubes for analysis.
7. Implement CRUD operations and advanced features in a NoSQL database.
8. Analyze and optimize query performance using EXPLAIN plans.
9. Simulate database failure and recovery using backup techniques.
10. Enforce business rules and advanced integrity constraints in a database.

CS-502E	TRENDS IN ARTIFICIAL INTELLIGENCE AND SOFT COMPUTING	L	T	P	Credit
		3	0	0	3

OBJECTIVES

1. To introduce the concepts and techniques of building blocks of Artificial Intelligence and Soft Computing techniques and their difference from conventional techniques.
2. To generate an ability to design, analyze and perform experiments on real life problems using various Neural Network algorithms.
3. To conceptualize Fuzzy Logic and its implementation for various real-world applications.
4. To provide the understanding of Genetic Algorithms and its applications in developing solutions to real-world problems.
5. To introduce the need and concept of hybrid soft computing algorithms.

COURSE OUTCOMES

The students undergoing this course will be able to:

CO1: Understand AI concepts used to develop solutions that mimic human like thought process on deterministic machines for real-world problems.

CO2: Analyze and evaluate whether a problem can be solved using AI techniques and analyze the same using basic concepts of AI.

CO3: Understand the fundamental concepts of Neural Networks, different neural network architectures, algorithms, applications and their limitations.

CO4: Apply Fuzzy Logic, the concept of fuzziness and fuzzy set theory in various systems. 5.

CO5: Apply Genetic Algorithms in problems with self-learning situations that seek global optimum.

CO6: Create solutions to real-world problems using Neural Network, Genetic Algorithms, Fuzzy Logic or their Hybrid systems.

UNIT I

FOUNDATIONS OF ARTIFICIAL INTELLIGENCE: Introduction to artificial intelligence; Application areas of artificial intelligence; State space search: Depth first search, Breadth first search;

HEURISTIC SEARCH: Best first search, Hill Climbing, Beam Search, Tabu Search; Introduction to randomized search: Simulated annealing, Genetic algorithms, Ant colony optimization; Introduction to expert systems; Introduction to AI-related fields like game playing, speech recognition, language detection machine, computer vision, robotics Supervised and unsupervised learning.

UNIT II

INTRODUCTION TO SOFT COMPUTING: Importance of soft computing; Soft computing versus hard computing; Introduction to main components of soft computing: Fuzzy logic, Neural networks, Genetic algorithms. Basic concepts of neural network; Overview of learning rules and parameters; Activation functions; Single layer perceptron and multilayer perceptron; Multilayer feed forward network;

BACKPROPAGATION NETWORKS: Architecture, Algorithm, Variation of standard backpropagation neural network; Radial basis function network; Recurrent neural network; Introduction to Associative Memory; Recent applications.

UNIT III

GENETIC ALGORITHMS: Difference between traditional algorithms and Genetic Algorithm (GA); Basic concepts of GA; Working principle; Encoding methods; Fitness function; GA Operators: Reproduction, Crossover, Mutation; Convergence of GA; Detailed algorithmic steps; Adjustment of parameters; Multi-criteria optimization; Solution of typical problems using genetic algorithm; Recent applications.

UNIT IV

FUZZY LOGIC: Concepts of uncertainty and imprecision; Concepts, properties and operations on classical sets and fuzzy sets; Classical & fuzzy relations; Membership functions and its types; Fuzzification; Fuzzy rule-based systems; Defuzzification; Fuzzy propositions; Fuzzy extension principle; Fuzzy inference system; Recent applications.

INTRODUCTION TO HYBRID SYSTEMS: Fuzzy-neural systems, Genetic fuzzy systems, Neuro-genetic systems; Details of any one method for each hybrid system.

UNIT V

RESEARCH-BASED STUDY: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of latest research published in IEEE/ACM transactions, SCI/SCIE/Web of Science/SCOPUS indexed journals and Tier-1 conference of this area. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT-BOOKS

1. Artificial Intelligence: A Modern Approach by S. Russell and P. Norvig, Prentice Hall.
2. S. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, PHI.
3. S. N. Sivanandam and S. N. Deepa, Principles of Soft Computing, 2 nd ed., Wiley India.

REFERENCE BOOKS

1. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill.
2. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Pearson Education.
3. J. Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House.
4. D. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, AddisonWesley
5. G. Klir, B. Yuan, Fuzzy Sets & Fuzzy Logic: Theory and A: Theory & Applications, Pearson

CS-504E	DATA MINING & DATA WAREHOUSING	L	T	P	Credit
		3	0	0	3

COURSE OUTCOMES

CO1: Understand the functionality of the various data mining and data warehousing component

CO2: Appreciate the strengths and limitations of various data mining and data warehousing models

CO3: Explain the analyzing techniques of various data

CO4: Describe different methodologies used in data mining and data ware housing.

CO5: Compare different approaches of data ware housing and data mining with various technologies.

UNIT I

DATA WAREHOUSE FUNDAMENTALS: Introduction to Data Warehouse, OLTP Systems; Differences between OLTP Systems and Data Warehouse, Characteristics of Data Warehouse; Functionality of Data Warehouse, Advantages and Applications of Data Warehouse; Top- Down and Bottom-Up Development Methodology, Tools for Data warehouse development: Data Warehouse Types, Components of Data warehouse Architecture: Different Data warehouse architectures

DIMENSIONAL MODELING: Introduction: E-R Modeling: Dimensional Modeling: E-R Modeling VS Dimensional Modeling: Data Warehouse Schemas; Star Schema, Inside Dimensional Table, Inside Fact Table, Fact Less Fact Table, Granularity, Star Schema Keys: Snowflake Schema: Fact Constellation Schema:

UNIT II

EXTRACT, TRANSFORM AND LOAD: ETL Overview or Introduction to ETL: ETL requirements and steps: Data Extraction; Extraction Methods, Logical Extraction Methods, Physical Extraction Methods: Data Transformation; Basic Tasks in Transformation, Major Data Transformation Types: Data loading; Data Loading Techniques: ETL Tools

UNIT II

DATA WAREHOUSE & OLAP: Introduction: What is OLAP, Characteristics of OLAP, Steps in the OLAP Creation Process, Advantageous of OLAP: What is Multidimensional Data: OLAP Architectures; MOLAP, ROLAP, HOLAP: Data Warehouse and OLAP: Hypercube & Multicubes

META DATA MANAGEMENT IN DATA WAREHOUSE: Introductions to Metadata: Categorizing Meta data: Meta data management in practice; Meta data

requirements gathering, Meta data classification, Meta data collection strategies: Meta Data Management in Oracle and SAS: Tools for Meta data management:

UNIT IV

INTRODUCTION TO DATA MINING: Introduction, categories of web mining – web content mining, web structure mining, web usage mining, Scope of Data Mining, How does Data Mining Works, Data Mining VS Data Warehousing: Architecture for Data Mining, Applications of Web Mining, and Web mining Software.

DATA MINING TECHNIQUES I- An Overview, Classification and Prediction – Basic Concepts – Decision Tree Induction , Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods and Prediction.

UNIT V

DATA MINING TECHNIQUES II- Introduction of Cluster Analysis, Categorization of Major Clustering Methods: K-means, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid Based Methods, Model-Based Clustering Methods, Clustering High Dimensional Data, Constraint – Based Cluster Analysis & Outlier Analysis, Agglomerative clustering, Divisive clustering, clustering and segmentation software, evaluating clusters.

REFERENCES

1. Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Person Education, 2007.
4. K.P. Soman, Shyam Diwakar and V. Aja, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006.
5. G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006.
6. Daniel T.Larose, "Data Mining Methods and Models", Wiley-Interscience, 2006.

CS-552E	SOFT COMPUTING & ARTIFICIAL INTELLGENCE LAB	L	T	P	Credit
		0	0	4	2

COURSE OUTCOMES

CO1: Implement the AI concepts used to develop solutions that mimic human like thought process on deterministic machines for real-world problems.

CO2: Analyze and evaluate whether a problem can be solved using AI techniques and analyze the same using basic concepts of AI.

CO3: Implement the the fundamental concepts of Neural Networks, different neural network architectures, algorithms, applications and their limitations.

LIST OF EXPERIMENTS

- Case based lab sessions will be conducted in this laboratory.
- Implementation of AI and Soft Computing techniques to understand, analyse, compare and visualize the performance of the induced models will be done using Python with Pytorch, Numpy, NLTK, Scikit-learn, etc.
- Packages and MATLAB.
- The research based real problems will be decided by the course faculty and students.

CS-554E	DATA MINING & DATA WAREHOUSIG LAB	L T P	CR
		0-0-4	2

COURSE OUTCOMES

CO1: Use and Demonstrate the Data Mining Tools : Tanagra, Weka
CO2: Learn the counterparts of the business intelligence like data warehouse, Tanagra, Weka, ERP etc.
CO3: Visualization of the data and dashboards

LIST OF EXPERIMENTS

1 Study Of Tanagra As A Data-Mining Tool

2 Study Of Weka As A Data-Mining Tool

3 Importing and viewing data in TANAGRA

4 Defining status of data using Tanagra

5 Program to apply instance selection on given data using Tanagra.

6 Program to apply clustering algorithms on given data by using Tanagra tool.

7 Program to apply A Priori algorithms on given data using Tanagra:

8 Program to generate decision tree using Weka tool

9 Program to use Weka tool to perform clustering:

10 Program to visualize all attributes of Preprocess using Weka

11 Program for processing the data using Weka

12 Program for Classification of Data using Neural Network

13 Program for Classification of Data using Bayesian Network

14 What attributes do you think might be crucial in making the analysis of diabetes? Come up with some simple rules in plain English using your selected attributes using diabetes. arff database

15 What attributes do you think might be crucial in making the analysis of contact-lenses? Come up with some simple rules in plain English using your selected attributes using contact Lenses. arff

CS-592E	PROJECT WITH SEMINAR	L T P	CR
		0-0-8	4

OBJECTIVES

The objective of the seminar is to impart training to the students in collecting materials on a specific topic in the broad domain of Engineering/Science from books, journals and other sources, compressing and organizing them in a logical sequence, and presenting the matter effectively both orally and as a technical report.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

CO1: Organize and illustrate technical documentation with scientific rigor and adequate literal standards on the chosen topic strictly abiding by professional ethics while reporting results and stating claims

CO2: Demonstrate communication skills in conveying the technical documentation via oral presentations using modern presentation tools.

CO3: To impart training to students to face audience and present their ideas and thus creating in them self esteem and courage that are essential for engineers.

CO4: To assess the debating capability of the student to present a technical topic.

CO5: To learn real working condition and technologies of Industry.

Individual students are required to choose a topic of their interest. A committee consisting of at least three faculty members preferably Expertise in respective fields shall assess the presentation of the seminar and award marks to the students.

Each student shall submit two copies of a write up of his/her seminar topic. One copy shall be returned to the student after duly certifying it by the chairman of the assessing committee and the other will be kept in the departmental library. Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.

LINGAYA'S
VIDYAPEETH

Deemed-to-be University
u/s 3 of UGC Act 1956

choose to know

Syllabus

Of

M.Tech(CSE)

2nd Year

(3rd Semester & 4th Semester)

LINGAYA'S VIDYAPEETH
SCHEME OF STUDIES
SESSION: 2025-26

School: School of Engineering & Technology	**Batch: 2024-2026**
Department: CSE	**Year: 2nd**
Course: M.Tech	**Semester: III**

SN	Category	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PCC	CS-601E	Digital Image Processing	3	0	0	3	15	25	60	-	-	100
2	PCC	CS-603E	Data Science using python	3	0	0	3	15	25	60	-	-	100
3	PCC	CS-605E	Machine Learning	3	0	0	3	15	25	60	-	-	100
4	PEC	RD-601E	Introduction to Blockchain Technology	3	0	0	3	15	25	60	-	-	100
5	PCC	RD-603E	Research paper writing & IPR	2	0	0	2						100
6	PEC		**Elective - II**	3	0	0	3	15	25	60	-	-	100
7	PCC	CS-653E	Data Science using python lab	0	0	4	2	-	-	-	60	40	100
8	PCC	CS-691E	Dissertation Preliminary	0	0	4	2	-	-	-	-	100	100
9	PEC	PEC(CS)-601E	MOOC Course-II (NPTEL)	0	0	0	3						100
10	PCC	CS-693E	Seminar I	0	0	4	2	-	-	-	-	100	100
			Total---->	**17**	**0**	**12**	**23**						

LINGAYA'S VIDYAPEETH

SCHEME OF STUDIES

SESSION: 2025-26

School: School of Engineering & Technology	Batch: 2024-2026
Department: CSE	Year: 2nd
Course: M.Tech	Semester: IV

SN	Category	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PCC	CS-692E	Dissertation	0	0	32	16	-	-	-	-	300	300
2	PCC	CS-694E	Seminar II	0	0	8	4	-	-	-	-	100	100
			Total---->	**0**	**0**	**40**	**20**						

LINGAYA'S VIDYAPEETH
SCHEME OF STUDIES

Elective I Courses		
S.No	**Course Code**	**Course Name**
1	CSE-502E	**Cloud Computing**
2	CSE-504E	**Network Security Management**
3	CSE-506E	**Information Retrieval**
Elective II Courses		
S.No	**Course Code**	**Course Name**
1	CSE-601E	**Natural Language Processing**
2	CSE-603E	**Cryptography and Cyber Security**
3	CSE-605E	**Agile Technology**

CS-601E	DIGITAL IMAGE PROCESSING	L T P	Cr
		3-0-0	3

OBJECTIVES

This course will equip the students with understanding of digital image processing, segmentation and feature extraction techniques of images, registration and image fusion, and 3D image visualization.

COURSE OUTCOMES

After completion of course, students would be able to:

CO1: Explain the essentials of digital image processing.
CO2: Describe various segmentation techniques for image analysis.
CO3: Outline the various feature extraction techniques for image analysis.
CO4: Discuss the concepts of image registration and fusion.
CO5: Illustrate 3D image visualization.

UNIT I

REVIEW OF DIGITAL IMAGE PROCESSING: Steps in digital image processing- Elements of visual perception- brightness adaptation, Mach band effect. Image enhancement in spatial and frequency domain, Histogram equalization

UNIT II

SEGMENTATION & FEATURE EXTRACTION: Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour models, Texture feature based segmentation, Graph based segmentation,Wavelet based Segmentation - Applications of image segmentation. **Feature Extraction:** First and second order edge detection operators, Phase congruency, Localized feature extraction -detecting image curvature, shape features, Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors- Autocorrelation, Co-occurrence features, Runlength features, Fractal model based features, Gabor filter, wavelet features.

UNIT III

REGISTRATION AND IMAGE FUSION:N Registration - Preprocessing, Feature selection - points, lines, regions and templates Feature correspondence - Point pattern matching, Line matching, Region matching, Template matching.Transformation functions - Similarity transformation and Affine Transformation. Resampling – NearestNeighbour and Cubic Splines. Image Fusion - Overview of image fusion, pixel fusion, wavelet based fusion -region based fusion.

UNIT IV

3D IMAGE VISUALIZATION: Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection,

Surfaces, Multiple connected surfaces, Image processing in 3D, Measurements on 3D images.

UNIT V

RESEARCH-BASED STUDY: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of latest research published in IEEE/ACM transactions, SCI/SCIE/Web of Science/SCOPUS indexed journals and Tier-1 conference of this area. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT-BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing',Pearson,Education, Inc.,Second Edition, 2004.
2. Mark Nixon, Alberto Aguado, “Feature Extraction and Image Processing”, Academic Press, 2008.

REFERENCE-BOOKS

1. Ardeshir Goshtasby, “ 2D and 3D Image registration for Medical, Remote Sensing and Industrial Applications”,John Wiley and Sons,2005.
2. John C.Russ, “The Image Processing Handbook”, CRC Press,2007.
3. Anil K. Jain, Fundamentals of Digital Image Processing', Pearson Education, Inc., 2002.

Rick S.Blum, Zheng Liu, “Multisensor image fusion and its Applications“, Taylor&Francis,2006.

CS-603E	DATA SCIENCE USING PYTHON	L T P	Cr
		3 0 0	3

OBJECTIVES

It will cover Python programming and its various package such as NUMPY, SCIPY and MATPLOTLIB. This course provides knowledge and expertise to become a proficient data scientist. It helps demonstrate an understand the statistics and machine learning concepts that are vital for data science.

COURSE OUTCOMES

The students undergoing this course will be able to:

CO1: Explain how data is collected, managed and stored for data science.

CO2: Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists.

CO3: Implement data collection and management scripts using Python Pandas.

CO4: Understand how to use the Python standard library to write programs, access the various data science tools, and document and automate analytic processes.

CO5: understand the data science processes, data exploration, data visualization, hypothesis building, and testing; and the basics of statistics.

CO6: analyze data as well as perform data manipulation using data structures and tools provided in the Pandas package.

CO7: Understand an integrated analysis environment for doing data science with Python.

CO8: Understand supervised learning and unsupervised learning models such as linear regression, logistic regression, clustering, dimensionality reduction, K-NN, and pipeline.

UNIT I

PYTHON BASICS AND PROGRAMMING CONCEPTS:N Introducing Python, Types and Operations - Numbers, Strings, Lists, Tuples, Dictionaries, Files, Numeric Types, Dynamic Typing; Statements and Syntax – Assignments, Expressions, Statements, Loops, iterations, comprehensions; Functions -Function Basics, Scopes, Arguments, Advanced Functions; Modules – Module Coding Basics, Module Packages, Advanced Module Topics; Classes and OOP -Class, Operator Overloading, Class Designing; Exceptions and Tools – Exception Basics, Exception Coding Details, Exception Objects, Designing With Exceptions, Parallel System Tools

UNIT II

GUI PROGRAMMING:N Graphical User Interface - Python gui development options, Adding Widgets, GUI Coding Techniques, Customizing Widgets; Internet Programming -

Network Scripting, Client-Side scripting, Pymailgui client, server-side scripting, Pymailcgi server; Tools and Techniques -databases and persistence, data structures, text and language, python/c integration

UNIT III

PANDAS AND NUMPYNNUMPY BASICS - Fast Element wise array functions, Multidimensional Array, Data Processing using arrays, file i/o with arrays; Pandas - Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics, Handling Missing Data, Hierarchical Indexing

UNIT III

DATA PREPROCESSING: Data Loading, Storage, and FileFormats -Reading and Writing data in text format, binary data formats, interacting with html and web apis, interacting with databases; Data Wrangling: Clean, Transform, Merge, Reshape - Combining and Merging Data Sets, Reshaping and Pivoting, Data Transformation, String Manipulation; Data Aggregation

UNIT IV

GROUP OPERATIONS – Group by Mechanics, Data Aggregation, Groupby Operations and Transformations, Pivot Tables and Cross-Tabulation

DATA VISUALIZATION: A Brief matplotlib API Primer, Plotting FunctionsNin pandas, Time Series, Financial and Economic Data Applications

UNIT V

RESEARCH-BASED STUDY:N The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of latest research published in IEEE/ACM transactions, SCI/SCIE/Web of Science/SCOPUS indexed journals and Tier-1 conference of this area. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT-BOOKS

1. Python For Data Analysis (O Reilly, Wes Mckinney)
2. Rakshith Vasudev, Introduction to Numpy -1 : An absolute beginners guide to Machine Learning and Data science., 2017.

REFERENCE-BOOKS

1. Python: The Complete Reference, Martin C. Brown, McGraw Hill Education
2. Head First Python, Paul Barry, O′Reilly
3. Learning Python , OReilly, Mark Lutz
4. Programming Python, OReilly, Mark Lutz

CS-605E	MACHINE LEARNING	L T P	Cr
		3 0 0	3

OBJECTIVES

- To understand and apply both supervised and unsupervised machine learning algorithms to detect and characterize patterns in real-world data.
- To understand complexity of machine learning algorithms, their limitations and open-issues

COURSE OUTCOMES

After completion of course, students would be able to:

CO1: Understand the fundamentals of machine learning.
CO2: Analyze the performance of machine learning algorithms, and effect of parameters.
CO3: Develop an understanding what is involved in learning models from data.
CO4: Understand a wide variety of learning algorithms.
CO5: Apply principles and algorithms to evaluate models generated from data.
CO6: Apply the algorithms to a real-world problem.

UNIT I

INTRODUCTION TO MACHINE LEARNING: Learning - Types of machine learning - Supervised learning - The brain and the neurons, Linear Discriminants -Perceptron - Linear Separability -Linear Regression - Multilayer perceptron – Examples of using MLP - Back propagation of error. Problems, data, and tools, Visualization tools, Artificial Neural Networks, Regression Techniques, Linear regression, SSE, gradient descent, closed form, normal equations, features, Overfitting and complexity, training, validation, test data,

UNIT II

CLASSIFICATION ALGORITHMS: Maximum-Likelihood estimation; Maximum a posteriori estimation; Naïve Bayes and Bayesian classifiers; K-nearest neighbour method; Support Vector Machines; Algorithms for clustering: K-means, Hierarchical and other methods, Ensemble Classifiers: Need and usefulness of ensemble classifiers; Bagging; Boosting, Random forests; Decorate; Vote; Stacking. Decision trees - Constructing decision trees - Classification of regression trees - Regression example - Probability and Learning: Turning data into probabilities - Some basic statistics - Gaussian mixture models - Nearest Neighbor methods.

UNIT III

ANALYSIS: The k-Means algorithm - Vector Quantization's - Linear Discriminant Analysis - Principal component analysis - Factor Analysis - Independent component analysis - Locally

Linear embedding – Isomap - Least squares optimization - Simulated annealing.

UNIT IV

OPTIMIZATION TECHNIQUES: The Genetic algorithm - Genetic operators - Genetic programming - Combining sampling with genetic programming - Markov Decision Process - Markov Chain Monte Carlo methods: sampling - Monte carlo -Proposal distribution.

UNIT V

RESEARCH-BASED STUDY: The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of latest research published in IEEE/ACM transactions, SCI/SCIE/Web of Science/SCOPUS indexed journals and Tier-1 conference of this area. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered.

TEXT-BOOKS

1. Machine Learning: An Algorithmic Perspective by Stephen Marsland, Chapman and Hall/CRC.
2. T. Mitchell, Machine Learning, McGraw Hill.
3. M. Gopal, Applied Machine Learning, McGraw Hill.
4. Sutton R. S. and Barto, A. G., Reinforcement Learning: An Introduction, The MIT Press (2017).

REFERENCE-BOOKS

1. Introduction to Machine Learning by Ethem Alpaydin, PHI Learning.
2. M. Evangelia, Supervised and Unsupervised Pattern Recognition, CRC Press.
3. C. Bishop, Neural Networks for Pattern Recognition, Oxford University Press.
4. G. James, D. Witten, T. Hastie, R. Tibshirani, Introduction to Statistical Learning, Springer.

RD-601E	INTRODUCTION TO BLOCKCHAIN TECHNOLOGY	L T P	Cr
		3 0 0	3

OBJECTIVE

To provide a foundational understanding of blockchain concepts, including its architecture, consensus mechanisms, cryptography, and decentralized applications. Students will learn how blockchain ensures transparency, security, and immutability, exploring real-world applications in finance, supply chains, and beyond.

COURSE OUTCOMES

After completion of course, students would be able to:

CO1: Understand the fundamentals of Blockchain.

CO2: Analyze the cryptographic techniques used in blockchain systems, such as hashing, digital signatures, and public-key cryptography.

CO3: Evaluate various consensus mechanisms used in blockchain networks, such as Proof of Work (PoW) and Proof of Stake (PoS), and discuss their advantages and limitations.

CO4: Develop and deploy basic blockchain applications and smart contracts using platforms like Ethereum.

CO5: Assess Blockchain Use Cases

CO6: Discuss Blockchain challenges.

UNIT-1

Discover Blockchain Technology: Blockchain, Growth of blockchain technology, Distributed systems, History of blockchain and Bitcoin, Types of blockchain. Decentralization: Methods of decentralization, Routes of decentralization, Blockchain and full ecosystem decentralization, Smart contracts, Decentralized organizations and platforms for decentralization.

UNIT-II

Blockchain: Architecture, Versions, Variants, Use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to cryptocurrencies, Types, Applications. Bitcoins: Introducing Bitcoin, Bitcoin digital keys and addresses, Transactions, Blockchain mining. Alternative Coins. Limitations of Bitcoin.

UNIT-III

Blockchain: Architecture, Versions, Variants, Use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to cryptocurrencies, Types, Applications.

Bitcoins: Introducing Bitcoin, Bitcoin digital keys and addresses, Transactions, Blockchain mining. Alternative Coins. Limitations of Bitcoin.

UNIT-4

Introduction to Blockchain Platforms: Ethereum, Hyperledger, IOTA, EOS, Multichain, Bigchain, etc. Advantages and Disadvantages, EthereumvsBitcoin, Design a new blockchain, Potential for disruption, Design a distributed application, Blockchain applications.

Text Books:

1 "Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher

2 "Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications" by Imran Bashir

3 "Blockchain Technology: Introduction to Cryptocurrencies and the Decentralization of Everything" by Daniel Drescher

4"Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World" by Don Tapscott and Alex Tapscott

5"Introduction to Blockchain Technology" by R. B. Patel and B. S. Rajput

Reference Books:

1 "Blockchain Enabled Applications: Understand the Blockchain Ecosystem and How to Build Blockchain Applications" by Vikraman S

2 "Blockchain Technology: Concepts and Applications" by Raj Kumar and Naveen Kumar

3 "Blockchain Basics: Introduction to Blockchain Technology and Its Application" by C. P. Goh

4 "Blockchain for Dummies" by Tiana Laurence.

RD-603E	RESEARCH PAPER WRITING & IPR	L T P	Cr
		2 0 0	2

OBJECTIVES:

To impart knowledge on formulation of research problem, research methodology, ethics involved in doing research, and importance of IPR protection.

OUTCOMES:

At the end of this course, students will be able to:

CO1: Understand that today's world is controlled by Computer and Information Technology, but tomorrow's world will be ruled by ideas, concepts, and creativity, understand research problem formulation, analyze research-related information, and follow research ethics, correlate the results of any research article with other published results.

CO2: Write a review article in the field of engineering, appreciate the importance of IPR and protect their intellectual property, and understand that IPR protection provides an incentive to inventors for further research work and investment in R&D, which leads to the creation of new and better products and, in turn, brings about economic growth and social benefits.

UNIT I:

Meaning of research problem, Sources of research problem, Criteria characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, Approaches of investigation of solutions for research problem, Data collection, analysis, Plagiarism, Research ethics.

UNIT II:

Importance and scientific methodology in recording results, Importance of negative results, Different ways of recording, Industrial requirement, Artifacts versus true results, Types of analysis: analytical, objective, subjective, Outcome as new idea, hypothesis, concept, theory, model, etc.

UNIT III: TECHNICAL WRITING

Effective technical writing, How to write a manuscript/responses to reviewers' comments, Preparation of research article/research report, Writing a research proposal: presentation and assessment by a review committee.

UNIT IV:

Nature of Intellectual Property: Patents, Designs, Trade Mark, and Copyright, Process of Patenting and Development: technological research, innovation, patenting & development, Procedure for grants of patents, Patenting under PCT.

UNIT V:

Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications, New Developments in IPR: Administration of Patent System.

TEXT BOOKS:

Ranjit Kumar, *Research Methodology- A Step-by-Step Guide for Beginners*, Pearson Education, Australia, 2005,

Ann M. Korner, *Guide to Publishing a Scientific Paper*, Bioscript Press, 2004,

T. Ramappa, *Intellectual Property Rights Under WTO*, S. Chand, 2008.

REFERENCES:

Kothari, C. R., *Research Methodology - Methods and Techniques*, New Age International Publishers, New Delhi, 2004,

Stuart Melville and Wayne Goddard, *Research Methodology: An Introduction for Science & Engineering Students*, Juta & Company, 1996,

Robert P. Merges, Peter S. Menell, and Mark A. Lemley, *Intellectual Property in New Technological Age*, Aspen Publishers, 2016,

Halbert, *Resisting Intellectual Property*, Taylor & Francis Ltd, 2007,

Mayall, *Industrial Design*, McGraw Hill, 1992,

Niebel, *Product Design*, McGraw Hill, 1974,

Asimov, *Introduction to Design*, Prentice Hall, 1962.

CS-653E	DATA SCIENCE USING PYTHON LAB	L T P	Cr
		0 0 4	2

COURSE OUTCOMES

CO1 To Access the .txt file by using Python Libraries.
CO2 Demonstrate the output of data in .txt file.
CO3 Practical Knowledge of Data Analysis, Understanding structured and unstructured data
CO4 Importing and Exporting Data, Basic Insights from Datasets, Cleaning and Preparing the Data
CO5 Implementation of Exploratory data analysis, Statistical techniques, Evaluation methods, Machine Learning and Data Science techniques will be done using Python.

LIST OF EXPERIMENTS

Experiment 1: Write a Python Program to Find the Sum of the Series: 1 + 1/2 + 1/3 + .. + 1/N.

Experiment 2: Write a Python Program to Split the array and add the first part to the end.

Experiment 3: Write a Python Program to Create a List of Tuples with the First Element as the number and Second Element as the Square of the Number.

Experiment 4: Write a Python program to count number of vowels using sets in given string.

Experiment 5: Write a program to implement permutation of a given string using inbuilt function.

Experiment 6: Write a python program to sort list of dictionaries by values in Python – Using lambda function.

Experiment 7: Write a Python Program for following sorting: i. Quick Sort ii. Heap Sort

Experiment 8: Write a Python Program to Reverse a String Using Recursion.

Experiment 9: Write a Python Program to Count the Number of Words in a Text File.

Experiment 10: Write a Python Program to Read the Contents of a File in Reverse Order.

Experiment 11: Write a program to Merge and Join DataFrames with Pandas in Python.

Experiment 12: Write a program to implement Merge and Join DataFrames with Python Pandas.

Experiment 13: Write a Python Program to Append the Contents of One File to Another File.

Experiment 14: How to install and Load CSV files to Python Pandas.

Experiment 15: Write a program to implement Data analysis and Visualization with Python. using pandas.

Experiment 16: Write a program to Implement Plotting Functions in python pandas.