



BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI - 620 024.

M.Sc. COMPUTER SCIENCE

**CHOICE BASED CREDIT SYSTEM - LEARNING OUTCOMES BASED CURRICULUM
FRAMEWORK (CBCS - LOCF)**

(Applicable to the candidates admitted from the academic year 2026 - 2027 onwards)

Sem	Course	Course Title	Ins. Hrs	Credit	Exam Hrs	Marks		Total
						Int.	Ext	
I	Core Course - 1 (CC - 1)	Mathematical Foundations of Computer Science	6	4	3	30	70	100
	Core Course - 2 (CC - 2)	Advanced Data Structures and Algorithms	6	4	3	30	70	100
	Core Practical - 1 (CP - 1)	Advanced Data Structures and Algorithms Lab	3	2	3	40	60	100
	Discipline Centric Elective Course - 1 (DCEC - 1)	Any one from the list	5	4	3	30	70	100
	Discipline Centric Elective Practical - 1 (DCEP - 1)	Any one from the list	3	2	3	40	60	100
	Generic Elective Course - 1(GEC - 1)	Any one from the list	5	3	3	30	70	100
	Skill Enhancement Course -1 (SEC-1)	Ethical Hacking	2	2	3	30	70	100
	Value Added Course - 1 (VAC - 1) *	Web Development	-	2*	3	30	70	100*
	Total			30	21	-	-	-
II	Core Course - 3 (CC - 3)	Machine Learning	6	4	3	30	70	100
	Core Course - 4 (CC - 4)	Automata Theory and Compiler Design	6	4	3	30	70	100
	Core Practical - 2 (CP - 2)	Machine Learning Lab	3	2	3	40	60	100
	Discipline Centric Elective Course - 2 (DCEC - 2)	Any one from the list	4	4	3	30	70	100
	Discipline Centric Elective Practical - 2 (DCEP - 2)	Any one from the list	3	2	3	40	60	100
	Generic Elective Course - 2(GEC - 2)	Any one from the list	4	3	3	30	70	100
	Skill Enhancement Course -2 (SEC-2)	Soft Skills	2	2		30	70	100
	Non-Major Elective - 1 (NME -1)	One Course from Outside Department	2	2	3	30	70	100
	Total			30	23	-	-	-
Summer Internship / Industrial Activity during the Summer Vacation after 1 st Year								

Sem	Course	Course Title	Ins. Hrs	Credit	Exam Hrs	Marks		Total
						Int.	Ext	
III	Core Course - 5 (CC - 5)	Advanced Database Management Systems	6	4	3	30	70	100
	Core Course - 6 (CC - 6)	Quantum Computing Fundamentals	6	4	3	30	70	100
	Core Practical - 3 (CP - 3)	Advanced Database Management Systems Lab	3	2	2	40	60	100
	Discipline Centric Elective Course - 3 (DCEC - 3)	Any one from the list	5	4	3	30	70	100
	Discipline Centric Elective Practical - 3 (DCEP - 3)	Any one from the list	3	2	2	40	60	100
	Generic Elective Course - 3(GEC - 3)	Any one from the list	5	3	3	30	70	100
	Non-Major Elective - 2 (NME - 2)	One Course from Outside Department	2	2	3	30	70	100
	Summer Internship / Industrial Activity @			2		20	80	100
		Total	30	23	-	-	-	800
IV	Core Course - 7 (CC - 7)	Cloud Computing and Internet of Things	4	4	3	30	70	100
	Core Course - 8 (CC - 8)	Mobile App Development	4	4	3	30	70	100
	Core Course - 9 (CC - 9)	Agile Process And Devops	4	4	3	30	70	100
	Discipline Centric Elective Course - 4 (DCEC - 4)	Any one from the list	4	4	2	30	70	100
	Entrepreneurship / Industry Based Course @	Startups and Entrepreneurship	4	3	3	30	70	100
	Project Work @	Project Report	5	5	-	20	80	100
	Value Added Course - 2 (VAC - 2)*	Data Analysis with R	-	2*	3	30	70	100*
		Total	30	24	-	-	-	600
Grand Total				91				2900

LIST OF DISCIPLINE CENTRIC ELECTIVE COURSE / PRACTICAL

Discipline Centric Elective Course 1		Discipline Centric Elective Practical 1	
1.	Network Security and Cryptography	1.	Network Security and Cryptography
2.	Big Data Analytics	2.	Big Data Analytics
Discipline Centric Elective Course 2		Discipline Centric Elective Practical 2	
1.	Advanced Python Programming	1.	Advanced Python Programming
2.	Block chain Technology	2.	Block chain Technology
Discipline Centric Elective Course 3		Discipline Centric Elective Practical 3	
1.	Full Stack Development	1.	Full Stack Development
2.	Natural Language Processing	2.	Natural Language Processing
Discipline Centric Elective Course 4			
1	Introduction to Prompt Engineering		
2	Immersive Technologies		

LIST OF NON-MAJOR ELECTIVE COURSE (for other Department Students only)

Sl. No.	Non-Major Elective (NMEC)
1.	Cyber Security
2.	Principles of Web Programming

LIST OF GENERIC ELECTIVE COURSE

Generic Elective Course 1	
1.	Mathematics for Machine Learning
2.	Biological Databases
3.	Digital Marketing Analytics
Generic Elective Course 2	
1.	Probability and Statistics
2.	Design Thinking
3.	Research Methodology and IPR
Generic Elective Course 3	
1.	Optimization Techniques
2.	Foundations of Cognition and Problem Solving
3.	Geographical Information System

SUMMARY OF CURRICULUM STRUCTURE OF PG PROGRAMMES

Sl. No.	Types of the Course	No. of Courses	Credits for each Course	Total Credits	Marks
1.	Core Course	9	4	36	900
2.	Core Practical	3	2	6	300
3.	Discipline Centric Elective Course	4	4	16	400
4.	Discipline Centric Elective Practical	3	2	6	300
4.	Generic Elective Course	3	3	9	300
5.	Skill Enhancement Course	2	2	4	200
6.	Non-Major Elective Courses	2	2	4	200
7.	Internship/Industrial Activity@	1	2	2	100
8.	Entrepreneurship/ Industry Based Course @	1	3	3	100
9.	Project @	1	5	5	100
Total		29	-	91	2900
Value Added Courses *		2*	2	4*	200*

*	The value-added courses credit will not be included in the total CGPA. These courses are extra-credit courses. Instruction hours for these courses is 30 hours								
@	Summer Internship will be carried out during the summer vacation after the First year. Viva Voce will be conducted by the college and Marks shall be sent to the University and the same will be included in the 3rd semester Mark Statement. Summer Internship / Industrial Activity & Project Scheme of Evaluation <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th>Description</th><th>Marks</th></tr> <tr> <td>Report</td><td>80</td></tr> <tr> <td>Viva</td><td>20</td></tr> <tr> <td>Total</td><td>100</td></tr> </table>	Description	Marks	Report	80	Viva	20	Total	100
Description	Marks								
Report	80								
Viva	20								
Total	100								

Programme Outcome

PO1	Disciplinary Knowledge: Broad and in-depth knowledge of advanced scientific concepts, principles, and methodologies within the chosen domain. Ability to critically explain, integrate, and apply scientific knowledge to theoretical and practical problems. Opportunities to earn additional credits through specialized and interdisciplinary courses further enhance expertise and broaden disciplinary understanding.
PO 2	Critical Thinking: Field visits, academic interactions, and experiential learning activities will help students develop critical observation, interpretation, and analytical skills. Ability to evaluate and interpret scientific data, formulate hypotheses, and draw logical conclusions. Encourages independent thinking and the ability to assess scientific problems from multiple perspectives.
PO 3	Analytical Reasoning: Through classroom discussions, scientific literature reviews, and interactive learning environments, students will strengthen their analytical reasoning abilities. Ability to critically evaluate scientific texts, identify gaps in existing knowledge, formulate research questions, and synthesize new ideas and concepts. Promotes evidence-based reasoning and logical interpretation of scientific information.
PO 4	Scientific Reasoning: Strong foundation in scientific methods, experimental design, and data interpretation through laboratory-based courses. Enhances practical knowledge of scientific instrumentation, calibration procedures, laboratory safety, and appropriate research techniques. Ability to conduct scientifically sound experiments and interpret results accurately.
PO 5	Self-Directed Learning: Encourages independent and self-directed learning through assignments, field reports, project work, and literature-based studies. Ability to organize, analyze, and present scientific findings in professional formats relevant to academic and industrial settings. Fosters responsibility, time management, and continuous self-improvement in learning.
PO 6	Reflective Thinking: Laboratory-intensive core courses will expose students to a broad range of research methodologies and experimental techniques. Ability to reflect on learning experiences, evaluate the effectiveness of scientific approaches, and understand the broader applications of scientific techniques within the discipline.
PO 7	Problem-Solving Skills: Ability to develop and apply scientific principles, quantitative reasoning, and mathematical concepts to solve discipline-specific problems. Ability to analyze experimental data, interpret scientific observations, and derive meaningful conclusions. Prepares students to address real-world scientific and societal challenges effectively.
PO 8	Research-Related Skills: Internships, dissertation work, and research-oriented projects provide opportunities to design, develop, and execute independent research studies. Students gain hands-on experience in research methodology, experimental techniques, data analysis, scientific writing, and ethical research practices. These experiences strengthen laboratory competence and prepare students for advanced research and professional careers.
PO 9	Lifelong Learning: Cultivates a mindset of continuous learning and professional adaptability. Ability to identify gaps in knowledge and skills, adapt to emerging technologies and scientific advancements, and pursue self-directed learning throughout their careers. Encourages lifelong learning that supports academic growth, employability, and professional excellence.
PO 10	Leadership Readiness: Ability to take initiative, work collaboratively, and manage academic and research responsibilities effectively. Through seminars, group projects, internships, and research activities, students develop decision-making, problem-solving, organizational, and interpersonal skills. Ability to lead scientific teams, communicate effectively in professional environments, and contribute responsibly to academic, industrial, and societal development.

Programme Specific Outcome

PSO1	Apply advanced concepts of computer science, including algorithms, data structures, software engineering, database systems, artificial intelligence, and computer networks, to solve complex computing problems
PSO2	Design, develop, test, and maintain efficient software applications using modern programming languages, development frameworks, and software engineering practice
PSO3	Identify, formulate, and provide effective computing solutions for real-world challenges through critical thinking, analytical reasoning, and innovative approaches.
PSO4	Developed in-house applications in terms of projects.
PSO5	Interact with IT experts & knowledge by IT visits.
PSO6	Get industrial exposure through the 6 months Industrial Internship in IT industry.
PSO7	To make them employable according to current demand of IT Industry and responsible citizen
PSO8	Conduct independent research, adapt to emerging technologies, and engage in lifelong learning to meet the evolving demands of academia, industry, and society
PSO9	Develop entrepreneurial competencies for establishing and managing software enterprises and technology startups
PSO10	Integrate emerging technologies with business strategies to generate sustainable economic and societal value

Year: I

CORE COURSE 1

Semester: I

Mathematical Foundations of Computer Science

Code:

(Theory)

Credits: 4

Course Objectives

After completing this course, students will be able to:

1. Understand mathematical logic and proof techniques used in computer science.
2. Apply set theory, relations, and functions in computational problems.
3. Analyze combinatorial and counting problems using mathematical methods.
4. Understand algebraic structures and Boolean algebra used in digital systems and cryptography.
5. Develop mathematical reasoning skills required for advanced computer science subjects.

Unit I –Mathematical Logic and Proof Techniques:

Propositions and Logical Connectives -Truth Tables -Logical Equivalences - Predicate Logic-Quantifiers - Rules of Inference -Methods of Proof -Direct Proof - Contradiction - Contrapositive - Mathematical Induction - Strong Induction

Unit II – Set Theory, Relations and Functions:

Sets and Operations -Power Sets - Cartesian Product - Relations and Their Properties - Equivalence Relations -Partial Order Relations - Functions - One-One, Onto and Bijective Functions -Recursive Functions

Unit III – Combinatorics and Recurrence Relations:

Principles of Counting Permutations and Combinations - Inclusion-Exclusion Principle -Pigeonhole Principle -Generating Functions -Recurrence Relations - Solving Linear Recurrence Relations

Unit IV – Graph Theory and Trees:

Graphs and Digraphs - Graph Representation - Connectivity - Euler and Hamiltonian Graphs -Trees and Spanning Trees - Binary Trees - Graph Coloring - Applications of Graphs in Computer Science

Unit V – Algebraic Structures and Boolean Algebra:

Groups -Subgroups -Rings -Fields -Modular Arithmetic --Boolean Algebra -Logic Gates -Boolean Functions -Minimization Techniques

Unit – VI Current Contours (For continuous internal assessment only):
Contemporary Developments Related to the Course during the Semester Concerned.

Text Books

1. Discrete Mathematics and Its Applications – Kenneth H. Rosen.
2. Elements of Discrete Mathematics – C. L. Liu.

Reference Books

1. K. S. Trivedi Probability and Statistics with Reliability, Queuing and Computer Science Applications, First Edition, Prentice Hall of India.,2008
2. Schönig, Uwe, Pruim, Randall J, Gems of Theoretical Computer Science, Springer Publications.
3. Hary R Lewis, Christor H Papadi metrion ,Elements of the Theory of Computation, Prentice-Hall International, 1998.
4. Schaum's Outline of Discrete Mathematics.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

- CO1: Construct and evaluate logical arguments and mathematical proofs.
- CO2: Apply set theory, relations, and functions to computational models.
- CO3: Analyze graph-theoretic structures and algorithms.
- CO4: Use algebraic structures and Boolean algebra in computing applications.
- CO5: Apply Combinatorics and Recurrence Relations.

Year: I

CORE COURSE 2

Semester: I

Advanced Data Structures and Algorithms

Code:

(Theory)

Credits: 4

Course Objectives:

After completing this course, students will be able to:

- CO1: Explore advanced linear, tree, and graph data structures and their applications.
- CO2: Provide in-depth knowledge of advanced data structures and their role in solving complex computational problems efficiently.
- CO3: Develop analytical skills to evaluate algorithm performance using time and space complexity measures.
- CO4: Introduce advanced data structures such as balanced trees, heaps, hash tables, graphs, and disjoint-set structures.
- CO5: Familiarize students with algorithm design paradigms including divide-and-conquer, greedy method, dynamic programming, backtracking, and branch-and-bound techniques.

Unit I: Advanced Tree Data Structures: Balanced Trees: AVL, Red-Black Trees, Splay Trees, Treaps, Multi-way Trees: B-Trees, B+ Trees, R-Trees, Segment Trees, Fenwick Trees, Suffix Trees and Tries for string processing, Applications in indexing, text retrieval, computational geometry.

Unit II : Graph Data Structures and Algorithms: Representation: Adjacency list/matrix, incidence matrix, compressed storage, Traversals: DFS, BFS with applications, Shortest Path Algorithms: Dijkstra, Bellman-Ford, Floyd-Warshall, Johnson's algorithm, Minimum Spanning Trees: Prim's, Kruskal's, Network Flow Algorithms: Ford Fulkerson.

Unit III : Algorithm Design and Paradigms: Divide and Conquer: Strassen's algorithm, Greedy Methods: Huffman coding, interval scheduling, set cover approximation,

Unit IV Dynamic Programming: Matrix chain multiplication, Floyd-Warshall, Backtracking and Branch-and-Bound, Randomized Algorithms and Probabilistic Analysis.

Unit V : Computational Complexity and Approximation Algorithms: Complexity Classes: P, NP, NP-Complete, NP-Hard, Reductions: Polynomial-time reductions, Cook-Levin theorem (overview), Approximation Algorithms: Vertex cover, set cover, TSP, k-center problem

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

References:

1. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). Introduction to algorithms. MIT Press.
2. La Rocca, M. (2021). Advanced algorithms and data structures. Manning Publications.
3. Goodrich, M. T., Tamassia, R., & Mount, D. M. (2011). Data structures and algorithms in C++. John Wiley & Sons, Inc.
4. Weiss, M. A. (2014). Data structures and algorithm analysis in C++. Pearson Education.
5. Drozdek, A. (2013). Data structures and algorithms in C++. Cengage Publications.

E-resources:

1. <https://www.theiotacademy.co/blog/data-structures-and-algorithms-in-c/>
2. https://github.com/afrid18/Data_structures_and_algorithms_in_cpp
3. <https://www.udemy.com/course/introduction-to-algorithms-and-data-structures-inc/>
4. <https://www.theiotacademy.co/blog/data-structures-and-algorithms-in-c/>
5. https://github.com/afrid18/Data_structures_and_algorithms_in_cpp
6. <https://www.udemy.com/course/introduction-to-algorithms-and-data-structuresin-c/?srsltid=AfmBOorEZlkgV7QzaEh6IqzAaKLjC->

Course Outcomes: Upon successful completion of the course, students will be able to:

C01: Describe advanced data structures and algorithmic strategies used in efficient problem solving

C02: Analyze the computational complexity and performance of algorithms.

C03: Implement advanced data structures for managing and processing large datasets.

C04: Apply suitable algorithm design techniques to solve complex computational problems.

C05: Design efficient and scalable algorithmic solutions for real-world problems.

Year: I

CORE PRACTICAL 1

Semester:I

Advanced Data Structures and Algorithms Lab

Code:

(Using C/C++/Java/Python)

Credits:2

1. Implementation of Balanced Search Trees
 - (i) AVL Trees
 - (ii) Red-Black Trees
2. Implementation of Advanced Sorting Algorithms
 - (i) Quick Sort
 - (ii) Merge Sort
 - (iii) Heap Sort
3. Performance Analysis of Sorting Algorithms - Best, Average, and Worst Case Analysis
4. Implementation of Graph Traversal Algorithms
 - (i) Breadth First Search (BFS)
 - (ii) Depth First Search (DFS)
5. Implementation of Shortest Path Algorithms
 - (i) Dijkstra's Algorithm
 - (ii) Minimum Spanning Tree Algorithms
 - (iii) Prim's Algorithm
6. Implementation of Greedy Algorithms - Fractional Knapsack
7. Implementation of Dynamic Programming Algorithms
 - (i) 0/1 Knapsack Problem
 - (ii) Backtracking Algorithms
 - (iii) N-Queens Problem
8. Implementation of Branch and Bound Technique - Travelling Salesman Problem (TSP)

Year: I	DISCIPLINE CENTRIC ELECTIVE COURSE 1	Semester: I
	1. Network Security and Cryptography	
Code :	(Theory)	Credits: 4

Course Objectives

After completing this course, students will be able to:

1. Introduce the fundamental concepts of cryptography, including encryption, decryption, and cryptanalysis.
2. Provide a strong mathematical foundation for cryptographic techniques, including modular arithmetic and totient functions.
3. Study various cryptographic concepts, techniques, and security principles used in data protection.
4. Apply symmetric key cryptographic algorithms like DES, AES, and RC4 for secure data encryption and decryption.
5. Design and evaluate secure communication systems using appropriate cryptographic methods and protocols.

Unit-I - Cryptography concepts and Secure Communication:

Plaintext, Ciphertext, Encryption, Decryption, Modular arithmetic and Euclid's Algorithm Number Theory concepts: Prime numbers, GCD, Fermat's Little Theorem (basic use), One-way functions (hashing), Standard security protocols and agencies (FIPS, NIST).

Unit-II - Symmetric Key Cryptography:

Private key, Block Ciphers: Modes of Operation, Data Encryption Standard (DES), Double DES, Triple DES, International Data Encryption Algorithm (IDEA), Advanced Encryption Standard (AES), Stream Ciphers.

Unit-III - Asymmetric Key Cryptography:

Public Key vs. Private Key Encryption, Public Key Cryptosystems, Diffie-Hellman Key Exchange, RSA Algorithm, ElGamal Cryptosystem, Knapsack Cryptosystem. Asymmetric Cryptosystems attacks (Brute-Force, Mathematical, Side-Channel).

Unit-IV - Authentication Protocol:

Authentication Fundamentals, Authentication using Symmetric and Asymmetric Key Cryptography, Reflection Attack, Man-in-the-Middle Attack, Replay Attacks, Denial of Service (DoS) and Distributed Denial of Service (DDoS) Attacks. Key Distribution Center (KDC), Kerberos Protocol, X.509 Directory Authentication Service, Pretty Good Privacy (PGP), Secure/Multipurpose Internet Mail Extensions (S/MIME).

Unit-V - Digital Signature and Hash Function:

Digital Signature, Digital Signature Attacks, Hash Functions in Cryptography, Secure Hash Algorithm (SHA), Message Digest Algorithms (MD5), HMAC (Hash-based Message Authentication Code), HMAC Specifications, Digital Signature Standards (DSS), RSA.

Unit – VI Current Contours (For continuous internal assessment only):
Contemporary Developments Related to the Course during the Semester Concerned

Text Books:

1. Cryptography and Network Security: Principles and Practice-William Stallings, Pearson Education
2. Cryptography Engineering: Design Principles and Practical Applications- Niels Ferguson, Bruce Schneier, and Tadayoshi Kohno, Wiley

References:

1. Cryptography and Network Security-Behrouz A. Forouzan, McGraw-Hill Education
2. Network Security Essentials: Applications and Standards- William Stallings, Pearson Education
3. Cryptography and Network Security-Atul Kahate, Tata McGraw-Hill Education

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

1. Understand the fundamentals of network security and cryptography.
2. Identify and analyze network attacks and security threats.
3. Apply encryption, decryption, and hashing techniques.
4. Implement authentication, digital signatures, and key management methods.
5. Design secure communication systems using cryptographic principles.

Year: I

DISCIPLINE CENTRIC ELECTIVE (P) 1
1. Network Security and Cryptography
(Practical)

Semester: I

Code:

Credits: 2

1. Implementation of Classical Cipher Techniques
(i) Caesar Cipher (ii) Playfair Cipher
2. Implementation of Symmetric Key Algorithms
(i) Data Encryption Standard (DES) (ii) Advanced Encryption Standard (AES)
3. Implementation of RSA Algorithm
(i) Key Generation (ii) Encryption and Decryption
4. Implementation of Digital Signature Scheme - RSA Digital Signature
5. Implementation of Diffie–Hellman Key Exchange
6. Performance Analysis of Symmetric Encryption Algorithms
(i) Encryption/Decryption Time (ii) Throughput Analysis

Year: I

DISCIPLINE CENTRIC ELECTIVE COURSE 1

Semester: I

2. Big Data Analytics

Code:

(Theory)

Credits: 4

Course Objectives:

After completing this course, students will be able to:

1. Explore the fundamental concepts of big data analytics and big data framework.
2. Understand NoSQL database
3. Understand HDFS framework
4. Familiarize big data tools PIG & HIVE in Hadoop ecosystem.
5. Apply basic knowledge of MapReduce Architecture and Programming

Unit I: INTRODUCTION TO BIG DATA:

Introduction to Big Data: Types of Digital Data-Characteristics of Data – Evolution of Big Data - Definition of Big Data - Challenges with Big Data - 3Vs of Big Data - Big Data classification - Business Intelligence vs. Big Data – Introduction to Big Data platform - Data warehouse and Hadoop environment – Big Data Storage, Big Data Analytics: Classification of analytics – Big Data Analytics Applications, Fundamental concepts of Big Data management and analytics - Current challenges and trends in Big Data Acquisition - Analytic scalability, Analysis versus reporting, Popular Big Data Techniques and tools.

Unit II: NoSQL DATABASES NoSQL:

Use of NoSQL, Types of NoSQL, Advantages of NoSQL. Use of NoSQL in Industry, SQL versus NoSQL, NewSQL Mongo DB: Introduction – Features - Data types - Mongo DB Query language – Arrays - Functions: Count – Sort – Limit – Skip – Aggregate - Map Reduce. Cursors – Indexes - Mongo Import – Mongo Export. Cassandra: Introduction – Features - Data types – CQLSH - Key spaces - CRUD operations – Collections – Counter – TTL - Alter commands - Import and Export - Querying System tables.

Unit III: INTRODUCTION TO BIG DATA FRAMEWORK :

Introduction to Big data framework - Introduction to Hadoop: Features – Advantages – Versions - Overview of Hadoop Eco systems - Hadoop distributions - Hadoop vs. SQL – RDBMS vs. Hadoop - Distributed Computing Challenges - Hadoop Components – Architecture – HDFS (Hadoop Distributed File System), HDFS Daemons, Anatomy of File read, Write, Replica management Strategy, working with HDFS Commands - Processing Data with Hadoop - Map Reduce Framework. Hadoop 2 (YARN): Architecture - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Eco systems

Unit IV: HADOOP ECO SYSTEMS Hadoop Eco systems: Hive – Introduction to Hive, Hive Query Language, Architecture - data type - File format – HQL – SerDe - User defined functions - Pig: Features – Anatomy - Pig on Hadoop - Pig Philosophy - Pig Latin overview - Data types - Running pig - Execution modes of Pig - HDFS commands - Relational operators - Eval Functions - Complex data type - Piggy Bank - User defined Functions - Parameter substitution - Connecting

to Mongo DB - Connecting to Cassandra. Hadoop environment. Frameworks: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive.

Unit V: MAPREDUCE:

MapReduce: Introduction, Map Tasks– Grouping by key – Partitioner - Reduce Tasks – Combiners, Details of MapReduce Execution - Coping With Node Failures, Composing MapReduce for Calculations, Algorithms Using MapReduce - Matrix vector multiplication by Map Reduce. MapReduce Programming: Introduction – Developing a Map Reduce Application - How Map Reduce Works - Anatomy of a Map Reduce Job run – Failures - Job Scheduling - Shuffle and Sort – Task execution - Map Reduce Types and Formats - Map Reduce Features.

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Books

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publication, 2015.
2. Raj Kamal and Preeti Saxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine- Learning”, McGraw Hill Education, 2018.

Reference Books

1. Radha Shankarmani, M Vijayalakshmi, ”Big Data Analytics”, Wiley Publications, first Edition 2016.
2. Anand Rajaraman, Jure Leskovec, and Jeffrey D. Ullman , Mining of Massive Datasets, Copyright © 2014,
3. O’Reilly Media, Hadoop: The Definitive Guide, Third Edition.
4. DT Editorial Services, “Black Book- Big Data (Covers Hadoop 2, MapReduce, Hive, Yarn, PIG, R, Data visualization)”, Dream tech Press edition 2016.
5. Boris Lublinsky, Kevin T. Smith. Alexcy Yakubovich, "Professional Hadoop Solutions", Wiley, 2015.

Course Outcomes:

After the completion of the course the student will be able to

CO1: Learn the fundamental concepts of big data analytics.

CO2: Analyze the various NoSQL Databases.

CO3: Understand and implement Hadoop Bigdata Framework.

CO4: Successfully apply appropriate big data tools to solve actual Big Data problems.

CO5: Understand the MapReduce framework and apply Map Reduce Programming in big data analysis

Year: I

DISCIPLINE CENTRIC ELECTIVE (P)

Semester: I

2. Big Data Analytics Lab

Code:

(Practical)

Credits: 2

1. Reading and writing files in HDFS
2. Word Count Application Using MapReduce
3. Finding Maximum, Minimum, and Average Values Using MapReduce
4. Log File Analysis Using MapReduce
5. Data Warehousing Operations Using Hive
 - (i) Creating Databases and Tables
 - (ii) Loading Data
6. Implement NoSQL Database Operations: CRUD operations, Arrays using MongoDB
7. Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB
8. Develop Pig Latin scripts to sort, group, join, project, and filter the data

Year: I

GENERIC ELECTIVE COURSE 1

Semester: I

1. Mathematics for Machine Learning

Code:

Credits: 3

Course Objectives: After completing this course, students will be able to

1. Develop a strong foundation in linear algebra, calculus, probability, and statistics required for machine learning.
2. Understand the matrix operations.
3. Apply mathematical techniques for data representation, analysis, optimization, and prediction.
4. Acquire the statistic knowledge
5. Prepare students for advanced study and research in artificial intelligence and machine learning.

Unit-I: Introduction, Vector Spaces, Linear Independence, Dimensions and Basis, Linear Transformations, Norms and Spaces, Orthogonal Complement and projection, Systems of Linear equations- Gaussian Elimination, LU decomposition

Unit-II: Matrix and Operations: Addition, Multiplication, Transpose, Inverse, Rank of a matrix, Matrix factorization: Matrix properties and trace, Eigenvalues and Eigenvectors, Cholesky decomposition, Singular value decomposition, diagonalization Gradient, convex sets and convex functions, Properties of convex functions, Gradient of matrices, Numerical Optimization in ML, Gradient descent optimization

Unit III: Analytic Geometry: Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Orthogonal Projections – Projection into One Dimensional Subspaces, Projection onto General Subspaces, Gram-Schmidt Orthogonalization.

Unit-IV: Applications of Probability, Events and Sample Spaces, Axioms of Probability, Conditional Probability, Baye's Theorem, Random Variable, Expectation, Variance, Concept of Distributions – Bernoulli, Binomial, Poisson, Exponential and Normal.

Unit-V: Mean, Median, Mode, Standard Deviation, Regression - Linear, Multiple and Logistic regression, Least Square Method.

Unit - VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Book:

1. M. P. Deisenroth, A Aldo Faisal, Cheng Soon Ong, "Mathematics for Machine Learning", Cambridge University Press.
2. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong published by Cambridge University Press (freely available at [https:// mml - book.github.io](https://mml-book.github.io))

Reference Books: Samuel Hack, “Machine Learning Mathematics”. Richard Han, “Math for Machine Learning”.

Outcomes: Upon completion of this course, students will be able to:

1. Understand the algebra and matrix theory.
2. Apply the idea of Vectors.
3. Understand Analytic Geometry
4. Learn foundations of probability.
5. Apply statistical methods in Machine Learning problems.

Year: I

GENERIC ELECTIVE COURSE 1

Semester: I

2. Biological Databases

Code:

Credits: 3

Course Objectives: After completing this course, students will be able to

1. Develop basic knowledge on the available online biological databases
2. Create, integrate and mine of all kinds of nucleotide and protein databases
3. Analyze latest tools and technologies for biological data analysis and processing
4. Get Knowledge about Protein structures
5. Understand Cloud-based Biological Data formats

Unit 1: Sequence Submission Tools- Introduction, relational database, motivation of biological database; Central dogma of life - Submission of sequences to the database, sequence formats, Interconversion of molecular sequences.

Unit 2: Biological Data Integration and Mining -General data integration; Major areas in biological data integration; Biological data miningGeneral and biological data mining; Case study of biological pattern discovery, Case study in biological data mining.

Unit 3: Nucleotide and Protein Sequence Databases - European molecular biology laboratory (EMBL), NCBI GenBank DNA Data Bank of Japan (DDBJ), Genes and genetic disorders: COSMIC, Clinvar - SNP database (DbSNP), UniProt Knowledgebase - SwissProt and TrEMBL - Protein Information Resource (PIR).

Unit 4 Protein Structure Databases -Protein data bank (PDB), SCOP - Structural classification of proteins, CATH – Protein structure classification database.

Unit 5 Cloud-based Biological Data Processing -Biological data processing in general, data processing in the cloud; Role of cloud computing in handling the huge biological data.

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Book(s)

Bioinformatics Database Systems, By Kevin Byron, Katherine G. Herbert, Jason T. L. Wang, 2017, 1st Edition, CRC Press, USA.

Reference Books

1. Biological Database Modeling 1st Edition, by Jake Chen, Amandeep S., Amandeep S, Sidhu, 2012, Artech House Publishers, UK.
2. Bioinformatics: Methods and Applications, by Dev Bukhsh Singh, Rajesh Kumar Pathak, 1st Edition, 2021, Oxford, UK.

Course Outcomes: Upon completion of this course, students will be able to:

1. Discuss concepts of biological data and database creations
2. Infer the process of biological data integration and mining
3. Distinguish among biomolecular sequence databases and structural databases
4. Identify various databases employed to determine protein functions, interactions and pathways
5. Correlate genomic and transcriptomic databases with microarray data

Year: I

GENERIC ELECTIVE COURSE 1
3. Digital Marketing Analytics

Semester: I

Code:

Credits: 3

Course Objectives

After completing this course, students will be able to:

1. Introduce the fundamentals of digital marketing and online business ecosystems.
2. Develop understanding of digital marketing channels and strategies.
3. Enable students to analyze marketing data using analytical tools.
4. Provide knowledge of SEO, SEM, social media analytics, and web analytics.
5. Equip learners with data-driven decision-making in marketing.

Unit I: Introduction to Digital Marketing: Basics of Digital Marketing -Traditional vs Digital Marketing -Digital Marketing Ecosystem -Customer Journey and Funnel -Digital Marketing Metrics

Unit II: Search Engine Optimization (SEO) and Search Engine Marketing (SEM)
Introduction to SEO - On-page and Off-page SEO -Keyword Research -Google Algorithms Basics -SEM and Google Ads -PPC Campaigns

Unit III: Social Media Marketing and Analytics- Social Media Platforms Overview
Content Marketing Strategies - Facebook, Instagram, LinkedIn Marketing
Social Media Metrics (Engagement, Reach, CTR) -Influencer Marketing
Social Media Analytics Tools

Unit IV: Web Analytics - Introduction to Web Analytics - Google Analytics Basics
Traffic Sources and User Behavior -Bounce Rate, Conversion Rate -Goal Tracking and Funnels -Dashboard Reporting

Unit V: Data-Driven Marketing and Tools - Marketing Analytics Concepts
A/B Testing - Customer Segmentation - CRM and Marketing Automation
Introduction to AI in Marketing -Tools: Google Analytics, SEMrush, HubSpot

Unit - VI Current Contours (For continuous internal assessment only):
Contemporary Developments Related to the Course during the Semester Concerned

Text Books

1. Digital Marketing: Strategy, Implementation and Practice is a leading academic and professional textbook by Dave Chaffey and Fiona Ellis-Chadwick. Published by Pearson Education,
2. Social Media Marketing Workbook is a business and marketing guidebook by Jason McDonal
3. Marketing Analytics, Mike Grigsby, Publisher: Kogan Page, 2015
4. Digital Marketing for Dummies is a practical business guide by Ryan Deiss and Russ Henneberry, published by Wiley's

Reference Books

1. Google Analytics Breakthrough
2. Social Media Marketing Workbook
3. SEO 2024

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO1: Explain the concepts and evolution of digital marketing and analytics.

CO2: Analyze consumer behavior using digital platforms and data.

CO3: Apply SEO and SEM techniques to improve online visibility.

CO4: Evaluate social media marketing campaigns using analytics tools.

CO5: Design data-driven digital marketing strategies for business growth.

Year: I

Skill Enhancement Course - I
ETHICAL HACKING

Semester: I

Code:

(SEC - 1)

Credits: 2

COURSE OBJECTIVES: At the end of the course the student will be able to:

1. Assurance of changing point of view towards a computer and its security
2. Student get trained about hacking methodology.
3. Understand Hacking Operating systems
4. Get knowledge about hacking network hosts
5. Understand the hacking applications

UNIT 1 Introduction to Ethical Hacking: Cracking the Hacker mindset- Developing Ethical Hacking plan- Hacking Methodology.

UNIT 2 Putting security testing in motion : Information Gathering- Gathering public Information Mapping Network- Social Engineering- Physical security- Passwords.

UNIT 3 Hacking Network hosts : Network Infrastructure Systems- Wireless Networks- Mobile devices.

UNIT 4 Hacking Operating systems- Windows- Linux

UNIT 5 Hacking Applications - Communication and Messaging System - Web Application and Mobile Apps- Databases and storage systems.

Text books:

1. Kevin Beaver, (2012), "Hacking For Dummies", John Wiley & Sons.
2. Rajat Khare, (2006), "Network Security and Ethical Hacking", Luniver Press.
3. Kimberly Graves, (2010), "Certified Ethical Hacker", Wiley India Pvt Ltd.
4. Thomas Mathew, (2003), "Ethical Hacking", OSB publishers.
5. Ramachandran V, (2011), "BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.). Packt Publishing.

References: 1. Michael T. Simpson, (2010), "Hands-on Ethical Hacking & Network Defence", Course Technology. 2. Rajat Khare, (2006), "Network Security and Ethical Hacking", Luniver Press. 3. Certified Ethical Hacker, Version 9, Second Edition, Michael Gregg, Pearson IT Certification 4. Hein Smith and Hilary Morrison, (2018), "Ethical Hacking: A Comprehensive Beginner's Guide to Learn and Master Ethical hacking". 5. Zaid Sabih (2018), "Learn Ethical Hacking from Scratch: Your Stepping Stone to Penetration Testing".

Web resources:

1. <https://hackaday.com/>
2. <https://breakthesecurity.cysecurity.org/>
3. <https://www.eccouncil.org/programs/certified-ethical-hacker-ceh/>
4. <https://www.hackthissite.org/> 5. <http://www.udemy.com/>

COURSE OUTCOMES: Upon successful completion of this Course, the student will be able to

- 1 Describe and understand the basics of ethical hacking
- 2 Explain social engineering and host reconnaissance.
- 3 Analyses the network infrastructure system and avoid the hacking network hosts.
- 4 Examine the hacking of windows and Linux operating system.
- 5 Learn the hacking applications in mobile apps, database storage systems.

Year: I

VALUE ADDED COURSE – 1
Web Development
(VAC - 1)

Semester: I

Code:

Credits: 2

COURSE OBJECTIVE: At the end of the course the student will be able to:□

1. Introduce the core concepts of the World Wide Web and web technologies.
2. Design structured and styled web pages using HTML5 and CSS based on semantic principles and best practices.
3. Familiarize students with interactive behavior using JavaScript to enhance user experience. □
4. Teach basic principles of responsive and accessible web design. □
5. Introduce the process of web hosting and domain fundamentals using modern platforms. □
6. Encourage practical problem-solving and hands-on webpage creation.

Unit I Introduction to Web & HTML5 Internet vs. Web-Working of the Web – Client, Server, DNS, HTTP/HTTPS Introduction to HTML5-HTML Elements: Tags, Attributes, Lists, Tables, Forms, Media Embeds-Semantic HTML and Best Practices.

Unit II Styling with CSS3: Introduction to CSS: Inline, Internal, External-CSS Selectors and Properties-Colors, Fonts, Backgrounds, Borders, Box Model-Flexbox and Grid Layout-CSS Media Queries for Responsiveness.

Unit III JavaScript for Web Interactivity: Basics of JavaScript: Syntax, Variables, Operators, Data Types-Conditional Statements and Loops- Functions and Events-DOM Manipulation (getElementById, innerHTML)- Form Validation Basics

Unit IV Responsive and Accessible Web Design: Introduction to Responsive Design-Mobile-First Approach-Viewport and Breakpoints Accessibility Guidelines (WCAG), Alt Text, ARIA Roles-Introduction to Bootstrap Framework

Unit V Web Publishing & Tools: Introduction to Web Hosting and Domain Registration-Git & GitHub Basics-Hosting on GitHub Pages or Netlify-Introduction to Browser Developer Tools-Web Design Tools: Canva, Figma (Basic overview).

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

TEXT BOOKS:

1. Jon Duckett, “HTML and CSS: Design and Build Websites”, Wiley, 2021.
2. Jennifer Robbins, “Learning Web Design: A Beginner's Guide” , 5th Edition, O'Reilly Media, 2022.
3. Terry Felke-Morris, “Web Development with HTML5, CSS, JavaScript” , Pearson, 2021.

4. Ben Frain, “Responsive Web Design with HTML5 and CSS” , 4th Edition, Packt Publishing, 2023
5. David Flanagan, “JavaScript: The Definitive Guide” , 7th Edition, O’Reilly Media, 2020

REFERENCE BOOKS:

1. Zak Ruvalcaba and Anne Boehm, Mike Murach & Associates, “Murach’s HTML5 and CSS3” , 2021
2. Cay S. Horstmann, “Modern JavaScript for the Impatient”, Addison-Wesley, 2021.
3. Jonathan Fielding, “Beginning Responsive Web Design with HTML5 and CSS3”, Apress, 2020.

WEB REFERENCES:

1. <https://developer.mozilla.org/> (MDN Web Docs)
2. <https://www.w3schools.com/>
3. <https://css-tricks.com/>
4. <https://www.freecodecamp.org/>
5. <https://web.dev/> (by Google)

COURSE OUTCOME Upon completion of the course, students will be able to:

1. Describe the functioning of the web, client-server models, and browsers.
2. Develop structured web pages using HTML5.
3. Apply CSS to design visually appealing and responsive layouts.
- 4 Demonstrate interactivity using basic JavaScript functions and events.
- 5 Create accessible web content compatible with different devices.

Year: I

CORE COURSE 3
Machine Learning
(Theory)

Semester:II

Code:

Credits:4

Objectives of the course :

After completing this course, students will be able to:

1. Understand the basic concepts and techniques of Machine Learning and to develop skills of using recent machine learning software for solving practical problems.
2. Apply different techniques of machine learning to real time problems
3. Understand Tree models
4. Apply Distance-based Models
5. Understand the roles of feature engineering

Unit 1:The Fundamentals of Machine Learning: The Machine Learning Landscape - Types of Machine Learning Systems - Main Challenges of Machine Learning - Testing and Validating. End-to-End Machine Learning Project - Look at the Big Picture - Get the Data - Discover and Visualize the Data to Gain Insights - Prepare the Data for Machine Learning Algorithms - Select and Train a Model - Fine-Tune Your Model - Launch, Monitor, and Maintain Your System.

Unit 2: Ingredients of machine learning: Tasks – Models – Features. Supervised Learning: Classification – Binary classification and related tasks – Scoring and ranking – class probability estimation – Multi-class classification. Unsupervised Learning: Regression – Unsupervised and descriptive learning. Concept Learning: The hypothesis space – paths through the hypothesis space – beyond conjunctive concepts – learnability.

Unit 3: Tree Models: Decision trees – Ranking and probability estimation trees – tree learning as variance reduction. Rule Models: Learning ordered rule lists – learning unordered rule sets – descriptive rule learning – first-order rule learning. Linear Models: The least-squares method – The perceptron – Support vector machines.

Unit 4: Distance-based Models: Neighbours and exemplars – Nearest-neighbour classification – Distance-based clustering – K-Means algorithm – Hierarchical clustering. Probabilistic Models: The normal distribution and its geometric interpretations – probabilistic models for categorical data – Naïve Bayes model for classification – probabilistic models with hidden values – Expectation-Maximization.

Unit 5: Features: Kinds of features – Feature transformations – Feature construction and selection. Model ensembles: Bagging and random forests – Boosting – Mapping the ensemble landscape. Machine Learning experiments: What to measure – How to measure it – How to interpret it.

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Books:

1. Flach, P, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, 2012
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", First Edition, 2017 (Chapters 1 and 2)

References

1. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy, "Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies", The MIT Press, First Edition, 2012
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
3. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014
4. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997
5. Stephen Marsland, "Machine Learning - An Algorithmic Perspective", Chapman and Hall/CRC Press, Second Edition, 2014.

Course Outcome:

After successful completion of this course, the students will be able to

1. Recognize the characteristics of Machine Learning techniques that enable to solve real world problems
2. Recognize the characteristics of machine learning strategies
3. Apply various supervised learning methods to appropriate problems
4. Identify and integrate more than one technique to enhance the performance of learning
5. Understand the feature engineering

Year: I

CORE COURSE 4
Automata Theory and Compiler Design
(Theory)

Semester:II

Code:

Credits:4

Course Outcomes: At the end of the Course the student shall be able to

- 1: Understand finite state machines for modelling and their power to recognize the languages.
- 2: Summarize the concept of Regular languages and context free languages
- 3: Understand the phases of Compilers
- 4: Build the Intermediate Codes
- 5: Build the Intermediate Representations

Unit-I : Fundamentals: Formal Languages, Strings, Alphabets, Languages, Chomsky Hierarchy of languages. Finite Automata: Introduction to Finite State machine, Acceptance of strings and languages, Deterministic finite automaton (DFA) and Non-deterministic finite automaton (NFA), Equivalence of NFA and DFA – Equivalence of NDFAs with and without ϵ -moves, Minimization of finite automata, Equivalence between two DFA's, Finite automata with output

Unit-II : Regular Languages: Regular expressions, Identity rules, Conversion of a given regular expression into a finite automaton, Conversion of finite automata into a regular expression, Pumping lemma for regular sets, Closure properties of regular sets .Context Free Grammars: Context free grammars and languages, Derivation trees, Leftmost and rightmost derivation of strings and Sentential forms, Ambiguity, left recursion and left factoring in context free grammars

Unit-III: Introduction To Compiling: Overview of Compilers, Phases of a Compiler. Lexical Analysis: The Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, A language for specifying Lexical Analyzers(LEX). Syntax Analysis: The role of the Parser, First and Follow, Predictive Parsing, LR Parsers-SLR, Canonical LR, LALR, Parser Generator(YACC).

Unit IV :Intermediate Code Generation- Intermediate languages – Declarations – Assignment Statements – Boolean Expressions – Case Statements – Back patching – Procedure calls.

Unit – V: Code Optimization and Run Time Environments- Introduction– Principal Sources of Optimization – Optimization of basic Blocks – DAG representation of Basic Blocks. Code Generation- Issues in the design of code generator – The target machine – Runtime Storage management – Basic Blocks and Flow Graphs – Peephole Optimization.

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Course Outcomes:

After successful completion of this course, the students will be able to

1. Describe about Finite Automata Model
2. Know Regular Sets and Regular Expressions
3. Comprehend the phases of a compiler and its functionalities

4. Understand graphical representations in intermediate code generation
5. Understand the representations of three address codes.

TEXT BOOKS:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, “Introduction to Automata Theory Languages and Computation”, 3rd Edition, Pearson Education, 2011.
2. Alfred Aho, Monica S Lam, Ravi Sethi, Jeffrey D.Ullman, “Compilers- Principles Techniques and Tool”, 2 nd Edition, Pearson Education India, 2013.

REFERENCE BOOKS:

1. Peter Linz, “ An introduction to Formal Languages and Automata”, 6th Edition, Jones & Bartlett, 2016
 2. V.Raghavan, “Principles of Compiler Design”, 1st Edition, McGrawHill Education, 2017.
 3. Mishra and Chandrashekar, “Theory of Computer Science – Automata Languages and Computation”, 3rd Edition, PHI, 2009
 4. K.V.N.Sunitha , N.Kalyani, “Formal Languages and Automata Theory”, 1st Edition, TMH, 2010
- Michel Sipser, “Introduction to Theory of Computation”, 2nd Edition, Thomson, 2012

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_cs79/preview

Year: I

CORE PRACTICAL 2
Machine Learning Lab
(Practical)

Semester:II

Code:

Credits:2

1. Data Preprocessing Activities:

a. Data Cleaning b. Data Transformation c. Data Reduction d. Feature extraction.

2. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets

3. Calculate the accuracy, precision, and recall for your data set.

4. Write a program to implement k-Nearest Neighbor algorithm to classify the iris. print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

5. Write a program to implement Logistic Regression algorithm to classify the housing price data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

6. Write a program to implement and compare SVM, KNN and Logistic regression algorithm to classify the iPhone purchase records data set. Print both correct and wrong predictions. Java/ Python ML library classes can be used for this problem

Year: I

DISCIPLINE CENTRIC ELECTIVE COURSE 2

Semester:II

1. Advanced PYTHON Programming

Code:

(Theory)

Credits: 4

Course Objectives : At the end of the Course the student shall be able to,

1. Understand the concepts of Machine Learning.
2. Understand complexity of Machine Learning algorithms and their limitations.
3. Understand various features of Python language.
4. Implement various packages of python library.
5. Perform experiments in machine learning on real-world data using python.

Unit-I Introduction to Python: Installing python, Data types, Basic operators, Strings, Lists, Tuple, Sets, Dictionary, Control structures, Functions, Modules, File Input/Output, Exception handling.

Unit-II Introduction to Machine Learning - Introduction, Types of machine learning: supervised, unsupervised, semi-supervised reinforcement learning, Batch learning and Online learning, Machine learning model, Steps in the design of learning system, Challenges in machine learning, Applications of machine learning. Machine learning python packages: NumPy, Pandas, Matplotlib, Scikit Learn

Unit-III Classification- Labelled data, Introduction to classification and its types, Statistical summary of data, Data preprocessing, Normalization, Training and Testing, Cross Validation, Steps in building a classifier in python. Classification algorithms: K-nearest neighbor, Support vector machine, Decision tree, Classification evaluation metrics etc.,

Unit-IV Feature Selection and Clustering Feature Selection: Introduction and its importance, Feature selection techniques, Principal component analysis. Unlabeled data, Introduction to clustering and its applications, Cluster formation methods, means algorithm, Hierarchical clustering, etc.

Unit-V Model Diagnosis and Tuning - Overfitting, Underfitting, Bias and Variance, Imbalanced dataset and its handling, Hyperparameter tuning, Ensemble methods: Bagging and Boosting, Ensemble voting.

Unit - VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Books:

1. Manohar Swamynathan "Mastering Machine Learning with Python in Six Steps", Apress, ISBN-13 (pbk): 978-1-4842-2865-4, ISBN-13 (electronic): 978-1-4842-2866-1
2. Machine Learning, "A Probabilistic Perspective", MIT Press, 2012 by Kevin Murphy. Shai Shalev-Shwartz, Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms".

References:

1. Mark Summerfield, "Programming in python : A Complete Introduction to Python Programming". Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", 2009 .

Web Resources:

1. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
2. <https://www.tutorialspoint.com/python/index.htm>

Course Outcomes : After successful completion of this course, the students will be able to

- 1: Demonstrate proficiency in advanced Python programming concepts, including modules, packages, decorators, generators, iterators and exception handling.
- 2: Design and develop efficient, modular, and reusable Python applications using object-oriented programming principles.
- 3: Apply advanced data structures, file handling techniques, and regular expressions to solve complex computational problems.
- 4: Utilize Python libraries and frameworks for data processing, scientific computing, and automation tasks.
- 5: Implement data analysis and visualization solutions using popular Python libraries such as NumPy, Pandas and Matplotlib.

Year: I

DISCIPLINE CENTRIC ELECTIVE (P) 2
1. Advanced PYTHON Programming Lab
(Practical)

Semester:II

Code:

Credits: 2

1. Perform data preprocessing tasks such as handling missing values, encoding categorical variables, and scaling numerical features. Visualize data distributions, correlations, and relationships using Pandas and Matplotlib libraries.
2. Implement a simple linear regression model using scikit-learn to predict a continuous target variable. Visualize the regression line and residuals to assess model performance.
3. Implement and compare different classification algorithms (e.g., logistic regression, KNN, decision trees) using scikit-learn.
4. Apply the K-Means clustering algorithm to group data points into clusters based on similarity. Visualize clusters and centroids to interpret clustering results.
5. Perform dimensionality reduction using Principal Component Analysis (PCA) to reduce the number of features in a dataset.
6. Implement a Support Vector Machine (S V M) classifier for both linear and non-linear datasets.
7. Build and train a simple artificial neural network (ANN) using Keras and TensorFlow backend.
8. Implement a Convolutional Neural Network (CNN) architecture using Keras for image classification tasks (e.g., MNIST, CIFAR-10).
9. Evaluate CNN performance on test data and visualize feature maps and filters

Year: I

DISCIPLINE CENTRIC ELECTIVE COURSE 2

Semester:II

2. Blockchain Technology

Code:

(Theory)

Credits: 4

Course Objectives: At the end of the Course the student shall be able to,

1. Understand the strong technical knowledge of Blockchain technologies.
2. Analyzing the blockchain decentralization and cryptography concepts.
3. Explore the driving force behind the cryptocurrency Bitcoin, along with the Decentralization.
4. Formulate alternate coins
5. Analyze smart contracts

Unit-1 Blockchain : Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

Unit-2 Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys

Unit-3 Bitcoin and Alternative Coins: A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash

Unit-4 Smart Contracts and Ethereum: Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.

Unit-5 Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Books:

Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016
Reference Books:

Blockchain Basics: A Non-Technical Introduction in 25 Steps, Daniel Drescher, Apress, First Edition, 2017

Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

Web links and Video Lectures (e-Resources):

<https://nptel.ac.in/courses/106105184>

<https://ocw.mit.edu/courses/15-s12-blockchain-and-money-fall>

018/video_galleries/video-lectures/

Course outcomes:

At the end of the course the student will be able to :

- 1 Explore the emerging abstract models for Blockchain Technology and to familiarise with the functional/operational concepts.
2. Understand Cryptography
- 3 Analyze the various consensus mechanisms, applications, research challenges and future directions
- 4 Practical implementation of Blockchain operations and solutions using Ethereum
5. Explore alternate bitcoins

Year: I

DISCIPLINE CENTRIC ELECTIVE (P) 2

Semester:II

2. Block Chain Technology Lab

Code:

(Practical)

Credits: 2

1. Design and develop Cryptocurrency.
2. Write and deploy chain code in Hyperledger Fabric
3. Create your own wallet using Metamask for crypto transactions.
4. Write a smart contract on a test network, for Bank account of a customer for following operations: (i). Deposit money (ii) Withdraw Money (iii) Show balance
5. Write a program to create a Business Network using Hyperledger
6. Develop a Blockchain based application for health related medical records

Year: I

GENERIC ELECTIVE COURSE 2

Semester:II

1. Probability and Statistics

Code:

Credits:3

Course Objectives: At the end of the Course the student shall be able to

- 1.Understand the fundamental concepts of probability and statistics and their role in data analysis and decision-making.
- 2.Apply probability theories and distributions to model uncertainty and solve real-world problems.
- 3.Analyze and summarize data using descriptive statistical measures and graphical techniques.
- 4.Perform statistical inference, including estimation and hypothesis testing, to draw conclusions from sample data.
- 5.Understand random variables and probability distributions and apply them in engineering, science, and computing applications.

Unit I: Introduction - Combinatorial methods- Principles of counting - Permutation - Combination - Binomial theorem- problems.

Unit II: Probability : Classical - relative frequency and axiomatic definitions of probability - addition rule and conditional probability - multiplication rule - total probability - Bayes' Theorem and independence - problems.

Unit - III: Random Variables: Discrete - continuous random variables - probability mass - probability density and cumulative distribution functions - mathematical expectation - Variance- Moments - Joint Distribution: Joint - marginal and conditional distribution - correlation - problems.

Unit - IV: Special Distributions: Discrete uniform - binomial - geometric - negative binomial - Poisson - continuous uniform - exponential - Normal Distribution. Sampling Distribution: The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-square, T and F distributions, problems

Unit - V: Testing of Hypotheses: Null and alternative hypotheses, the critical regions, two types of error, level of significance, power of the test, tests for mean for one sample and two sample problems from normal populations, Tests for single mean, difference of means using T, paired T test.

Unit - VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Book(s):

Gupta, S.C. and Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand and Sons, Tenth Edition, 2000.

Reference Book(s):

1. Irwin Miller and Marlyees Miller, John E Freund's Mathematical Statistics with Applications, PHI Learning, Eight Edition, 2012.

2. S.M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Elsevier, Fourth Edition

Course Outcomes: Upon successful completion of the course, students will be able to:

- 1: Understand the fundamental concepts of probability, random variables, and probability distributions.
- 2: Organize, summarize, and interpret data using descriptive statistical measures and graphical representations.
- 3: Apply probability laws and distributions to solve problems involving uncertainty and risk.
- 4: Conduct hypothesis testing and draw valid conclusions from sample data.
- 5: Analyze relationships between variables using correlation and regression techniques

2. Design Thinking**Code:****Credits:3****Course Objectives:** At the end of the course, students will be able to

1. Understand the design thinking fundamental concepts
2. Know about different phases of Design Thinking
3. Apply theoretical knowledge to Design thinking
4. Formulate Design Thinking Methods
5. Design Prototype Exploration map

Unit 1: Introduction To Design Thinking: Introduction to Design Thinking for Engineers, Essential Design Thinking Skills, Core Principles of Design Thinking, Foundations of Design Thinking, Building an Effective Design Thinking Team, Discussion of Problems from IT sector.**Unit II :Design Thinking Phases:** Stages of Design Thinking, Role of observation in understanding product and process challenges, Preparation of AEIOU and other canvases with defined problem statement, Exploring Design Thinking in Innovation- Understanding the Role of Design Thinking in Product and Process Innovation, Differentiating Engineering Design and Design Thinking, Double Diamond model and its application.**Unit III : Design Thinking Techniques:** Understanding, Listening and Empathizing Techniques, Exploring observation methods, Utilizing a structured, open-ended approach for effective communication, Ideation Tools, Brainstorming techniques for idea generation, Applying innovation to foster creativity, Application of SCAMPER Technique to an approved Problem Statement; Prototyping- Creating low-fidelity and high-fidelity prototypes, Testing of Prototype.**Unit IV:Design Thinking Methods:** Methods and Tools for Design Thinking Practice; Empathize: Ask five why questions, Empathy map, storytelling, critical items diagram, mind map, journey map; Ideate: Brainstorming, 2X2 matrix, NeedApproach-Benefit-Competition (NABC) Methods;**Unit V :Prototype Exploration map:** Minimum Viable Product (MVP), Feasibility Testing, Viability Testing, A/B Testing, Sustainability Testing, Collect Feedback, Iterate and Improve the ideas; PDC canvas verification.**Unit – VI Current Contours** (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned**Text Books**

- 1 Soni, Pavan. Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problemsolving. Penguin Random House India Private Limited, 2020.
- 2 Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins e-books (2009).
- 3 Liedtka, Jeanne, Randy Salzman, and Daisy Azer. Design thinking for the greater good: Innovation in the social sector. Columbia University Press, 2019.

4 Lockwood, Thomas. Design thinking: Integrating innovation, customer experience, and brand value. Simon and Schuster, Allworth Press, 2010.

Course Outcomes: Upon successful completion of the course, students will be able to:

1 Understand the fundamental principles and importance of Design Thinking in fostering innovation, ethics and its relevance in engineering.

2 Apply systematic problem identification, problem framing, articulation, and problem-solving approaches in the context of Design Thinking.

3 Analyze and evaluate different tools and methodologies used in Design Thinking, such as observation, ethnographic research and mind mapping to gain insights into users' needs.

4 Develop and refine product concepts by preparing product development canvases (PDC) that consider product experience, functions, features, and sustainable development of the components.

5 Create a final working prototype for projects with limitations, documenting the Functionality and Features, Viability, Impact, Sustainability, Scalability, Cost and Resource Utilization for the product

Year: I

GENERIC ELECTIVE COURSE 2
3. Research Methodology and IPR

Semester:II

Code:

Credits:3

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

1. Understand the knowledge on basics of research and its types.
2. Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
3. Learn Ethics in Engineering Research.
4. Acquire the concepts of Intellectual Property Rights in engineering
5. Understand procedure for Copyrights

Unit 1 Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.

Unit-2 :Literature Review and Technical Reading: New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet. Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.

Unit-3 Introduction To Intellectual Property: Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India. Patents: Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting. Process of Patenting. Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Commercialization of a Patent. Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models.

Unit 4:Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word

'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC).

Unit-5: Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Course Outcomes: Upon successful completion of the course, students will be able to:

1. Know the meaning of engineering research.
2. Know the procedure of the literature Review and Technical Reading
3. Understand the fundamentals of the patent laws and drafting procedure CO4.
4. Understanding the copyright laws and subject matters of copyrights and designs
5. Understanding the basic principles of design rights

Textbook

1. Dr. Santosh M Nejakar, Dr. Harish Bendigeri "Research Methodology and Intellectual Property Rights", ISBN 978-93-5987-928-4, Edition: 2023-24. Reference Book:
2. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488

Year: I

Skill Enhancement Course - II

Semester: II

Soft Skills

Code:

(SEC - 2)

Credits: 2

Course Objectives: □ At the end of the course the student will be able to:

1. Develop communicative competence among the Students. □
2. Enhance the learner's soft skills by giving adequate exposure in LSRW and sub skills. □
3. Apply Interpersonal skills
4. Develop Corporate skills
5. Enable learners to put the life skills into practice with confidence.

UNIT- I KNOW THYSELF / UNDERSTANDING SELF: Introduction to Soft skills- Self discovery-Developing positive attitude-Improving perceptions- Forming values.

UNIT -II INTERPERSONAL SKILLS/ UNDERSTANDING OTHERS: Developing interpersonal relationship-Team building-group dynamics-Net working- Improved work relationship

UNIT -III COMMUNICATION SKILLS / COMMUNICATION WITH OTHERS: Art of listening –Art of reading –Art of speaking –Art of writing-Art of writing e-mails e mail etiquette.

UNIT- IV CORPORATE SKILLS / WORKING WITH OTHERS : Oral Presentation – Memos- Note taking - Note making and preparing Minutes- Reports, Proposals, Abstracts - Technical Writing.

UNIT -V SELLING SELF / JOB HUNTING Writing resume/cv-interview skills- Group discussion- Mock interview-Mock GD – Goal setting - Career planning

UNIT - VI: CURRENT CONTOURS: (for continuous internal assessment only):

Text Books:

1. Meena.K and V.Ayothi (2013) A Book on Development of Soft Skills (Soft Skills : A Road Map to Success), P.R. Publishers
2. N. Krishnasamy, Manju Dhariwel and Lalitha Krishnasamy(2015). Mastering Communication Skills and Soft Skills – Bloomburg.
3. Meera Banerjee and Krishna Mohan: Developing Communication Skills, Trinity Publishers- (Lakshmi Publications.
4. Alex K. (2012) Soft Skills – Know Yourself & Know the World, S.Chand & Company LTD, Ram Nagar, New Delhi- 110 055.

COURSE OUTCOMES:

Upon successful completion of this Course, the student will be able to

1. Develop listening, speaking, reading and writing skills in English. □
2. Enhance soft skills and engage in a range of communicative tasks and activities
3. Comprehend a text and identify specific and global information □
4. Promote communicative ability in both spoken and written form of the language
5. Develop corporate skills to promote leadership qualities and team spirit

Year: II

CORE COURSE 5

Semester:III

Advanced Database Management Systems

Code:

(Theory)

Credits:4

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

1. Identify relational model
2. Apply query, transaction processing & concurrency control
3. Explore recovery and security mechanism
4. Get Knowledge about parallel and distributed databases
5. Understand emerging database technologies

Unit I - THE RELATIONAL MODEL OF DATA AND DATABASE DESIGN :

Structure of Relational Database – Relational Algebra – Relational Query Languages: Introduction – SQL – ER Model : Basic ER Concepts – ER Diagram Symbols – Enhanced Entity Relationship Model(EER) : Specialization and Generalization. DBLC - Functional Dependency Diagram and Examples – Lossy Decomposition-Lossless-join Decomposition. Normalization: Boyce-Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

Unit II - QUERY, TRANSACTION PROCESSING & CONCURRENCY CONTROL

Query Processing – Syntax Analyzer – Query Decomposition and Optimization – Cost Estimation in Query Optimization – Pipelining and Materialization – Structure of Query Evaluation Plans – Transaction Processing and Concurrency Control – Transaction Concepts – Concurrency Control Locking Methods for Concurrency Control.

Unit III- RECOVERY AND SECURITY : Database Recovery Concepts – Types of Database Failures – Types of Database Recovery – Recovery Techniques – Buffer Management – Database Security – Goals of Database Security – Discretionary Access Control – Mandatory Access Control – Firewalls – Statistical Database Security – Data Encryption

Unit IV - PARALLEL AND DISTRIBUTED DATABASES- Parallel Database Systems: Introduction – Parallel Databases – Architecture – Key Elements of Parallel Database Processing – Query Parallelism. Distributed Database Systems: Introduction – Distributed Databases – Architecture – Distributed Database System Design – Distributed Query Processing – Concurrency Control – Recovery Control

Unit V -EMERGING DATABASE TECHNOLOGIES - Data Warehousing: Evolution-Main Components-Characteristics-Benefits-Limitations-Architecture. Data Mining: Process Knowledge Discovery Goals-Tools-Applications-Object Oriented database concepts; Object Relational database concepts; Active database concepts; Temporal database concepts; Spatial database concepts and architecture; Deductive databases and Query processing; Mobile Databases; Geographic Information Systems.

Unit - VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Books:

Singh. S. K,(2006), “Database Systems” Concepts, Design and Applications, Pearson Education Publications, New Delhi, Singh.

Raghu Ramakrishnan, Johannes Gehrke, (2004) Database Management Systems, McGraw-Hill

Course Outcomes: Upon successful completion of the course, students will be able to:

1. Understand the fundamental concepts and principles of the Database Management Systems
2. Apply theoretical knowledge to solve practical problems.
3. Comprehend Database Recovery Concepts
4. Understand parallel and distributed databases
5. Understand emerging database technologies

Year: II

CORE COURSE 6
Quantum Computing Fundamentals
(Theory)

Semester: III

Code:

Credits: 4

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

1. Identify the differences between Quantum Computing and conventional computing
2. Understand the different quantum computing mechanics.
3. Know the indepth of quantum computation theory.
4. Understand Quantum algorithms, and their advantages over classical algorithms.
5. Get the knowledge about quantum cryptography

Unit-I: INTRODUCTION OF QUANTUM COMPUTING AND OVERVIEW :History of quantum computation and quantum information, Quantum bits, Multiple qubits, Quantum computation, Single qubit gates, Multiple qubit gates, Measurements in bases other than the computational basis, Quantum circuits, Qubit copying circuit.

Unit-II: Quantum Circuits: Quantum Algorithms – Classical computations on a quantum computer, Quantum parallelism, Deutsch’s algorithm, The Deutsch-Jozsa algorithm-Universal Quantum Gates – Quantum Circuit Model of Computation – Simulation – Quantum Fourier Transform and Applications – Quantum Search Algorithms – Quantum Computers.

Unit - III: QUANTUM INFORMATION - Quantum Noise and Quantum Operations: Classical Noise and Markov processes – Quantum Operations – Examples – Applications – Distance Measures for Quantum Information – Quantum Error Correction – Entrop.

Unit-IV: QUANTUM ERROR-CORRECTION - The three-qubit bit flip code, the Three-qubit phase flip code, The Shor code, the Theory of quantum error correction Discretization of the errors, Independent error models, Degenerate codes, The quantum Hamming bound.

Unit-V: QUANTUM CRYPTOGRAPHY :Private key cryptography, Privacy amplification and information reconciliation, Quantum key distribution, Privacy, and coherent information, and security of quantum key distribution.

Unit - VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

TEXT BOOKS:

Nielsen and Chuang, Quantum Computation and Quantum Information, 10th Anniversary Edition, Cambridge University Press, 2010.

Wong, H. Y. (2024). Introduction to quantum computing: From a layperson to a programmer in 30 steps (2nd ed.)

REFERENCE BOOKS:

Scott Aaronson, “Quantum Computing since Democritus”, Cambridge, 2013.

Riley Tipton Perry, “Quantum Computing from the Ground Up”, World Scientific Publishing Ltd 2012.

V.K Sahni, Quantum Computing (with CD), TATA McGraw-Hill, 2007.

Thapliyal, H., & Humble, T. (Eds.). (2024). Quantum computing: Circuits, systems, automation and applications

□ Hidary, J. D. (2021). Quantum computing: An applied approach (2nd ed.).

WEB REFERENCES:

<https://fivebooks.com/best-books/quantum-computing-chris-bernhardt/>

<https://philpapers.org/browse/quantum-computation>

https://link.springer.com/referenceworkentry/10.1007/978-1-4020-8265-8_1230

<https://www.fi.muni.cz/usr/gruska/qbook1.pdf>

<https://library.oapen.org/handle/20.500.12657/48236>

<https://freecomputerbooks.com/Quantum-Computing-for-the-Quantum-Curious.html>

https://www.open.edu/openlearn/science-maths-technology/introduction-quantum-computing?utm_source=chatgpt.com

https://www.researchgate.net/publication/329818131_Open_source_software_in_quantum_computing?utm_source=chatgpt.com

https://www.reddit.com/r/opensource/comments/1k2cr9e?utm_source=chatgpt.com

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- 1 Analyze the performance of data transmission between the systems using quantum computing algorithms.
- 2 Identify suitable technique to minimize complexity of different computational problems.
- 3 Apply quantum search algorithms of find quantum information for speeding up the solutions of NP-complete problems.
- 4 Apply three-qubit phase flip code & shor code to discretize and correct the errors.
- 5 Identify suitable cryptography algorithms to provide security for quantum information

Year: II

CORE PRACTICAL 3
Advanced Database Management Systems Lab
(Practical)

Semester: III

Code:

Credits:2

1. Create relational database structures for a real-world application.(Identify entities, attributes, and relationships, Define primary keys and foreign keys.)
2. Create tables using SQL DDL commands.
3. Perform the following fundamental relational algebra operations.
Selection (σ) ,Projection (π) ,Union ($\cup$) ,Intersection ($\cap$) ,Difference ($-$) ,Cartesian Product ($\times$),Join ($\bowtie$)
4. Perform the following data retrieval methods
Inner Join
Outer Join
Self Join
Nested Queries
5. Decompose relations into smaller relations. Test lossless join property
Normalize a relation step-by-step.(1NF ,2NF ,3NF ,BCNF)
6. Implement and analyze transaction logging.(Create transaction logs. ,Record database updates and Examine log entries during failures.)
7. Create tables with temporal attributes. (Store valid time and transaction time. Insert historical records.)
8. Retrieve data based on time periods. (Current records, Historical records, Time-range queries)

Year: II

Discipline centric elective course 3

Semester: III

1. FULL STACK DEVELOPMENT

Code:

(Theory)

Credits:4

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

1. Familiar to implement fast, efficient, interactive and scalable web applications using run time environment provided by the full stack components.
2. Understand the working principles of Node.js
3. Develop problem-solving skills in MongoDB
4. Demonstrate the use of Angular application
5. Analyze and interpret the React components

Unit-I Introduction to Full Stack Development: Understanding the Basic Web Development Framework- User, Browser, Webserver, Backend Services, Full Stack Components - Node.js, MongoDB, Express, React, Angular. Java Script Fundamentals, NodeJS- Understanding Node.js, Installing Node.js, Working with Node Packages, creating a Node.js Application, Understanding the Node.js Event Model, Adding Work to the Event Queue, Implementing Callbacks

Unit-II Node.js: Working with JSON, Using the Buffer Module to Buffer Data, Using the Stream Module to Stream Data, Accessing the File System from Node.js- Opening, Closing, Writing, Reading Files and other File System Tasks. Implementing HTTP Services in Node.js- Processing URLs, Processing Query Strings and Form Parameters, Understanding Request, Response, and Server Objects, Implementing HTTP Clients and Servers in Node.js, Implementing HTTPS Servers and Clients. Using Additional Node.js Modules-Using the os Module, Using the util Module, Using the dns Module, Using the crypto Module.

Unit-III MongoDB: Need of NoSQL, Understanding MongoDB, MongoDB Data Types, Planning Your Data Model, Building the MongoDB Environment, Administering User Accounts, Configuring Access Control, Administering Databases, Managing Collections, Adding the MongoDB Driver to Node.js, Connecting to MongoDB from Node.js, Understanding the Objects Used in the MongoDB Node.js Driver, Accessing and Manipulating Databases, Accessing and Manipulating Collections

Unit-IV Express and Angular: Getting Started with Express, Configuring Routes, Using Requests Objects, Using Response Objects. Angular: importance of Angular, Understanding Angular, creating a Basic Angular Application, Angular Components, Expressions, Data Binding, Built-in Directives, Custom Directives, Implementing Angular Services in Web Applications.

Unit-V React: Need of React, Simple React Structure, The Virtual DOM, React Components, Introducing React Components, Creating Components in React, Data and Data Flow in React, Rendering and Life Cycle Methods in React, Working with forms in React, integrating third party libraries, Routing in React.

Unit - VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

TEXT BOOKS:

Brad Dayley, Brendan Dayley, Caleb Dayley., Node.js, MongoDB and Angular Web Development, 2nd Edition, Addison-Wesley, 2019.

Mark Tielens Thomas, React in Action, 1st Edition, Manning Publications.

REFERENCE BOOKS:

Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, 2nd Edition, Apress, 2019.

Chris Northwood, The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', 1st edition, Apress, 2018.

Kirupa Chinnathambi, Learning React: A Hands-On Guide to Building Web Applications Using React and Redux, 2nd edition, Addison-Wesley Professional, 2018.

Course Outcomes: After successful completion of the course, students will be able to:

1. Understand Full stack components for developing web application.
2. Apply packages of NodeJS to work with Data, Files, Http Requests and Responses.
3. Use MongoDB data base for storing and processing huge data and connects with NodeJS application.
4. Design faster and effective single page applications using Express and Angular.
5. Create interactive user interfaces with react components

Year: II

DISCIPLINE CENTRIC ELECTIVE (P) 3

Semester: III

1. FULL STACK DEVELOPMENT LAB

Code:

(Practical)

Credits:2

1. Create an application to setup node JS environment and display “Hello World”
2. Write a Node JS program to perform read, write and other operations on a file.
3. Write a Node JS program to read form data from query string and generate response using NodeJS
4. Create a food delivery website where users can order food from a particular restaurant listed in the website for handling http requests and responses using NodeJS.
5. Perform Count, Limit, Sort, and Skip operations on the given collections using MongoDB.
6. Develop a Job Registration form and validate it using angular JS.
7. Write a program to create a simple calculator Application using React JS.
8. Write a program to create a voting application using React JS
9. Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days using react application.
10. Build a music store application using react components and provide routing among the web pages.
11. Create a react application for an online store which consist of registration, login, product information pages and implement routing to navigate through these pages

Year: II

DISCIPLINE CENTRIC ELECTIVE COURSE 3

Semester: III

2. NATURAL LANGUAGE PROCESSING

Code:

(Theory)

Credits: 4

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

1. Understand basic approaches to NLP
2. Analyze the text representation
3. Get knowledge about text classification
4. Build the Chatbots
5. Understand the topic modeling

Unit I : INTRODUCTION TO NLP and NLP Pipeline: Introduction to NLP, Applications of NLP. Basic approaches to NLP -Heuristics based NLP, Machine Learning for NLP, Deep Learning for NLP. NLP Pipeline- Data Acquisition, Text Extraction and Cleanup, Pre-processing, Feature Engineering, Building the model, Evaluation.

Unit II:TEXT REPRESENTATION: Vector space models, Basic Vectorization approaches, Distributed representations, Universal Text Representations.Search and Information Retrieval- Components of Search Engine.

Unit III: TEXT CLASSIFICATION Pipeline for building Text classification systems, One pipeline-many classifiers, Using Neural Embeddings in Text Classification, Deep Learning for Text Classification, Learning with no or less data and adapting to new domains.

Unit IV : INFORMATION EXTRACTION and CHATBOTS: Information Extraction-IE Applications, IE Tasks, General IE Pipeline, Key-Phrase Extraction, Named Entity Recognition, Building an NER System, Relationship Extraction. Chatbots- Applications, Taxonomy of Chatbots, Pipeline for building Dialog Systems

Unit V:Topic Modeling: Text Summarization, Recommender Systems, Machine Translation, Question Answering Systems. NLP for Social Media Data, e-commerce Catalog, Review Analysis

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

TEXTBOOKS:

Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta and Harshit Surana, "Practical Natural Language Processing", O'Reilly Media Inc., 2021, ISBN: 978-93-8588-918-9.

REFERENCE BOOKS:

Daniel Jurafsky and James H Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2009.

C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA, 1999.

James Allen, “Natural Language Understanding”, The Benjamin/Cummings Publishing Company Inc.

ToolkitSteven Bird, Ewan Klein, and Edward Loper, “Natural Language Processing with Python – Analyzing Text with the Natural Language”, 1st Edition, 2009.

WEBREFERENCES:

https://www.tutorialspoint.com/natural_language_processing/natural_language_processing_tutorial.pdf

<http://www.nptelvideos.in/2012/11/natural-languageprocessing.html>

Course Outcomes: At the end of the course the student will be able to:

- 1: Understand the basic concepts of NLP and NLP-Pipeline.
- 2: Understand the Text Representation and Search Engine.
- 3: Apply the Text Classification Techniques.
- 4: Use of Information Extraction and Chatbots.
- 5: Analyze various applications of NLP.

Year: II

DISCIPLINE CENTRIC ELECTIVE (P) 3

Semester: III

2. Natural Language Processing Lab

Code:

(Practical)

Credits: 2

1. Write a program in Python to collect text data using Twitter APIs.
2. Write a program in Python to extract text from PDF file and store it for further analysis.
3. Write a program in Python to read parse/read HTML pages.
4. Write a program in Python for
(I) Standardizing the Text (ii)Tokenizing the Text
(iii) Stemming the Text (iv) Lemmatizing the Text
5. Write a program in Python to replace an emoji with a relevant, meaningful word.
6. Write a program in Python to remove emoticons.
7. Write a program in Python to generate the n-grams for a given sentence.
8. Write a program in Python to convert text to features .
9. Write a program in Python to find the similarity between two texts.
10. Write a program in Python to do a sentiment analysis.

Year: II

Generic elective course 3
1. OPTIMIZATION TECHNIQUES

Semester: III

Code:

Credits: 3

Objectives:

At the end of the course the student will be able to:

1. Understand the fundamental concepts of optimization and their importance in decision-making and resource allocation.
2. Formulate real-world problems as mathematical optimization models involving objective functions and constraints.
3. Apply linear programming techniques to solve optimization problems in engineering, business, and management.
4. Develop skills in solving Genetic algorithm.
5. Apply integer programming and dynamic programming techniques for discrete optimization problems.

Unit - I: Classical Methods & Linear Programming Problems Terminology Introduction to Classical Methods & Linear Programming Problems Terminology: Design Variables – Constraints - Objective Function - Problem Formulation. Calculus method - Kuhn Tucker conditions - Method of Multipliers. Linear Programming Problem - Simplex method - Concept of Duality.

Unit - II: Single Variable Optimization: Problems Optimality Criterion - Bracketing Method - Region Elimination Methods - Interval Halving Method - Fibonacci Search Method - Golden Section Method. Gradient Based Methods: Newton - Raphson Method - Bisection Method - Secant Method - Application to Rootfinding.

Unit - III: Multivariable Optimization Algorithms Optimality: Criteria - Unidirectional Search. Direct Search Methods: Hooke - Jeeves pattern search method - Powell's Conjugate Direction Method. Gradient Based Methods: Cauchy's Steepest Descent Method - Newton's method - Marquardt's Method.

Unit - IV: Advance Optimization Techniques :Quadratics Programming – sequential quadratic programming - Integer Programming - Penalty Function Method - Branch and Bound Method - Geometric Programming.

Unit - V: Dynamic Programming: Genetic algorithm - Problem formulation and application in Design of continuous beam and Optimal geometric layout of a truss - Capacity expansion and Reservoir operation.

Unit - VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Book(s):

1. S. S. Rao: Engineering Optimization: Theory and Practice, New Age International, Third Edition 2013.
2. E. J. Haug and J.S. Arora, Applied Optimal Design: Mechanical and Structural Systems, Wiley, 1979.

Reference Book(s):

1. Kalyanmoy Deb, Optimization for Engineering Design: Algorithms and Examples, Prentice Hall of India, Second Edition, 2012.
2. A. Ravindran and K.M. Ragsdell, G.V. Reklaites, Engineering Optimization: Methods and Applications, Wiley, Second Edition, 2006.

Course Outcomes:

After completing the course, students will be able to:

1. Apply mathematical and computational techniques to optimization problems.
2. Make data-driven decisions for efficient allocation of resources.
3. Model and solve real-world problems arising in industry, logistics, networking, and management.
4. Build a foundation for advanced studies in Operations Research, Artificial Intelligence, Machine Learning, and Data Science.
5. Apply Dynamic Programming concepts

Year: II

GENERIC ELECTIVE COURSE 3

Semester: III

2. Foundations of Cognition and Problem Solving

Code:

Credits:3

Objectives:

At the end of the course the student will be able to:

1. Understand Cognitive Psychology
2. Interpret Perceptual Processes
3. Understand information processing
4. Apply different forms of heuristic techniques
5. Understand different types of thinking

Unit I - Introduction to Cognitive Psychology: Introduction - What Is Cognitive Psychology- Psychology B.C.-Structuralism – Functionalism- Behaviourism - Early Memory Researchers - Gestalt Approach - Emergence of cognitive psychology - Information-Processing: A Computer Metaphor for Cognition: Connectionism, Alternate approaches to cognitive psychology, Research Methods in Cognitive Psychology: Descriptive Research - Experimental Research.

Unit II - Perceptual Processes: Basic Issues In Perception - Bottom-Up and Top-Down Processing - Basic Tasks of Visual Perception - Multisensory Interaction and Integration- Synesthesia - Comparing the Senses - Perception and Action - Change Blindness - Attention and Consciousness.

Unit III - Working Memory: Introduction - Classical Research on Short-Term Memory - Brown/Peterson & Peterson Technique - Serial Position Effect - Semantic Similarity of the Items in Short-Term Memory - Atkinson & Shiffrin's Model of Information Processing - Turn to Working Memory - Evidence for Components with Independent Capacities - Phonological Loop - Neuroscience Research on the Phonological Loop - Long-Term Memory - Memory Strategies and Metacognition.

Unit IV - Problem Solving and Creativity: Introduction - Understanding the Problem - Methods of Representing the Problem - Symbols - Matrices - Diagrams - Visual Images - Situated and Embodied Cognition Perspectives on Problem Solving - Situated Cognition - Embodied Cognition - Problem-Solving Strategies - Analogy Approach - Structure of the Analogy Approach - Means-Ends Heuristic - Research on the Means-Ends Heuristic - Computer Simulation - Hill-Climbing Heuristic - Factors That Influence Problem Solving - Deductive Reasoning and Decision Making.

Unit V - Future Skills - Critical thinking - Adaptive thinking - Cognitive Load Management - Design thinking - Virtual Collaboration - Cultural Sensitivity.

Unit VI - Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Books

1 Thomas A. Farmer, Margaret W. Matlin Cognition Wiley Publication 10th Edition, 2019

Reference Books

1 Riegler, B.R., Reigler, G.L. Cognitive Psychology – Applying the Science of Mind
Pearson Education 4 th Edition, 2016

WebResources

https://en.wikibooks.org/wiki/Cognition_and_Instruction/Problem_Solving_Critical_Thinking_and_Argumentation Pedagogy □ Lectures, Group discussions, Assignment

Course Outcomes

On the successful completion of the course, students will be able to

- 1 Apply the concepts of various classical and modern methods for constrained and unconstrained problems in both single and multivariable problems
2. Recall the basic concepts and terminologies in cognitive psychology
3. Understand the proportional relationships from verbal, graphical, symbolic or numerical scenarios
4. Apply knowledge and understanding of well-established theories in cognitive psychology and demonstrate the use of traditional research designs in cognitive psychology
5. Analyze cognitive science concepts including perception, attention, learning, memory, reasoning, problem-solving, judgment, and decision making

Year: II

GENERIC ELECTIVE COURSE 3
3. Geographical Information System

Semester: III

Code:

Credits: 3

Course Objective: At the end of the course the student will be able to:

1. Provide both theoretical and practical knowledge of Geographical Information System.
2. Apply digital mapping concepts
3. Understand spatial data structures
4. Apply different methods for data captures
5. Comprehend Open GIS

Unit 1: Introduction to Geographic Information System (GIS)-Overview, concepts of GIS, components of GIS-Origin of GIS, History of GIS and geospatial technology-Functions and benefits of GIS- Scope and application areas of GIS-Data base management system (DBMS) and concept of spatial and attribute data

Unit 2: Digital Mapping Concepts and Visualization -Database and mapping concept: geographic features and attributes, thematic maps, map layers, map scales, resolution and representation-Map outputs and elements, map design and layout- Map projection: coordinate systems, projection systems, common map projections in GIS, conversion among coordinate systems

Unit 3: Spatial Data Structure and Database Design-concepts of geographic phenomena and data modeling, geographic objects and fields-vector data and raster data model-spatial relationships and topology- GIS data formats and data conversion-Spatial database design with the concepts of geo-database

Unit 4: Data Acquisition, Data Quality and Management-different methods of data capture-geo-referencing and digitization-data preparation, conversion and integration-spatial data quality and accuracy- introduction to global navigation and satellite systems (GNSS)- Basics of remote sensing (RS) technology-integration of RS and GNSS data into GIS

Unit 5: Open GIS -Introduction of open concept in GIS- Open source software for spatial data analysis- Web Based GIS system-Open source GIS data-GIS application case studies

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Books:

1. Chang, K. T. Introduction to geographic information systems. Ninth edition, Boston: McGraw-Hill.
2. Principles of geographic information systems: An introductory textbook, international institute for Geo-information science and Earth observation, the Netherlands- By rolf De By, Richard A. knippers, yuxian sun
3. ESRI guide to GIS analysis Andy Mitchell, ESRI press, Red lands GIS Cook BOOK

Course Outcomes

On the successful completion of the course, students will be able to

1. Understand GIS components
2. Apply Digital Mapping and visualization concepts
3. Get knowledge about Spatial data structures
4. Understand data capturing techniques
5. Understand open GIS softwares

Year: II

CORE COURSE 7
Cloud Computing and Internet of Things
(Theory)

Semester: IV

Code:

Credits: 4

Course objectives : At the end of the course the student will be able to:

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To equip students with a solid foundation in Cloud Computing for practical use and adoption in real-world scenarios.
3. To understand building blocks of Internet of Things and characteristics
4. Students will be able to explain the core concepts, characteristics, benefits, and challenges of cloud computing models and services.
5. Students will be exposed to the revolution of Internet in Mobile Devices, Cloud & Sensor Networks

Unit-I Cloud Computing Cloud Computing Concepts, Principles of Parallel and Distributed Computing, Cloud Characteristics. Elasticity in Cloud, On-demand Provisioning.

Unit-II Cloud Architecture, Services and Storage Layered Cloud Architecture Design - NIST Cloud Computing Reference Architecture, Types of Cloud (Public, Private and Hybrid), Cloud services (IaaS, PaaS, SaaS). Architectural Design Challenges, Cloud Storage, Storage-as-a-Service, Cloud Storage Providers, S3, Resource Provisioning Methods in Cloud.

Unit-III Cloud Enabling Technologies and Security Service Oriented Architecture, REST and Systems of Systems, Web Services, Publish Subscribe Model, Basics Virtualization, Types of Virtualizations, Implementation Levels of Virtualization. Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtualization Support and Disaster Recovery. Security Overview, Cloud Security Challenges, Software-as-a-Service Security, Security Governance, Virtual Machine Security, IAM, Security Standards.

Unit-IV Internet of Things (IoT) and M2M IoT & Web Technology, IoT Applications, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization. Difference between IOT and M2M, M2M AND IoT Value Chains, ETSI M2M SCL resource structure, Security in ETSI M2M framework.

Unit-V IOT Architecture & Platforms IOT architecture and different layers, IOT standards (RFID, NFC; IEEE 802. 15. 4: ZigBee, Z-WAVE, THREAD; Bluetooth Low Energy) and protocols. IOT sensors (Temperature, Pressure, Proximity etc.), Microcontrollers, Microprocessors, SoC, Arduino, Pi, Spark, Intel Galileo.

Unit - VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Suggested readings/ references:

1. Cloud Computing: Concepts, Technology and Architecture- Thomas Erl and Zaigham Mahmood, Pearson Publication
2. Cloud Computing: Implementation, Management, and Security- John W. Rittinghouse and James Ransome, CRC Press F.
3. Cloud Computing Black Book- Kailash Jayaswal, DreamTech Press
4. The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities are Changing the World-Michael Miller, Pearson
5. Internet of Things: A Hands-on Approach- Arshdeep Bahga and Vijay Madisetti, University Press
6. The Internet of Things- Oliver Hersent, David Boswarthick, and Omar Elloumy

Course Outcomes:

On the successful completion of the course, students will be able to:

1. Construct the cloud computing basics
2. Analyze the Cloud architectures
3. Identify Cloud Enabling Technologies
4. Understand IoT basic concepts
5. Analyze IoT standards

Year: II

CORE COURSE 8
MOBILE APP DEVELOPMENT
(Theory)

Semester: IV

Code:

Credits: 4

Course Objectives: At the end of the course the student will be able to:

1. Outline the platforms, tools for developing mobile applications.
2. Create user interface with flutter.
3. Develop fully featured apps.
4. Understand the handling of user inputs.
5. Analyze Firebase Plugins

Unit I: Introduction to Dart: Getting started with Dart: The evolution of Dart-How Dart works- Hands-on Dart-Understanding why flutter uses Dart-Introducing the structure of the Dart Language- Dart Operators-Dart data types and variables Control flows and loops- functions-Data structures, collections and generics.

Unit II:Oops concept in Dart: Dart Oops Features: Object and classes-Encapsulation-Inheritance and composition-Abstraction Polymorphism-Intermediate Dart Programming: Dart classes and constructors- The enum type-The cascade notation-constructors-Named constructors- Factory constructors-Field accessors-static fields and methodsclass inheritance-abstract classes interfaces-dart libraries and packages.

Unit III: Creating User Interface with flutter : Comparisons with other mobile app development frameworks- differences between existing frameworksflutter compilation and rendering- widgets-Hello Flutter-Building layouts in flutter-Built-In WidgetsUnderstanding built-in layout widgets-Creating a UI with widgets-Creating custom widget.

Unit IV: Handling user Input and Navigations : Handling User Input and Gestures: Pointers, Gestures-Input Widgets-Validating input forms-Custom input and form field-Theme widgets- Navigating between screens: Navigator-Overlay-Route-Named routesscreen transitions-Hero animations.

Unit V: Developing Fully Featured Apps: Firebase Plugins: Firebase overview-firebase authentication-NoSQL database with cloud Firestore-Cloud storage with firebase storage-Ads with Firebase Admob-ML with Firebase ML Kit, SQLite Database.

Unit - VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Book: Alessandro Biessek, “Flutter for Beginners”, Packt Publishers, 2019, ISBN: 978178899608.

Reference Books:

1. Marco L. Napoli, “Beginning Flutter A Hands-on Guide to App Development”, Wrox, 2020, ISBN: 9781119550822.
2. Jakob Iversen, Michael Eierman, “Learning Mobile App Development A Hands-on Guide to Building Apps with IOS and Android”, Addison Wesley, 2014, 9780321947864.
3. Rap Payne, “Beginning App Development with Flutter: Create Cross – Platform Mobile Apps”, Apress, ISBN: 9781484251805. DIGITAL SCIENCES (2022) 5
4. Thomas Bailey, “Flutter for Beginners: An introductory guide to building cross-platform mobile applications with Flutter 2.5 and Dart”, Packt Publishers, 2019, ISBN: 9781800565999

Course Outcomes: On the successful completion of the course, students will be able to:

1. summarize the basics on dart.
2. explore the object-oriented concepts in dart.
3. design a user interface using flutter.
4. build themes and animation in flutter.
5. create firebase plugins

COURSE OBJECTIVES: The course should enable the students to:

1. Understand the differences between conventional and agile approaches
2. Define and discuss the key concepts and principles of DevOps
3. Explain the concepts of test automation, infrastructure automation, and build and deployment automation
4. Learn DevOps for CI/CD using containers, container orchestration and pipelines
5. Describe the Service Delivery process

UNIT – I INTRODUCTION TO AGILE: Introduction to Agile: Agile versus traditional method comparisons, Various Agile methodologies - Scrum, XP, Lean, and Kanban, Agile Manifesto, Scrum: Scrum process, roles - Product Owner, ScrumMaster, Team, Project Manager, product manager, architect, events, and artifacts; Agile Requirements - User personas, story mapping, user stories, 3Cs, INVEST, acceptance criteria, sprints, requirements, product backlog and backlog grooming, JIRA.

UNIT – II AGILE Vs DEVOPS : DevOps Big Picture: DevOps Culture, View of DevOps, History of DevOps, Open sourcesoftware and Proprietary services, Agile Infrastructure, Current state of DevOps, Relation between Agile and DEVOPS, DevOps Lifecycle, Software Tools for DevOps,

UNIT – III FOUNDATIONAL TERMINOLOGY: Foundational terminology and concepts, DevOps misconceptions and Patterns, The Four Pillars of Effective DevOps, Foundations, Deployment Pipeline, The Delivery Ecosystem, Managing Data, Components and Dependencies.

UNIT – IV TESTING IN DEVOPS: Testing in DevOps: Continuous Integration and Continuous Delivery CI/CD: Jenkins Creating pipelines, Setting up runners Containers and container orchestration (Docker and Kubernetes) for application development and deployment; Checking build status; Fully Automated Deployment; Continuous monitoring with Nagios; Introduction to DevOps on Cloud

UNIT – V BRIDGING DEVOPS CULTURE: Building Bridges with the Four Pillars of Effective DevOps, Learning from Stories-Values, Myths, Prohibitions, Rituals, Inter organizational Interactions, Fostering Human Connections, Case- studies.

Text Books:

1. Agile Project Management: Creating Innovative Products, Second Edition By Jim Highsmith, Addison-Wesley Professional, 2009
2. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim, Jez Humble, Patrick Debois, and John Willis
3. Effective DevOps: Building A Culture of Collaboration, Affinity, and Tooling at Scale by Jennifer Davis & Ryn Daniels.
4. Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, is by Jez Humble and David Farley.

Reference Books:

1. Agile Project Management: Managing for Success, By James A. Crowder, Shelli Friess, Springer 2014
2. Learning Agile: Understanding Scrum, XP, Lean, and Kanban, By Andrew Stellman, Jennifer Greene, 2015, O Reilly
3. DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive ... By Sritharan Vadapalli, Packt, 2018

4. Agile Testing: A Practical Guide For Testers And Agile Teams, Lisa Crispin, Janet Gregory, Pearson, 2010
5. DevOps: Puppet, Docker, and Kubernetes By Thomas Uphill, John Arundel, NeependraKhare, Hideto Saito, Hui-Chuan Chloe Lee, Ke-Jou Carol Hsu, Packt, 2017

COURSE OUTCOMES: Upon successful completion of the course, the student is able to

1. Compare and contrast the differences between Agile and other project management methodologies.
2. Identifies the key concepts and current state of DevOps towards Agile development
3. Acquire an insight towards DevOps misconceptions and Patterns.
4. Understand and implement DevOps principles for CI/CD
5. Implement the effective delivery of Four pillars of Effective DevOps

Year: II

Discipline Centric Elective Course 4
1. Introduction to Prompt Engineering

Semester: IV

Code:

Credits: 4

Course Objectives: At the end of the course the student will be able to:

1. Help students understand the basics of Generative AI and how prompts are used to interact with AI systems.
2. Teach students how to create effective prompts that produce useful and accurate responses from AI tools.
3. Explore real-world applications of prompt engineering across various fields like education, business, healthcare, and creative writing.
4. Use Prompt Engineering for Industries
5. Understand the applications of Prompts

Unit 1: The Basics of Generative Artificial Intelligence: Understanding AI, Machine Learning, and Deep Learning, What Is Generative AI, The Future of Generative AI, Language Model, Transformer Models, GPT (Generative Pretrained Transformer), Applications of AI in Business.

Unit 2: The Role of Prompts in Generative AI: How Did Prompts Originate, How Prompts Guide the AI's Response, Tokenization and Vectorization, Generative Capability, Bias and Ethical Considerations, How Do Generative AI Systems Understand Input and Provide Output, The Need to Create Prompts to Receive the Best Output.

Unit 3: A Step-by-Step Guide to Creating Effective Prompts: A Step-by-Step Guide to Creating Effective Prompts, Common Mistakes to Avoid When Crafting Prompts, Understanding Different Components of a Prompt, The Role of Context in Shaping AI Responses, Using Temperature and Max Tokens to Guide AI Responses, The Art of Iterative Prompting.

Unit 4: Prompt Engineering across Industry: Mastering Creative Writing Use Cases for Content Creators, Transforming Operations: Business Applications of Prompt Engineering, Revolutionizing Education: Classroom Applications of Prompt Engineering, Streamlining Research Applications for Academics and Market Analysts, Prompt Engineering in Health Care: Reinventing Patient Communication and Data Analysis.

Unit 5: Advanced Topics and Applications in Prompt Engineering: Understanding Bias in AI and Prompts, Strategies for Reducing Bias in Your Prompts, Ethical Guidelines for Prompt Design, Prompts and Privacy Considerations, Advanced Techniques: Automated Bias Detection, Applications in Prompt Engineering, GPT-4, Exploring Prompts with ChatGPT, Use Cases and Examples.

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Textbook:

1. Ian Khan, The Quick Guide to Prompt Engineering: Generative AI Tips and Tricks for ChatGPT, Bard, Dall-E, and Midjourney, 1st edition, Wiley, 2024.

Reference Book:

1. James Phoenix, Mike Taylor, Prompt Engineering for Generative AI, 1st edition, O'Reilly Media, 2024.
2. Jay Alamar, Maarten Grootendorst, Hands-On Large Language Models, 1st edition, O'Reilly Media, 2024.

Web Resources:

1. "Prompt Engineering Guide", <https://www.promptingguide.ai/>
2. "Prompt Engineering", OpenAI, <https://platform.openai.com/docs/guides/promptengineering/strategy-test-changessystematically>
3. <https://developers.google.com/machine-learning/resources/prompt-eng>

Course Outcomes: On the successful completion of the course, students will be able to:

1. Describe the core concepts of AI and Generative AI, including how models like GPT function.
2. Explain how prompts influence the behavior and responses of generative AI systems.
3. Develop clear and effective prompts for different AI tools and applications.
4. Apply prompt engineering techniques across domains such as education, business, and healthcare.
5. Identify bias, and privacy considerations in prompt engineering and explore the use of advanced tools like GPT-4 and ChatGPT.

Year: II

DISCIPLINE CENTRIC ELECTIVE COURSE 4

Semester:IV

2. Immersive Technologies

Code:

Credits: 4

Course Outcomes: At the end of the Course the student will be able to:

- 1: Describe the concept of virtual reality and Communication Media.
- 2: Understand current virtual reality hardware and software.
- 3: Understand various modeling approaches.
- 4: Illustrate the concepts of Human Factors and Applications of VR.
- 5: Build a Virtual Reality Application.

UNIT - I -INTRODUCTION TO VIRTUAL REALITY (VR): Defining Virtual Reality, Key elements of virtual reality experience, Virtual Reality, Telepresence, Augmented Reality and Cyberspace. Bird's-Eye View: Hardware, Software, Human Physiology and Perception.

UNIT-II Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. Output Devices: Graphics displays, sound displays & haptic feedback.

UNIT-III Modeling: Geometric modeling, Kinematics modeling, Physical modeling, Behaviour modeling, Model management.

Learning Outcomes: At the end of the unit, students will be able to 1. Demonstrate the usage of modeling.(L2) 2. Classify modeling techniques. (L2) 3. Understand the Model Management.(L2)

UNIT-IV Augmented Reality (AR): Taxonomy, Technology and Features of Augmented Reality, AR Vs VR, Challenges with AR, AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, Enhancing interactivity in AR Environments, Evaluating AR systems AR software development : AR software, Camera parameters and camera calibration, Marker-based augmented reality, AR Toolkit.

UNIT-V Interaction & Audio: Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction. Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering. Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction. Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

TEXT BOOKS:

1. Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc, 2017.
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.

REFERENCES:

1. Rajesh K. Maurya, Computer Graphics with Virtual Reality System, 3 rd Edition, Wiley Publication, 2018.
2. William R. Sherman and Alan B. Craig, Understanding Virtual Reality Interface, Application, and Design, 2 nd Edition, Morgan Kaufmann Publishers, Elsevier, 2019.
3. Grigore C. Burdea, Philippe Coiffet, Virtual Reality Technology, 2 nd Edition, Wiley, 2017.
4. K.S. Hale and K. M. Stanney, Handbook on Virtual Environments, 2 nd Edition, CRC Press, 2015.

WEB REFERENCES:

1. <http://vr.cs.uiuc.edu/vrbook.pdf>
2. <https://nptel.ac.in/courses/106/106/106106138/>

Course Outcomes:

1. Understand the Human Physiology and perception
2. Understand the navigation and manipulation
3. Classify modeling techniques
4. Understand the use of AR Software and Toolkit
5. .identify the role of Immersion in VR.

Year: II

**Entrepreneurship / Industry Based Course
Startups and Entrepreneurship**

Semester: IV

Code:

Credits: 3

Course objective: At the end of the course the student will be able to:

1. Introduce the students to the concept of Startups and Entrepreneurship.
2. Provide the knowledge of becoming an entrepreneur by identifying business opportunities and developing business plans.
3. Know about the different supports for Entrepreneurs
4. Understand enterprise planning
5. Develop business models

Unit I Introduction: Meaning and importance of Entrepreneurship, Evolution of the term entrepreneurship, Factors influencing entrepreneurship, characteristics of entrepreneurship, types of entrepreneurship, objectives of entrepreneurship development, Startups- Definition, Types.

Unit II Entrepreneurship Development Skills: Types of entrepreneurial skills - team work and leadership skill, analytical and problem solving skills, critical thinking skills, branding, marketing and networking skills. Role of entrepreneurship development programmes (EDP)

Unit III Institutions supporting Entrepreneurs: Various Central and State Level Organizations which Help the Entrepreneurs, Banks and non banking financial organisations, Fund Collection for Entrepreneurship

Unit IV Entrepreneurial opportunity and enterprise planning: Sensing entrepreneurial opportunities, selecting the right opportunity, Site Selection, Feasibility Analysis

Unit V Preparation of Business model/Plan: Business plan - concept, format, components of business plan. Significance of Business Plan. Making of a Business plan

Unit - VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Books

1. Kathleen R Allen, Launching New Ventures, An Entrepreneurial Approach, Cengage Learning.
2. Anjan Raichaudhuri, Managing New Ventures Concepts and Cases, Prentice Hall International.
3. S. R. Bhowmik & M. Bhowmik, Entrepreneurship, New Age International

Reference Books:

1. Steven Fisher, Ja-nae' Duane, The Startup Equation -A Visual Guidebook for Building Your Startup, Indian Edition, Mc Graw Hill Education India Pvt. Ltd.
 2. Byrd Megginson, Small Business Management An Entrepreneur's Guidebook, 7th ed, McGrawHill
- A Fayolle Entrepreneurship and new value creation, Cambridge, Cambridge University Press

Course Outcome: Upon completion of the course, students will be able to:

- 1, Students will be able to start his/ her own business by understanding the opportunities that are lying in front of them.
2. He / she will learn how to make a business plan and how to approach funding agencies for getting their loans sanctioned.
3. Develop Entrepreneurship Development Skills
4. Understand Entrepreneurial opportunity
5. Develop business models

Year: II

VALUE ADDED COURSE - 2

Semester: IV

Data Analysis with R

Code:

(VAC - 2)

Credits: 2

Course Objectives : At the end of the course the student will be able to:

1. Understand foundations of R
2. Apply matrix and arrays operations
3. Learn statistical foundations
4. Understand regression analysis
5. Apply graphics methods

Unit-I: Foundations of R - Mathematics and Data Structures Overview of R and its application, Numeric, Arithmetic, Assignment, And Vectors: R for Basic Math, Arithmetic, Logarithms and Exponentials, E-Notation, Assigning Objects, Vectors, creating a Vector, Sequences, Repetition, Sorting, and Lengths, Subsetting and Element Extraction, Vector-Oriented Behavior

Unit II Matrices and Arrays: Defining a Matrix, subsetting, Matrix operation and Algebra, Multidimensional array, Non-Numeric Values: Logical values, character, factors, List and Data frame. Special values, classes and coercion. Basic Plotting, Reading and Writing Files: R-Ready Data Sets, reading in external data files, Writing out data files and plot.

Unit-III: Programming Essentials and Statistical Foundations Programming: Calling Functions, conditions and Loops, Writing Functions, Exceptions, Timings, and Visibility. Statistics and Probability: Elementary Statistics, Basic Data Visualization, Probability, Common Probability Distributions

Unit-IV: Statistical Inference and Regression Analysis in R: Sampling Distributions and Confidence, Hypothesis Testing, Analysis of Variance, Simple Linear Regression, Multiple Linear Regression, Linear Model Selection and Diagnostics.

Unit-V: Advance Graphics : Advanced Plot Customization - Going Further with the Grammar of Graphics, Defining Colors and Plotting in Higher Dimensions, Interactive 3D Plots.

Unit - VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Books:

1. The Book of R: A First Course in Programming and Statistics, by Tilman M. Davies

References:

1. R in Action, Data Analysis and Graphics with R, Robert I. Kabacoff, Manning Publication.
2. THE ART OF R PROGRAMMING, by Norman Matloff, No Starch Press, ISBN-10: 1-59327-384-3

Course Outcome: Upon completion of the course, students will be able to:

1. Students will acquire proficiency in fundamental numeric operations, vector manipulation, matrix algebra, handling non-numeric data types, and basic plotting, enabling them to perform essential data manipulations and analyses in R.
2. Understand matrix operations
3. Students will adeptly apply essential R programming concepts and acquire foundational skills in elementary statistics, data visualization, and probability.
4. Students will effectively apply R to grasp concepts related to sampling distributions, hypothesis testing, analysis of variance, and various regression techniques, enhancing their practical statistical modeling and inference skills.
5. Students will excel in advanced R plot customization, understand the nuances of the Grammar of Graphics, and gain expertise in defining colors, plotting in higher dimensions, and creating interactive 3D visualizations.

Year: I

Non-Major Elective - 1
Cyber Security

Semester: I

Code:

(NME -1)

Credits: 2

Course Objectives: At the end of the course the student will be able to:

1. Categorize and familiar with computer-related crime.
2. Explain the basic concepts of cryptographic technology.
3. Understand the Web based crimes
4. Develop adequate countermeasures to secure the systems.
5. Understand different attacks

Unit I: Introduction to Cyber Crime Definition – Role of Electronic Communication devices and Communication technologies in cyber crime – Crimes associated with mobile electronic communication devices – Classification of Cyber Criminals – Tools used – Factors influencing cyber crime – Challenges to cyber crimes – Strategies to prevent cyber Crimes – Extent of cyber crime.

Unit II: Classification of cyber crime Cyber Crime against individuals – Cyber Crimes against property – Cyber crimes against nation – present and future of cyber crime – Cryptocurrency – Bitcoin – Ethereum – Ransomware – Deep web and dark web

Unit III :Contemporary Computer Crime: Web based criminal activity – Malware – Theft of Information, Data Manipulation and Web encroachment – Neo traditional Crime – Ancillary Crimes

Unit IV :Cyber Security Information assurance fundamentals: basic cryptography –Domain Name system – Firewalls – Virtualization – Microsoft windows security.

Unit V:Attacker Techniques: Phishing, Smishing - Mobile malicious code – Rogue antivirus – Click fraud –Threat infrastructure – proxies – Tunneling techniques

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Book:

1. James Graham, Richard Howard, Ryan Olson, “Cyber Security Essentials”, Auerbach Publications; 1 st Edition, 2011, ISBN: 9781439851265

Reference Books:

1. Deje, Murugan, “Cyber Forensics”, Oxford University Press; First edition, 2018, ISBN: 9780199489442.
2. Chuck Easttom, “CCFPSM Certified Cyber Forensics Professional Certification ALL-IN-ONE (Exam Guide)”, McGraw-Hill Education, 2015, ISBN: 9780071836111.

3. Britz, "Computer Forensics and Cyber Crime: An Introduction", Pearson Education India; 3rd edition, 2013, ISBN: 9780132677714 DIGITAL SCIENCES (2020)
4. Nina Godbole Sunit Belapure, "Cyber Security", Wiley (2011), ISBN: 9788126521791.
5. Raef Meeuwisse, "Cybersecurity for Beginners", Cyber Simplicity Ltd; 2nd Revised edition, 2017, ISBN: 9781911452034
6. Thomas J. Holt, Adam M. Bossler and Kathryn C. Seigfried-Spellar, "Cybercrime and Digital Forensics", Second Edition, ISBN: 9781138238725.

Course Outcomes: Upon successful completion of this Course, the student will be able to

1. categorize the changes in society associated with the advent of technological changes and the introduction of the Internet
2. explain computer-related crime.
3. develop a working knowledge of the classifications of motive for modern computer intruders and how they relate to each other in the digital security realm.
4. discuss the basic concepts of cryptographic technology and the major mathematical principles used by cryptographic systems.
5. describe the risks posed by the various types of malicious code objects and develop adequate countermeasures to protect the systems.

Year: II

Non-Major Elective - 2
Principles of Web Programming

Semester: III

Code:

(NME -2)

Credits: 2

Course Objective: At the end of the course the student will be able to:

1. Study about the Basic web concept.
2. Learn about fundamental HTML tags.
3. Understand the image related tags
4. Learn about CSS
5. Apply the different effects on tables

Unit I - Defining web design- Web design pyramid- The medium of the web – Types of websites- Web design themes.

Unit II - Fundamentals of HTML- working with text – organizing text in HTML- working with links and Urls -creating tables

Unit III - Working with Images: Colors and canvas, working with forms, interactive elements, working with multimedia

Unit IV - Overview of CSS: Backgrounds and color gradients in CSS- font and text styles-creating boxes and columns

Unit V - List :Liststyles, table layout-effects, frames and controls.

Unit – VI Current Contours (For continuous internal assessment only): Contemporary Developments Related to the Course during the Semester Concerned

Text Books:

1. Thomas Powell, “Web Design: The Complete Reference Second Edition”, Tata McGraw Hill Education Private Limited, Fifteenth reprint 2013, ISBN: 978-0-07-058252-1.
2. Kogent Learning Solutions Inc., “HTML 5 Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP & jQuery Black Book”, Kogent Learning Solutions Inc., 2013, ISBN: 978-93-5004-095-9.

Reference Books: 1. Joel Sklar, “Principles of Web Design: The Web Warrior Series”, Cengage Learning

Course Outcome: Upon successful completion of this Course, the student will be able to

1. Apply the design principles, techniques and technologies in web designing.
2. Demonstrate the HTML tags used in designing a web page. □
3. Select and apply markup languages for processing, identifying and presenting information in web pages. □
4. Use critical thinking skills to design and create web sites.
5. Design web pages using HTML and CSS.