MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL
(Formerly West Bengal University of Technology)
Syllabus of B. Sc. in IT
(Effective from 2023-24 Academic Sessions)

Semester: VIII

Name of the Course: IOT and its Application
Course Code: BSCITM801
Credit: 5
Contact Hours: 5 hours/week
Marks: 100 (70 Theory + 30 Internal Assessment)

Course Description

This course provides a comprehensive theoretical understanding of the Internet of Things (IoT), including its architecture models, communication protocols, sensors, actuators, security challenges, and applications in various domains such as healthcare, agriculture, industry, and smart cities. The focus is on conceptual clarity, use cases, and emerging trends.

Course Outcomes (COs)

After completing this course, students will be able to:

CO No.	Course Outcome (CO)
CO1	Understand the basic concepts, characteristics, architecture models, and enabling technologies of IoT systems.
CO2	Identify and compare communication protocols, wireless standards, and network topologies used in IoT deployments.
CO3	Explain various IoT architecture models and analyze their advantages, limitations, and use in real-time scenarios.
CO4	Examine security threats, privacy concerns, and ethical issues in IoT systems and propose appropriate security solutions and best practices.
CO5	Describe industrial and social applications of IoT across different sectors and evaluate their practical challenges and benefits.
CO6	Apply knowledge of IoT systems to solve practical problems related to automation, monitoring, and data management in diverse application areas.

CO No.	Course Outcome (CO)	Mapped Module(s)
CO1	Understand the basic concepts, characteristics, architecture models, and enabling technologies of IoT systems.	Module 1, Module 3
CO2	Identify and compare communication protocols, wireless standards, and network topologies used in IoT deployments.	Module 2
CO3	Explain various IoT architecture models and analyze their advantages, limitations, and use in real-time scenarios.	Module 3
CO4	Examine security threats, privacy concerns, and ethical issues in IoT systems and propose appropriate security solutions and best practices.	Module 4
CO5	Describe industrial and social applications of IoT across different sectors and evaluate their practical challenges and benefits.	Module 5
CO6	Apply knowledge of IoT systems to solve practical problems related to automation, monitoring, and data management in diverse application areas.	Module 1, Module 2, Module 3, Module 5

Theory Topics

Module 1 – Introduction to IoT

Definition, characteristics, and importance of IoT, Evolution from Machine-to-Machine (M2M)
Key enabling technologies: sensors, actuators, embedded devices, IoT architecture overview and its layers,
Applications across sectors: healthcare, agriculture, smart cities and industrial automation.
Hours: 15 **Marks:** 10

Module 2 – Communication Protocols in IoT

Wireless communication standards: Wi-Fi, Bluetooth, Zigbee, LoRaWAN, NB-IoT, 6LoWPAN
Network topologies: star, mesh, tree, hybrid, IoT-specific protocols: MQTT, CoAP, HTTP
Edge vs cloud computing paradigms, Gateways, routing, and energy efficiency
Challenges: interference, latency, scalability.
Hours: 15 **Marks:** 15

Module 3 – Various Architecture Models of IoT

Three-layer architecture, Four-layer architecture, Five-layer architecture and seven -layer architecture,
Service-oriented architecture (SOA)
Cloud-based architecture: storage and analytics
Fog computing architecture: advantages and real-time processing
Comparison of architecture models for scalability, latency, fault tolerance
Implementation challenges and best practices.
Hours: 15 **Marks:** 15

Module 4 – Security, Privacy, and Ethical Aspects

Security threats in IoT systems: spoofing, unauthorized access, DDoS, Authentication methods and encryption techniques, Secure communication protocols and identity management
Privacy concerns and regulations (GDPR, HIPAA), Ethical considerations in data collection and usage
Case studies on IoT security incidents and countermeasures

Hours: 15 **Marks:** 15

Module 5 – Industrial and Social Applications of IoT

Industrial IoT vs consumer IoT, Technologies: SCADA, PLCs, robotics, industrial sensors, Automation, monitoring, predictive maintenance, and safety
Smart cities: traffic, waste, and energy management
Healthcare: remote monitoring, wearables, emergency alerts
Agriculture: precision farming, irrigation control, soil health
Smart homes: automation, security, environment control
Environmental monitoring: pollution tracking, disaster warnings
Retail, logistics, and energy management applications

Hours: 15 **Marks:** 15

List of Reference Books

Sl. No.	Author(s)	Title	Edition / ISBN	Publisher
1	Jeeva Jose	Internet of Things	1st Ed., ISBN: 9789386173591	Khanna Publishing House
2	Raj Kamal	Internet of Things: Architecture and Design Principles	1st Ed., ISBN: 9789352605224	McGraw Hill Education
3	Sudhir Kumar	Fundamentals of Internet of Things	1st Ed., ISBN: 9781032126500	CRC Press
4	Samuel Greengard	The Internet of Things	1st Ed., ISBN: 9780262542623	MIT Press
5	Arshdeep Bahga & Vijay Madisetti	Internet of Things: A Hands-on Approach	1st Ed., ISBN: 9780996025515	VPT

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SUBJECT NAME: Distributed Database Management System
SUBJECT CODE: BSCITM802

SUBJECT NAME: Distributed Database Management System Lab
SUBJECT CODE: BSCITM892
CREDIT: 3+2
CONTACT HOURS/WEEK: 4 hours (Theory) + 6 hours (practical)

TOTAL MARKS:

Theory-100 (External: 70, Internal: 30) Practical-100(External-60, Internal-40)

COURSE OBJECTIVE:

The objective of the course "Distributed Database Management System" is to provide students with fundamental knowledge of database systems in a distributed environment. The course aims to introduce the principles, architecture, and design strategies of distributed databases and to equip students with the skills to handle data distribution, replication, and query processing. The course also familiarizes students with modern database models including NoSQL and PostgreSQL and builds foundational skills in SQL and PL/SQL.

COURSE OUTCOME:

CO1 Understand the fundamental concepts of DBMS and RDBMS including data models, relational schemas, and SQL queries.
CO2 Explain distributed database architectures, types of fragmentation, replication, and allocation techniques.
CO3 Analyze transparency issues and implement query processing and optimization strategies in distributed environments.
CO4 Write PL/SQL programs using control structures, recursion, and user-defined functions.
CO5 Identify and apply concurrency control and recovery techniques in distributed systems.
CO6 Compare SQL with NoSQL and understand the usage of PostgreSQL in practical applications.

Module No.	Module Title	Mapped COs
Module I	Introduction to DBMS and SQL	**CO1**
Module II	Distributed Databases Basics	**CO2**
Module III	Fragmentation, Replication & Allocation	**CO2, CO3**
Module IV	Distributed Query Processing & PL/SQL	**CO3, CO4**
Module V	Distributed Transactions & Concurrency Control	**CO5**

Module VI	NoSQL & PostgreSQL	**CO6**

DETAILED SYLLABUS:

Module I:
Introduction to Database Management Systems (DBMS); Comparison of File System and DBMS; Relational DBMS concepts; Data models, schemas, and instances; Database languages: DDL, DML; Introduction to SQL: SELECT, INSERT, UPDATE, DELETE; Concept of keys: primary, foreign, candidate keys; Entity-Relationship model basics.
Hours: 10 **Marks:** 10

Module II:
Introduction to Distributed Databases; Features and objectives of Distributed DBMS; Distributed vs Centralized systems; Architecture of Distributed DBMS; Overview of client-server and peer-to-peer models; Advantages and limitations of DDBMS.
Hours: 10 **Marks:** 10

Module III:
Data Fragmentation: horizontal, vertical, and mixed; Data Replication and its types; Data Allocation techniques; Fragmentation Transparency, Location Transparency, and Replication Transparency; Overview of Distributed Database Design Issues.
Hours: 8 **Marks:** 10

Module IV:
Query processing in distributed databases; Query decomposition and data localization; Query optimization techniques; Introduction to PL/SQL: block structure, variables, data types, conditional statements, loops, simple PL/SQL programs.
Hours: 7 **Marks:** 15

Module V:
Distributed Transactions and Concurrency Control; ACID properties in distributed systems; Lock-based and timestamp-based concurrency control; Deadlock detection and prevention; Two-phase and three-phase commit protocols; Overview of distributed recovery techniques: log-based recovery and checkpoints.
Hours: 8 **Marks:** 15

Module VI:
Introduction to NoSQL: characteristics, types (Key-value, Document, Column, Graph); SQL vs NoSQL comparison; Introduction to PostgreSQL: features, architecture, simple queries using PostgreSQL, usage in modern applications; Advantages over traditional RDBMS.
Hours: 10 **Marks:** 10

Practical

COURSE OUTCOME:

CO1 Implement basic SQL operations and understand relational database connectivity.
CO2 Demonstrate data fragmentation, replication, and allocation through simulation or SQL-based tools.
CO3 Write PL/SQL programs using conditional statements, loops, and functions.
CO4 Apply transaction management concepts such as commit, rollback, and concurrency control in a practical setup.
CO5 Compare distributed query performance using query plan and optimization techniques.
CO6 Simulate distributed database environments using open-source platforms such as PostgreSQL or MySQL.

LIST OF PRACTICALS:

1. **Basic SQL Operations**: Creating tables, inserting, updating, and deleting records.
2. **Simple Queries and Joins**: Execute SELECT queries with WHERE, GROUP BY, ORDER BY, and different types of joins.
3. **PL/SQL Programs**: Write PL/SQL blocks using variables, IF-ELSE statements, and loops.
4. **PL/SQL Functions and Procedures**: Create and call user-defined functions and procedures.
5. **Data Fragmentation**: Simulate horizontal and vertical fragmentation using multiple tables/databases.
6. **Data Replication and Allocation**: Demonstrate replication across databases or simulate data allocation techniques.
7. **Transaction Management**: Use COMMIT, ROLLBACK, and SAVEPOINT in SQL; implement concurrency scenarios.
8. **Concurrency Control**: Simulate locking mechanisms and observe deadlock conditions.
9. **Query Optimization**: Analyze query performance using EXPLAIN PLAN in PostgreSQL or MySQL.

SUGGESTED TOOLS/PLATFORMS:

- PostgreSQL
- MySQL
- Oracle Database
- pgAdmin / DBeaver / MySQL Workbench

SUGGESTED READING:

1. *Database System Concepts* by Silberschatz, Korth, and Sudarshan – McGraw Hill
2. *Distributed Databases: Principles and Systems* by Stefano Ceri and Giuseppe Pelagatti – McGraw Hill
3. *SQL, PL/SQL: The Programming Language of Oracle* by Ivan Bayross – BPB Publications
4. *NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence* by Pramod J. Sadalage and Martin Fowler – Pearson
5. *PostgreSQL: Up and Running* by Regina O. Obe and Leo S. Hsu – O'Reilly Media

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SUBJECT NAME: Introduction to Data Science
SUBJECT CODE: BSCITM803-A

CREDIT: 3
CONTACT HOURS/WEEK: 4 hours

TOTAL MARKS:

Theory-100 (External: 70, Internal: 30)

COURSE OBJECTIVES:

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

1. **Understand** the fundamental concepts, scope, workflow, and real-world applications of Data Science.
2. **Develop proficiency** with essential data science toolboxes including Python and associated libraries.
3. **Apply** descriptive statistics and perform exploratory data analysis for effective data understanding.
4. **Analyse and evaluate** supervised and unsupervised learning algorithms for solving data-driven problems.
5. **Interpret and investigate** networks and graphs using centrality measures and community detection techniques.

CO No.	Course Outcome
CO1	Explain the scope, workflow, and applications of Data Science.
CO2	Use Python toolboxes and perform data manipulation, cleaning, and visualization.
CO3	Analyse datasets using descriptive statistics and exploratory data analysis.
CO4	Evaluate statistical inference methods such as estimation, hypothesis testing, and p-value interpretation.
CO5	Implement supervised and unsupervised machine learning models for regression and clustering tasks.
CO6	Interpret graph-based data, compute centrality, and identify communities in networks.

Module No.	Module Description	Mapped COs
I	Objective, scope, workflow & applications of Data Science	**CO1**
II	Python toolboxes, IDEs, data operations & data handling	**CO1, CO2**
III	Descriptive statistics, EDA, distribution, inference & hypothesis testing	**CO2, CO3**
IV	Supervised & Unsupervised learning, regression, clustering & case	**CO3, CO4**

	study	
V	Network Analysis, graphs, centrality, PageRank & communities	**CO5, CO6**

Contents

Module		**Hours**	**Marks**
1	Objective, scope, and outcomes of Data Science.Overview of data science process and workflow. Applications of data science in various domains (business, healthcare, IoT, etc.).	3	5
2	Toolboxes: Python, fundamental libraries for data Scientists. Integrated development environment (IDE). Data operations: Reading, selecting, filtering, manipulating, sorting, grouping, rearranging, ranking, and plotting.	10	10
3	Descriptive statistics, data preparation. Exploratory Data Analysis, data summarization, data distribution, measuring asymmetry. Sample and estimated mean, variance and standard score. Statistical Inference: frequency approach, variability of estimates, hypothesis testing using confidence intervals, using p-values.	10	20
4	Supervised Learning: First step, learning curves, training-validation and test. Learning models generalities, support vector machines, random forest. Examples. Regression analysis, Regression: linear regression, simple linear regression, multiple & Polynomial regression, Sparse model. Unsupervised learning, clustering, similarity and distances, quality measures of clustering, case study.	12	20
5	Network Analysis, Graphs, Social Networks, centrality, drawing centrality of Graphs, PageRank, Ego-Networks, community Detection.	10	15

Text Books

1. **V.K. Jain, *Data Science and Analytics*, Wiley India, 1st Edition, 2018.**
2. **Wes McKinney, *Python for Data Analysis*, O'Reilly Media, 2nd Edition, 2017.**
3. **Prateek Joshi, *Artificial Intelligence with Python*, Packt Publishing, 2017.**

Reference Books

1. **Narsimha Karumanchi, *Data Structures and Algorithms Made Easy – Data Science & ML Edition*, CareerMonk Publications, 2020.**
2. **Joel Grus, *Data Science from Scratch*, O'Reilly Media, 2nd Edition, 2019.**

SUBJECT NAME: Machine Learning
SUBJECT CODE: BSCITM803-B

CREDIT: 3
CONTACT HOURS/WEEK: 4 hours

TOTAL MARKS:
Theory-100 (External: 70, Internal: 30)

Subject Name:

Course Objectives:

1. Ability to comprehend the concept of supervised and unsupervised learning techniques.
2. Differentiate regression, classification and clustering techniques and to implement their algorithms.
3. To analyze the performance of various machine learning techniques and to select appropriate features for training machine learning algorithms.

CO No.	Course Outcome
CO1	Understand the fundamental concepts, paradigms, and applications of machine learning.
CO2	Apply data preprocessing, feature engineering, and handling techniques for building ML models.
CO3	Implement and analyze supervised learning algorithms including regression, classification, and ANN models.
CO4	Apply unsupervised learning and clustering techniques to extract patterns from unlabeled data.
CO5	Evaluate and optimize ML models using performance metrics, ensemble methods, Bayesian inference, and EM algorithm.
CO6	Interpret, visualize, and communicate machine learning results effectively for practical problem solving.

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Module No.	Module Description	Mapped COs
Module 1	Introduction to Machine Learning: learning paradigms, feature engineering, generalization, PAC, VC Dimension, applications	**CO1**
Module 2	Data Handling & Artificial Neural Networks: feature selection, outlier detection, ANN, backpropagation	**CO2, CO3**
Module 3	ML Models & Evaluation: regression, classification, model evaluation, statistical decision theory	**CO3, CO5**
Module 4	Model Assessment & Inference: ensemble learning, Bayesian inference, EM algorithm, model selection	**CO5**
Module 5	Clustering: K-Means, hierarchical, MST, BIRCH clustering	**CO4, CO6**

Module 1: Introduction to Machine Learning (8 hours, 10 marks)
Introduction to Machine Learning (ML); Feature engineering; Learning Paradigm, Generalization of hypothesis, VC Dimension, PAC learning, Applications of ML.

Module 2: Data Handling and ANN (8 hours, 15 marks)
Feature selection mechanisms, Imbalanced data, Outlier detection; Artificial Neural Networks including backpropagation; Applications.

Module 3: ML Models and Evaluation (15 hours, 20 marks)
Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression.
Classification – KNN, Naïve Bayes, SVM, Decision Tree; Training and testing classifier models; Cross-validation; Model evaluation (precision, recall, F1-measure, accuracy, area under curve). Statistical decision theory including discriminant functions and decision surfaces.

Module 4: Model Assessment and Inference (8 hours, 10 marks)
Model assessment and selection – Ensemble Learning – Boosting, Bagging, Model Inference and Averaging, Bayesian Theory, EM Algorithm.

Module 5: Clustering (8 hours, 15 marks)
K-Means, Hierarchical Clustering – Single, Complete, Average linkage; Ward's algorithm; Minimum spanning tree clustering; BIRCH clustering.

Text Books

1. Ethem Alpaydin, *Introduction to Machine Learning*, MIT Press, Pearson, Third Edition, 2014.
2. Friedman Jerome, Trevor Hastie, and Robert Tibshirani, *The Elements of Statistical Learning*, Springer-Verlag, 2nd Edition, 2013.

Reference Books

1. Kevin P. Murphy, *Machine Learning: A Probabilistic Perspective*, MIT Press, 2012.
2. Peter Flach, *Machine Learning: The Art and Science of Algorithms that Make Sense of Data*, Cambridge University Press, 2012.

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SUBJECT NAME: Neural Network and Deep Learning
SUBJECT CODE: BSCITM803-C

CREDIT: 3
CONTACT HOURS/WEEK: 4 hours

TOTAL MARKS:

Theory-100 (External: 70, Internal: 30)

Course Objectives

1. To introduce the basic concepts of artificial neural networks and their working principles.
2. To develop understanding of supervised, unsupervised, and deep learning techniques.
3. To learn optimization, backpropagation, and model regularization techniques.
4. To explore deep architectures like CNN, RNN, and Autoencoders for real-world applications.

CO No.	Course Outcome (CO)
CO1	Understand the fundamentals of artificial neural networks, perceptron models, activation functions, and feed-forward architectures.
CO2	Apply training techniques including loss functions, gradient descent, backpropagation, and regularization to optimize neural networks.
CO3	Analyze deep neural network architectures, optimization methods, and regularization techniques for effective model training.
CO4	Implement Convolutional Neural Networks (CNNs) for image processing and classification tasks.
CO5	Apply Recurrent Neural Networks (RNNs), including LSTM and GRU, for sequential data and NLP applications.
CO6	Explore advanced architectures such as Autoencoders, GANs, and transfer learning for real-world deep learning problems.

Module No.	Module Description	Mapped COs
Module 1	Neural network basics, perceptron, activation, feed-forward architecture	**CO1**
Module 2	Training: loss, gradient descent, backpropagation, overfitting/underfitting	**CO2**
Module 3	Deep networks: regularization, optimization	**CO3, CO2**
Module 4	Convolutional Neural Networks (CNN)	**CO4**
Module 5	Recurrent Neural Networks (RNN)	**CO5**
Module 6	Autoencoders, GANs, transfer learning, advanced topics	**CO6**

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Contents

Module	Content	Hours	Marks
1: Introduction to Neural Networks	Overview of AI & ML; biological neuron vs artificial neuron; perceptron model; activation functions (sigmoid, ReLU, tanh); architecture of feed-forward neural networks.	8	10
2: Training Neural Networks	Loss function, cost minimization, gradient descent, backpropagation algorithm, learning rate, overfitting, underfitting.	8	10
3: Deep Neural Networks	Concept of deep learning, deep feed-forward networks, regularization (dropout, batch normalization), optimization (Adam, RMSProp).	10	15
4: Convolutional Neural Networks (CNN)	Convolution operation, pooling, feature maps, CNN architecture (LeNet, AlexNet, VGG, ResNet), image classification case study.	10	15
5: Recurrent Neural Networks (RNN)	Sequential data, RNN architecture, vanishing gradient problem, LSTM, GRU, sequence modeling, NLP applications.	10	10
6: Autoencoders and Advanced Topics	Encoder-decoder architecture, denoising autoencoders, variational autoencoders, GANs, transfer learning, deep learning in research.	5	10

Text Books

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville — *Deep Learning*, MIT Press.
2. Charu Aggarwal — *Neural Networks and Deep Learning: A Textbook*, Springer.
3. Simon Haykin — *Neural Networks: A Comprehensive Foundation*, Pearson.

Reference Books

1. Michael Nielsen — *Neural Networks and Deep Learning* (Online Book).
2. François Chollet — *Deep Learning with Python*, Manning.

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SUBJECT NAME: Big Data Analytics
SUBJECT CODE: BSCITM804-A

CREDIT: 3
CONTACT HOURS/WEEK: 4 hours

TOTAL MARKS:

Theory-100 (External: 70, Internal: 30)

Course Objectives

The objective of this course is to introduce students to the fundamental concepts of Big Data and large-scale data processing systems. The course aims to help learners understand the architecture of distributed computing tools such as Hadoop, HDFS, MapReduce, Hive, Pig, Spark, and NoSQL databases. Students will also gain knowledge of big data challenges, data ingestion, data storage, and large-scale analytical processing. By the end of the course, students will be able to comprehend how big data technologies solve complex real-world problems and support intelligent decision-making.

CO No.	Course Outcome (CO)
CO1	Understand the motivation, characteristics, and applications of Big Data in industry and real-world scenarios.
CO2	Explain NoSQL concepts, different data models, and consistency/replication mechanisms.
CO3	Comprehend Hadoop and HDFS architecture, data flow, file storage formats, and data integrity processes.
CO4	Develop and analyze MapReduce workflows, including job execution, scheduling, and error handling.
CO5	Implement basic operations using HBase and Cassandra and explain their integration with Hadoop ecosystems.
CO6	Use Pig and Hive for data querying, manipulation, and analysis, and compare their suitability for various workloads.

Unit No.	Unit Description	Mapped COs
Unit 1	Introduction to Big Data, industry applications, technologies	**CO1**
Unit 2	NoSQL databases, data models, consistency, replication	**CO2**
Unit 3	Hadoop & HDFS: architecture, data flow, storage, integrity	**CO3**

Unit 4	MapReduce workflows, job execution, scheduling, YARN	**CO4**
Unit 5	HBase & Cassandra: data models, clients, Hadoop integration	**CO5**
Unit 6	Pig & Hive: data models, scripts, queries, analysis	**CO6**

Course Contents

Unit 1:
What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud andbig data, risk and big data, credit risk management, big data and algorithmictrading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloudand big data, mobile business intelligence, Crowd sourcing analytics, inter andtrans firewall analytics.

Hours:10 Marks: 15

Unit 2:
Introduction to NoSQL, aggregate data models, aggregates, key-value anddocument data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peerpeer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reducecalculations.
Hours: 10 Marks: 15

Unit 3:
Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadooppipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Javainterface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based datastructures

Hours: 8 Marks: 10
Unit 4:

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomyof MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduceand YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

Hours: 8 Marks: 10
Unit 5:
Hbase, data model and implementations, Hbase clients, Hbaseexamples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.

Hours: 8 Marks: 10
Unit 6:
Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

Hours: 6 Marks: 10

References

1. **Michael Minelli, Michelle Chambers, Ambiga Dhiraj**, *Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses*, Wiley, 2013.
2. **V. K. Jain**, *Big Data and Hadoop*, Khanna Publishing House, New Delhi, 2017.
3. **V. K. Jain**, *Data Analysis*, Khanna Publishing House, New Delhi, 2019.
4. **P. J. Sadalage and M. Fowler**, *NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*, Addison-Wesley Professional, 2012.
5. **Tom White**, *Hadoop: The Definitive Guide*, 3rd Edition, O'Reilly Media, 2012.

SUBJECT NAME: Data Visualization
SUBJECT CODE: BSCITM804-C

CREDIT: 3
CONTACT HOURS/WEEK: 4 hours

TOTAL MARKS:

Theory-100 (External: 70, Internal: 30)

Course Objectives

The main objective of this course is to introduce students to the fundamental concepts and importance of data visualization in the field of data analysis and decision-making. It aims to develop an understanding of various types of data and the statistical measures used to summarize and interpret them. The course focuses on helping students learn different visualization techniques for both univariate and bivariate data to identify patterns, trends, and relationships effectively. It also aims to provide practical knowledge of using Python libraries such as NumPy, Matplotlib, and Pandas to perform data handling, analysis, and visualization. By the end of the course, students will be able to create meaningful, accurate, and visually appealing representations of data to support analytical insights and communication.

Course Outcomes

CO No.	Course Outcome (CO)
CO1	Understand the fundamental concepts, need, and benefits of data visualization in data analysis.
CO2	Apply basic statistical measures for summarizing and interpreting data patterns.
CO3	Construct and analyze univariate visualizations such as bar charts, histograms, pie charts, and box plots.

CO4	Design and interpret bivariate visualizations like scatter plots, line charts, and hex plots to explore relationships.
CO5	Utilize Python's NumPy library for data manipulation, numerical computation, and array-based operations.
CO6	Create, customize, and enhance visualizations using Python libraries such as Matplotlib and Pandas for effective data presentation.

Unit No.	Unit Description	Mapped COs
Unit 1	Introduction to data visualization: need, history	**CO1**
Unit 2	Statistical preliminaries: data types, centrality, dispersion, association	**CO2**
Unit 3	Univariate visualizations: bar chart, histogram, pie chart, box plot	**CO3**
Unit 4	Bivariate visualizations: scatter plot, line chart, hex plot	**CO4**
Unit 5	Python NumPy library: ndarrays, operations, broadcasting	**CO5**
Unit 6	Data visualization in Python: Matplotlib, Pandas, plot customization	**CO6**

Prerequisites

Students are expected to have:

- Basic computer skills (file management, software handling).
- Knowledge of **data structures** (tables, databases).
- Basic understanding of **data analysis** and **data types** (numerical, categorical, etc.).

Unit 1:

Introduction (Hours: 6 Marks: 5)
About data visualization, The need for data visualization, Brief history of data visualization

Unit 2:

Statistical Preliminaries (Hours: 8 Marks: 10)
Different types of data, Measures of Centrality, Measures of Dispersion, Measures of Association

Unit 3:

Univariate Visualizations (Hours: 10 Marks: 15)
Stem-and-Leaf Plot, Pie Chart, Bar Graph, Histogram, Line Chart, Box Plot, Analysis and drawing conclusions

Unit 4:

Bivariate Visualizations (Hours: 8 Marks: 15)
Scatter Plot, Bivariate Line Chart, Hex Plot, Analysis and drawing conclusions

Unit 5:

Python NumPy Library (Hours: 10 Marks: 15)
NumPy and its advantages, NumPy n-dimensional array (ndarray), Creating ndarrays in NumPy, Slicing ndarrays, ndarray operations, Broadcasting

Unit 6:

Data Visualizations in Python (Hours: 10 Marks: 15)
Plotting with matplotlib, Univariate graphs using matplotlib, Bivariate graphs using matplotlib, Plotting through pandas, Improving plot aesthetics

Text Books

1. **Cole Nussbaumer Knaflic**, *Storytelling with Data: A Data Visualization Guide for Business Professionals*, Wiley, 2015.
2. **Edward Tufte**, *The Visual Display of Quantitative Information*, Graphics Press USA, 2001.

Reference Books

1. **Kieran Healy**, *Data Visualization: A Practical Introduction*, Princeton University Press, 2018.
2. **Alberto Ferrari & Marco Russo**, *Analyzing Data with Power BI and Power Pivot for Excel*, Microsoft Press, 2017.
3. **Devin Knight et al.**, *Microsoft Power BI Complete Reference*, Packt Publishing, 2018.

SUBJECT NAME: Data Security & Privacy
SUBJECT CODE: BSCITM804-B

CREDIT: 3
CONTACT HOURS/WEEK: 4 hours

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TOTAL MARKS:

Theory-100 (External: 70, Internal: 30)

Course Objective:

The primary objective of this course is to provide students with a comprehensive understanding of data security and privacy principles necessary in modern digital environments. It aims to familiarize learners with fundamental concepts, privacy threats, data-linking attacks, and various access-control models used to safeguard information. The course helps students analyze the rapidly increasing volume of personal data, understand real-world data-sharing practices, and evaluate associated risks and vulnerabilities. Students will explore different privacy-preserving protection models, disclosure-control techniques, and computational tools such as MinGen, Datafly, Mu-Argus, and Scrub for protecting sensitive data. Additionally, the course emphasizes legal, ethical, and policy-related aspects of privacy, enabling students to appreciate the balance between technology, user rights, and regulatory frameworks.

Course outcomes:

CO No.	Course Outcome (CO)
CO1	Understand fundamental concepts of data security, privacy, data-linking attacks, and access-control models.
CO2	Analyze issues related to large-scale data collection, data explosion, risk measurements, and uniqueness in datasets.
CO3	Apply privacy protection models such as Null-map, k-map, and Wrong-map to safeguard sensitive data.
CO4	Evaluate disclosure-control techniques and assess strengths and weaknesses of privacy-preserving approaches.
CO5	Use computational tools like MinGen, Datafly, Mu-Argus, k-Similar, and Scrub to implement data privacy measures.
CO6	Interpret legal, ethical, and policy frameworks relevant to data privacy and security.

Unit No.	Unit Description	Mapped COs
Unit 1	Introduction: concepts, privacy attacks, access-control models, privacy policies	**CO1**

Unit 2	Data explosion, large-scale data collection, risk measurement, uniqueness	**CO2**
Unit 3	Privacy protection models: Null-map, k-map, Wrong-map	**CO3**
Unit 4	Disclosure-control techniques, strengths & weaknesses	**CO4**
Unit 5	Computational tools for data privacy: MinGen, Datafly, Mu-Argus, k-Similar, Scrub	**CO5**
Unit 6	Legal, ethical, and policy frameworks: medical, web, FOI Act	**CO6**

Course Contents:

Unit 1:
Introduction: Fundamental Concepts, Definitions, Statistics, Data Privacy Attacks, Data linking and profiling, access control models, role based access control, privacy policies, their specifications, languages and implementation, privacy policy languages, privacy in different domains- medical, financial, etc.
Hours: 8 Marks: 10
Unit 2:
Data explosion :Statistics and Lack of barriers in Collection and Distribution of Person-specific information, Mathematical model for characterizing and comparing real-world data sharing practices and policies and for computing privacy and risk measurements, Demographics and Uniqueness.
Hours: 10 Marks 15
Unit 3 – Privacy Protection Models
privacy protection models: Null-map, k-map, Wrong-map, principles and applications of each, real-world scenarios for safeguarding sensitive data, implementation approaches, limitations and trade-offs, comparative analysis to choose suitable models for specific privacy challenges.

Hours: 8 Marks 10

Unit 4:
Survey of techniques: Protection models (null-map, k-map, wrong map), Disclosure control, Inferring entity identities, Strength and weaknesses of techniques, entry specific databases.
Hours: 8 Marks 10

Unit 5:
Computation systems for protecting delimited data: MinGen, Datafly, Mu-Argus, k-Similar, Protecting textual documents: Scrub
Hours: 8 Marks 10

Unit 6

Technology, Policy, Privacy and Freedom: Medical privacy legislation, policies and best practices, Examination of privacy matters specific to the World Wide Web, Protections provided by the Freedom of Information Act or the requirement for search warrants.
Hours: 8 Marks 15

Reference books:

- *Data Privacy: Principles and Practice* — Nataraj Venkataramanan & Ashwin Shriram
- *Practical Data Privacy* — Katharine Jarmul
- *Blockchain Technology for Data Privacy Management* — Sudhir Kumar Sharma, Bharat Bhushan, Aditya Khamparia, Parmanand Astya, Narayan C. Debnath
- *The Complete Book of Data Anonymization* — Balaji Raghunathan

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BSC-IT (Honours)

Course Title: Major Project
Course Code: SEC 881
Credits: 6
Course Category: Skill Enhancement Course

Course Objective:

The Major Project course aims to enable students to apply the theoretical and practical knowledge acquired throughout the B.Sc. IT programme to solve real-world problems through the design and development of a working software, hardware, or data-driven system.
This course encourages innovation, problem solving, teamwork, and professional communication. Students will experience the complete project life cycle—from problem identification and analysis to system design, implementation, testing, and documentation—culminating in a final presentation and Viva-Voce examination.

Course Outcomes (CO):

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

1. Identify, define, and analyse real-world IT problems and propose effective solutions.
2. Apply software engineering principles to design and implement robust systems.
3. Integrate appropriate programming tools, databases, and frameworks to develop applications.
4. Conduct effective testing and prepare professional technical documentation.
5. Present and defend their project findings confidently through oral and written

Methods for Final Year Project Viva-Voce Procedure

1. Panel Introduction and Verification of Student Details

- The Viva panel introduces themselves, stating their name, designation, and role.
- The student is requested to submit their **project report**, **presentation file**, and **identity proof**.
- The panel verifies:
    - Student's Name
    - Roll & Registration Number
    - Project Title
    - Supervisor's Name
    - Project Type (Software/Hardware/Data Analytics/AI-ML etc.)

- The panel briefly explains the structure and norms of the Viva-Voce session.

2. Student Presentation (8–12 minutes)

- The student presents their Final Year Project through a structured PPT.
- Presentation must include the following sections:
    a. **Project Title & Introduction**
    b. **Problem Statement and Motivation**
    c. **Objectives & Scope**
    d. **Methodology / System Architecture / Workflow**
    e. **Technologies, Algorithms & Tools Used**
    f. **Implementation Highlights (Modules/Screenshots/Demos)**
    g. **Results, Analysis & Performance**
    h. **Conclusion & Future Work**
- The panel allows uninterrupted presentation and notes key points for later questioning.
- Over-length presentations may be restricted and the student may be asked to summarize.

3. Detailed Question–Answer Session

- After the presentation, each panel member asks domain-specific and project-specific questions.
- Types of questions include:
    - **Conceptual questions** relating to the underlying theory
    - **Technical questions** about algorithms, code, tools, and architecture
    - **Analytical questions** about decisions, design choices, and alternatives
    - **Evaluation questions** about limitations, improvements, and real-world applicability
- The student must answer confidently and justify all technical decisions.
- The panel may ask the student to show:
    - Part of the code
    - Demonstration of modules
    - Database schema
    - System flow
    - Test cases or logs
- Follow-up questions test depth of understanding.

4. Assessment of Subject Knowledge and Project Understanding

- The panel evaluates how strongly the student understands:
    - The core IT/CS concepts behind the project
    - The theoretical foundation (DSA, DBMS, Networking, OS, SE, AI/ML, etc.)
    - How these fundamentals are applied in the project
- The student should demonstrate:
    - Clear conceptual explanation
    - Logical reasoning
    - Ability to relate academic knowledge to implementation

- Marks depend on conceptual clarity and accuracy of responses.

5. Assessment of Technical Competence and Problem-Solving

- The panel reviews the student's:
  - Understanding of chosen algorithms and technologies
  - Ability to justify tool/framework selection
  - Problem-solving approach during development
  - Debugging methods and error-handling practices
  - Use of software engineering principles
- Students may be asked to explain:
  - Specific code segments
  - Data structures used
  - Workflow and logic
  - Efficiency and optimization choices
- Scenario-based questions may be used to test real-time problem-solving ability.

6. Assessment of Communication, Professionalism, and Ethics

- Communication skills evaluated through:
  - Clarity of explanation
  - Logical flow of answers
  - Confidence and composure
  - Use of technical terminology
- Professionalism assessed through:
  - Behaviour, punctuality, and attentiveness
  - Honesty about project work and contribution
  - Ethical conduct (no plagiarism or false claims)
  - Respectful interaction with the panel
- Overall demeanor and attitude contribute to scoring.

7. Final Scoring and Constructive Feedback

- Each panel member assigns marks based on the official Viva-Voce rubric.
- Scores from all evaluators are combined for the final Viva-Voce marks.
- The panel provides constructive feedback regarding:
  - Strengths of the project
  - Areas of improvement
  - Technical or academic shortcomings
  - Suggestions for future enhancement or research direction
- The student may ask questions or seek clarification before exiting.

Expectations from Students

During the Final Year Project Viva Voce, students are expected to demonstrate a comprehensive understanding of their work along with maturity in technical knowledge, analytical skills, and professional behavior. The following expectations outline the standard performance criteria:

Project Mastery
Students must demonstrate complete command over their project. They should be able to clearly explain every stage including project motivation, objectives, design decisions, methodology adopted, implementation details, results obtained, and conclusions drawn. The student must also justify why specific tools, algorithms, models, or techniques were selected over alternatives. A project owner is expected to show confidence and ownership of the work done.

Fundamental Knowledge
Students should effectively link the theoretical concepts taught in the curriculum with their project work. They must show clarity in core subject fundamentals relevant to the domain of their project—such as data structures, algorithms, networking, machine learning, databases, electronics, or system design. Answers should reflect understanding, not memorization, and must show how classroom concepts support the project's logic and implementation.

Technical Competence
Students must exhibit a strong understanding of all technical components used in the project. This includes familiarity with tools, programming languages, frameworks, algorithms, hardware, instrumentation, datasets, and data-handling techniques. They should be able to explain system workflow, architecture, implementation steps, and troubleshoot common issues. Technical justification is essential to establish competence.

Critical Thinking
Students should demonstrate the ability to analyze problems, evaluate alternate solutions, justify their chosen approach, and interpret results meaningfully. They must be capable of discussing limitations, challenges faced during development, how they were solved, and possible improvements. A critical thinker should show logical reasoning, evidence-based decision-making, and the ability to defend conclusions.

Professional Behavior
Students are expected to maintain high standards of professionalism throughout the viva. This includes confident communication, honesty in reporting work, punctuality, discipline, and respectful interaction with the panel. Ethical behavior is essential—students must avoid plagiarism, acknowledge external contributions, and present their work with integrity. Attentiveness and a positive academic attitude are key indicators of professionalism.

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Detailed Rubric for Viva Voce Assessment (100 Marks)

The following rubric outlines the performance levels for evaluating final-year project viva voce. Each criterion is assessed under four grading categories:

Excellent (A), **Good (B)**, **Average (C)**, and **Poor (D)**.

Criteria	Excellent (A)	Good (B)	Average (C)	Poor (D)
Understanding of Project Work (30 marks)	Demonstrates comprehensive and in-depth understanding of the project; explains objectives, methodology, implementation, and results with clarity and strong insight.	Shows good understanding with minor conceptual gaps; explanations are mostly clear and structured.	Shows partial or surface-level understanding; explanations lack depth and include confusion in describing methodology or results.	Demonstrates poor understanding; unable to explain major components or rationale behind the project.
Subject Knowledge & Fundamentals (25 marks)	Exhibits strong conceptual clarity; accurately connects theoretical fundamentals with project work.	Shows good grasp of core concepts with occasional inaccuracies.	Shows basic understanding but struggles to apply theory to the project.	Weak in fundamentals; major conceptual errors or lack of clarity in core subjects.
Technical Skills & Application (20 marks)	Provides strong justification for tools, technologies, and methods used; demonstrates excellent technical reasoning and problem-solving ability.	Justifies most technical choices logically; shows good command of tools and methods.	Gives limited justification; displays only basic technical knowledge.	Fails to justify technical decisions; shows poor technical understanding and weak reasoning.
Communication & Presentation Skills (15 marks)	Presents confidently with a well-organized structure; communicates clearly; uses visual aids effectively where applicable.	Communicates clearly with good structure; minor hesitation or gaps in flow.	Communication is understandable but lacks fluency or proper structure.	Presentation is unclear, poorly structured, or delivered with low confidence.
Attitude,	Highly	Generally	Engagement is	Displays

Engagement & Academic Integrity (10 marks)	professional, attentive, honest, and respectful throughout the interaction.	professional with minor issues in engagement or attentiveness.	inconsistent; may show minor behavioral or discipline issues.	unprofessional behavior or indications of academic d

Comprehensive Viva Voce Rubric (100 Marks)

The comprehensive rubric outlines the mark distribution and evaluation descriptors for assessing final-year project viva voce performance.

Criteria	Marks	Descriptors
Understanding of Project Work	**30**	Assesses depth of understanding, clarity of project objectives, ability to explain methodology, implementation, key findings, and conclusions.
Subject Knowledge & Fundamentals	**25**	Evaluates conceptual clarity, accuracy of responses, and the ability to relate core academic fundamentals to the project work.
Technical Skills & Application	**20**	Measures the justification of chosen tools, technologies, and methods; analytical ability; and overall problem-solving competence.
Communication & Presentation Skills	**15**	Focuses on clarity of speech, confidence, logical structure of presentation, and overall professionalism in delivery.
Attitude, Engagement & Academic Integrity	**10**	Examines honesty, preparedness, responsiveness to questions, respectful behavior, and adherence to ethical standards.

Sample Major Project Report Structure

A well-structured report helps students present their project work in a professional, organized, and readable format. The following layout is recommended for preparing the **Major Project Report**.

1. Title Page

Includes:

- Project title
- Student’s name, roll number, registration number, semester, department, and university
- Supervisor’s name and designation
- Academic session and submission date

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Example:

"Online Fee Management System using PHP and MySQL"

Student Name Supervisor's Name
Class and Year Designation

Research Project Submitted in Partial Fulfilment of the Requirements for the Degree of Bachelor of Science in Information Technology from [University]
Month Year

2. Certificate

- Signed by the **Supervisor and Head of Department (HOD)**.
- Certifies that the project is **originally carried out under supervision** and fulfills partial requirements for the degree.

3. Declaration

- A statement by the student confirming that the work is **independent, original, and not submitted elsewhere**.
- Must include **student's signature and date**.

4. Acknowledgement

- Expression of gratitude towards **supervisor, faculty members, college authorities, friends, and family**.
- Keep it short, polite, and genuine (150–200 words).

5. Abstract

- A concise summary (within **250–300 words**) covering:
  - **Objective** of the project
  - **Tools and technologies used**
  - **Key features** and **methodology**
  - **Expected outcome or result**

6. Table of Contents, List of Figures & Tables

- Include an automatic or manually formatted **Table of Contents**.
- Add **List of Figures** and **List of Tables** for easy navigation.

7. Chapter 1: Introduction

This chapter introduces the project idea and context. It includes:

- **Background / Motivation** behind selecting the topic
- **Problem Statement**
- **Objectives and Scope**
- **Methodology overview** (brief)
- **Organization of the Report** (summary of chapters)

8. Chapter 2: System Analysis and Design

This section should describe how the system was **analyzed and designed** before implementation. It covers:

- **Requirement Analysis** – functional and non-functional requirements
- **Feasibility Study** – technical, economic, and operational feasibility
- **System Flowchart / DFDs / UML Diagrams** – data flow, process flow, and interaction diagrams
- **System Architecture** – overall system block diagram
- **Database Design** – entity–relationship diagram and schema

9. Chapter 3: Implementation and Testing

- Description of **tools, programming languages, frameworks**, and **software/hardware platforms** used
- Detailed explanation of **module-wise implementation**
- Inclusion of **program flowcharts**, **screenshots**, and **sample outputs**

10. Chapter 4: Results and Discussion

- Show **final system output**, **working snapshots**, and **sample execution results**
- Compare **expected vs. obtained results**
- Explain **performance, accuracy, and efficiency** if measurable
- Discuss **key achievements**, **limitations**, and **user feedback (if collected)**

11. Chapter 5: Conclusion and Future Scope

- Summarize the entire work done and its outcomes
- Highlight how the objectives were achieved
- Suggest **future enhancements or upgrades**, such as adding automation, AI/ML integration, or cloud deployment
- Reflect on **learning outcomes** and **real-world applicability** of the project

12. References

- List of all **books, websites, tutorials, or documentation** referred during development

- Use **APA or IEEE format** for uniformity.
  Example:

  Pressman, R. S. (2010). *Software Engineering: A Practitioner's Approach*. McGraw-Hill Education.

13. Appendices

Include any supporting material such as:

- Source code snippets
- Screenshots of interfaces
- Database tables
- User manuals or installation guides

Formatting Guidelines

• **Font Size:** 12 (body), 14 (titles).
• **Font Type:** Times New Roman.
• **Line Spacing:** 1.5.
• **Headings:** Bold, not underlined.
• **Margins:** 1 inch (top, bottom, right), 1.25 inches (left).
• **Tables:** Font size 10–11 may be used for large tables.
• **Figures/Tables:** Refer properly (e.g., "Table 4.1 shows that…").
• **Binding:** Blue hardcover binding.
• **Pagination:** Bottom-centred.

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BSC-IT (Honours with Research)

Course Title: Dissertation
Course Code: SEC 882
Number of Credits: 12
Course Category: Skill Enhancement Course

Course Objective

The Dissertation course enables final-year students to undertake an independent research project based on original investigation in the field of Information Technology. The primary objective of this course is to allow students to apply the theories, concepts, and analytical skills learned throughout the B.Sc. IT programme to a real-world problem or research topic.

The course guides students through selecting an appropriate research problem, reviewing relevant literature, choosing suitable methodologies, using modern tools and technologies, and preparing a complete research report following academic standards. It encourages creativity, critical thinking, and problem-solving while helping students explore emerging trends and practical applications in IT.

Overall, this course strengthens research competence, analytical reasoning, and academic writing skills. It also provides a strong foundation for higher studies and future research careers in Computer Science and Information Technology.

Course Outcomes

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

- **Identify and define a research problem** relevant to the domain of Information Technology.
- **Use appropriate research tools, methods, and techniques** for systematic data collection, analysis, and interpretation.
- **Independently plan, execute, and document a research project** following scientific and ethical standards.
- **Apply IT knowledge and analytical skills** to investigate issues and propose evidence-based solutions.
- **Prepare a structured dissertation report**, demonstrating clarity in writing, organization, and academic integrity.
- **Develop readiness for advanced academic research**, such as postgraduate studies or industry-based R&D work.

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GUIDELINES FOR DISSERTATION

B.Sc. in Information Technology
(Honours with Research)

All students must complete an independent research project in an area related to Information Technology. The project allows students to apply theoretical knowledge to real-life challenges and explore new ideas in computing, data science, or related fields. It enhances their analytical and problem-solving skills while preparing them for research or industry-based innovation.

Students are expected to produce quality research work that:
• Addresses current and relevant IT-related problems.
• Demonstrates technical and analytical skills gained during the course.
• Shows proficiency in academic writing and documentation.

General Regulations

• The thesis report must be submitted before the final university examinations in Semester VIII.
• Each student will work under the guidance of a faculty supervisor appointed by the Department.
• After proposal approval by the supervisor, the student must defend it before a panel formed by the project coordinator.
• Students must submit at least two copies of the proposal to the coordinator two weeks before the final examination of Semester VII.
• Proposal defense marks and corrections will be reviewed before continuing with the full project.
• Students will then complete chapters 5 and 6.
• The final report, approved by the supervisor, must be submitted for Viva Voce evaluation.
• Two hard copies of the final project report must be submitted two weeks before the Semester VIII examination.
If unsuccessful, students must follow the resubmission policy as per university rules.

Choosing a Project Title

• The title should clearly reflect the research problem in the field of IT.
• Avoid duplication of topics among students.
• The project must be original and not copied.
• Supervisor approval is mandatory for the title.
• All topics must be ratified by the departmental research committee.

Formatting Guidelines

• **Font Size:** 12 (body), 14 (titles).
• **Font Type:** Times New Roman.
• **Line Spacing:** 1.5.
• **Headings:** Bold, not underlined.
• **Margins:** 1 inch (top, bottom, right), 1.25 inches (left).
• **Tables:** Font size 10–11 may be used for large tables.

- **Figures/Tables:** Refer properly (e.g., "Table 4.1 shows that…").
- **Binding:** Blue hardcover binding.
- **Pagination:** Bottom-centred.

Guidelines for Thesis paper

1. Introduction

The Introduction gives readers a clear understanding of what the research is about. This section begins by presenting the research problem and explaining why it is important to study. It then states the general and specific objectives that guide the entire project. The scope of the study should also be described by clarifying what areas are covered and what areas are excluded. Additionally, the significance of the research must be explained, highlighting the practical or academic benefits. This chapter usually ends with a short outline of how the remaining chapters of the thesis are organized.

2. Literature Review

The Literature Review summarizes previous studies that are related to the research topic. It discusses major theories, models, and findings from both global and local research works. This section should identify what earlier researchers have already achieved and where limitations still exist. By comparing different studies, the researcher must point out gaps, contradictions, or weaknesses in previous work. These gaps provide justification for why the present study is necessary and how it contributes something new. The review should be written critically, showing understanding rather than just listing information.

3. Methodology

The Methodology explains how the research was carried out in a systematic and reproducible manner. It includes the research design, such as whether the study is experimental, survey-based, qualitative, or quantitative. This section also describes the data collection processes, such as interviews, questionnaires, datasets, or observations. The tools, software, algorithms, or instruments used in the project must also be clearly stated. Furthermore, the methodology should describe the step-by-step workflow or procedure followed to complete the project. Flowcharts, diagrams, and tables may be added to increase clarity and allow others to replicate the study.

4. Results & Analysis

The Results and Analysis section presents the findings of the study in a clear and understandable manner. Data may be displayed using tables, charts, graphs, images, or screenshots depending on the project type. After presenting the results, the researcher must interpret what they mean and how they relate to the research questions or objectives. The analysis should highlight important patterns, trends, accuracies, or performance measures. It is also important to compare the actual

results with expected outcomes to show whether the study achieved its goals. This section forms the core evidence that supports the project's conclusions.

5. Discussion

The Discussion explains the significance of the results obtained and connects them to the broader academic context. This section compares the findings with existing literature to show whether they support or contradict earlier studies. It also highlights the theoretical or practical implications of the results, explaining why the findings matter. The researcher must honestly address any limitations or challenges faced during the study, such as small sample size, limited data, or technical constraints. The discussion should demonstrate critical thinking by offering insights and interpretations beyond the raw results.

6. Conclusion

The Conclusion provides a concise summary of the entire research work. It restates the major findings and explains the overall contribution of the study. This section should not introduce new information; instead, it should highlight the significance of what has already been presented. Based on the findings, the researcher may provide recommendations for improving systems, policies, algorithms, or future studies. Finally, suggestions for future work are included to indicate how the study can be extended, refined, or further explored by other researchers or by the same student in later research.

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Thesis Report Format

TITLE PAGE

Title in uppercase, centered, font size 14.

Example:

TOPIC – APPLICATION OF MACHINE LEARNING IN PREDICTIVE ANALYTICS

Student Name
Dept.
Reg. No
Year

Supervisor's Name
Designation

Research Project Submitted in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Information Technology from [University]
Month Year

CERTIFICATE (Roman ii, 14 pt)

This is to certify that the research project titled:

"_____"

submitted by **[Student Name]**,
Registration No: **[_____]**,
Department,
in partial fulfilment of the requirements for the degree of **Bachelor of Science in Information Technology**,
has been carried out under my supervision and guidance.

I hereby certify that the work embodied in this thesis is an original contribution made by the student and has not been submitted, either wholly or in part, to any other university or institution for the award of any degree or diploma.

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The project work meets the prescribed standards of the University.

Supervisor's Name: _____
Designation: _____
Department: _____
Signature: _____ **Date:** _____

Head of the Department (HOD): _____
Signature: _____ **Date:** _____

DECLARATION (Roman iii, 14 pt)

"I declare that this project is my original work and has not been submitted for a degree in any other university or institution."

Student's Name: Sign: Date:

Supervisor's Declaration:

"I confirm that the candidate carried out the work reported in this thesis under my supervision."

Name: Sign: Date:

ACKNOWLEDGEMENT (Roman i v, 14 pt)
Acknowledgement (max 250 words) expressing gratitude to those who contributed to the research.

ABSTRACT (Roman v, 14 pt)
Abstract (max 300 words) summarising the purpose, significance, methodology, findings, and recommendations.

TABLE OF CONTENTS (Roman vi)
LIST OF TABLES (Roman vii)
LIST OF FIGURES (Roman viii)
LIST OF ACRONYMS AND ABBREVIATIONS (Roman ix)
DEFINITION OF KEY TERMS (Roman x)

MAIN DOCUMENT (Pagination starts from Chapter One)

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1.0 CHAPTER ONE: INTRODUCTION

1.0 Introduction
1.1 Background of the Study
1.2 Problem Statement
1.3 Objectives (General and Specific)
1.4 Research Questions
1.5 Significance of the Study
1.6 Limitations
1.7 Scope
1.8 Organization of the Study

2.0 CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction
2.2 Theoretical Framework
2.3 Similar Research Works (Global and Local)
2.4 Critical Review and Research Gap
2.5 Summary

3.0 CHAPTER THREE: METHODOLOGY

3.0 Introduction
3.1 Project Design
- Data collection methods (survey, interviews, focus groups, etc.)
- Analytical tools (SPSS, Python, Excel, etc.)
- Expected outcomes

4.0 CHAPTER FOUR: RESULTS AND ANALYSIS

4.1 Introduction
4.2 Presentation of Results (tables, figures, charts, screenshots)
4.3 Data Analysis (interpretation of the collected data)
4.4 Model/System Performance Evaluation
4.5 Interpretation of Results (relation to objectives and research questions)
4.6 Summary

5.0 CHAPTER FIVE: DISCUSSION

5.1 Introduction
5.2 Discussion of Key Findings
5.3 Comparison with Previous Studies
5.4 Implications of the Findings
5.5 Limitations of the Study
5.6 Summary

6.0 CHAPTER SIX: CONCLUSIONS AND FUTURE WORK

6.1 Introduction
6.2 Conclusions
6.3 Recommendations
6.4 Suggestions for Future Work

7.0 REFERENCES

Use APA/IEEE/Other Standard Format .

8.0 APPENDICES

A. Questionnaire
B. Response Summary Sheet
C. Supporting Documents (e.g., code, screenshots, charts, pictures)

Assessment Rubric (100 Marks)

Criteria	Marks	Descriptors
Title, Abstract & Presentation	10	Clarity of title, concise abstract, professional formatting and structure.
Introduction & Problem Definition	15	Clear background, motivation, objectives, problem statement.
Literature Review	15	Depth of analysis, relevance, synthesis of sources, identification of research gap.
Methodology	20	Appropriateness, clarity, reproducibility, justification of methods.
Results & Analysis	20	Accuracy, clarity, depth of analysis, effective use of figures/tables.
Discussion & Conclusion	10	Critical evaluation, insightfulness, alignment with objectives, future scope.
Referencing & Academic Integrity	5	Correct citation style, use of credible sources, no plagiarism.
Viva Voce / Defense	5	Understanding, clarity of explanation, response to questions.