Department of Information Technology
Structure & Syllabi

T. Y. B. Tech (2023 Pattern)
w.e.f. Academic Year 2025-2026

Dr. N. M. Ranjan
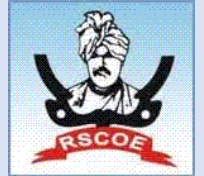**BoS Chairman**

Dr. A. M. Badadhe
Dean of Academics

Dr. S. P. Bhosle
Director

Department of Information Technology

Vision

"To create quality information technology professionals through superior academic environment."

Mission

- To incorporate the IT fundamentals in students to be successful in their career.
- To motivate students for higher studies, research and entrepreneurship.
- To provide IT services to society.

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Department of Information Technology
Program Outcomes (POs)

Engineering Graduates will be able to:

1.Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2.Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4.Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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

6.The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. JSPM's Rajarshi Shahu College of Engineering Department of IT Engineering

7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

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

10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11.Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

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Program Specific Outcomes (PSOs)

PSO1:

Apply principles of mathematics, computing, and programming to develop innovative, sustainable, and interdisciplinary IT solutions addressing real-world challenges.

PSO2:

Design and develop secure, efficient, and intelligent computing solutions by applying core IT concepts and fostering holistic development.
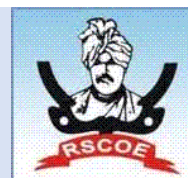
PSO3:

Demonstrate leadership, project management, and entrepreneurial skills to manage multidisciplinary projects, contributing to societal and economic development.

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Highlights of the Syllabus

Curriculum of Information Technology Department is designed in consultation with experts like:

Academic Experts

Industry/Corporate Experts

Distinguished Alumni

Following are the features of the curriculum of the **Information Technology Department** designed in association with the **Tata Consultancy Services, Pune**

Focus on Fundamentals

Outcome Based Education

Creativity and Innovation

Experiential Learning

Global Competence

Four Tracks in B-Tech

Blend of Activities

Industry Internship

Ethics and Values

Self Learning
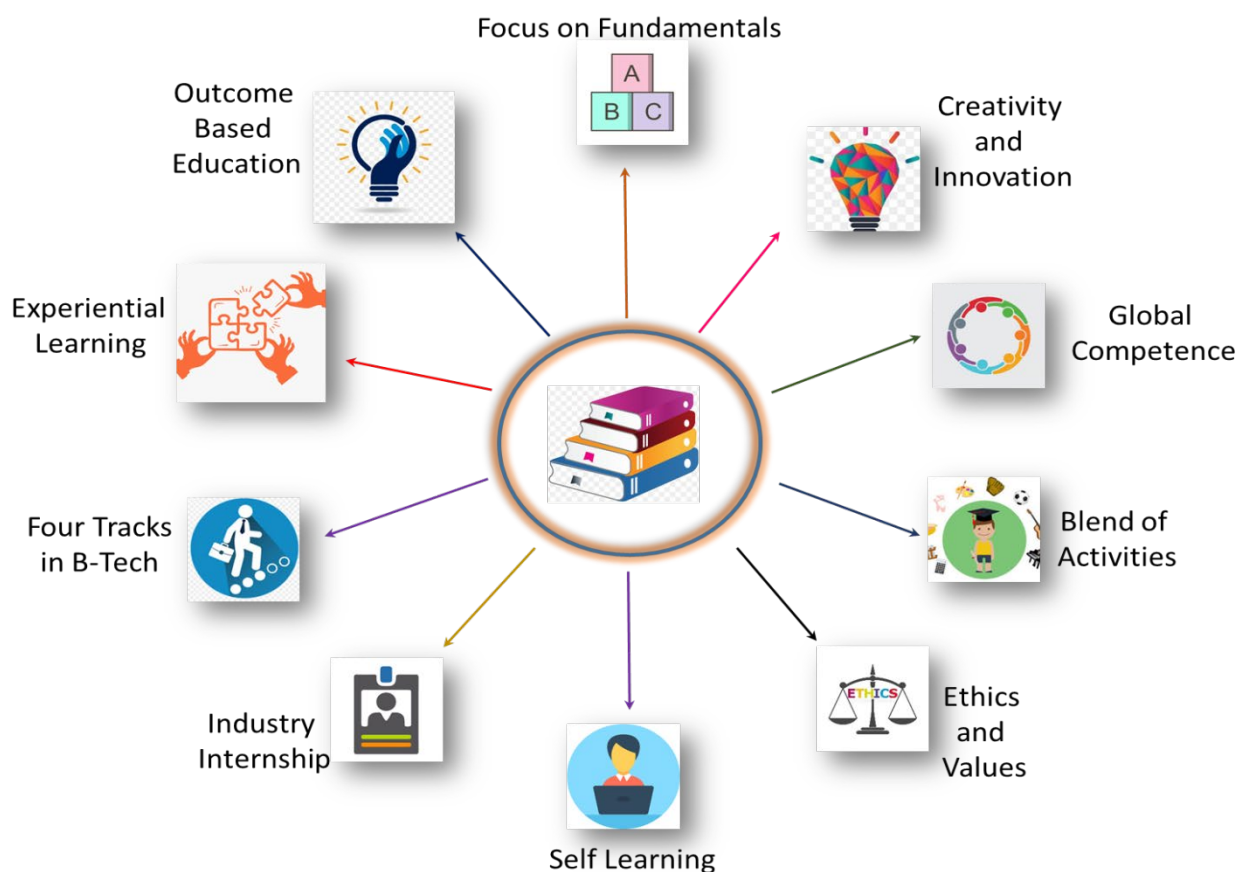
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Unique features of the curriculum

1. **Curriculum centered at Outcome Based Education:**

   The new Curriculum is based on student-centered instruction models that focus on measuring student performance through outcomes. The outcomes include subject knowledge, industry required skills and attitudes.

2. **Emphasize on Fundamentals:**

   The nature of the new curriculum is rigorous and well prescribed so that the students can spend more time on preparation and self-study. The students have to learn core subjects, solve practical based assignments and must attempt periodical quizzes. This will benefit them to grasp and keep a strong hold on fundamentals of Engineering in the most effective way.

3. **Experiential Learning:**

   The curriculum emphasizes on hands-on sessions along with theoretical information. The new curriculum considers Problem Based Learning (PBL) as a teaching pedagogy and includes different subjects that encourage the students for hands on learning through virtual labs, mini-projects, etc. Accordingly, the curriculum maintains good balance between theory and laboratory credits.

4. **Promote Creativity and Innovation:**

   Along with experiential learning, the curriculum also motivates the students to inculcate creativity and innovation. Apart from conventional lab, the curriculum provides a freedom for students to perform industry assignments, pilot projects, innovative development, etc.

5. **Inculcating Ethics and Values:**

   To improvise student's behavior, the curriculum has included systematic courses on ethics and values. The moral principles can help students to make right decisions, lead their professional lives and become ethical citizen.

6. **Blend of Curricular and Noncurricular Activities**

   The curriculum also gives importance of different activities like co-curricular, extra-curricular, sports, culture, etc. This will help to do all round development of students in all possible ways.

7. **Four Tracks in B-Tech:**

   The curriculum provides four tracks in the curriculum as

I.	Industry Internship	II.	Entrepreneur
II.	Higher Studies and Research	IV.	In house Project

8. **Global Competence:**

   The curriculum provides a unique opportunity for students to learn and engage in open and effective interaction with people from diverse and interconnected world. The combination of foreign languages (German, Japanese, English) and international internships in the curriculum help the students to build a capacity to examine global and intercultural issues and to propose perspectives and views.

9. **Industry Induced Internship Program**

   To support ever demanding industry requirements, the curriculum has included an industry internship with an objective to learn technologies pertaining to their discipline and enhance their technical knowledge with a support of the live platform of Industry.

10. **Motivation for Self Learning:**

    The curriculum also offers a freedom to students to take the initiatives in their learning needs and set the goals with the help of online learning platforms like MOOCs, NPTEL, Swayam, etc.
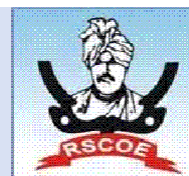
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T. Y. B. Tech (Information Technology)
Academic Year -2025-2026 (Semester –V)
(Level 5.5 - B.Voc./ B.Sc. Engg) -Semester V
(2023 Pattern)

Course	Course Code	Course	Teaching Scheme				Credit	Examination Scheme			Total Marks	Ownership
			L	T	P	Hr	C	ISE	MSE	ESE		
PCC	IT3201T	Database Management System	3	-	-	3	3	20	30	50	100	IT
PCC	IT3201L	Database Management System Laboratory	-	-	2	2	1	ISCE: 30		20	50	IT
PCC	IT3202T	Design and Analysis of Algorithm	3	-	-	3	3	20	30	50	100	IT
PCC	IT3202L	Design and Analysis of Algorithm Laboratory	-	-	2	2	1	ISCE-30		20	50	IT
MDM		Multi-Disciplinary Minor-II	3	-	-	3	3	20	30	50	100	Other department
MDM		Multi-Disciplinary Minor-II Laboratory	-	-	2	2	1	ISCE: 30		20	50	Other department
OE	ITO3201T	Open Elective I	3	-	-	3	3	20	30	50	100	Other department
PEC	IT3203T	Professional Elective-I	3	-	-	3	3	20	30	50	100	IT
PEC	IT3203L	Professional Elective-I Laboratory	-	-	2	2	1	ISCE: 30		20	50	IT
Skill Course (VSEC)	IT3204L	Programming Lab III (Java Programming)	-	-	4	4	2	ISCE: 50		50	100	IT
CC	IT3205L	Co-curricular Course	-	-	2	2	1	ISCE: 30		20	50	Respective Department
	Total		15	-	14	29	22	-		-	850	

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Professional Elective I		Professional Elective I Lab	
Course	**Course Name**	**Course**	**Course Name**
IT3203T-A	Artificial Intelligence	IT3203L-A	Artificial Intelligence Lab
IT3203T-B	Cyber Security and Privacy(MOOC) https://onlinecourses.nptel.ac.in/noc25_cs116/preview	IT3203L-B	Cyber Security and Privacy Lab
IT3203T-C	Cloud Computing (MOOC) https://onlinecourses.nptel.ac.in/noc25_cs107/preview	IT3203L-C	Cloud Computing Lab
IT3203T-D	UI and UX Design	IT3203L-	UI and UX Design Lab

Elective courses guidelines:

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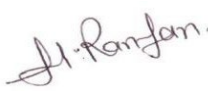**Dean of Academics**

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T. Y. B. Tech (Information Technology)
Academic Year -2025-2026 (Semester –VI)
(Level 5.5 - B.Voc./ B.Sc. Engg) -Semester VI
(2023 Pattern)

Course	Course Code	Course	Teaching Scheme				Credit	Examination Scheme			Total Marks	Ownership
			L	T	P	Hr	C	ISE	MSE	ESE		
PCC	IT3206T	Machine Learning	3	-	-	3	3	20	30	50	100	IT
PCC	IT3206L	Machine Learning Laboratory	-	-	2	2	1	ISCE: 30		20	50	IT
MDM		Multi-Disciplinary Minor-III	3	-	-	3	3	20	30	50	100	Other department
OE	ITO3202T	Open Elective	3	-	-	3	3	20	30	50	100	Other department
PEC	IT3207T	Professional Elective-II	3	-	-	3	3	20	30	50	100	IT
PEC	IT3207L	Professional Elective-II Laboratory	-	-	2	2	1	ISCE: 30		20	50	IT
PEC	IT3208T	Professional Elective-III	3	-	-	3	3	20	30	50	100	IT
PEC	IT3208L	Professional Elective-III Laboratory	-	-	2	2	1	ISCE: 30		20	50	IT
Skill Course (VSEC)	IT3209L	Programming Lab-IV: Advanced Java Programming	-	-	4	4	2	ISCE: 50		50	100	IT
Project	IT3210L	Engineering Innovation and Society-I (Project-I)	-	-	4	4	2	ISCE: 50		50	100	IT
	Total		15	-	14	29	22	-		-	850	

Professional Elective II		Professional Elective II Lab	
Course Code	Course Name	Course Code	Course Name
IT3207T-A	Natural Language Processing (MOOC) https://onlinecourses.nptel.ac.in/noc25_cs51/preview	IT3207L-A	Natural Language Processing Lab
IT3207T-B	Ethical Hacking (MOOC) https://onlinecourses.nptel.ac.in/noc25_cs142/preview	IT3207L-B	Ethical Hacking Lab
IT3207T-C	Internet of Things & Industry 4.0	IT3207L-C	Internet of Things & Industry 4.0 Lab
IT3207T-D	Advanced Web Technology	IT3207L-D	Advanced Web Technology Lab

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Professional Elective III		Professional Elective III Lab	
Course Code	**Course Name**	**Course Code**	**Course Name**
IT3208T-A	Computer Vision (MOOC) https://onlinecourses.nptel.ac.in/noc25_cs143/preview	IT3208L-A	Computer Vision Lab
IT3208T-B	Digital Forensics (MOOC) https://onlinecourses.swayam2.ac.in/nou25_cs05/preview	IT3208L-B	Digital Forensics Lab
IT3208T-C	Cloud Security and Governance	IT3208L-C	Cloud Security and Governance Lab
IT3208T-D	DevOps Fundamentals	IT3208L-D	DevOps Fundamentals Lab

Abbreviations:

L – Lecture, T – Tutorial, P – Practical, Hr – Hours, C – Credits, TuT – Tutorial, ISE – In Semester Evaluation, MSE – Mid Semester Evaluation, ESE – End Semester Evaluation

Notes:

For Theory courses: There shall be MSE, ISE and ESE. The ESE is a separate head of passing.

For Lab courses: There shall be continuous assessment (ISCE consists of ISE and MSE). The ESE is a separate head of passing.

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List of Exit Courses after completion of Semester V and VI

1. Exit option is available for students those who have earned the total 132 credits at the End of sixth Semester.

2. Student who wants to avail the exit option after third year have to earn additional 8 credits from the list of courses shown below.

3. These courses student have to complete within summer vacation after 3rd Year.

4. After fulfilment as mentioned in 1 to 3 above, Students can earn **B.Voc./ B.Sc. Engg** and same will be issued by the Institute.

Sr. No.	Course code	Name	Credits
1.	EX-IT3201	Certified Database Engineer	2
2.	EX-IT3202	Certified Java Programmer	2
3.	EX-IT3203	Certified Machine Learning Engineer	2
4.	EX-IT3204	Certified Security Engineer	2

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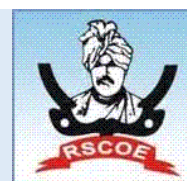
T. Y. B. Tech (Department of Information Technology)
Semester - V
[IT3201T]: Database Management System (2023 Pattern)

Teaching Scheme: TH : 03 Hours/Week	Credits: TH : 03	Examination Scheme: In Sem. Evaluation:20 Marks Mid Sem. Exam :30 Marks End Sem. Exam :50 Marks

Course Prerequisites: Data Structures, Discrete Mathematics

Course Objectives:

- Learn the fundamental concepts of database management.
- Provide a strong formal foundation for database design and creation for real time applications.
- Study the basic issues of transaction processing and concurrency control.
- Learn and understand concepts of Parallel and Distributed Databases
- To learn scalable general-purpose database to handle big data

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

CO1: Describe concepts of Relational database , parallel databases and Distributed databases
CO2: Design ER diagrams, relational databases and NoSQL databases for applications.
CO3: Apply relational database concepts and NoSQL database concepts for applications.
CO4: Create, populate, and manipulate a relational database and NoSQL.

Course Contents		
UNIT-I	**Introduction**	**07 Hours**

Database Concepts: File System Vs Database Management System Database System Architecture
Data Modeling: Data Models, Basic Concepts, entity, attributes, relationships, constraints, keys, ER Model, Relational Model: Basic concepts, Attributes and Domains, Hierarchical Model, Network Model and object-oriented data models
Relational Integrity: Domain, Entity, Referential Integrities, Enterprise Constraints, Schema Diagram
Case Study: ER diagram on University Database

UNIT-II	**Relational Database Design**	**07 Hours**

Database Design: Functional Dependency, Purpose of Normalization, Data Redundancy and Update Anomalies.
Single Valued Normalization: 1NF, 2NF, 3NF, BCNF. Decomposition: lossless join decomposition and dependency preservation.
Relational Algebra: Basic Operations, Selection, projection, joining, outer join, union, difference, intersection, Cartesian product, division operations

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Case Study: Apply normalization for University Database		
UNIT-III	**SQL and PL/SQL**	**07 Hours**

Introduction to SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Indexes.

SQL DML Queries: Select, Insert, Update and Delete Queries, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, roles and privileges. Concept of Stored Procedures, Cursors, Triggers

Case Study: Employee / Banking database system

UNIT-IV	**DATABASE TRANSACTIONS**	**07 Hours**

Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non recoverable Schedules, Checkpoints

Concurrency Control: Need, Locking Methods, Deadlocks, Time-stamping Methods, and Optimistic Techniques. Recovery Methods: Shadow-Paging and Log-Based Recovery, Checkpoints, Performance Tuning

UNIT-V	**No SQL Databases**	**07 Hours**

Introduction to No sql Databases, Introduction to Big Data, XML: DTD, XML Schemas, XQuery, XPath, XML Databases, Mobile Databases, SQLite Database, MongoDB

JSON: Overview, Data Types, Objects, Schema

Case Study-Unstructured data from social media

UNIT-VI	**Parallel and Distributed Databases**	**07 Hours**

Introduction to Parallel Databases: Introduction to Parallel Databases, Key elements of Parallel Database Processing, Architecture of Parallel Databases, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intra operation Parallelism, Interoperation Parallelism

Introduction to Distributed Databases, Architecture of Distributed Databases, Distributed Database Design, Distributed Transactions, Commit Protocols

Text Books:

    T1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", 6thEdition, McGraw Hill Publishers, ISBN 0-07-120413-X

    T2. S.K. Singh, "Database Systems: Concepts, Design and Application", 2nd Edition, Pearson, 2013, ISBN 978-81-317-6092-5.

    T3. Connally T., Begg C., "Database Systems", 3rd Edition, Pearson Education, 2002, ISBN 81-7808-861-4

Reference Books:

    R1. Kristina Chodorow, Michael Dirolf, "MangoDB: The Definitive Guide" ,O'Reilly Pubications

    R2. Bill Schmarzo, "Big Data: Understanding How Data Powers Big Business", Wiley,ISBN:978-81- 265-4545-2

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RAJARSHI SHAHU COLLEGE OF ENGINEERING
TATHAWADE, PUNE-33
(An Autonomous Institute Affiliated to Savitribai Phule Pune
University, Pune)
Department of Information Technology

T. Y. B. Tech
Semester - V
[IT3201L]: Database Management System Laboratory (2023 Pattern)

Teaching Scheme: LAB: 02 Hours/Week	Credits: LAB: 01	Examination Scheme: ISCE: 30 ESE:20

Course Prerequisites: Programming fundamentals, Problem solving skills.

Laboratory Objective:
- To learn database management design and development concepts
- To apply Normalization techniques in database design.
- To apply the basic concepts and techniques for database creation and manipulation commands in SQL and PL/SQL.
- To understand Spatial extension for relational database and configure Database on cloud

Laboratory Outcomes:
LO1 : Design and create database for an application, apply DDL and DML commands.
LO2 : Apply database retrieval and manipulation commands using PL/SQL for structured database
LO3 : Design, create, and manipulate NoSQL database.
LO4 : Apply Spatial extension for relational database and configure Database on cloud.

Lab Contents

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.

List of Laboratory Assignments/Experiments

1	Draw suitable ER/EER diagram for the system with all types of attributes and Entity types.

2	Design database with at least 3 entities and relationships between them for any one of the following application and use DCL and DDL commands for database creation (MySQL / PostgreSQL/ MariaDB)
	    1. Hospital Management System
	    2. University Management System
	    3. Hotel Management System

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	4. Banking System 5. Air line reservation system 6. Online shopping Platform etc.
3	Design and implement a database and apply at least 10 different DML queries for the following task. a) For a given input string display only those records which match the given pattern or a phrase in the Search string. b) Make use of wild characters and LIKE operator for the same. c) Make use of Boolean and Arithmetic operators wherever necessary
4	Execute the aggregate functions a) Use functions like count, sum, avg etc. on the suitable database. b) Make use of built in functions according to the need of the database chosen. c) Retrieve the data from the database based on time and date functions like now (), date (), day (), time () etc. d) Use group by and having clauses
5	Implement nested sub queries. Perform a test for set membership (in, not in), set comparison and set cardinality
6	Write and execute following triggers for banking database a) Write a row-level trigger to log every withdrawal over 10,000. b) Write a statement-level trigger to record timestamp of batch inserts. c) Log info into AuditLog table.
7	Write and execute PL/SQL stored procedures and functions using cursor with suitable database
8	Create a database with suitable example using MongoDB and implement all data definition and manipulation operations. Execute at least 10 queries on created database that demonstrates following querying techniques: a) Find and findOne (specific values) b) Query criteria (Query conditionals, OR queries, $not, Conditional semantics) c) Type-specific queries (Null, Regular expression, Querying arrays) $ where queries d) Implement the aggregation with suitable example
9	Write a query to create a table that includes a spatial column for storing geographic location data. Insert spatial data in created table and retrieve the inserted data. (MySQL / MariaDB / PostgreSQL)
10	Configure and Create a Database in cloud platform (AWS /AZURE /Google GCP)
11	Mini Project

Text Books:

T4. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", 6thEdition, McGraw Hill Publishers, ISBN 0-07-120413-X

T5. S.K.Singh, "Database Systems : Concepts, Design and Application", 2nd Edition, Pearson,

	2013,ISBN 978-81-317-6092-5.
T6.	Connally T., Begg C., "Database Systems", 3rd Edition, Pearson Education, 2002, ISBN 81-7808-861-4

Reference Books:

R3. Kristina Chodorow, Michael Dirolf, "MangoDB: The Definitive Guide" ,O'ReillyPubications

R4. Wendy Neu, Vlad Vlasceanu, Andy Oram and Sam Alapati "Introduction to cloud databases" Shroff publications

R5. Bill Schmarzo, "Big Data:Understanding How Data Powers Big Business", Wiley,ISBN:978-81- 265-4545-2

R6. Alex Holmes, "Hadoop in Practice", DreamTech Press, ISBN : 978-93-5119-150-6

ebooks:http://www.lincoste.com/ebooks/english/pdf/computers/database_management_systems.pdf

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T. Y. B. Tech (Department of Information Technology)
Semester -V
[IT3202T]: Design and Analysis of Algorithm(2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Discrete Mathematics, Data Structures and Algorithms

Course Objectives:

1. To develop problem solving abilities using mathematical theories.
2. To know the basics of computational complexity analysis and various algorithm design strategies.
3. To apply algorithmic strategies while solving problems.
4. To develop time and space efficient algorithms.

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

CO1: Describe various algorithmic problem solving methods for divide & conquer and Greedy strategy.
CO2: Apply various algorithmic techniques for Graph and Tree.
CO3: Analyse the complexities for dynamic programming strategies.
CO4: Evaluate algorithms for Backtracking, Branch & Bound and complex theory classes.

	Course Contents	
UNIT-I	**Problem Solving and Algorithmic Analysis**	**07 Hours**

Algorithm, Pseudo code for expressing algorithms, Asymptotic notations, lower bound and upper bound: best case, worst case, average case analysis, classification of time complexities (linear, logarithmic etc.), Recurrences: Formulation and solving recurrence equations using Master Theorem, Proving correctness of algorithms.
Case Study: To calculate time complexity of Searching Algorithm.

UNIT-II	**Divide-And-Conquer and Greedy Strategy**	**07 Hours**

Divide and Conquer Strategy Problem subdivision – Divide and Conquer: Binary search, Quick sort, Merge sort, Integer Arithmetic, Maximum sub-array, Master's theorem and its uses.
Greedy strategy: Principle, control abstraction, time analysis of control abstraction, knapsack problem, Job scheduling algorithm, Optimal Storage on Tape.
Case Study: Karatsuba algorithm for fast multiplication using Divide-And-Conquer Algorithms

UNIT-III	**Graph and Tree Algorithms**	**07 Hours**

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Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS) Minimum Spanning Tree: Prim's method for MST, Kruskal's method for MST Shortest path algorithms: Dijkstra's Algorithm, Bellman-Ford, Topological sorting, Network Flow Algorithm.
Case Study: Kruskal's algorithm on TV Network

UNIT-IV	Dynamic Programming Strategy	07 Hours

Dynamic Programming: Principle, control abstraction, time analysis of control abstraction, binomial coefficients, multistage graphs, 0/1 knapsack, Optimal Binary Search Tree, sum of subset Problem.
Case Study: Google Map to find shortest distance from source to destination.

UNIT-V	Backtracking, Branch and Bound	07 Hours

Backtracking General method, Recursive backtracking algorithm, Iterative backtracking method. 8-Queen problem, Graph coloring, Hamiltonian Cycle.

Branch And Bound Principle, control abstraction, time analysis of control abstraction, strategies – Branch and Bound using TSP. **Case Study:** Hamilton Cycle Practical Implementation in Circuit Design and Chip Testing Hamilton Cycle.

UNIT-VI	Complexity Theory Classes	07 Hours

Polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P-class problems, NP-class of problems, Polynomial problem reduction NP complete problems- vertex cover.

Text Books:

T1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekhara, Galgotia publications Pvt. Ltd. Second Edition, published in 2008.

T2. Design and Analysis Algorithms - Parag Himanshu Dave, Himanshu Bhalchandra Dave Publisher: Pearson

T3. Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia Publications Pvt.Ltd.

Reference Books:

R1. Gilles Brassard, Paul Bratley, "Fundamentals of Algorithmics", PHI.

R2. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet Examples", Wiley Publication.

R3. Anany Levitin, Introduction to the Design & Analysis of Algorithm, Pearson.

R4. Steven S Skiena, The Algorithm Design Manual, Springer.

R5. George T. Heineman, Gary Pollice, Stanley Selkow, Algorithms in a Nutshell, A Desktop Quick Reference, O'Reilly.
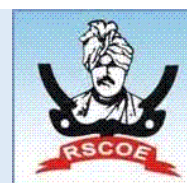
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T. Y. B. Tech (Department of Information Technology)
Semester -V
[IT3202L]: Design and Analysis of Algorithm Lab (2023 Pattern)

Teaching Scheme: LAB: 02 Hours/Week	Credits: LAB: 01	Examination Scheme: ISCE:30 Marks ESE:20 Marks

Course Prerequisites: Programming fundamentals, Problem Logic skills.

Laboratory Objective:
- To implement and analyse various sorting algorithms (such as Merge Sort, Quick Sort, Heap Sort) and evaluate their time complexities in best, average, and worst-case scenarios.
- To design and develop algorithms using the Divide and Conquer
- To apply Dynamic Programming techniques in solving optimization problems.
- To construct and simulate backtracking algorithms by solving the Hamiltonian Cycle problem.
- To implement the Branch and Bound technique for solving combinatorial optimization problems.

Laboratory Outcomes: After successful completion of the course, students will be able to-
LO1.Apply different algorithmic paradigms to implement and solve real-world problems.
LO2.Analyse the performance of algorithms by calculating time complexities for practical inputs.
LO3. Evaluate algorithmic solutions for different optimization problems.
LO4.Design and implement mini-projects to model problems using appropriate algorithmic strategies.

Lab Contents
Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In -Semester continuous evaluation and End semester evaluation.

List of Laboratory Assignments/Experiments

1	a) Write a program to implement Quick sort algorithm for sorting a list of integers in ascending Order. Calculate time Complexity of the algorithm for sample input for best, average, Worst case. b) Write a program to implement Bellman-Ford Algorithm using Dynamic Programming.
2	a) Implement Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm/Prims algorithm. b) Implement Strassen's matrix multiplication algorithm.

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3	a) Implement N Queen's problem using Back Tracking.
	b) Implement Hamiltonian Cycle problem using Backtracking
4	a) Implement Hamiltonian Cycle problem using Backtracking.
	b) Implement Travelling Salesperson Problem using Branch and Bound.
5	A city wants to build a road network connecting 5 neighbourhood's such that the total length of roads is minimized. Given the distances between each pair of neighbourhood's, Model this problem as a minimum spanning tree problem and implement it.
6	A company has to model resource allocation where resources need to be allocated without conflicts like scheduling tasks on multiple processors or machines without conflicts, Allocating frequencies in wireless communication systems to avoid interference. Model this problem as a n queen problem and implement it.
7	A delivery person needs to visit 6 cities and return to the starting point. Model this problem as a graph and find a Hamiltonian Circuit.
8	A company has 4 resources (e.g., machines) and 6 tasks that need to be assigned to these resources. Each task has constraints on which resources it can be assigned to. Model this problem as a graph colouring problem and find a solution.
9	Mini Project based on Sorting/MST/Backtracking/Dynamic Programming/Greedy Method

Text Books:

T1. C++ Programming Language by Bjarne Stroustrup, Pearson Publication, Fourth Edition.

T2. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia publications Pvt. Ltd. 2008 Edition

T3. Design and Analysis Algorithms - Parag Himanshu Dave, Himanshu Bhalchandra Dave Publisher: Pearson.

T4. Horowitz and Sahani, Fundamentals of computer Algorithms, Galgotia Publication.

Reference Books:
 R1. Gilles Brassard, Paul Bratley, "Fundamentals of Algorithmics", PHI.
 R2. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet Examples", Wiley publication.
 R3. Anany Levitin, Introduction to the Design & Analysis of Algorithm, Pearson Publication.
 R4. Steven S Skiena, The Algorithm Design Manual, Springer.

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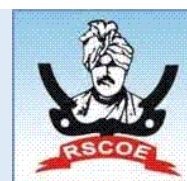**BoS Chairman**

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T. Y. B. Tech (Department of Information Technology)
Semester -V
[IT3203T-A]: Artificial Intelligence(2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Data Structures and Algorithms, Programming Fundamentals, Probability and Statistics.

Course Objectives:
- To introduce students to the fundamental concepts, history, and types of Artificial Intelligence,
- To develop proficiency in classical search algorithms, heuristic search techniques, and adversarial game playing algorithms to solve AI-related problems effectively.
- To familiarize students with knowledge representation schemes, AI planning techniques and frameworks.
- To understand the architecture and components of expert systems and to explore the evolution, working principles, and applications of generative AI models

Course Outcomes: After successful completion of the course, students will able to-
CO1: Describe fundamental concepts of Artificial Intelligence, expert systems and generative AI models.
CO2: Apply search strategies and planning methodologies to design intelligent solutions for AI problem
CO3: Apply knowledge representation techniques to model and infer information in AI systems.
CO4: Analyze traditional and modern generative AI models and discuss challenges.

Course Contents		
UNIT-I	**Introduction to Artificial Intelligence**	**07 Hours**
Introduction to AI – Types of AI: Narrow, General, and Super AI .AI vs. Generative AI Agents and Environments – concept of rationality – nature of environments – Structure of agents. Problem solving agents – search algorithms – uninformed search strategies.		
UNIT-II	**Problem Solving in AI**	**07 Hours**
Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing- Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.		

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UNIT-III	Knowledge Representation	07 Hours

Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution.

UNIT-IV	Planning in AI	07 Hours

Introduction to Planning, Planning vs search, Components of a planning problem, Types of planning: classical, conditional, temporal, hierarchical, Representing Planning Problems, Planning domain definition language (PDDL) basics, Forward and Backward State-Space Search, Real-World Applications and Modern Trends.

UNIT-V	AI Expert Systems	07 Hours

Introduction to Expert Systems, Architecture of an Expert System, Knowledge Representation in Expert Systems, Inference Mechanisms, Uncertainty Handling in Expert Systems, Development of Expert Systems, Applications, Challenges, and Limitations.
Case study PROSPECTOR, XCON, DXplain.

UNIT-VI	Introduction to Generative AI	07 Hours

Generative AI- Difference between discriminative and generative models, Key characteristics of generative models, Traditional vs modern generative models Evolution of Generative AI-From rule-based generation to deep generative models, GPT-2/3/4, DALL·E, Stable Diffusion Core Applications of Generative AI, Text: Chatbots, Deepfakes Audio/Music: Text-to-speech, Music composition (e.g., Jukebox),Challenges and Limitations .

Text Books:

T1. Stuart Russell and Peter Norvig: Artificial Intelligence: A Modern Approach, 4th Edition , Pearson Education 2021.

T2. David L. Poole and Alan K. Mackworth: Artificial Intelligence: Foundations of Computational Agents, 3rd Edition, Cambridge University Press.

Reference Books:

R1. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.

R2. Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 2013.

R3. Dan W. Patterson, "Introduction to AI and ES", Pearson Education,2007
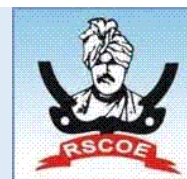
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T. Y. B. Tech Semester - V
[IT3203L-A]: Artificial Intelligence Lab(2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
LAB: 02 Hours/Week	LAB: 01	ISCE:30M ESE:20M

Course Prerequisites: Data Structures and Algorithms, Programming Fundamentals, Probability and Statistics.

Laboratory Objectives:

- To provide hands-on experience with fundamental Artificial Intelligence algorithms and techniques.
- To explore knowledge representation and reasoning by developing rules and relationships in a logic programming language (e.g., Prolog).
- To develop practical understanding of classical search methods such as Breadth-First Search (BFS) and Depth-First Search (DFS).

Laboratory Outcomes:
LO1: Demonstrate simple facts presentation using Prolog.
LO2: Demonstrate uninformed and informed search of AI.
LO3: Demonstrate AI problems and Generative AI tools.

Lab Contents
Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.

List of Laboratory Assignments/Experiments

1.	Use Prolog or a Python logic framework to: • Represent family relationship • Bike Prize and its Comparison. • Calculator Program

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2.	Implement Breadth-First Search (BFS), Depth-First Search (DFS) for Water Jug Problem.
3.	Implement A* algorithm for 8-puzzle problem.
4.	Implement AO* Algorithm.
5.	Implement the N-Queen problem using the backtracking algorithm to place N queens on an N×N chessboard.
6.	Demonstrate generative AI tool: DALL·E , Soundraw or Boomy to generate a short piece of music.
7.	Mini Project : A. Develop AI applications for different AI games. B. Develop an AI system that suggests possible diseases based on symptoms entered by the user. C. Generate a story and related visuals based on keywords using GPT and image models like DALL·E or Stable Diffusion. D. Design a Chabot that can simulate human-like conversation using GPT models or a basic seq2seq model.

Text Books:

T1. Patrick D. Smith : Hands-On Artificial Intelligence for Beginners, Packt Publishing 2018.

T2. Stuart Russell and Peter Norvig: Artificial Intelligence: A Modern Approach, 4th Edition 2020, Pearson.

T3. David L. Poole and Alan K. Mackworth: Artificial Intelligence: Foundations of Computational Agents, 3rd Edition, Cambridge University Press.

Reference Books:

R1. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.

R2. Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 2013.

R3. http://nptel.ac.in.

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Semester -V
[IT3203T-B]: Information and Cyber Security (2023 Pattern)

Teaching Scheme: TH : 03 Hours/Week	Credits: TH : 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Computer Network

Course Objectives:

1. To understand computer, network and information security basics.
2. To understand and apply cryptography techniques using various algorithms.
3. To understand and analyze various protocols at network layer.
4. To understand and analyze risk management strategy with code of ethics for security.
5. To study various cybercrimes and cyber laws.

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

CO1: Describe security fundamentals including common threats and security model.
CO2: Apply cryptography techniques using symmetric and asymmetric algorithms.
CO3: Examine various security protocols at network layer.
CO4: Analyze risk management strategies with code of ethics and security laws.

Course Contents

UNIT-I	Introduction to Information, Computer and Network Security	07 Hours

Information Security Concepts, Security Threats and Vulnerabilities, Security Architectures and Operational Models, Types of Security attacks, Goals of Security, Malicious code, Intrusion detection system (IDS): Need, Types, Limitations and Challenges, security and privacy. Case Study: Banking Organization

UNIT-II	Symmetric and Asymmetric Key Cryptography	07 Hours

Introduction, Classical Encryption Techniques, DES , Triple DES, Block Ciphers and Data Encryption standards, Advanced Encryption standard, Public Key Cryptography and RSA, ECC, Key Distribution, Attacks. Case Study: Whatsapp messages encryption.

UNIT-III	Integrity, Authentication and Non-Repudiation	07 Hours

Cryptographic Hash Functions SHA5, MD5 MAC, Digital Signature using DSA, IP Security: Architecture Protocols IPv4, IPv6, AH, EPS, ISAKMP, Web Security: SSL, HTTPS, Mail Security: PGP, S/MIME. Case study: PGP email tool

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UNIT-IV	Risk Management	07 Hours
Overview, Risk identification, Risk Assessment, Risk Control Strategies, Quantitative vs. Qualitative Risk Control Practices. Risk Management. Risk Monitoring and Reporting, **Risk Management Frameworks and Standards,** NIST Risk Management Framework (RMF), ISO/IEC 27005 Risk Management		
UNIT-V	Cyber Crime and Laws	07 Hours
Introduction, Definition and origin, Cybercrime and Information security, Classification of Cybercrimes, The legal perspectives- Indian perspective, Global perspective, Categories of Cybercrime, Introduction to Cyber Laws and Ethics in Information Security, Codes of Ethics , Social Engineering, Cyber stalking, Cloud Computing and Cybercrime.		
UNIT-VI	Recent Trends in Cyber Security	07 Hours
Cyber security crimes through social medias, Cyber security for cloud and IoT, Cyber security for AI and machine learning driven domains, Mobile cyber security, Cyber security for medical domain.		

Text Books:

T1. William Stallings, Computer Security : Principles and Practices, Pearson 6th Ed.

T2. Nina Godbole, Sunit Belapure , Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiely India Pvt.Ltd.

T3. Bernard Menezes, Network Security and Cryptography, Cengage Learning , Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition.

Reference Books:

R1. Cyber Smart: Five Habits to Protect Your Family, Money, and Identity from Cyber Criminals 1st Edition, Kindle Edition by Bart R. McDonough.s

R2. Next Level Cybersecurity: Detect the Signals, Stop the Hack Kindle Edition by Sai Hunda

R3. CCNA Security Study Guide, Tim Boyle, Wiley

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TATHAWADE, PUNE-33
(An Autonomous Institute Affiliated to Savitribai Phule
Pune University, Pune)
Department of Information Technology

T. Y. B. Tech
Semester - V
[IT3203L-B]: Information and Cyber Security Lab(2023 Pattern)

Teaching Scheme: LAB: 02 Hours/Week	Credits: LAB: 01	Examination Scheme: ISCE: 30 Marks ESE: 20 Marks

Course Prerequisites: C, C++, Java, Python programming

Laboratory Objectives:
1. To understand classical and modern cryptographic algorithms like DES, AES, RSA, Playfair Cipher, and Diffie-Hellman.
2. To understand the process of secure communication using PGP and SHA1 hashing techniques for message authentication and data integrity.
3. To understand mobile cyber security threats and apply countermeasures using Android device analysis and secure app development practices.
4. To understand network vulnerability using assessment tools such as Wire Shark , SNORT etc.and analyse suspicious network traffic and potential attacks.

Laboratory Outcomes:
LO1: Apply classical and modern cryptographic algorithms.
LO2: Illustrate message authentication and data integrity using PGP for secure email communication.
LO3: Analyze mobile security threats to determine suitable measures for smartphone protection.
LO4: Evaluate network vulnerabilities and suspicious traffic using tools like Wireshark, SNORT, and others.

Lab Contents
Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.

List of Laboratory Assignments/Experiments	
1	Implement conventional cryptography technique like Playfair Cipher and symmetric-key cryptography algorithms like DES/AES to ensure encryption and decryption.

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2	Implement RSA algorithm for encryption and decryption of e-mail message and Diffie-Hellman Key exchange algorithm. Assume suitable Private and Public Keys.
3	Illustrate the use of SHA-1 hash algorithm using libraries (API) to ensure message digest for digital signature.
4	Demonstrate the process of secure communication using PGP by examining how encryption, decryption, and digital signatures work
5	Demonstrate the identification and mitigation of mobile cybersecurity threats by evaluating app behaviors, permissions, and applying appropriate security measures on Android devices.
6	Configure and demonstrate use of vulnerability assessment tool like Wireshark or SNORT.
7	Mini Project: Design and Implementation of a Secure Communication System with Threat Detection Capabilities

Text Books:

T1. William Stallings, Computer Security : Principles and Practices, Pearson 6th Ed, ISBN: 978-0-13- 335469-0

T2. Bernard Menezes, Network Security and Cryptography, Cengage Learning , ISBN-978-81-315-1349-1

T3. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN- 978-81-203-5082-3

Reference Books:

R1. Cyber Smart: Five Habits to Protect Your Family, Money, and Identity from Cyber Criminals 1st Edition, Kindle Edition by Bart R. McDonough

R2. Next Level Cybersecurity: Detect the Signals, Stop the Hack Kindle Edition by Sai Hunda

R3. CCNA Security Study Guide, Tim Boyle, Wiley

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T. Y. B. Tech (Department of Information Technology)
Semester -V
[IT3203T-C]: Cloud Computing(2023 Pattern)

Teaching Scheme: TH : 03 Hours/Week	Credits: TH : 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Computer Network

Course Objectives:

1. To understand the foundational concepts of cloud computing including its evolution.
2. To analyze cloud infrastructure, virtualization, and storage mechanisms.
3. To evaluate parallel and distributed programming models, management strategies for application development in cloud environments.

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

CO1: Explain the fundamentals and evolution of cloud computing, including service models.

CO2: Describe data center architecture, cloud infrastructure and management strategies for efficient deployment operations.

CO3: Analyze the use of virtualization technologies and cloud-based tools to optimize computing resources.

CO4: Evaluate cloud storage, distributed programming models and application design in terms of performance and domain-specific optimization.

Course Contents		
UNIT-I	**Introduction to Cloud Computing**	**07 Hours**
Introduction: Definition and evolution of Cloud Computing, Enabling Technologies, Service and Deployment Models, Popular Cloud Stacks and Use Cases, Benefits, Risks, and Challenges of Cloud Computing, Layers in cloud architecture, Economic Models and SLAs Topics in Cloud Security Case Study: The Evolution of Cloud Computing and Its Impact on Modern Businesses		
UNIT-II	**Cloud Infrastructure**	**07 Hours**
Historical Perspective of Data Centers, Datacenter Components: IT Equipment and Facilities, Design Considerations: Requirements, Power, Efficiency, & Redundancy, Power Calculations, PUE and Challenges in Cloud Data Centers, Cloud Management and Cloud Software Deployment Considerations Case Study: Cloud Management and Software Deployment: Lessons from a Major Cloud Provider		
UNIT-III	**Virtualization in Cloud**	**07 Hours**

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Virtualization (CPU, Memory, I/O), Types of Virtualization, Isolation types and Security isolations provided by Virtualization, resource sharing as provided by virtualization, Types of virtual machines, Conditions for virtualizing CPUs, difference between full virtualization and para virtualization.
Case Study: Amazon EC2

UNIT-IV	Cloud Storage	07 Hours

Fundamentals of Cloud Storage, Types of Cloud Storage Services, Storage Mechanisms (HDFS, Ceph) and Technologies, Security and Compliance, Emerging Trends in Cloud Storage, Advantages and disadvantages of cloud storage.
Case Study: Cloud Storage for Healthcare Data Management

UNIT-V	Cloud Resource Management	07 Hours

Difference between classical OS virtual memory and system memory virtualization, Hypervisor - Xen, Three main interfaces with I/O virtualization, I/O virtualization to Xen, Recent developments in software defined networking and software defined storage from the cloud computing perspective, Automation in Resource Management, Resource Optimization.
Case Study: Resource Optimization in Cloud Computing: A Practical Approach

UNIT-VI	Recent Trends in Cloud Computing	07 Hours

Fundamental aspects of parallel and distributed programming models, Basic definitions: cluster, grid, meta-computing, middleware etc., examples of representative applications, Performance metrics and profiling, Cloud programming models, Recent tools used for cloud computing
Case Study : Introduction to Salesforce.com

Text Books:

T1. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach

T2. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008.

T3. "Grid Computing a Research Monograph" by D. Janakiram, Tata McGraw hill publications

Reference Books:

R1. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010

R2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011

R3. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010

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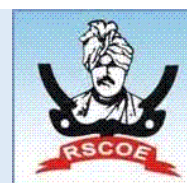**BoS Chairman**

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T. Y. B. Tech (Department of Information Technology)
Semester -V
[IT3203L-C]: Cloud Computing Lab(2023 Pattern)

Teaching Scheme: LAB: 02 Hours/Week	Credits: LAB: 01	Examination Scheme: ISCE : 30 ESE : 20

Course Prerequisites:

Laboratory Objective:
- To Understand and Implement Cloud Platform Basics
- To Simulate Cloud Scenarios and Evaluate Scheduling Algorithms
- To Explore Virtual Machine Operations and File Transfers
- To Set Up and Utilize Hadoop for Big Data Processing
- To Integrate Tools for Cloud-Based Application Development

Laboratory Outcomes:

LO1: Develop basic web applications using different cloud service providers, demonstrating proficiency in cloud application deployment.

LO2: Implement cloud scenarios in CloudSim and custom scheduling algorithms to enhance cloud resource management.

LO3: Demonstrate virtual machine management by transferring files between VMs, launching VMs using TryStack.

LO4 : Execute Hadoop single-node cluster for simple applications.

Lab Contents

Guidelines for Assessment

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List of Laboratory Assignments/Experiments	
1	Install Google App Engine. Create hello world app and other simple web applications using python.
2	Use GAE launcher to launch the web applications.
3	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

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4	Find a procedure to transfer the files from one virtual machine to another virtual machine.
5	Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
6	Install Hadoop single node cluster and run simple applications like word count.
7	Mini Project

Text Books:

T1. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach

T2. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008.

T3. "Grid Computing a Research Monograph" by D. Janakiram, Tata McGraw hill publications

T4. "Python for Everybody : Exploring Data in Python 3" by Charles Russell Severance

Reference Books:

R1. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010

R2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011

R3. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010

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Department of Information Technology
Semester - V
[IT3203T-D]: UI and UX Design(2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Web Technology

Course Objectives:

- To understand basic concepts of user interface and user experience design.
- To Study skills required for an application of specific methods in user experience design.
- To Improve individual and collaborative skills in design problem solving.

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

CO1: Describe core principles, components, and tools of UI/UX design.
CO2: Apply design thinking and user-centered methods to interface design.
CO3: Apply prototyping and wireframing techniques using modern tools.
CO4: Apply advanced tools to create responsive and visually appealing interfaces.
CO5: Analyze usability through testing methods and refine UI/UX solutions.

Course Contents

UNIT-I	Introduction to User Interface Design	07 Hours

Overview and history of UI design, UI design methodology and user-centered design, User roles, responsibilities, capabilities, Principles of UI design and UI testing, Components of UX and visual communication in interface design. Applications of UX design
Introduction to Design Technologies and Tools Sketch, Wireframe, Invision, Axure, Figma, Flutter, Mockups

UNIT-II	Foundations of UI Design	07 Hours

Difference between UI and UX design, Design Thinking stages, divergent/convergent thinking, Brainstorming, game storming, and observational empathy, Information architecture, UI elements, and interaction behaviors, Brand platforms, style guides, UX trends, Six stages of UX design

Case Study: Apply Design Thinking on Mobile E-Commerce Application

UNIT-III	Elements of UX Design	07 Hours

User Interaction, Cognitive Model, Mental Model, User Experience (UX) Design and its used, Elements used in User Experience Design, Defining the UX Design Process and its Methodology Flow Chart, User Map, Research in User Experience Design, Tools and Method used for Research, User Needs and its Goals.

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Case Study: Apply Tools and Method used for Research Design for Fitness Tracker App.

UNIT-IV	UX Design Process	07 Hours

Design principles, information design, and data visualization, Wireframing & storyboarding, screen layouts, elements and widgets, Design testing techniques, usability principles, assessment methods, Evaluating interface design: expert reviews, usability testing, acceptance tests, Legal and human factors in design.

Case Study: Apply design principles and Information architecture on a Healthcare Mobile App for Patient Management

UNIT-V	Prototyping & Testing	07 Hours

Prototype creation, iteration, and evaluation methods, Usability testing: types, planning, and refinement, Wireframing: purpose, low/medium/high-fidelity, Sketching and layout design in tools like Figma, Device-based considerations: size, behavior, interaction

Case Study: Apply Prototyping & Testing methods for Food Delivery App for Enhanced User Experience (UX)

UNIT-VI	Advanced Tools	07 Hours

Google Tools for UX, HTML 5 & CSS 3, Responsive website coding with bootstrap, SEO, Photoshop & Illustrator, Figma & Sketch, Logo and Icon design with Color, Composition & Typography, Intro to Invision, Balsamic & UX Pin

Case Study: Apply UX Tools for designing a Restaurant Website.

Text Books:

T1. Wilbent. O. Galitz, "The Essential Guide to User Interface Design", John Wiley& Sons, 2001.

T2. Buxton, B. Sketching User Experiences: Getting the Design Right and the Right Design. Morgan Kaufmann, (2007)

T3. Raskin, Jef. The Humane Interface: New Directions for Designing Interactive Systems. Addison-Wesley Professional, 2000.

Reference Books:

R4. Alan Cooper, "The Essential of User Interface Design", Wiley – Dream Tech Ltd., 2002.

R5. Shneiderman, Ben, and Catherine Plaisant. Designing the User Interface: Strategies for Effective Human-Computer Interaction. 4th ed. Addison Wesley, 2004. ISBN: 9780321197863.

R6. Olsen, Dan R. Developing User Interfaces (Interactive Technologies). Morgan Kaufmann, 1998. ISBN: 9781558604186

R7. Jhonson, Jeff. GUI Bloopers: Don'ts and Do's for Software Developers and Web Designers (Interactive Technologies). Morgan Kaufmann, 2000. ISBN: 9781558605824

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JSPM's
RAJARSHI SHAHU COLLEGE OF ENGINEERING
TATHAWADE, PUNE-33
(An Autonomous Institute Affiliated to Savitribai Phule Pune
University, Pune)
Department of Information Technology

T. Y. B. Tech
Semester - V
[IT3203L-D]: UI and UX Design Lab(2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
LAB: 02 Hours/Week	LAB: 01	ISCE: 30 ESE: 20

Course Prerequisites: Web Technology

Laboratory Objective:
- To learn a comprehensive library of UI elements and use them in sample projects
- To understand an existing application or website to identify improvement areas in UI and UX design.
- To study medium-fidelity prototypes using tools like Adobe XD, based on wireframes and style guides.
- To understand the user interface elements for mobile apps or websites

Laboratory Outcomes:
LO1: Analyze and redesign user interfaces by applying core UX principles.
LO2: Develop low-fidelity and high-fidelity wireframes for mobile applications.
LO3: Design consistent and reusable UI elements for digital interfaces.
LO4: Create interactive prototypes and perform usability testing to improve user experience.

Lab Contents

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.

List of Laboratory Assignments/Experiments

1.	Redesign an existing application or website, dividing responsibilities into UI and UX tasks.
2.	Design user persona for the users of selected product / system.
3.	Create Low-Fidelity Wireframes: Mobile E-Commerce App Low-Fidelity Wireframes: Sketch main screens (Home, Product Listing, Product Detail, Cart, Checkout) using pen/paper

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	or a simple digital tool. Use boxes and placeholders to show layout, navigation, product images, and action buttons.
4.	Create High-Fidelity Wireframes: Mobile E-Commerce App Digitally refine in Figma or Adobe XD. Add real product names, prices, images, colors, and typography. Focus on consistency, spacing, and user flow for a realistic shopping experience.
5.	Create wireframes for a job search platform that includes job listings, company profiles, application tracking, and resume uploads. Design the user interface for browsing jobs, viewing details, applying to positions, and monitoring application status.
6.	Create a library of UI elements (e.g., buttons, navigation bars, modals) and apply them to a sample project.
7.	Create a simple UI for a mobile app or website with basic elements such as buttons, text fields, and images.
8.	Build a prototype for a Food Delivery App, design a usability test plan, conduct user testing with 3–5 users, and iterate based on feedback.
9.	Use Photoshop or Illustrator to design a logo and icon set for the restaurant website. Focus on color theory, composition, and typography
10.	Design a responsive restaurant website using HTML5, CSS3, and Bootstrap. Integrate UX principles and SEO best practices.
11.	Mini Project

Text Books:

T1. Wilbent. O. Galitz, "The Essential Guide to User Interface Design", John Wiley& Sons, 2001.

T2. Buxton, B. Sketching User Experiences: Getting the Design Right and the Right Design. Morgan Kaufmann, (2007)

T3. Raskin, Jef. The Humane Interface: New Directions for Designing Interactive Systems. Addison-Wesley Professional, 2000.

Reference Books:

R8. Alan Cooper, "The Essential of User Interface Design", Wiley – Dream Tech Ltd., 2002.

R9. Shneiderman, Ben, and Catherine Plaisant. Designing the User Interface: Strategies for Effective Human-Computer Interaction. 4th ed. Addison Wesley, 2004. ISBN: 9780321197863.

R10.   Olsen, Dan R. Developing User Interfaces (Interactive Technologies). Morgan Kaufmann, 1998. ISBN: 9781558604186.

R11.   Jhonson, Jeff. GUI Bloopers: Don'ts and Do's for Software Developers and Web Designers (Interactive Technologies). Morgan Kaufmann, 2000. ISBN: 9781558605824.

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Department of Information Technology
T. Y. B. Tech
Semester - V
[IT3204L]: Programming Lab III(2023 Pattern)

Teaching Scheme: LAB: 04 Hours/Week	Credits: LAB: 02	Examination Scheme: ISCE:50 ESE:50

Course Prerequisites: Object Oriented Programming

Laboratory Objectives:
- To introduce java integrated development environment
- To understand an object-oriented way of solving problems using Java.
- To study multithreading concepts and handle exceptions

Laboratory Outcomes:
LO1: Apply object-oriented programming features to develop real-world applications.
LO2: Design Java-based applications using core programming constructs and principles.
LO3: Develop Java programs using multithreading, collections, and exception handling mechanisms.
LO4: Develop and organize user-defined packages for application development in Java.

Lab Contents
Guidelines for Assessment
Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.

	List of Laboratory Assignments/Experiments
1	Write a program in Java to implement real-life entities (e.g., Student, Book, Account,) using Classes and Objects.
2	Write a Java program to demonstrate Default and Parameterized Constructors in an Online Course Enrollment System where courses are created with constructors that auto-generate unique IDs and initialize course details.
3	Write a program in Java to implement method overloading in a Scientific Calculator application that supports overloaded calculate() methods for different operations: — Integer-based math (add, subtract) — Double-based math (trigonometric, logarithmic)

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	— Matrix operations (overload with 2D arrays)
4	Implement concept of inheritance for University Academic System where a base class Person is extended by Student, Faculty, and AdminStaff. Each subclass adds specific attributes and methods: — Student: enrolls in courses — Faculty: grades students — AdminStaff: manages records and implement polymorphic behavior and override common methods.
5	Implement an Interface for a Smart Device Interface System where multiple devices (SmartTV, SmartFridge, SmartAC) implement a ControllableDevice interface with methods like powerOn(), powerOff(), and statusReport(). Add another interface InternetEnabled with connectWifi() for selective devices. Use interface references to call methods dynamically.
6	Write a Java program with multiple threads a. Thread for printing even numbers and odd numbers concurrently b. Build a Multithreaded Train Reservation System where multiple user threads try to book tickets from a shared pool.
7	Create custom packages for logical separation in a Finance Application with multiple user-defined packages: a. com.finance.accounts for account operations b. com.finance.tax for tax calculations
8	Demonstrate use of Java Collection (List, Set, Map, Queue) for different real-life application like a. Order Management System. b. Movie ticket booking system c. Team management system
9	Write a Java program to handle exceptions using try-catch-finally and custom exceptions for any application
10.	Write a Java program to process a list of record using Stream API for filtering, mapping, and sorting. a. Given a list of integers, use Stream API to filter and display only the even numbers. b. Given a list of names, use Stream API to convert all names to uppercase and print them c. Given a list of strings, count how many start with the letter "A" using Stream API.
11.	Write a program that takes unformatted resumes (text files), extracts structured information like Name, Email, Skills, and creates a clean formatted version. a. Read from raw .txt files in a directory b. Make data in structure format

	c. Output cleaned resumes to a new file
12.	Mini Project

Text Books:

T1. Programming with Java A Primer, E. Balaguruswamy Tata McGraw Hill Companies

T2. Java Programming John P. Flynt Thomson 2nd The complete reference JAVA2, Hervert schildt. TMH

Reference Books:

R1. Java – Balaguruswamy

R2. Core Java, Dietel and Dietel

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Semester - V
[IT3205L]: Co-curricular Course(2023 Pattern)

Teaching Scheme:	Credit 01 each for Semester availed	Examination Scheme: Continous assessment throughout semester Final marks- 50

Course Objective:

To provide students the opportunity to better explore their interests and to groom overall personality, apart from academic ability.

CourseOutcome:
Students will be able to

- Broaden students' breadth of knowledge and horizons.
- Stimulate out of the box thinking, self-reflection, and self-understanding to promote their individual growth.
- Build solid foundation for "Whole Person Education" which will nurture and foster the holistic development

Course Contents

List of Extra curricular activities :

1. Leadership Work and Positions

2. Sports and Athletic Participation

3. Academic Clubs and Teams/ Professional student chapters

4. Artistic and Creative Pursuits

5. Volunteering and Community Service

6. Internships

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Rules & Regulations:

- All the first year students should enroll in one of the Extra-Curricular Activities
- Students opting for Sports / Games / Yoga / Martial Arts / Dance can continue the same activity in the I/II/III/IV/V/VI/VII/VIII semester or can choose another activity
- Every week, any day last 2 hours are given for Cocurricular activity.
- Minimum of 50% attendance is required for these activities.
- In-charge faculty coordinator monitor the students and take the attendance.
- At the end of the year the attendance is submitted to the Attendance Committee and finally to the Exam Section.
- Students are given grades credits in the final memorandum.

Guideline for grading Co/Extra-Curricular Activity

- RSCOE shall organized various competitions through its various clubs(governed by either by Student Affairs pr Department) during the semester and academic year.
- All UG students shall choose at least ONE activity/event from the group of Co-curricular and Extra-curricular activities happening on campus or off campus during the semester. The student shall take active part in the activity, take part in competitions and earn grade points.
- On registering for a particular activity, the performance of a student shall be continuously monitored by the Faculty-in-charge.

RSCOE plans club activities into these categories and verticals given below
   1. Art Club
   2. Technical Club
   3. Sports and Games
   4. SWAYAM
- Verticals

A)Art & Design
Examples: Drawing, Painting, Rangoli, Calligraphy, Poster Making, Craftwork, Digital Art
B) Performing Arts
Examples: Dance (Classical, Folk, Western), Music (Vocal, Instrumental), Drama, Skit, Stand-up Comedy, Mime
C). Literary Arts
Examples: Debate, Elocution, Anchoring, Creative Writing, Poetry, Storytelling, Extempore
Innovation & Social Impact
Examples: Street Plays, Social Campaigns, Environmental Drives, Design Thinking Activities, Community Outreach
Art club include various clubs related to liberal arts, music, performing arts etc.
- Technical club include chapters of professional societies like SAE,ASRAE,ISHRAE,CSI,RSI,IEEE, ISTE, IET, Department Associations, Shashwat (socio-technical club),Rotaract, ASCE,ICI etc.
- National Service Scheme (NSS) and Similar activities such as Unnat Bharat, Social Work, Blood donation etc.
- SWAYAM portal offers some self-paced courses related with YOGA such as Physical Activity (YOGA) (योग) or approved by Dean concern.
- Participation in competitions, winning prizes, representing institute on state, national and international level etc shall get weightage as mentioned in the Annexure I and rubrics for same ids designed

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- All competition to which Academic credit is concerned, shall have set of guidelines and rubrics defined by the department or Student Affair or concern faculty in charges.
- Few examples of Competition/Activity and is given in Annexure II

Annexure I: Assessment Rubrics:

Table A Rubrics for Assessment for Clubs Sports and cultural events(@UG Level)

	Clubs/Activity					Marks*	Grade point	Letter Grade
	• Art clubs • Technical Clubs • Sports • Any other competition/activity defined by institute/ department.	NSS/NCC/Unnat Bharat Abhiyan	Participation in events outside of the institutes	SWAYAM Courses(only4 week course approved Dean concern)	Leadership & Management of clubs/activities/ Student Professional Societies/Institute Festival & Technical Events etc			
Achievement level	I Prize winner, II Prize Winner, III winner	Best NSS/NCC Volunteer Awardee (State/National level) / Participation in Republic Day Parade Camp/International Youth Exchange Programme, Supported by certification	I Prize winner, II Prize Winner, III Prize Winner	As reflected in grade sheet	Top level management	50-45	10	O
	Active Participation (High)	Active Participation (High)	Selection in such events supported By certification		Middle level management	40-35	9	A+
						35-30	8	A
	Active Participation (Medium)	Active Participation (Medium)			Lower-level management	30-25	7	B+
						25-20	6	B
	Active Participation (low)	Active Participation (low)				20-15	5	C
						12	4	P
	Not participate	Not participate	-		-	0	0	F

*Various clubs different marking system, however, it can be scaled down to 50 and assign credit accordingly.

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Table B Rubrics for Assessment for Professional Society/Hacathons events (@FY Level)

10 pts=1 credits

Sr No	Category	International			National			State			Inter college	In-house
1	Organizer	8 pts			5 pts			4 pts			3 pts	2 pt
2	Participants	Shortlisted for final round=5	Shortlisted for second round=4	Shortlisted for first round= 3	Shortlisted for final round =4	Shortlisted for second round =3	Shortlisted for first round=2	Shortlisted for final round=3	Shortlisted for second round= 2	Shortlisted for first round =1	2	1
3	Winner	Rank 1 = 10	Rank 2= 9	Rank 3= 8	Rank 1 = 9	Rank 2= 9	Rank 3= 7	Rank 1 = 8	Rank 2= 7	Rank 3= 6	7,6,5	7,6, 5

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Semester VI

T. Y. B. Tech (Department of Information Technology)
Semester -VI
[IT3206T]: Machine Learning (2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Linear Algebra, Probability and Statistics

Course Objectives:

1. To introduce foundational concepts, types, and applications of machine learning.
2. To develop skills to implement and evaluate classification and regression models.
3. To solve problems using distance-based, rule-based, tree-based, and probabilistic models.
4. To explore emerging trends and applications in machine learning for innovative solutions.

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

CO1: Describe machine learning concepts and types of machine learning.

CO2: Apply classification and regression algorithms for given dataset and evaluate their performance.

CO3: Analyze the performance of distance based**,** rule-based, tree based and probabilistic models.

CO4: Analyze various ensemble learning techniques and neural network architectures with real-world examples.

Course Contents		
UNIT-I	**Introduction to Machine Learning**	**07 Hours**

Introduction: What Is Machine Learning, Examples of Machine Learning Applications, Types of Learning: Supervised, Unsupervised, Semi-Supervised Learning, Reinforcement Learning, Concept of Feature, Feature Construction, Feature Selection and Transformation. Training Vs. Testing Dataset, Dataset Validation Techniques – Hold-Out, K-Fold Cross Validation, Leave-One-Out Cross-Validation (LOOCV). **Dimension reduction techniques**: Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA)

UNIT-II	**Classification**	**07 Hours**

Binary and Multiclass Classification: Assessing Classification Performance, Multiclass Classification-One vs One, One vs Rest, Linear Models: Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity: RBF, Gaussian, Polynomial, Sigmoid, Logistic Regression: Model, Cost Function.

UNIT-III	**Regression**	**07 Hours**

Regression: Least Square method, Univariate Regression, Multivariate Linear Regression, Cost Functions: MSE, RMSE, R-Square, Performance Evaluation, Ridge Regression, Lasso Regression,

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Optimization of Simple Linear Regression with Gradient Descent, Overfitting, Underfitting, Bias-Variance Dilemma, VC Dimensions.

UNIT-IV	Distance and Rule Based Models	07 Hours

Distance metrics, K-means clustering algorithm, KNN classification algorithm, Hierarchical clustering, Divisive Dendrogram for hierarchical clustering.
Association Rule Mining: Introduction, Rule learning for subgroup discovery, Apriori Algorithm, Performance Measures – Support, Confidence, Lift.

UNIT-V	Tree based and Probabilistic Models	07 Hours

Tree Based Model: Decision Tree – Concepts and Terminologies, Impurity Measures -Gini Index, Information gain, Entropy, Tree Pruning -ID3/C4.5, Advantages and Limitations
Probabilistic Models: Conditional Probability and Bayes Theorem, Naïve Bayes Classifier, Bayesian network for Learning and Inferencing.

UNIT-VI	Recent Trends in Machine Learning	07 Hours

Ensemble Learning: Bagging, Boosting, Stacking, Artificial Neural Network: Biological Neuron, Introduction to ANN, McCulloch Pitts Neuron, Perceptron and its Learning Algorithm, Activation Functions: Tanh, ReLu, Sigmoid, Multiplayer perceptron model. Case Study on Neural Network.

Text Books:
T1. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.
T2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
T3. Tom M Mitchell, ―Machine Learning‖, First Edition, McGraw Hill Education, 2013

Reference Books:
R1. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
R2. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition.
R3. Parag Kulkarni: Reinforcement Learning and Systemic Machine Learning for Decision Making, IEEE Press, Reprint 2015.
R4. Nikhil Buduma: Fundamentals of Deep Learning, O'Reilly Media, June 2017.
R5. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012.
R6. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.

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T. Y. B. Tech (Department of Information Technology)
Semester -VI
[IT3206L]: Machine Learning Lab(2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
LAB: 02 Hours/Week	LAB: 01	ISCE: 30 Marks
		ESE: 20 Marks

Course Prerequisites: Programming fundamentals, Problem solving skills.

Laboratory Objective:
- To introduce the basic concepts and techniques of Machine Learning and the need of Machine Learning techniques in real-world problems.
- To provide understanding of various Machine Learning algorithms and the way to evaluate performance of the Machine Learning algorithms.
- To apply Machine Learning to learn, predict and classify the real-world problems in the Supervised Learning paradigms as well as discover the Unsupervised Learning paradigms of Machine Learning.
- To understand, learn and design simple Artificial Neural Networks of Supervised Learning for the selected problems.

Laboratory Outcomes:
LO1: Analyze the performance of machine learning algorithms like PCA, SVM, Regression and decision trees by evaluating the performance metrics across various datasets.
LO2: Apply clustering techniques like K-Means and Agglomerative Clustering to identify meaningful patterns in real-world datasets.
LO3: Analyze the generated association rules to interpret their significance and applicability in decision-making scenarios.
LO4: Create neural networks for given dataset and evaluate its performance.

Lab Contents
Guidelines for Assessment
Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.
List of Laboratory Assignments/Experiments

1	**Perform dimensionality reduction on a dataset using the Principal Component Analysis**

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	(PCA) method.
	• Select a dataset with multiple features.
	• Implement PCA to reduce the dimensions of the dataset while retaining maximum variance.
	• Visualize the results of dimensionality reduction in 2D or 3D space.
	• Discuss the effect of dimensionality reduction on dataset information retention.

2	**Implement the Support Vector Machine (SVM) algorithm on a dataset and compare the classification accuracy using different kernel functions.**
	• Choose an appropriate dataset for binary or multiclass classification.
	• Apply SVM with the following kernel functions:
	   ➢ Linear
	   ➢ Polynomial
	   ➢ Radial Basis Function (RBF)
	• Compare the classification accuracy for each kernel.
	• Summarize and analyze the results.

3	**Implement a regression algorithm and evaluate its performance on a dataset.** • Use a suitable regression dataset (e.g., Boston Housing or a custom dataset). • Implement any regression algorithm such as Linear Regression or Polynomial Regression. • Evaluate the model using performance metrics such as Mean Squared Error (MSE), Mean Absolute Error (MAE), and R-squared score. • Provide a detailed interpretation of the performance results.
4	**Implement K-Means clustering on unlabeled dataset.** • Preprocess the dataset to handle missing values and scale the features appropriately. • Apply the K-Means clustering algorithm. • Determine the optimal number of clusters using the Elbow method. • Visualize the clustering results and provide an interpretation of the clusters.
5	**Implement agglomerative clustering on unlabeled dataset.** • Select a dataset for clustering (e.g., customer segmentation). • Perform hierarchical clustering using the Agglomerative method. • Use dendrograms to decide the number of clusters. • Visualize and analyze the clustering results.
6	**Create association rules for the Market Basket Analysis for the given Threshold.** • Use transaction data to identify frequent itemsets. • Apply the Apriori algorithm or FP-Growth algorithm to generate association rules. • Set thresholds for support, confidence, and lift. • Analyze and interpret the generated rules.

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7	**Implement decision tree algorithm to perform multiclass-classification.**
	• Choose a suitable dataset for multiclass classification
	• Build a decision tree classifier
	• Visualize the decision tree
	• Evaluate the model using metrics like accuracy, precision, recall, and F1-score
8	**Recognize optical characters using an Artificial Neural Network (ANN).**
	• Use a dataset like MNIST for handwritten digit recognition.
	• Build an ANN model for character recognition.
	• Train the model and evaluate its accuracy.
	• Provide visual results of correctly and incorrectly recognized characters
9	**Mini Project:** Students should design and implement a project using Reinforcement Learning techniques to solve real-world problems, such as game playing, robotics, or resource optimization. The project should include defining an environment, formulating rewards, and developing a learning agent to achieve optimal performance through trial-and-error learning.

Text Books:

T1. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.

T2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.

T3. Tom M Mitchell, ―Machine Learning‖, First Edition, McGraw Hill Education, 2013

Reference Books:

R1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, O'Reilly Media, 2019.

R2. Python Machine Learning, Sebastian Raschka, Vahid Mirjalili, Packt Publishing, 2020.

R3. Deep Learning with Python ,François Chollet, Manning Publications, 2018.

R4. Programming Collective Intelligence, Toby Segaran, O'Reilly Media, 2007.
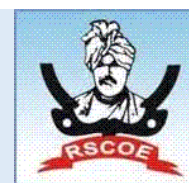
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T. Y. B. Tech
Semester -VI
[IT3207T-A]: Natural Language Processing (2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Calculus and Transform, Programming in Python

Course Objectives:

1. To introduce students to leading trends and systems in Natural Language Processing.
2. To make students understand the concepts of morphology, syntax, semantics and pragmatics of the language.
3. To make students learn the statistical approaches for machine translation.

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

CO1: Describe concepts of Natural Language Processing and word level analysis.
CO2: Apply Syntactic, Semantic and Pragmatic analysis to effectively process linguistic data.
CO3: Apply Discourse analysis and Lexical resources on different types of data.
CO4: Analyze sentiments to effectively process different types of data.

Course Contents		
UNIT-I	**Introduction to NLP**	**07 Hours**
Overview of Natural Language Processing, origins and challenges of NLP, Language Modeling: Grammar-based LM, Statistical LM, Regular Expressions, Finite-State Automata, English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.		
UNIT-II	**Word Level Analysis**	**07 Hours**
Unsmoothed N grams, Evaluating N grams, Smoothing, Interpolation and Backoff, Word Classes, Part of Speech Tagging, Rule-based, Stochastic and Transformation based tagging, Issues in PoS tagging, Hidden Markov and Maximum Entropy models.		
UNIT-III	**Syntactic Analysis**	**07 Hours**
Context Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Dynamic Programming parsing, Shallow 85 parsing, Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs, Feature structures, Unification of feature structures.		
UNIT-IV	**Semantics and Pragmatics**	**07 Hours**
Requirements for representation, First Order Logic, Description Logics, Syntax-Driven Semantic analysis, Semantic attachments, Word Senses, Relations between Senses, Thematic Roles, Selectional restrictions, Word		

Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods,Word Similarity using Thesaurus and Distributional methods.

UNIT-V	Discourse Analysis and Lexical Resources	07 Hours

Discourse segmentation, Coherence, Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm, Coreference Resolution Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus.

UNIT-VI	Sentiment Analysis	07 Hours

Introduction to Sentiment Analysis and Opinion Mining, Polarity Classification, Fine-grained Sentiment Analysis, Aspect-based Sentiment Analysis, Approaches to Sentiment Analysis, Preprocessing for Sentiment Analysis, Feature Engineering, Deep Learning for Sentiment Analysis

Text Books:

   T1. Dan Jurafsky and James Martin. Speech and Language Processing: An Introduction to Natural Language Processing, Pearson Education,2nd Edition,2013.
   T2. Computational Linguistics and Speech Recognition. Prentice Hall, Second Edition,2009.
   T3. Chris Manning and Hinrich Schutze. Foundations of Statistical Natural Language Processing. MIT Press, Cambridge, MA: May 1999.

Reference Books:

   R1. Siddiqui T., Tiwary U. S. Natural language processing and Information retrieval, OUP, 2008
   R2. Bharati A., Sangal R., Chaitanya V. Natural language processing: a Paninian perspective, PHI, 2000

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T. Y. B. Tech
Semester -VI
[IT3207L-A]: Natural Language Processing Lab(2023 Pattern)

Teaching Scheme: LAB: 02 Hours/Week	Credits: LAB: 01	Examination Scheme: ISCE: 30 marks ESE : 20 marks

Course Prerequisites: Python Programming

Laboratory Objective:
- Tokenize text, remove stop words, and apply stemming to clean and prepare text for analysis.
- Implement a basic bigram or trigram model for word prediction.
- Label words in a sentence with their correct parts of speech.
- Identify and extract named entities (people, places, organizations) from text.

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

LO1: Apply cleaning and tokenizing on text data with stop words and reducing words to their root forms.
LO2: Analyse functional N-gram model to predict the next word in a sequence.
LO3: Implement identification and tagging of parts of speech for each word in a sentence correctly.
LO4: Evaluate extraction of named entities like people, places, and organizations from the text accurately

Lab Contents

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In -Semester continuous evaluation and End semester evaluation.

List of Laboratory Assignments/Experiments	
1	Implement text preprocessing steps including tokenization, filtration, script validation, stop word removal, and stemming using Python NLP libraries (e.g., NLTK or spaCy).
2	Apply rule-based or tool-based approaches for morphological structure of words by identifying roots, prefixes, and suffixes using.
3	Construct unigram, bigram, and trigram models on a given text corpus to predict word sequences and calculate their probabilities.

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4	Implement POS tagging using rule-based and statistical models such as Hidden Markov Models (HMM) and compare results with built-in NLP libraries.
5	Apply rule-based or tool-based approaches a shallow parser to identify phrases (noun phrases, verb phrases) using POS-tagged input, chunk patterns, and chunking algorithms.
6	Implement a NER system to recognize entities such as names, locations, and organizations using supervised learning or pre-trained models.
7	Use pre-trained language models or create custom models to generate meaningful text from seed input and evaluate the fluency of generated output.
8	Implement a mini-project applying NLP techniques to real-world problems such as sentiment analysis, chatbot, text summarization, or information extraction.

Text Books:

   T1. Core Python Programming, R. Nageswara, Net,3rd Edition.

   T2. "Speech and Language Processing" Daniel Jura sky and James H. Martin, Edition:
      3rd Edition, Pearson Education.

   T3. "Foundations of Statistical Natural Language Processing" Christopher D. Manning and
      Hinrich Schütze, Publisher: MIT Press

Reference Books:

   R1. "Natural Language Understanding" by James Allen Publisher: Benjamin/Cummings
      Publishing

   R2. "Neural Network Methods in Natural Language Processing" by Yoav Goldberg
      Publisher: Morgan & Claypool Publishers

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JSPM's
RAJARSHI SHAHU COLLEGE OF ENGINEERING
TATHAWADE, PUNE-33
(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)
Department of Information Technology
T. Y. B. Tech
Semester -VI
[IT3207T-B]: Ethical Hacking(2023 Pattern)

Teaching Scheme: TH : 03 Hours/Week	Credits: TH : 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Computer Network and Cyber Security

Course Objectives:

- To prepare students with the technical knowledge and skills needed to protect and defend cyber-attacks and understand ethical hacking methodology
- To analyze and understand security attacks.
- To analyze web server vulnerabilities and prevention techniques to avoidexploitation.
- To analyze and understand web security.

Course Outcomes: After successful completion of the course, students will able to-
CO1: Describe the basics of the ethical hacking.
CO2: Apply Nmap to identify hosts, open ports, services, OS details, and vulnerabilities.
CO3: Demonstrate the use of tools like Metasploit and SQL Map to exploit vulnerabilities and sniff traffic.
CO4: Analyze advanced hacking techniques and implement their countermeasures.

Course Contents

UNIT-I	Introduction to Ethical Hacking	07 Hours

Important Terminologies, Ethical hacking process, Hacker's behavior and mindset, Hacking Methodology, Information Gathering, Active and Passive Sniffing, Physical security vulnerabilities and counter measures. Security Fundamental, Security testing, Hacker and Cracker, Ethical and Legality.

UNIT-II	Scanning	07 Hours

Information Gathering, Determining the Network Range, Identifying Active Machines, Finding Open Ports and Access Points, OS Fingerprinting, Fingerprinting Services, Mapping the Network Attack Surface.

UNIT-III	Vulnerability Assessment	07 Hours

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Scanning the target for vulnerabilities with the information gathered, Ping and Ping Sweeps, Port Scanning with N-map, scanning for the services on a target server, Finding vulnerable service. Case study on vulnerability assessment.

UNIT-IV	Exploitation Tools	07 Hours

Introduction to exploitation, Introduction to Metasploit (Hack like a Pro with Metasploit), Sniffing the network traffic, Spying on network, Hacking a remote system with SET (Social Engineering Toolkit), Case study on SQL Map.

UNIT-V	Malware Threats	07 Hours

Viruses and Worms, Trojans, Covert Communication, Keystroke Logging and Spyware, Malware Counter measures 6 Sniffers, Session Hijacking and Denial of Service: Sniffers, Session Hijacking, Denial of Service and Distributed Denial of Service

UNIT-VI	Wireless and Web Hacking	07 Hours

Wireless Hacking, Introducing Air crack- Cracking the WEP, cracking a WPA/WPA2 Wireless Network Using Air cracking, Web Hacking – Attacking the Authentication, Brute Force and Dictionary Attacks, Testing for the Vulnerability, Automating It with Burp Suite, Session Attacks –XSS (Cross-Site Scripting), Server-Side Request Forgery(SSRF), Cross-Site Request Forgery (CSRF)

Text Books:

T1. Hands On Ethical Hacking and Network Defense – By Michael T. Simpson, Kent Backman, James Corley

T2. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy by Patrick Engebretson, Syngress Media, 2011.

T3. Hacking the Hacker, Roger Grimes, Wiley

Reference Books:

R1. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy (Syngress Basics Series)

R2. Ethical Hacking and Penetration Testing Guide by Rafay Baloch, CRC Press, 2015.

R3. Hands on Ethical Hacking and Network Defense [Print Replica] [Kindle Edition]

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T. Y. B. Tech (Department of Information Technology)
Semester -VI
[IT3207L-B]: Ethical Hacking Laboratory(2023 Pattern)

Teaching Scheme: LAB: 02 Hours/Week	Credits: LAB: 01	Examination Scheme: ISCE: 30 ESE: 20

Course Prerequisites: Computer Network and Cyber Security

Laboratory Objective:

- To introduce ethical hacking principles, methodologies, and legal compliance.
- To perform network reconnaissance using Nmap to identify machines, ports, services, and OS fingerprints.
- To explore the concepts of vulnerabilities using Metasploit and SQL Map, sniff traffic, and apply social engineering.
- To analyze and execute advanced hacking techniques, including malware, wireless, and web attacks.

Laboratory Outcomes:

LO1: Apply ethical hacking principles, methodologies, and associated ethical considerations for scanning networks and machines.
LO2: Demonstrate network scanning using Nmap to detect hosts, ports, services, and vulnerabilities.
LO3: Evaluate the vulnerabilities and social engineering attacks using Metasploit and SQL Map.
LO4: Develop a system using advanced hacking methods and construct a report on appropriate security countermeasures.

Lab Contents

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.

List of Laboratory Assignments/Experiments

1	Explain the steps involved in the **ethical hacking process: Reconnaissance, Scanning, Gaining Access, Post-exploitation,** and **Reporting.**
2	a. Use **Nmap** to scan a target network. Perform **ping sweeps**, identify **open ports, active**

	machines, and **services**. Document findings and create a network map. b. Use Nmap OS fingerprinting to determine the operating systems of remote machines. Scan for open ports and services, mapping the network attack surface.
3	Use a vulnerability scanner (e.g., **Nessus** or **OpenVAS**) to identify vulnerabilities based on information gathered (e.g., open ports, services). Generate a vulnerability report.
4	Use Metasploit to exploit it, and gain access to the target machine. Perform post-exploitation tasks, such as gathering system information.
5	Use SQL map to identify and exploit SQL injection vulnerabilities in a web application. Analyze the database structure and retrieve sensitive information.
6	Use **Aircrack-ng** to crack **WEP** or **WPA2** encryption. Document the steps and analyze the strength of wireless encryption.
7	Mini Project: Select a real-time information system (e.g., a web app, ERP, or network service) and carry out penetration testing using ethical hacking practices. Summarize your findings in a detailed report that includes test cases, vulnerabilities found, tools used, and security recommendations.

Text Books:
T1. Hands On Ethical Hacking and Network Defense – By Michael T. Simpson, Kent Backman, James
Corley
T2. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy by Patrick Engebretson, Syngress Media, 2011.
T3. Hacking the Hacker, Roger Grimes, Wiley

Reference Books:
R1. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy
(Syngress Basics Series)
R2. Ethical Hacking and Penetration Testing Guide by Rafay Baloch, CRC Press, 2015.
R3. Hands on Ethical Hacking and Network Defense [Print Replica] [Kindle Edition]

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T. Y. B. Tech (Department of Information Technology)
Semester -VI
[IT3207T-C]: Internet of Things & Industry 4.0(2023 Pattern)

Teaching Scheme: TH : 03 Hours/Week	Credits: TH: 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam: 30 Marks End Sem. Exam: 50 Marks

Course Prerequisites: Data Communication, Computer Networks

Course Objectives:
1. To understand fundamentals of IoT and embedded systems including essence, basic design strategy and process modeling.
2. To introduce learners a set of advanced topics in embedded IoT and lead them to understand opportunities in IoT domain.
3. To develop a comprehensive approach towards building small low cost embedded IoT applications.
4. To learn infrastructure for IoT applications with Industry 4.0.

Course Outcomes: After successful completion of the course, students will able to-
CO1: Describe the fundamental requirements of embedded system components and their role in real time IoT applications within the context of Industry 4.0.
CO2: Apply IoT communication models, APIs, and sensor networks to implement real-time IoT solutions.
CO3: Analyze various IoT protocol stacks and architectures to evaluate their suitability for domain-specific applications.
CO4: Evaluate cloud-based platforms, communication frameworks, and security models to develop and secure scalable IoT applications.

Course Contents		
UNIT-I	**Introduction to Internet of Things**	**07 Hours**
IoT: Definition and characteristics of IoT, Internet of Things: Vision, Trends in Adoption of IoT, IoT Devices, IoT Devices Vs Computers, Societal benefits of IoT, Technical Building Blocks, Physical design of IoT: Things in IoT, Interoperability of IoT Devices, Sensors and Actuators, Need of Analog/Digital conversion, Logical design of IoT: IoT functional blocks, IoT enabling technologies, IoT levels and deployment templates, Applications in IoT		
UNIT-II	**IOT Platform and Design Methodology**	**07 Hours**

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Basics of IoT Networking, Networking Components, Internet Structure, Connectivity Technologies, IoT communication models and IoT Communication APIs, Sensor Networks, IoT Design Methodology, Four pillars of IoT (M2M, SCADA, WSN, DCM)

UNIT-III	IOT Protocols	07 Hours

Protocol Standardization for IoT, M2M and WSN Protocols, SCADA and RFID Protocols, Protocols – IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, IP based protocols : 6LoWPAN and RPL, ZigBee Smart Energy 2.0, ETSI TC M2M, Canbus, LoRa

UNIT-IV	Cloud Platform for IOT	07 Hours

Software Defined Networking, Introduction to Cloud Storage Models, Communication API, WAMP: AutoBahn for IoT, Xively Cloud for IoT, Python Web Application Framework: Django Architecture and application development with Django, Amazon Web Services for IoT, SkyNet IoT Messaging Platform, RESTful Web Service, GRPC,SOAP

UNIT-V	IOT Security	07 Hours

IoT Security: Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling, Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non-repudiation and availability, Security model for IoT, Challenges in designing IOT applications, lightweight cryptography

UNIT-VI	Introduction to Industry 4.0	07 Hours

The various Industrial revolutions, Drivers, Enablers, Compelling Forces and Challenges for Industry 4., Road to Industry 4.0: Internet of Things (IoT) & Industrial Internet of Things (IoT), Internet of Services, Smart Manufacturing, Smart Devices and Products, Smart Logistics, Smart Cities, Predictive Analytics, Cyber Physical systems and next generation sensors, collaborative platform and product lifecycle management

Text Books:
T1: Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on Approach, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515
T2: Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition, Wiley Publication, ISBN: 978-1-119-99435-0
T3: Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress, 2016.

Reference Books:
R1: Charles Crowell, IoT - Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT, ISBN-13: 979-8613100194
R2: David Hanes, Gonzalo Salgueiro, Robert Barton, Jerome Henry -IoT
R3: Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1 ISBN-10: 1-58714-456-5

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Semester -VI
[IT3207L-C]: Internet of Things & Industry 4.0 Lab(2023 Pattern)

Teaching Scheme: LAB: 02 Hours/Week	Credits: LAB: 01	Examination Scheme: ISCE: 30 ESE-20 Total : 50

Course Prerequisites: Computer Network

Laboratory Objective:
This course is to understand the principles of IOT components, connectivity and communication in real time applications.

Laboratory Outcomes:
LO1: Demonstrate the use of IOT components and their connections for IOT applications.
LO2: Apply GPIO Programming Techniques for Interfacing with External Devices.
LO3: Evaluate Sensor and Actuator Interfacing Techniques for Developing Efficient IoT Applications.
LO4: Develop an Innovative IoT Application incorporating Security Measures.

Lab Contents
Guidelines for Assessment
Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.

	List of Laboratory Assignments/Experiments
1	Demonstrate interfacing of display devices using GPIO programming.
2	Demonstrate the use of Sensors and Actuators with Arduino – I: Interfacing of light sensor to identify intensity of light and automate light operations.
3	Illustrate the use of Sensors and Actuators with Arduino – II : Temperature Monitoring System Using LM35 Sensor
4	Apply ESP8266 NODEMCU WiFi Module with programming NODEMCU using Arduino IDE.

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5	Implement a Django web application that controls simulated IoT devices (like lights, fans, sensors) using RESTful API endpoints.
6	Design interfacing the regular USB Webcam with the IOT device and turn it into IP webcam.
7	Design home automation using IoT communication models and IoT Communication APIs.
8	**Mini Project:** Students can opt any one of the following topics or they can have their own real time problem statement for IoT based mini project**.** • **IoT-based Air Quality Monitoring:** Measure air pollutants and send data to the cloud for analysis and visualization. • **IoT-enabled Energy Metering:** Monitor and analyze electricity consumption remotely using smart meters connected to the IoT network. • **Remote Patient Monitoring System:** Use wearable sensors to monitor patient health metrics and transmit data to doctors for continuous observation. • **Smart Parking System:** Detect available parking slots in a parking lot and provide real-time updates via a mobile app. • **Vehicle Tracking System using GPS and IoT:** Monitor the real-time location of vehicles and send alerts for route deviations or speeding.

Text Books:
T1: Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515
T2: Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition,Wiley Publication, ISBN: 978-1-119-99435-0
T3: Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress, 2016.

Reference Books:
R1: Charles Crowell, IoT - Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT, ISBN-13: 979-8613100194
R2: David Hanes, Gonzalo Salgueiro, Robert Barton, Jerome Henry -IoT
R3: Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1 ISBN-10: 1-58714-456-5

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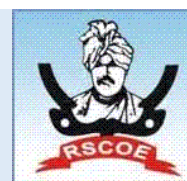**BoS Chairman**

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T. Y. B. Tech (Department of Information Technology)
Semester - VI
[IT3207T-D]: Advanced Web Technology(2023 Pattern)

Teaching Scheme: TH : 03 Hours/Week	Credits: TH : 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Web Technologies Basics, HTML, CSS, Databases

Course Objectives:

- To understand the basic concepts of web technology and apply them for the various problems.
- To learn various frontend & backend types and use it for the various web technology tasks.
- To optimize the emerging trends in web technology and generalize it for project.

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

CO1: Describe web evolution, architecture, protocols, and JavaScript basics.

CO2: Apply HTML5, CSS3, ES6+, and modern JavaScript frameworks (React, Angular, Vue) to build responsive single-page applications.

CO3: Apply Node.js and Express.js to develop backend services and RESTful APIs with integrated database and authentication mechanisms.

CO4: Analyze web services and emerging technologies to design modern web applications.

Course Contents

UNIT-I	Introduction to Advanced Web Technologies	07 Hours

Introduction: Evolution of Web Technologies- Web 1.0, Web 2.0, Web 3.0, Overview of Frontend and Backend Technologies, Client-Server Architecture, HTTP/HTTPS Protocols and Status Codes, Basics of Web Performance Optimization, Java Script Basics.

UNIT-II	Advanced Frontend Development	07 Hours

HTML5 Features- Semantic Elements, Canvas and SVG, Audio and Video Embedding, CSS3 Techniques- Responsive Web Design using Media Queries, CSS Grid and Flexbox, Animations and Transitions, JavaScript Enhancements- ES6+ Features: Arrow Functions, Async/Await, DOM Manipulation

Case study- CSS Grid and Flexbox

UNIT-III	Modern JavaScript Frameworks	07 Hours

Introduction to Single-Page Applications (SPA), Overview of Popular Frameworks- ReactJS: Components, Hooks, and Context API, Angular: Components, Directives, and Services, Vue.js: Directives, Lifecycle Hooks, and Vuex, Routing and State Management.

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Case study- React and Angular JavaScript Frameworks.		
UNIT-IV	**Backend Technologies**	**07 Hours**

Node.js and Express.js- Setting up a Node.js Server, Middleware and RESTful APIs, Database Integration- SQL Databases: MySQL, PostgreSQL, NoSQL Databases: MongoDB, ORM Tools: Sequelize, Mongoose, Authentication and Authorization: JWT
Case study- Real time MongoDB

UNIT-V	**Web Services and APIs**	**07 Hours**

Understanding Web Services: SOAP vs. RESTful APIs, JSON and XML Data Formats, API Development and Consumption: OpenAPI/Swagger Standards, Consuming Third-party APIs.
Case Study- Real time Twitter JSON example

UNIT-VI	**Emerging Trends in Web Technology**	**07 Hours**

Introduction to Web3 and Blockchain, Decentralized Applications (DApps), AI/ML Integration in Web Development, WebAssembly (Wasm), Web application Framework.
Case Study- Django or Spring

Text Books:
   T1. Eloquent JavaScript" by Marijn Haverbeke
   T2. You Don't Know JS Yet" (Series) by Kyle Simpson
   T3. Web Development with Node.js and Express" by Ethan Brown

Reference Books:
   R1. Learning React" by Alex Banks and Eve Porcello
   R2. Full-Stack React Projects" by Shama Hoque: Walks through full-stack projects using React, Node.js, and MongoDB
   R3. Building APIs with Node.js" by Mike Cantelon: Offers insights into RESTful and GraphQL API design with Node.js.
   R4. Microservices Patterns" by Chris Richardson: Explains microservice architecture, design patterns, and implementation strategies.

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T. Y. B. Tech
Semester - VI
[IT3207L-D]: Advanced Web Technology Lab(2023 Pattern)

Teaching Scheme: LAB: 02 Hours/Week	Credits: LAB: 01	Examination Scheme: ISCE: 30 ESE : 20

Course Prerequisites: Programming fundamentals, Problem solving skills.

Laboratory Objective:
- To equip students with knowledge of advanced web technologies for building dynamic and responsive web applications.
- To enable the design and integration of backend services, APIs, and databases.
- To implement interactivity using JavaScript and frameworks like React, Angular, or Vue.
- To apply techniques for optimizing web performance, scalability, and user experience.

Laboratory Outcomes:
LO1: Develop responsive web apps using modern frameworks.
LO2: Implement RESTful APIs for seamless communication between client and server in a web application.
LO3: Create dynamic, interactive user interfaces by using advanced JavaScript libraries and frameworks.
LO4: Design and integrate databases using web applications.

Lab Contents
Guidelines for Assessment

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List of Laboratory Assignments/Experiments	
1	Develop a Java Servlet that displays a "Welcome Message". Validates user credentials (user name and password) against data stored in the Servlet configuration file. Show "Authorized User" or "Unauthorized User" based on the validation result.
2	Write a java program to connect to a database server using JDBC and insert 10 students information of user choice in to student table.

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3	React: Build a single-page application (SPA) that fetches and displays data from an API, with a search and filter feature.
4	Node.js: Set up a REST API using Node.js and Express.js to handle CRUD operations for a blog application.
5	Angular: Create a dynamic to-do list application with features like add, edit, delete, and mark tasks as complete using Angular.
6	Database Integration: Use MongoDB or MySQL to design a database schema for a user management system, and integrate it with your Node.js application.
7	Develop a JSP application that validates user login credentials (username and password) stored in a database. Upon successful login, allow the user to insert, update, and delete student records through linked JSP pages with proper session management.
8	Mini Project/Web Application: Develop a complete web app where users can schedule tasks/events on a calendar interface with drag-and-drop support and event editing.
9	Mini Project/Web Application: Develop a simple web page that integrates a chatbot created in Dialogflow where users should be able to interact and receive smart replies from the bot.
10	Mini Project/Web Application. Develop an E-Learning Portal which build an online learning platform where users can register, access courses, track progress, and take assessments.

Text Books:

T1. Eloquent JavaScript" by Marijn Haverbeke

T2. You Don't Know JS Yet" (Series) by Kyle Simpson

T3. Web Development with Node.js and Express" by Ethan Brown

Reference Books:

R1. Learning React" by Alex Banks and Eve Porcello

R2. Full-Stack React Projects" by Shama Hoque: Walks through full-stack projects using React, Node.js, and MongoDB

R3. Building APIs with Node.js" by Mike Cantelon: Offers insights into RESTful and GraphQL API design with Node.js.

R4. Microservices Patterns" by Chris Richardson: Explains microservice architecture, design patterns, and implementation strategies.

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T. Y. B. Tech
Semester -VI
[IT3208T-A]: Computer Vision(2023 Pattern)

Teaching Scheme: TH: 03 Hours/Week	Credits: TH: 03	Examination Scheme: In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Programming in Python, Machine Learning, Calculus and Transform.

Course Objectives:

1. To understand basic concepts of image processing and computer vision.
2. To understand the ideas about image segmentation and feature based alignment.
3. To explore the ideas of Image Recognition and restoration.
4. Apply three-dimensional image analysis techniques.
5. Study real world applications of computer vision algorithms.

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

CO1: Describe fundamental concepts of image formation, filtering and transformation used for processing visual data.

CO2: Apply visual features to support reliable feature detection, correspondence matching and object segmentation.

CO3: Analyze methods for motion estimation and 3D reconstruction by applying multi view geometry, camera calibration and structure from motion techniques.

CO4: Evaluate vision based recognition and rendering methods for real world applications.

Course Contents		
UNIT I	**Introduction to Image formation and Processing**	**07 Hours**

Introduction: What is Computer Vision, Low level, Mid level, High level, Image formation, Geometric primitives and transformations, Photometric image formation, The digital camera, Point operators, Linear filtering, More neighborhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations, Global optimization.

UNIT II	**Feature Detection, Matching and Segmentation**	**07 Hours**

Points and patches, Edges, Lines, Segmentation, Active contours, Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods.

UNIT III	**Feature Based Alignment and Motion Estimation**	**07 Hours**

2D and 3D feature based alignment, Pose estimation, Geometric intrinsic calibration, Triangulation, Two frame structure from motion, Factorization, Bundle adjustment, Constrained structure and

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motion, Translational alignment, Parametric motion, Spline based motion, Optical flow Layered motion.

UNIT IV	3D Reconstruction	07 Hours

Shape from X, Active range finding, Surface representations, Point based representations, Volumetric representations, Model based reconstruction, Recovering texture maps and Albedos.

UNIT V	Image Based Rendering and Recognition	07 Hours

View interpolation Layered depth images, Light fields and Lumi graphs, Video based rendering, Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding, Recognition databases and test sets.

UNIT VI	Applications	07 Hours

Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content Based Image Retrieval, Video Data Processing, Virtual Reality and Augmented Reality.

Text Books:

T1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer Texts in Computer Science, Second Edition, 2022.

T2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

T3. Multiple View Geometry in Computer Vision: R. Hartley and A. Zisserman, Cambridge University Press, Second Edition.

Reference Books:

R1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.

R2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Fourth Edition, Academic Press, 2012.

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Semester -VI
[IT3208L-A]: Computer Vision Lab(2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
LAB: 02 Hours/Week	LAB: 01	ISCE:30 Marks ESE:20 Marks

Course Prerequisites: Python Programming

Laboratory Objective:
1. To implement basic image processing techniques such as resizing, cropping, and rotating.
2. To learn and apply Fourier Transform for filtering and manipulating images.
3. To explore image segmentation methods including thresholding and region-based segmentation.
4. To implement low-pass and high-pass filters to enhance or suppress certain image features.
5. To gain practical knowledge in advanced computer vision techniques including Harris corner detection, CNNs, GANs, and object detection.

Laboratory Outcomes: After successful completion of the course, students will be able to-
LO1.Apply basic image operations like resizing, cropping, and rotating on given images.
LO2.Analyze Fourier Transform and filtering techniques to process images effectively.
LO3.Implement image segmentation techniques to extract meaningful regions from images.
LO4.Evaluate various image filtering mechanisms and understand their effects on image quality.

Lab Contents

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.

List of Laboratory Assignments/Experiments

1	Implementing basic image operations like resizing, cropping and rotating images.
2	Implementing Fourier transform for filtering the image.
3	Implementing image segmentation using techniques like thresholding and region-based segmentation.
4	Implementing various low pass and high pass filtering mechanisms.

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5	Implementing Harris corner detection algorithm.
6	Implementing a CNN architecture using TensorFlow or Keras.
7	Implementing a simple Generative Adversarial Network (GAN) for image generation.
8	Implementing object detection using frameworks like TensorFlow Object Detection API or YOLO (You Only Look Once).

Text Books:

  T1. Core Python Programming, R. Nageswara, Net,3rd Edition.

  T2. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited,2011.

  T3. D. Forsyth and J. Ponce, "Computer Vision - A modern approach", 2nd edition, 2012 Pearson Education.

Reference Books:

  R1. Richard Hartley and Andrew Zisser man, Multiple view geometry in computer vision 2nd edition, Cambridge University press, 2015 (printing).

  R2. Anil Jain K, "Fundamentals of Digital Image Processing", Prentice-Hall of India, 2001.

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T. Y. B. Tech (Department of Information Technology)
Semester -VI
[IT3208T-B]: Digital Forensic and Cyber Laws (2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Computer Networks and Cyber Security

Course Objectives:

1. To *learn the fundamentals of computer forensics, legal concerns, and techniques for data recovery and acquisition methods.*
2. To *apply forensic tools to investigate cyber crime, email violations, and data-hiding techniques, with legal and cyber crime understanding.*
3. To *explore data and network forensics methods and tools.*
4. To *analyse ethical, social and political issues in e-commerce, emphasizing privacy.*

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

CO1: Describe computer forensics fundamentals for investigations, data recovery and evidence handling.

CO2: Apply concepts of forensics tools to investigate cyber crime, email violations, and data-hiding techniques.

CO3: Apply knowledge of data and Network Forensic with necessary tools.

CO4: Analyze the ethical, social, and political issues in e-commerce, focusing on privacy, intellectual property, and legal protections.

Course Contents

UNIT-I	Introduction to Digital Forensics	07 Hours

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

UNIT-II	Data Acquisition Methods	07 Hours

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence

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at scene, storing digital evidence, obtaining digital hash, reviewing case.

UNIT-III	Computer Forensic Tools	07 Hours

Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations-investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

UNIT-IV	Data and Network Forensics	07 Hours

Types and nature of data encountered in Forensic Investigations, utility of extracted data forensic analysis, open source and Subscription-based tools used for Data Forensics, Analysis of extracted data from different devices, Analysis of operating system artefacts i.e., Windows artefacts,and Linux based operating system artefacts. E-mail Forensics, Network Forensics, Social media forensics,Dark web forensics, Malware Forensics.

UNIT-V	Introduction to Cyber crimes and Cyber Laws	07 Hours

Cyber crimes and related offences: Introduction to Cyber crimes, Classification of cyber crimes, Distinction between cyber crime and conventional crimes, Reasons for commission of cyber crime, Kinds of cyber crimes – cyber stalking, forgery and fraud, Cyber terrorism, Spamming, Phishing, Privacy and National Security in Cyberspace, Cyber Defamation and hate speech, computer vandalism etc. Provisions in Indian Laws in dealing with Cyber Crimes and its critical analysis, Information Technology Act-2000, Penalties under IT Act.

UNIT-VI	E-commerce and related laws	07 Hours

History, Overview of developments in Information Technology and Defining E-Commerce, Understanding Ethical, Social and Political issues in E-Commerce: A model for organizing the issues, Basic Ethical Concepts, Analyzing Ethical Dilemmas, Candidate Ethical principles, Privacy and Information Rights: Information collected at E-Commerce Websites, The Concept of Privacy.

Text Books:
T1. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.
T2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.
T3. Justice Yatindra Singh: Cyber Laws, Universal Law Publishing Co., New Delhi
T4. Farouq Ahmed, Cyber Law in India, New Era publications, New Delhi
   T4.T5. Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.

Reference Books:
R1. Vacca, J, *Computer Forensics, Computer Crime Scene Investigation*, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.
R2. The Information Technology Act, 2000 Bare Act with Short Notes, Universal Law Publishing Co., New Delhi
R3. S.R.Myneni: Information Technology Law(Cyber Laws), Asia Law House, Hyderabad.
R4. Chris Reed, Internet Law-Text and Materials, Cambridge University Press. 15. Pawan Duggal: Cyber Law- the Indian perspective Universal Law Publishing Co., New Delhi

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Semester -VI
[IT3208L-B]: Digital Forensic and Cyber Laws Laboratory(2023 Pattern)

Teaching Scheme: LAB: 02 Hours/Week	Credits: LAB: 01	Examination Scheme: ISCE: 30 ESE: 20

Course Prerequisites: Computer Network and Cyber Security

Course Objectives:

- To understand cyber laws and cyber crimes.
- To understand types of cyber crimes and its countermeasures.
- To understand and analyze cyber forensic techniques.
- To be acquainted with cyber forensic tools.

Lab Outcomes: After successful completion of the course, students will able to-

LO1: Describe Cyber crimes with Real-World examples.

LO2: Demonstrate the use of a password cracking tool.

LO3: Evaluate mock phishing emails to identify phishing contents.

LO4: Apply a vulnerability assessment on a vulnerable machine or network using tools like Nessus or OpenVAS, and identify potential vulnerabilities.

LO5: Analyse data using network and forensic tools.

Lab Contents
Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.

List of Laboratory Assignments/Experiments

1	Summarize a report (500-700 words) on the different types of cyber crimes (e.g., hacking, phishing, online fraud, etc.), with real-world examples and the consequences for victims and society. Also, discuss digital investigation process in detail.
2	Demonstration (using a virtual machine) how a simple password cracking tool (e.g., John the Ripper or Hashcat) works to crack weak passwords. Prepare a report of it.

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3	Evaluate mock phishing emails to identify the phishing emails with warning signs.
4	Apply a mobile forensic tool (e.g., Oxygen Forensics, Cellebrite) to retrieve deleted text messages or call logs from a mock mobile device image.
5	Apply to scan a vulnerable machine or network and identify potential vulnerabilities using vulnerability assessment tool like Nessus or OpenVAS.
6	Apply data extraction process for a mobile device (e.g., call logs, messages, location data) using a mobile forensics tool. Document the steps involved in the extraction process.
7	Analyse data for e-mail contents/ social media contents/ dark web contents/ malware contents using data and network forensic tools .
8	Evaluate digital forensics techniques for the following case study with details: Hosting Obscene Profiles; Illegal money transfer, creating fake profile, fake travel agent (any TWO)

Text Books:

T1. Hands On Ethical Hacking and Network Defense – By Michael T. Simpson, Kent Backman, James
Corley

T2. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy by Patrick Engebretson, Syngress Media, 2011.

T3. Hacking the Hacker, Roger Grimes, Wiley

Reference Books:

R1. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy
(Syngress Basics Series)

R2. Ethical Hacking and Penetration Testing Guide by Rafay Baloch, CRC Press, 2015.

R3. Hands on Ethical Hacking and Network Defense [Print Replica] [Kindle Edition]

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T. Y. B. Tech (Department of Information Technology)
Semester -VI
[IT3208T-C]: Cloud Security and Governance(2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Cloud Computing

Course Objectives:
1. To analyze the evolution, key concepts, and service models of cloud computing, including security, privacy concerns, and compliance with regulations.
2. To evaluate infrastructure security levels, data protection measures, identity and access management practices, and their impact on cloud service delivery and governance.
3. To examine cloud governance frameworks, cost management strategies, and the use of cloud-native tools for optimizing resources, ensuring compliance, and managing privacy risks.

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

CO1: Explain the evolution, core concepts, and service models of cloud computing.

CO2: Apply identity and access management (IAM) and infrastructure security practices to reduce cloud security risks.

CO3: Analyze data privacy, governance, and regulatory compliance issues in cloud environments.

CO4: Evaluate cloud cost management strategies and optimization tools to enhance operational efficiency.

Course Contents		
UNIT-I	**Fundamentals of Cloud Security**	**07 Hours**
Introduction: Definition and evolution of Cloud Computing, Enabling Technologies, Service and Deployment Models, Popular Cloud Stacks and Use Cases, Benefits, Risks, and Challenges of Cloud Computing, Layers in cloud architecture, Economic Models and SLAs Topics in Cloud Security Case Study: The Evolution of Cloud Computing and Its Impact on Modern Businesses		
UNIT-II	**Infrastructure and Data Security in Cloud Computing**	**07 Hours**
Infrastructure Security: Infrastructure Security: The Network Level, Infrastructure Security: The Host Level, Infrastructure Security: The Application Level Data Security and Storage: Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security		
UNIT-III	**Identity and Access Management**	**07 Hours**

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Identity and Access Management: Trust Boundaries and IAM, Reason for IAM, IAM Challenges, IAM Definitions, IAM Architecture and Practice, Getting Ready for the Cloud, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management, Cloud Service Provider IAM Practice

UNIT-IV	Cloud Security Management and Availability	07 Hours

Security Management in the Cloud: Security Management Standards, Security Management in the Cloud Availability Management, SaaS Availability Management PaaS Availability Management, IaaS Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management

UNIT-V	Privacy and Compliance in Cloud Computing	07 Hours

Privacy : What Is Privacy, What Is the Data Life Cycle, What Are the Key Privacy Concerns in the Cloud, Who Is Responsible for Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

UNIT-VI	Governance for Cloud Security	07 Hours

Cloud Governance Framework: Policies for usage, cost management, and resource allocation, Compliance and Regulations : GDPR, HIPAA, CCPA, PCI DSS, ISO/IEC 27001, Audit and reporting tools for compliance, Monitoring and optimizing cloud spend, Cloud-native tools.

Text Books:

T1. Tim Mather, Subra Kumaraswamy, Shahed Latif "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance"
T2. John R. Vacca "Cloud Computing Security: Foundations and Challenges"
T3. Harry Katzan Jr. "Fundamentals of Information Security in Cloud Computing"

Reference Books:

R1. Vic (J.R.) Winkler "Securing the Cloud: Cloud Computing Security Techniques and Tactics".
R2. Raef Meeuwisse "Cybersecurity for Beginners in Cloud"
R3. Sudhir Kumar Sharma "Security and Privacy in IoT and Cloud Computing"

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T. Y. B. Tech (Department of Information Technology)
Semester -VI
[IT3208L-C]: Cloud Security and Governance Lab(2023 Pattern)

Teaching Scheme: LAB: 02 Hours/Week	Credits: LAB: 01	Examination Scheme: ISCE: 30 ESE: 20

Course Prerequisites: Cloud Computing

Laboratory Objective:
- To gain foundational knowledge of deploying web applications on a cloud platform and understand the configuration and operation of Google App Engine.
- To analyze the characteristics of cloud service models (IaaS, PaaS, SaaS) through practical deployments, enabling a comparative understanding of their use cases and features.
- To implement security best practices for cloud storage by encrypting data, ensuring secure upload, and accessing files securely.
- To evaluate the security of cloud-hosted applications by identifying potential vulnerabilities using industry-relevant tools and recommending mitigations.
- To study the stages of the data lifecycle in cloud environments, recognize privacy challenges in sensitive data handling, and propose privacy-preserving solutions.
- To design and test resource scheduling algorithms in a simulated cloud environment, optimizing resource allocation to enhance performance and efficiency.

Laboratory Outcomes:
LO1: Demonstrate the deployment of a basic application using Google App Engine (GAE) and analyze the functionality of cloud-hosted applications.
LO2: Differentiate between IaaS, PaaS, and SaaS models by deploying examples on platforms like AWS or Azure, showcasing their features and use cases.
LO3: Implement secure data handling techniques by encrypting files, uploading them to a cloud storage service, and ensuring secure access control.
LO4: Design and evaluate a custom resource scheduling algorithm in a simulated cloud environment using CloudSim to optimize resource utilization.

Lab Contents

Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance,

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innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.

	List of Laboratory Assignments/Experiments
1	Deploy a simple application using Google App Engine (GAE).
2	Compare IaaS, PaaS, and SaaS models by deploying examples on platforms like AWS or Azure.
3	Encrypt a file, upload it to a cloud storage service (e.g., AWS S3), and access it securely.
4	Develop a Disaster Recovery Plan for a Cloud-Based Service.
5	Analyze the data lifecycle and identify privacy concerns for a cloud-hosted healthcare application.
6	Simulate a cloud scenario in CloudSim and implement a custom scheduling algorithm for resource allocation.
7	Mini Project

Text Books:

T1. Tim Mather, Subra Kumaraswamy, Shahed Latif "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance"
T2. John R. Vacca "Cloud Computing Security: Foundations and Challenges"
T3. Harry Katzan Jr. "Fundamentals of Information Security in Cloud Computing"
T4. Charles Russell Severance "Python for Everybody : Exploring Data in Python 3"

Reference Books:

R1. Vic (J.R.) Winkler "Securing the Cloud: Cloud Computing Security Techniques and Tactics".
R2. Raef Meeuwisse "Cybersecurity for Beginners in Cloud"
R3. Sudhir Kumar Sharma "Security and Privacy in IoT and Cloud Computing"

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T. Y. B. Tech (Department of Information Technology)
Semester -VI
[IT3208T-D]: DevOps Fundamentals(2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
TH : 03 Hours/Week	TH : 03	In Sem. Evaluation: 20 Marks Mid Sem. Exam : 30 Marks End Sem. Exam : 50 Marks

Course Prerequisites: Operating Systems, Computer Network

Course Objectives:

1. To introduce different terms and concepts related to DevOps.
2. To describe principles of DevOps core.
3. To explain various DevOps practices
4. To introduce other popular frameworks in the context of DevOps
5. To introduce automation practices in deployment pipelines using DevOps toolchains
6. To introduce elaborate Critical success factors and key performance indicators related to DevOps

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

CO1: Explain concepts and terms related to DevOps methodology.

CO2: Demonstrate the core concepts of DevOps practices and their application in real-world scenarios.

CO3: Implement DevOps methods and compare their effectiveness with other frameworks in real-world use cases.

CO4: Analyze the integration of automation practices in deployment pipelines which impacts DevOps success factors and performance indicators.

Course Contents

UNIT-I	Introduction to DevOps	07 Hours

Introduction: History of devops, growth of software development methodologies, ethics of devops, business value of devops, scaling productivity, foundational terminologies and concepts, operation methodologies, System methodologies, infrastructure concepts, cultural concepts, Technology value stream, the three ways of Devops.

UNIT-II	DevOps Principles & Practices	07 Hours

The First Way: The principles of flow, The Second Way: The principles of feedback, The Third Way: The Principles of Continual Learning and Experimentation.

Agile, Continuous Delivery, continuous integration, Site Reliability & Resilience Engineering, DevSecOps, ChatOps, Kanban.

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UNIT-III	Business and Technology Frameworks	07 Hours
Agile, ITSM, Lean, Safety Culture, Learning Organizations, Sociocracy, The relationship between relevant frameworks, standards and DevOps.		
UNIT-IV	**Automation & Architecting DevOps Toolchains**	**07 Hours**
Foundation for deployment pipeline, enable automated testing, Practice continuous integration with CI/CD, Cloud. Containers, Kubernetes, DevOps Toolchain, automate and architect low risk releases		
UNIT-V	**Advanced Trends in DevOps**	**07 Hours**
Concept of Containers, Benefits of containerization, Containers vs. Virtual Machines, Introduction to docker, Introduction to container orchestration, Concept of Kubernetes, Kubernetes Architecture, Basic Kubernetes Objects.		
UNIT-VI	**DevOps Values**	**07 Hours**
Culture, Behaviors & Operating Models. Characteristics of a DevOps culture and of culture change, Measurement, Metrics & Reporting, Common DevOps practices and related processes, sharing, Shadowing and Reporting, Responsibilities of key roles and considerations relative to organizational structure.		

Text Books:

T1. The DevOps Handbook, Gene Kim, Jez Humble, Patrick Debois, IT Revolution Press
T2. Effective DevOps, Jennifer Davis and Author:Ryn Daniels, O'Reilly Media, Inc. June 2016

Reference Books:

R1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni.

R2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.

R3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.

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Department of Information Technology

T. Y. B. Tech (Department of Information Technology)
Semester -VI
[IT3208L-D]: DevOps Fundamentals Lab(2023 Pattern)

Teaching Scheme: LAB: 02 Hours/Week	Credits: LAB: 01	Examination Scheme: ISCE: 30 ESE: 20

Course Prerequisites: Operating Systems, Computer Network

Laboratory Objective:
To provide hands-on experience with essential DevOps tools and practices, including version control, containerization, CI/CD automation, infrastructure management, and system monitoring

Laboratory Outcomes:
LO1 : Demonstrate proficiency in using DevOps tools for version control, containerization, and automation scripting.
LO2 : Implement continuous integration and deployment workflows using Jenkins and GitHub Actions.
LO3 : Apply infrastructure management and system monitoring using Kubernetes, Ansible, and Linux performance commands.

Lab Contents
Guidelines for Assessment
Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.
List of Laboratory Assignments/Experiments

1	Build and configure a basic Docker container image for a simple application (e.g., "Hello World" Node.js app). Include steps to create a Dockerfile, build the image, run the container, and test the setup.
2	Use Docker to create and run a containerized web server (e.g., Apache), demonstrating container lifecycle management and networking.
3	Develop and execute a shell script to automate basic system administration tasks such as file management, backups, or service monitoring.
4	Set up Jenkins and create a simple pipeline job to automate tasks such as code compilation,

	testing, or deployment.
5	Use Minikube to create a local Kubernetes cluster and deploy a basic containerized application, including the use of pods and services.
6	Create and configure GitHub Actions to automate workflows such as testing, building, or deploying an application.
7	Create a YAML file defining a simple Ansible task and execute it to manage configuration or deploy an application on a target system.
8	Apply system monitoring commands to analyze system performance, memory usage, and CPU load.
9	Mini Project

Text Books:

T1. The DevOps Handbook, Gene Kim, Jez Humble, Patrick Debois, IT Revolution Press

T2. Effective DevOps, Jennifer Davis and Author:Ryn Daniels, O'Reilly Media, Inc. June 2016

T3. Charles Russell Severance "Python for Everybody : Exploring Data in Python 3"

Reference Books:

R1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni.

R2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.

R3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.

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Semester - VI
[IT3209L]: Programming Lab IV(2023 Pattern)

Teaching Scheme: LAB: 04 Hours/Week	Credits: LAB: 02	Examination Scheme: ISCE: 50 ESE: 50

Course Prerequisites: Programming Lab III

Laboratory Objectives:
- To understand the use of AWT/Swing in Java applications.
- To learn the use of Applets and servlets in Java.
- To understand the implementation of JDBC connectivity.

Laboratory Outcomes:
LO1: Develop desktop applications using AWT, Swing, and event handling.
LO2: Design database applications using JDBC and Hibernate.
LO3: Develop distributed apps using Servlets, JSP, RMI, and MVC.
LO4: Implement secured Spring Boot applications using REST APIs.

Lab Contents
Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation.

List of Laboratory Assignments/Experiments

1	Design a **Notification Popup System** using AWT where: • A lightweight AWT frame appears when the mouse **enters** a specific screen zone (like the bottom-right corner). • The frame displays a dynamic notification (e.g., "You have 3 new messages"). • On mouseClicked(), the notification opens a new frame with full message details. • On mouseExited(), the frame auto-hides after a short delay. • Use MouseListener, Timer, and AWT utilities.
2	Develop a **Simple AWT Text Editor**: • Create a MenuBar with menus: File, Edit, View. • Under File, create a submenu with options New, Open, Save, Exit.

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	• Implement basic file operations using FileDialog and BufferedReader/Writer. • Add keyboard shortcuts (Ctrl+N, Ctrl+O, etc.), and a status bar that updates on menu actions. • Add a View toggle option for switching font size or themes.

3	Develop a **Library Book Management System** using JDBC:
	• Connect to a MySQL/Oracle/PostgreSQL database.
	• Allow a librarian to:
	   o Add new books (INSERT)
	   o Delete books (DELETE)
	   o Update book details (UPDATE)
	   o Search books by title or author (SELECT)
	• Use PreparedStatement to prevent SQL injection.
	• Display results in a tabular format on the console.
	• Implement exception handling and input validation.

4	Build an **RMI-based Remote String Analyzer**:
	• The RMI server offers multiple remote methods:
	   o isPalindrome(String input)
	   o isNumberPalindrome(int number)
	   o reverseString(String input)
	• Client provides input via a GUI (Swing or AWT) and connects to server remotely.
	• The server logs each request with a timestamp and client IP.
	• Handle null, empty, and special character inputs gracefully.

5	Create a **feedback form** using HTML and Servlet. **Client-Side (HTML + JavaScript):** • Fields: Name, Email, Rating (1–5), Comments • Use HTML5 validation (required, type="email") • Use JS to limit comments to 200 characters **Server-Side (Servlet):** • FeedbackServlet handles POST request • Retrieves form data using request.getParameter() • Stores feedback (log to console or file) • Responds with "Thank you, [Name]"
6	Create a **Login Validation Servlet (Server-Side)**: • Accept the form input (username, password) from client-side form. • Validate credentials against a JDBC-connected user database. • If credentials are valid: o Start a HttpSession, store user info, redirect to dashboard. • If invalid:

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	o Redirect back to login with error message. • Log the login attempt (success/failure) to a server-side log file.
7	Create a simple **Contact Form** using the **MVC pattern** where users enter their name, email, and message. • **View (contact.jsp)**: Form with name, email, message • **Controller**: Handles form submission and redirects to thankyou.jsp • **Model (Contact.java)**: POJO to store user input
8	Create a **Personalized JSP Welcome Page**: • Display a welcome message based on session-stored username (Welcome, <user>). • Show the current server time and day dynamically. • Use JSP scriptlets and expressions, and JSTL (if applicable). Include a logout button that clears the session.

9	Build an **Online Examination System** where:
	• A student logs in with a valid **username and password**.
	• Based on the **session tracking mechanism chosen by the server or client preference**, maintain the session using:
	   o **Cookies**: Store user credentials or login token with "Remember Me" option (for auto-login).
	   o **HttpSession**: Maintain active exam session, answers, and time left.
	URL Rewriting: For clients that do not support cookies, append jsessionid to URLs.

10	Create a Java application using **Hibernate** to insert user data into a database. • Configure Hibernate with hibernate.cfg.xml • Map a User class (id, name, email, city) using annotations Insert records using Session.save()
11	Build a **Spring Boot** application that secures a REST endpoint using **Spring Security Basic Authentication**. • Use in-memory user credentials • Protect a route like /dashboard Show a welcome message on successful login
12	Mini Project

Text Books:

T3. Programming with Java A Primer, E. Balaguruswamy Tata McGraw Hill Companies

T4. Java Programming John P. Flynt Thomson 2nd

T5. The complete reference JAVA2, Hervert schildt. TMH

Reference Books:

   R12.   Java – Balaguruswamy

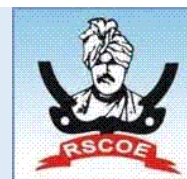   **R13.**   Core Java, Dietel and Dietel

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T. Y. B. Tech
Semester - VI
[IT3210L]: Engineering Innovation and Society-I (Project-I) (2023 Pattern)

Teaching Scheme:	Credits:	Examination Scheme:
LAB: 04 Hours/Week	LAB: 02	ISCE: 50 Marks ESE: 50 Marks

Course Prerequisites: Design Thinking

Laboratory Objective:

- To implement their ideas/real time industrial problem/ current applications from their engineering domain.

- To estimate and cost the human and physical resources required, and make plans to obtain the necessary resources.

- To allocate roles with clear lines of responsibility and accountability and learn team work ethics.

- To apply communication skills to effectively promote ideas, goals or products.

Laboratory Outcomes:

LO1: Describe motivation, objectives and scope of the project with problem definition.

LO2: Apply domain knowledge to identify requirement analysis of the project.

LO3: Analyze different technologies to implement a secure and efficient solution for the Project problem statement.

LO4: Write the report of the project work.

Lab Contents
Guidelines for Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab practical's /assignments performance of student. Each lab practical/assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness. Laboratory evaluation includes In-semester Continuous Evaluation and End Semester Evaluation..

The students must develop their domain interest at this stage, it may come from the projects they worked with in Tinkering lab or Design Thinking Lab or developed any mini projects with their own interest.

The student will undertake project as mentioned in the curriculum structure, which will involve the

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analysis, design of a system or sub system in the area identified earlier in the field of Information Technology and Computer Science and Engineering.

The student needs to identify a technological problem in the area of Computer Engineering or Information Technology of their choice like signal processing, computer vision, machine learning and artificial intelligence, control systems, game theory, and communication networks and address the problem by formulating a solution for the identified problem. B. Tech projects can be application oriented and/or will be based on some innovative/ theoretical work.

- The project will be undertaken preferably by a group of 3-4 students who will jointly work and implement the project.
- Once project group is formed and approved by the Head of Department/ Project coordinator, it can't be changed till the end of the project work
- The project groups must be formed solely based on the similar domain interest.
- Project guides will be allocated after mapping with the student's project group's domain interest
- In case of any special circumstances if the project topic need to be changed then the project group need to follow the project selection process again
- Project groups need to maintain project work book in the format given by the department.
- Students should prefer to take the live projects sponsored by the industries
- The Head of the department / Project coordinator shall constitute a review committee/ Panel for project group; project guide would be one member of that committee by default.
- There shall be two reviews in Engineering Innovation and Society-I (Project-I) in a semester.
- All project group members must be present for all project reviews
- The Project Review committee will be responsible for evaluating the timely progress of the projects.

	List of Laboratory Assignments/Experiments
1	**Project Selection Process:** • The project groups shall submit their domain interest and this will be mapped with the domain interest of the available faculty members (Guides) in the department • The Guide will be allocated and list will be displayed on the notice board. • The project group shall submit minimum two broader problem statement strongly supported by 2 to 3 good reference papers. • A formal presentation will be scheduled based on the topics submitted in front of the review committee/ panel members • The panel members approve / disapprove the topics. If the topic is not approved by the panel members then presentation will be rescheduled • Once the project topic is approved, project groups need to prepare and submit a synopsis to the project guide & project coordinator.
2	**Project Evaluation Process:** • Project groups should inform project progress to his/her guide on the scheduled meeting days and mention progress and suggestions given by guide in the project work book kept with the guide.

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	• Two reviews will be taken in the entire semester. Evaluation parameters for these reviews as decided by the Head of the Department/project coordinator are as follows: **Review-I** • Motivation & Introduction • Literature Review • Gap analysis & Feasibility Study • Problem Statement • Objectives and Scope • Project Design & Presentation **Review-II** • Proposed system • Algorithm/ Mathematical Model • Dataset Description • Status of Survey paper
3	**Survey Paper Publication:** At the end of the Project-1, one survey paper should be written and published in reputed International conference (Indexed in Scopus) based on literature survey carried out during the semester. • Use appropriate plagiarism tools • CMT Login • Apply in different Conferences • Acceptance of the paper • Registration • Presentation • Publication • Indexing
4	**Submission of Project Report:** Students need to submit 2 copies of Project -1 report containing the details as follows: **Contents:** • List of Abbreviations • List of Figures • List of Graphs • List of Tables • Introduction and aims/motivation and objectives • Literature Survey • Problem Statement/definition

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- Project Requirement specification
- Systems Proposed Architecture
- High level design of the project (DFD/UML)
- System implementation-code documentation-algorithm, methodologies, protocols used.
- GUI/Working modules/Experimental Results
- Project Plan
- Conclusions
- Bibliography in IEEE format

Appendices

- Plagiarism Report of Paper and Project Report
- Base Papers
- Survey Paper Publication Status
- Certificates of participation in project competition

At the end of the semester, project groups need to appear for project evaluation in front of external panel members where they need to present their project.

References:

- R1. Sharon J. Gerson, Steven M. Gerson, Technical Writing: Process and Product, Pearson Education   Asia, ISBN: 130981745, 4 th Edition.
- R2. Andrea J. Rutherford, Basic Communication Skills for Technology, Pearson Education Asia, 2nd Edition.
- R3. Lesikar, Lesikar's Basic Business Communication, Tata McGraw, ISBN :256083274, 1 st Edition.

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