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

SEMESTER: VII ((BCA HONOURS))

DEFINITION OF CREDIT

1 HR LECTURE PER WEEK	1 CREDIT
1 HR TUTORIAL PER WEEK	1 CREDIT
2 HR PRACTICAL PER WEEK	1 CREDIT

SUBJECT NUMBERING SCHEME:

CODE FOR THE DEPT. OFFERING SUBJECT	SUBJECT TYPE	SEM	SUBJECT CODE

C	CORE MAJOR

SUBJECT NAME: Introduction to Data Science **Credit: 5 (3L + 4P)**
SUBJECT CODE: BCAC701A

COURSE OBJECTIVE:
This course aims to build a strong statistical foundation for students to understand and apply data analysis techniques in data science. It focuses on developing the ability to compute and interpret measures of central tendency and dispersion for meaningful data summarization. Students will learn to analyze relationships between variables using correlation and regression methods. The course introduces basic probability concepts and important distributions such as Binomial, Poisson, and Normal distribution for modelling real-life data. It highlights how statistical reasoning supports data-driven decision making. In addition, the course provides an introductory understanding of fundamental data science methods including classification, decision trees, and clustering. By the end, students will be able to apply statistical thinking and basic data science approaches to interpret datasets and solve simple analytical problems effectively.

Course Outcome	
	DESCRIPTION
CO1	Apply measures of central tendency and dispersion to summarise and interpret datasets effectively.

CO2	Analyse relationships between variables using correlation and regression techniques.
CO3	Use basic probability concepts and probability distributions (Binomial, Poisson, Normal) to model real-life data situations.
CO4	Demonstrate foundational understanding of data science methods such as classification, decision tree, and clustering for basic data analysis.

DETAILED SYLLABUS:

Module	Title	Key Contents (Basics)	Hours	Marks
1	Introduction to Statistics for Data Science	Role of statistics in data science; types of data and variables; population vs sample; data collection and classification	5	10
2	Measures of Central Tendency	Mean, Median, Mode, Geometric Mean, Harmonic Mean; applications and simple problems	7	15
3	Measures of Dispersion	Range, Quartile Deviation, Mean Deviation, Standard Deviation, Variance, Coefficient of Variation	6	15
4	Correlation and Regression	Karl Pearson correlation; Spearman rank correlation; regression lines (X on Y, Y on X); interpretation	6	15
5	Probability and Distributions	Sample space; events; types of events; axiomatic approach to probability; problems based on permutation and combination; addition theorem; conditional probability; multiplication theorem; independent events; total probability; Bayes' theorem; Binomial distribution and its use; Poisson distribution and its use; Normal distribution (basic idea and use)	6	15
6	Basic Data Science Methods	Introduction to classification, decision tree, and clustering with simple examples and applications	15	30
		TOTAL	45	100

Practical:

SUBJECT NAME: Data Science Lab with Python **Credit: 2**

SUBJECT CODE: BCAC791A

After completing this lab, students will be able to use Python and essential libraries such as NumPy, Pandas, and Matplotlib to load, clean, and manage datasets effectively. They will perform exploratory data analysis to discover patterns and visualise data using appropriate charts. Students will apply statistical measures and basic probability concepts through practical coding exercises. They will implement fundamental data science techniques including classification, clustering, and

decision trees using suitable Python tools. Finally, students will interpret analytical results and present meaningful insights through well-organised outputs, visualisations, and brief reports, demonstrating practical skills required for real-world data analysis tasks.

TOPICS TO BE COVERED

Module	Module Title	Topics to be Covered (Practical)
1	Python Fundamentals for Data Science	Variables, data types, lists, tuples, dictionaries, loops, functions
2	NumPy for Numerical Operations	Array creation, indexing, slicing, mathematical operations on arrays
3	Pandas for Data Handling	Series and DataFrame, importing CSV files, data selection, filtering
4	Data Cleaning and Preparation	Handling missing values, removing duplicates, data transformation
5	Exploratory Data Analysis and Visualization	Descriptive statistics, summary measures, line chart, bar chart, histogram, pie chart using Matplotlib
6	Statistical Measures and Probability using Python	Mean, median, mode, standard deviation, variance, simple probability examples
7	Basic Data Science Techniques	Implementation of classification, decision tree, and clustering on simple datasets; mini case study

SUGGESTED READING:

1. Data Science and Business Analytics — S. P. Rajagopalan, Publisher: Wiley India
2. Statistics for Data Scientists: 50 Essential Concepts — Peter Bruce & Andrew Bruce Publisher: O'Reilly (Indian edition available)
3. Fundamentals of Statistics — S. C. Gupta & V. K. Kapoor, Publisher: Sultan Chand & Sons
4. Data Science: Introductory and Advanced Topics — N. G. Das, Publisher: McGraw Hill Education India
5. Machine Learning & Data Science – An Introduction to Statistical Learning Methods with R and Python — Daniel D. Gutierrez, Publisher: CRC Press (Indian edition)
6. Python for Data Science — Dr. Basant Agarwal & Dr. Sumit Chauhan, Publisher: Oxford University Press India

SUBJECT NAME: Introduction to Machine Learning **Credit: 5 (3L + 4P)**
SUBJECT CODE: BCAC701B

COURSE OBJECTIVE:

This course aims to introduce students to the fundamental concepts and principles of machine learning for data-driven problem solving. It provides an understanding of how computers learn from data using supervised and unsupervised learning techniques. Students will explore essential ideas such as data preprocessing, feature selection, model training, testing, and evaluation. The course covers basic algorithms including regression, classification, clustering, and decision trees with simple examples. Emphasis is given to understanding the workflow of building machine

learning models and interpreting their results. Learners will also become familiar with practical tools and libraries used to implement machine learning solutions. By the end, students will gain the foundational knowledge required to apply machine learning methods to real-world datasets and analytical tasks.

Course Outcome	
CO1	Explain the basic concepts, types, and applications of machine learning in data-driven problem solving.
CO2	Prepare datasets through preprocessing, feature selection, and data transformation for model building.
CO3	Apply fundamental machine learning algorithms for regression, classification, and clustering tasks.
CO4	Evaluate and interpret the performance of machine learning models using appropriate metrics.
C05	Use suitable tools and libraries to implement simple machine learning solutions on real datasets.

DETAILED SYLLABUS:

Module	Module Title	Detailed Topics Covered	Hours	Marks
1	Introduction to ML & Data Preprocessing	Meaning and scope of ML; types of learning; applications; ML workflow; data types; preprocessing; handling missing values; feature selection; training and testing data	9	20
2	Regression Techniques	Simple linear regression; multiple regression (basic idea); model prediction; evaluation using MAE, MSE, RMSE	9	20
3	Classification Techniques	Logistic Regression; KNN; Naïve Bayes; confusion matrix; accuracy, precision, recall	9	20
4	Clustering and Decision Tree	K-Means clustering; centroid concept; decision tree structure; entropy and information gain; tree construction	9	20
5	Model Evaluation and Applications	Model validation; overfitting and underfitting; cross-validation (basic idea); ML applications; case study	9	20
		TOTAL	45	100

Practical:

SUBJECT NAME: Machine Learning Lab **Credit: 2**

SUBJECT CODE: BCAC791B

After completing this lab, students will be able to implement basic machine learning workflows using suitable programming tools and libraries. They will prepare datasets through cleaning, preprocessing, and feature selection for model building. Students will apply regression, classification, clustering, and decision tree algorithms on real datasets and observe their behaviour. They will evaluate model performance using appropriate metrics and understand issues such as overfitting and underfitting. Learners will gain hands-on experience in training, testing, and validating models. Finally, students will interpret results and present meaningful insights through outputs, visualisations, and brief reports, demonstrating practical skills required for real-world machine learning tasks.

TOPICS TO BE COVERED

Module	Module Title	Practical Coverage in Python
1	Python Environment and Data Handling	Working in Jupyter/IDE; using NumPy and Pandas; importing CSV datasets; basic data operations
2	Data Preprocessing and EDA	Handling missing values; data cleaning; feature selection; train–test split; visualisation using Matplotlib
3	Regression Techniques	Implementing simple linear regression; prediction; calculating MAE, MSE, RMSE
4	Classification Techniques	Logistic Regression, KNN, Naïve Bayes; confusion matrix; accuracy, precision, recall
5	Decision Tree and Clustering	Building a decision tree model; implementing K-Means clustering; visualisation and interpretation
6	Model Evaluation and Mini Project	Cross-validation (basic idea); overfitting and underfitting; applying full ML workflow on a small dataset

SUGGESTED READING:

1. **"**Machine Learning using Python" by Manaranjan Pradhan & U. Dinesh Kumar – Wiley India *(2019; also 2nd edition 2025)*
2. "Machine Learning with Python" by Abhishek Vijayvargia – BPB Publications *(2018)*
3. "Applied Machine Learning Solutions with Python" by Siddhanta Bhatta – BPB Publications *(2022)*
4. "Introduction to Machine Learning with Python: A Guide for Data Scientists" by Andreas C. Müller & Sarah Guido (Greyscale Indian Edition) – Shroff Publishers *(2016)*
5. "Data Science and Machine Learning Using Python" by Reema Thareja – McGraw Hill India

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SUBJECT NAME: Advanced Data Analysis Tools **Credit: 3**
SUBJECT CODE: BCAC701C

COURSE OBJECTIVE:

This course aims to develop learners' ability to transform raw data into meaningful insights using modern analytical tools and statistical thinking. Students will understand the complete data analysis lifecycle and learn to work with different data types using Python-based libraries such as Pandas, NumPy, Matplotlib, Seaborn, and Scikit-learn. The course emphasizes data acquisition, cleaning, transformation, and exploratory data analysis to uncover patterns and trends through effective visualization and descriptive statistics.

A key objective is to build strong foundations in statistical estimation and hypothesis testing, including point and interval estimation, unbiased estimators of population mean and variance, and tests such as t-test and chi-square. Learners will also be introduced to predictive analysis through supervised learning techniques and model evaluation methods. The course further develops the ability to interpret analytical results, prepare structured reports, and apply ethical practices in data analysis. By the end of the course, students will be equipped to apply analytical tools confidently for data-driven decision making across real-world domains.

COURSE OUTCOME:

CO No.	Course Outcome (CO)
CO1	Explain the data analysis lifecycle and apply Python libraries such as Pandas and NumPy to acquire, clean, and transform structured datasets.
CO2	Perform exploratory data analysis and create meaningful visualizations using Matplotlib and Seaborn to interpret patterns, trends, skewness, and kurtosis.
CO3	Apply statistical estimation and hypothesis testing techniques, including unbiased estimators of mean and variance, t-tests, and chi-square tests, to draw valid inferences from sample data.
CO4	Build and evaluate basic predictive models using Scikit-learn and present analytical findings through clear reports while adhering to ethical data practices.

DETAILED SYLLABUS:

Module No.	Detailed Syllabus (Theory)	Hours	Marks (100)
M 1	**Introduction to Advanced Data Analysis** • Data analysis lifecycle and stages • Types of data: structured, semi-structured, unstructured • Role of data analysis in decision making • Overview of tools and libraries: Python, Pandas, NumPy, Matplotlib, Seaborn, Scikit-learn	6	10
M 2	**Data Acquisition and Pre-processing using Pandas** • Reading data from CSV, Excel, JSON • Handling missing values and duplicates • Data transformation and formatting • Data integration and reshaping • Feature engineering basics	9	20
M 3	**Exploratory Data Analysis (EDA) and Visualization** • Descriptive statistics using Pandas and NumPy • Measures of distribution: skewness and kurtosis • Visualization using Matplotlib and Seaborn • Line chart, bar chart, histogram, box plot, heatmap • Interpretation of visualized data	10	20
M 4	**Statistical Estimation and Hypothesis Testing** • Estimation of population parameters • Methods of estimation: point and interval estimation • Unbiased estimator of population mean • Unbiased estimator of population variance • Steps in hypothesis testing • Null and alternative hypothesis, level of significance, p-value • One-sample and two-sample t-test, Chi-square test	8	20
M 5	**Predictive Analysis using Scikit-learn** • Machine learning workflow • Training and testing data split • Supervised learning: Linear Regression, K-NN, Decision Tree • Model evaluation: accuracy, confusion matrix	8	20
M 6	**Data Reporting, Interpretation and Ethics** • Presenting analytical results in tabular and graphical form • Interpreting statistical and model outputs for decision making • Preparation of analytical reports • Ethics in data analysis and reporting	4	10

SUBJECT NAME: Advanced Data Analysis Tools Lab **Credit: 2**
SUBJECT CODE: BCAC791C

Course Objective:
The lab component of this course is designed to provide hands-on experience in applying data analysis techniques using Python and key libraries such as Pandas, NumPy, Matplotlib, Seaborn, and Scikit-learn. Students will learn to import, clean, transform, and analyze real datasets, perform exploratory data analysis, and create meaningful visualizations. The lab work emphasizes practical understanding of statistical estimation, including unbiased estimators of mean and variance, and hypothesis testing using t-tests and chi-square tests. Learners will also implement basic predictive models, split datasets into training and testing sets, and evaluate model performance using appropriate metrics. By engaging in structured experiments, students will strengthen their

problem-solving skills, interpret analytical outputs accurately, and develop confidence in applying data-driven methods to real-world scenarios while following ethical practices in data handling and reporting.

Topics to be covered:

Lab No.	Practical Exercise / Experiment	Tools / Libraries
Lab 1	Working with datasets: creating Series and DataFrame, importing CSV/Excel/JSON files, viewing structure, rows, columns	Python, Pandas
Lab 2	Data cleaning: handling missing values, removing duplicates, type conversion, renaming columns	Python, Pandas
Lab 3	Data transformation: filtering, sorting, grouping, aggregation, reshaping datasets	Python, Pandas
Lab 4	Descriptive statistics: mean, median, standard deviation, skewness, kurtosis	Python, NumPy, Pandas
Lab 5	Data visualization: line chart, bar chart, histogram, box plot	Python, Matplotlib
Lab 6	Advanced visualization: heatmap, pairplot, distribution plot	Python, Seaborn
Lab 7	Estimation of population mean and variance from sample data, point and interval estimation	Python, NumPy
Lab 8	Hypothesis testing: one-sample and two-sample t-test	Python (statistical functions)
Lab 9	Chi-square test for goodness of fit and independence	Python (statistical functions)
Lab 10	Splitting dataset into training and testing sets, applying Linear Regression	Python, Scikit-learn
Lab 11	Implementing K-NN and Decision Tree classifiers	Python, Scikit-learn
Lab 12	Model evaluation: confusion matrix and accuracy measurement	Python, Scikit-learn

BOOKS AND REFERENCES:

1. Statistics for Data Science — *James D. Miller* — Pearson India
2. Fundamentals of Data Analytics — *S. Sumathi, S. N. Sivanandam* — Springer / McGraw-Hill Education (India)
3. Practical Statistics for Data Scientists: 50 Essential Concepts — *Peter Bruce, Andrew Bruce, Peter Gedeck* — O'Reilly / Shroff Publishers & Distributors (Indian edition)
4. Business Statistics and Analytics in Practice — *S. Christian Albright, Wayne L. Winston* — Cengage Learning India

5. Python for Data Analysis: Data Wrangling with Pandas, NumPy & Jupyter — *Wes McKinney*, Shroff Publishers & Distributors (Indian edition of O'Reilly Media)
6. Machine Learning in Data Science Using Python — *Dr. R. Nageswara Rao*, Wiley India / Dreamtech Press India Pvt Ltd (Indian publisher)
7. Hands-On Data Analysis and Visualization with Pandas — *Purna Chander Rao & Kathula*, BPB Publications (Indian publisher)
8. NumPy, Pandas, and Scikit-learn Masterclass — *Gary Hutson*, BPB Publications (Indian publisher)
9. Advanced Data Analytics Using Python: With Machine Learning, Deep Learning & NLP Examples — *Sayan Mukhopadhyay*, Apress (Springer Nature)
10. Python Data Analysis – Third Edition — *Avinash Navlani & Ivan Idris*, Packt Publishing (international technical publisher)

SUBJECT NAME: Research Methodology **Credit: 3**
SUBJECT CODE: BCAC702

COURSE OBJECTIVE:
This course aims to provide learners with a clear understanding of the fundamental principles and systematic procedures involved in conducting research. Students will learn how to identify and define research problems, formulate objectives and hypotheses, and design appropriate research plans. The course develops the ability to carry out effective literature reviews, recognize research gaps, and select suitable sampling and data collection methods such as surveys, interviews, and observations. Learners will acquire basic knowledge of statistical tools required for organizing, analyzing, and interpreting data, including estimation, correlation, regression, and hypothesis testing. Emphasis is given to data presentation through tables, charts, and graphs for meaningful interpretation of results. The course also focuses on developing skills for writing research reports, preparing proposals, and following standard referencing styles. Ethical practices in research, including avoidance of plagiarism and responsible data handling, are highlighted. By the end, students will be capable of planning, conducting, analyzing, and presenting research effectively in academic and professional settings

COURSE OUTCOME:

CO No.	Course Outcome (CO)
CO1	Identify and define research problems, formulate objectives and hypotheses, and design an appropriate research plan.
CO2	Conduct effective literature reviews, identify research gaps, and select suitable sampling and data collection methods.
CO3	Apply basic statistical tools such as estimation, correlation, regression, and hypothesis testing to analyze and interpret research data.

CO No.	Course Outcome (CO)
CO4	Prepare structured research reports and proposals using standard referencing styles while adhering to ethical research practices.

DETAILED SYLLABUS:

Module No.	Detailed Course Structure	Hours	Marks (100)
M 1	**Foundations of Research** • Meaning, objectives, and types of research (basic, applied, exploratory, descriptive) • Research process and characteristics of good research • Identifying and defining a research problem • Formulation of research questions and objectives • Variables in research and research motivation	10	15
M 2	**Literature Review and Research Design** • Importance of literature review • Sources of literature: journals, conference papers, reports, online databases • Research gap identification • Types of research design: experimental, descriptive, analytical • Developing hypotheses and conceptual framework	10	15
M 3	**Sampling Techniques and Data Collection Methods** • Census vs sampling • Probability and non-probability sampling methods • Primary and secondary data collection • Methods: surveys, observation, interview, questionnaire • Designing questionnaires and schedules	10	20
M4	**Statistical Tools for Research** • Classification and tabulation of data • Measures of central tendency and dispersion • Correlation and regression basics • Estimation of population parameters • Hypothesis testing: t-test, chi-square test, ANOVA (concept)	12	20
M 5	**Data Analysis, Interpretation and Presentation** • Data coding and data processing • Use of charts, tables, and graphs for presentation • Interpretation of statistical results • Drawing conclusions and recommendations • Use of software tools for analysis (overview)	10	15
M 6	**Research Reporting and Ethics** • Structure of research report / thesis / paper • Writing abstract, introduction, methodology, results, conclusion • Referencing styles (APA/MLA/IEEE) • Plagiarism and research ethics • Preparing research proposal and presentation	8	15

Reference Books:

1. Research Methodology: Methods and Techniques — C. R. Kothari — New Age International Publishers
2. Research Methodology: A Step-by-Step Guide for Beginners — Ranjit Kumar — Sage Publications India

3. Research Methods for Business: A Skill-Building Approach — Uma Sekaran & Roger Bougie — Wiley India
4. Fundamentals of Research Methodology and Statistics — Yogesh Kumar Singh — New Age International Publishers
5. Business Research Methods — Donald R. Cooper & Pamela S. Schindler — McGraw-Hill Education (India)
6. Social Science Research: Principles, Methods & Practices — Anol Bhattacherjee — University of Florida Press (widely used in India)
7. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches — John W. Creswell & J. David Creswell — Sage Publications (International edition often available in India)

Subject Name: Research Methodology Lab **Credit: 2**
Subject Code: BCAC792

Course Objective:
The course aims to develop a clear understanding of the principles, processes, and techniques involved in conducting systematic research. Learners will gain the ability to identify research problems, formulate objectives and hypotheses, and design appropriate research plans. The course emphasizes effective literature review, suitable sampling, and data collection methods. Students will learn to apply basic statistical tools for organizing, analyzing, and interpreting data. It also focuses on developing skills in research report writing, proper referencing, and maintaining ethical standards. By the end, students will be able to plan, execute, and present research studies confidently in academic and professional contexts.

What to be done:
Students should begin by identifying a relevant research problem and framing clear objectives and hypotheses. They must conduct a thorough literature review using reliable sources to identify research gaps. Based on the problem, an appropriate research design and sampling method should be selected. Learners need to prepare data collection tools such as questionnaires or interview schedules and gather primary or secondary data systematically. The collected data should be organized, coded, and presented using tables, charts, and graphs. Basic statistical techniques such as estimation, correlation, regression, and hypothesis testing should be applied to analyze the data. Students must interpret the results carefully and draw meaningful conclusions. Finally, they should prepare a well-structured research report or proposal following standard referencing styles and ethical practices, ensuring originality and clarity in presentation.

Experiment No.	Title of Experiment	Learning Outcome
1	Introduction to Research and Identification of Research Problem	Understand different types of research and formulate research problems.
2	Literature Review using Digital Libraries	Search and review research papers using databases such as Google Scholar, IEEE Xplore, Springer, and ACM Digital Library.
3	Research Objectives, Questions and Hypothesis Formulation	Develop research objectives, research questions, and hypotheses.
4	Research Design and Sampling Techniques	Learn qualitative, quantitative, and mixed research methods along with sampling techniques.
5	Designing Questionnaire using Google Forms	Create structured questionnaires for data collection.
6	Data Collection and Data Cleaning	Collect primary/secondary data and perform preprocessing.
7	Statistical Analysis using MS Excel/SPSS/R	Compute descriptive statistics such as mean, median, mode, standard deviation, and variance.
8	Data Visualization	Generate charts, graphs, and dashboards for data interpretation.
9	Hypothesis Testing	Perform t-test, chi-square test, ANOVA, or correlation analysis based on sample data.
10	Citation and Reference Management	Use tools such as Zotero or Mendeley for citations and bibliography in IEEE/APA formats.
11	Plagiarism Checking and Ethical Research Practices	Check similarity using plagiarism detection tools and understand research ethics.

Experiment No.	Title of Experiment	Learning Outcome
12	Research Paper Writing using IEEE/APA Format	Prepare a complete research paper including Abstract, Introduction, Methodology, Results, Conclusion, and References.

CO	Description
CO1	Identify research problems and formulate research objectives and hypotheses.
CO2	Conduct literature surveys using standard digital repositories and reference management tools.
CO3	Design research methodologies, collect data, and apply appropriate statistical techniques.
CO4	Interpret research findings, maintain research ethics, and prepare technical reports or research papers following standard publication formats.

SUBJECT NAME: Cyber Security **Credit: 4**
SUBJECT CODE: BCAC703

COURSE OBJECTIVE:
The primary objective of this course is to provide students with a comprehensive understanding of the fundamental concepts, practices, and technologies in the field of Cyber Security. It aims to build a strong foundation in networking essentials, security principles, cryptography, and information security management, enabling learners to analyze and address real-world security challenges. Students will gain knowledge of the security triad (confidentiality, integrity, availability) and explore the phases of ethical hacking, risk assessment, and security auditing through case-based learning. The course emphasizes various cyber threats, such as malware, phishing, denial-of-service attacks, and social engineering, alongside hands-on exposure to countermeasures including firewalls, IDS/IPS, VPNs, and modern authentication mechanisms. Additionally, learners will be introduced to emerging technologies like AI-driven security, blockchain, and quantum cryptography. By the end of the course, students will be equipped with the skills to critically assess vulnerabilities, implement security policies, and contribute effectively to safeguarding digital assets in professional environments.

COURSE OUTCOME:

Course Outcome	
	DESCRIPTION
CO1	Understand the fundamentals of computer networks, OSI/TCP-IP framework, transmission media, and network devices, and analyze their role in secure communication with real-life case studies.
CO2	Explain the core concepts of Cyber Security, including the security triad (confidentiality, integrity, availability), hacking methodologies, and the role of hackers, supported with practical examples.
CO3	Apply cryptographic techniques and watermarking methods to secure digital data, differentiate between symmetric and asymmetric encryption, and evaluate the RSA algorithm for practical use.
CO4	Analyze and implement Information Security Management practices, including ISMS procedures, goals, and security audits, through case-based discussion.
CO5	Identify, classify, and evaluate various types of cyberattacks and technological defense mechanisms, and propose suitable security measures for real-world scenarios.

DETAILED SYLLABUS:

Module	Topics	Hours	Marks Distribution
Module 1: Networking Fundamentals for Cyber Security	Introduction to Networking, OSI & TCP/IP Framework, Transmission Media (with Case Study), Network Devices (with Case Study), TCP/IP Framework in detail, Subnet Masking (with Case Study), Three-way Handshaking, NAT, Different Protocols & their uses	14 Hours	20 Marks
Module 2: Cyber Security Foundations	Cyber Security Definition, Security Triad (CIA) with Case Study, Hacking & Ethical Hacking, Types of Hackers, Phases of Hacking (Reconnaissance, Scanning, Gaining Access, Maintaining Access, Covering Tracks), Cryptography & Watermarking and their use, Types of Cryptography, Symmetric vs Asymmetric Algorithms, RSA Algorithm explained	14 Hours	20 Marks
Module 3: Information Security Management	Introduction to ISM, Goals of Information Security, ISMS (Information Security Management System) working procedure, Security Policies, Risk Management, Information Security Audit (with Case Study)	10 Hours	15 Marks
Module 4: Cyber Attacks	Types of Attacks: Passive & Active Attacks, Malware, Phishing, Denial of Service, SQL Injection, Social Engineering, Insider Threats, Case Studies of Major Cyber Attacks	10 Hours	20 Marks
Module 5: Technological Aspects of Cyber Security	Firewalls, IDS & IPS, VPNs, Security Protocols (SSL, TLS, IPsec), Intrusion Detection Systems, Honeypots, Multi-Factor Authentication, Emerging Technologies in Cyber Security (AI, Blockchain in Security, Quantum Cryptography)	12 Hours	25 Marks
Total		**60 Hours**	**100 Marks**

BOOKS AND REFERENCES:

- Bhushan, M., & Rathore, R. S. (2017). Fundamentals of Cyber Security (Principles, Theory & Practices). *New Delhi: BPB Publications.*
- Shukla, S. K., & Agrawal, M. (2020). Cyber Security in India: Education, Research and Training. *Singapore: Springer.*
- Basta, A., Basta, N., Brown, M., & Kumar, R. (2018). Cyber Security and Cyber Laws. New Delhi: Cengage Learning India.
- Godbole, N. (2011). *Cyber Security*. New Delhi: Wiley India.
- Mukhopadhyay, D., & Forouzan, B. A. (2011). Cryptography and Network Security. New Delhi: Tata McGraw-Hill Education.