AC: 10/03/2025

S P Mandali's
R. A. PODAR COLLEGE OF COMMERCE AND ECONOMICS
(EMPOWERED AUTONOMOUS),
Matunga, Mumbai-400019

Course Structure

Bachelor of Science (Data Science and Analytics)

Semester I and II

College Website: www.rapodar.ac.in

AC: 10/03/2025

S P Mandali's
R. A. PODAR COLLEGE OF COMMERCE AND ECONOMICS
(EMPOWERED AUTONOMOUS),
Matunga, Mumbai-400019

Bachelor of Science (Data Science and Analytics)
FYBSc Semester I

Syllabus
And
Question paper pattern of Course

As per National Education Policy 2020
To be implemented from Academic Year 2025- 2026

College Website: www.rapodar.ac.in

AC: 10/03/2025

Bachelor of Science (Data Science and Analytics) Programme
Syllabus as per National Education Policy 2020
Course Structure
F.Y.B.Sc. (Data Science and Analytics) (Level 4.5)
(To be implemented from Academic Year 2025-26)

No of Courses	Course Code	Semester I	Credits
1	**Major (09 credits)**		
1.A	**Discipline Specific Core**		
1.A.a		C Programming	**03**
1.A.b		Foundation of Data Science - I	**03**
2	**Minor (03 credits)**		
2.A.a		Mathematics for Data Science	**03**
3	**General Elective (GE)/ Open Elective (OE) (03 Credits)**		
3.A.a		Web Technology	**03**
4	**Vocational & Skill Enhancement Courses (VSEC) (02 credits)**		
4.A	**Skill Enhancement Course**		
4.A.a		Office Automation	**02**
5	**Ability & Value Enhancement Courses/Indian Knowledge System (AVEC/ IKS) (08 credits)**		
5.A	**Ability Enhancement Course**		
5.A.a		Language and Literature - I	**03**
5.B	**Value Enhancement Course**		
5.B.a		Cyber Laws	**03**
5.C	**Indian Knowledge System**		
5.C.a		Indian traditional approach in conservation and sustainability	**02**
TOTAL CUMULATIVE CREDITS			**22**

Exit option at the end of the First year (on completion of Semester I and semester II):
Under Graduate Certificate in Data Science and Analytics will be awarded to a learner on fulfillment of the following conditions:

1. The learner should have acquired 44 credits in Semester I and II considered together.
2. The learner should acquire an additional 4 credits as per norms by completing recognized courses under the National Skill Qualification Framework (NSQF) such as a certificate course on Foundations of Data Science, a Course on Mathematics and Statistics for Data Science.

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
1.Major
1.A. Discipline Specific Core Courses
1.A.a C Programming (3 Credits)
Semester I

1. Major	
1.A Discipline Specific Core	
1.A.a C Programming	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	Learn Programming fundamentals using C.
CObj 2	Understand the concepts and usage data types, variables, operators and Control statements.
CObj 3	Learn about using arrays, strings, pointers, structures.
CObj 4	Learn about functions in C.
Course Outcomes	
COut 1	Learner will able to apply various data types including, string, array Structures and Pointers
COut 2	Learners will be able to use regular expressions to perform complex operations in less code.
COut 3	Learners will be able to Work with user input to create functions and interactive programs.
COut 4	Learners will be able to build basic programs using fundamental programming constructs like variables, conditional logic, looping, and functions.
COut 5	Learners will be able to use Arrays in Data structures.
COut 6	Learners are able to understand and interpret the fundamentals of C syntax and semantics and be fluent in the use of C control flow statements.
COut 7	Learners will be able to apply to implement Loops ,break and continuous

	statements for C Programs.
COut 8	Learners will apply data manipulation with C.

Modules at a Glance

C Programming		
Sr. No.	**Modules**	**No. of Lectures**
1	Fundamental of C and I/O	15
2	Control Structures, Loops,Arrays, Strings and Structures	15
3	Functions, Pointers and Files	15
Total		**45**

Sr. No.	Modules
1	**Fundamental of C and I/O**
	Character Set and Tokens, Data Types, Constants, and Variables, Operators and Expressions, Math, Library Functions, Preprocessor Directives. Introduction to Input and Output in C, Unformatted Input and Output, Formatted Input and Output , Escape Sequences in C, Concept of Field, width, Precision and Flags Basics.
2	**Control Structures, Loops Arrays, Strings and Structures**
	Introduction to Control Structures , Decision-Making Control Structures , Looping Control Structures , Jumping Statements , Nested and Infinite Loops. Introduction to Arrays ,Types of Arrays: One- dimensional Arrays ,Multi-dimensional Arrays (2D and Higher Dimensions). Array Declaration, Initialization, and Accessing Elements, Memory Layout of Arrays. Operations on Arrays. String- Basic of String, Array of String, Functions in string.h, Structure- Declaration, Initialization, Nested structure, Operation on structures, Array of Structure.
3	**Functions , Pointers and Files**
	Introduction of Functions in C, Syntax and Structure of a Function, Parameter Passing in Functions, Return, Types in Functions, Scope, Lifetime, and Storage, Classes, Recursion in Functions, Passing Arrays and Strings to Functions, Standard Library Functions. Pointer: Pointer Variables, Reference and Dereference Operators, void Pointer, Call by Reference, Pointer Arithmetic, Pointer to Pointer, Pointers and Array, Passing Arrays to Function, Array of Pointers and Dynamic Memory Allocation. Files: Types of Files, File operation- Opening, Closing, Creating, Reading, Processing File.

AC: 10/03/2025

Practical Work (20 Marks)

List of Practicals to be Conducted	
1	To calculate simple interest taking principal, rate of interest and number of years as input from the user.
2	Write a program to find greatest of three numbers using conditional operator.
3	Write a program to check if the year entered is leap year or not.
4	Write a program to calculate roots of a quadratic equation.
5	Write a menu driven program using switch case to perform add / subtract / multiply / divide based on the user's choice.
6	Write a program to print the pattern of asterisks.
7	Write a program to find the factorial of a number using Function.
8	Write a program using a goto statement.
9	Write a program using strlen(), strcmp() function.
10	Write a program to print the structure using Title Author Subject Book ID Print the details of two students.
11	Create a mini project on “Bank management system”. The program should be menu driven.

Question Paper Pattern (Academic Year: 2025-2026)

C Programming

Semester End Examination and Practical Examination – 100 Marks

Semester I

A] Semester End Examination (SEE)- 60 Marks

Maximum Marks: 60
Duration: 2 Hours
Note: 1. All questions are compulsory.
2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q2.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q3.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
	Total	**75**	**60**

B] Practical Examination - 40 Marks

A Certified copy journal is essential to appear for the practical examination.

1.	**Practical Work**	**20**
2.	**Journal**	**10**
3.	**Viva Voce**	**10**

Books and References:

- K. R. Venugopal and Sudeep Prasad, “Mastering C”, Tata McGraw Hill.
- Behrouz Forouzan, “A Computer Science –Structure Programming Approaches using C”, Cengage Learning.
- Byron S. Gottfried, “Schaum’s outlines Programming with C”, Tata McGraw Hill.
- M. G. Venkateshmurthy, “Programming Techniques through C”, Pearson Publication.
- E. Balaguruswamy, “Programming in ANSI C”, Tata McGraw Hill Education.
- Pradeep Day and Manas Gosh, “Programming in C”, Oxford University Press.
- Yashwant Kanetkar, “Let Us C”, BPB Publication

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
1.Major
1.A. Discipline Specific Core Courses
1.A.b Foundation of Data Science - I (3 Credits)
Semester I

1. Major	
1.A Discipline Specific Core	
1.A.b Foundation of Data Science - I	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	Introduce students to foundational concepts in data science and its real-world applications.
CObj 2	Provide knowledge of data storage, retrieval, and preprocessing techniques.
CObj 3	Develop familiarity with data representation and transformation methods.
CObj 4	Instill an understanding of ethical concerns and privacy considerations in data science.
Course Outcomes	
COut 1	Explain the fundamental concepts and scope of data science.
COut 2	Understand different types of data and their applications.
COut 3	Demonstrate proficiency in data handling and preprocessing techniques.
COut 4	Utilize structured and unstructured data effectively.
COut 5	Apply data storage and retrieval techniques.
COut 6	Analyze the impact of data ethics and privacy policies.
COut 7	Recognize the importance of responsible AI and ethical data use.
COut 8	Develop a foundational mindset for advanced data science topics.

Modules at a Glance

Foundation of Data Science - I		
Sr. No.	**Modules**	**No. of Lectures**
1	Introduction to Data Science & Data Handling	15
2	Data Representation & Cleaning	15
3	Ethics in Data Science	15
Total		**45**

Sr. No.	Modules
1	**Introduction to Data Science & Data Handling**
	Definition, Scope, and Importance of Data Science: Interdisciplinary aspects of data science, Historical evolution and key milestones, Differentiating data science from statistics and computer science, Career opportunities and industry demand, Ethical considerations in data-driven decision-making **Data Science Applications across Industries:** Case studies in healthcare, finance, and e-commerce, manufacturing and predictive maintenance, Smart cities and IoT-driven analytics, Emerging trends in data-driven industries **Types of Data:** Structured, Semi-Structured, and Unstructured, Characteristics of structured data, Understanding JSON and XML as semi-structured formats, Challenges with unstructured data, Data integration across multiple formats, Tools and techniques for handling different data types **Data Collection Methods:** Designing effective surveys and data collection strategies, Web scraping techniques and ethical considerations, API-based data extraction and public datasets, Sensor data acquisition in IoT applications, Data licensing and compliance concerns **File Formats and Data Storage:** Overview of CSV, JSON, and XML file structures, Pros and cons of different storage formats, SQL vs NoSQL databases and their use cases, Data warehousing and cloud storage solutions, Best practices for data security and retrieval
2	**Data Representation & Cleaning**
	Data Structures: Tabular, Hierarchical, Graph-based, Basics of relational data models and schemas, Hierarchical data structures and applications (XML trees, JSON), Understanding graph databases and their use cases, Common real-world scenarios for different structures, Tools and technologies supporting various data structures **Data Preprocessing Techniques:** Handling missing data using imputation methods, Detecting and removing duplicate records, Outlier detection and handling techniques,

	Data normalization and standardization approaches, Feature selection and dimensionality reduction **Data Transformation:** Encoding categorical variables (One-Hot Encoding, Label Encoding), Scaling and transformation for model compatibility, Log transformations for skewed data distributions, Feature extraction techniques for improved analysis, Data augmentation strategies for handling imbalanced datasets
3	**Ethics in Data Science**
	Ethical Considerations in Data Science: Importance of ethical decision-making in AI and analytics, Establishing data ethics frameworks in organizations, Balancing innovation with responsible AI practices, Stakeholder roles in ethical data governance, Ethical concerns in automated decision-making **Bias in Data Collection and Model Development:** Identifying sources of bias in dataset selection, Techniques for bias mitigation in training data, Measuring fairness in AI models, Addressing bias in recommendation systems, Strategies for inclusive and diverse data collection **Data Privacy and Security Concerns:** Compliance with international data protection laws, Data anonymization and pseudonymization techniques, Handling sensitive and personally identifiable information, Secure authentication and data access control, Mitigating risks of data breaches and cyber threats **Fairness, Transparency, and Accountability in AI Models:** Explainability and interpretability in AI models, Creating responsible AI systems with transparency, The role of explainable AI (XAI) techniques, Auditing AI models for ethical compliance, Industry guidelines and best practices for responsible AI

Practical Work (20 Marks)

List of Practicals to be Conducted	
1	Writing a C program to read data from a file and perform basic statistics (Mean, Median, Mode)
2	Writing a C program for frequency distribution of numbers
3	Using Excel to create Histograms, Box Plots, and Pie Charts
4	Representing Categorical vs. Numerical Data with graphs
5	Using Pivot Tables to summarize dataset statistics
6	Calculating Mean, Median, Variance, Standard Deviation using Excel functions
7	Understanding Z-Scores and Outliers using Box Plot
8	Simulating a Coin Toss / Dice Roll Experiment in Excel

9	Handling missing values in Excel (Using IF Statements, Data Cleaning Tools)
10	Removing duplicates and correcting inconsistent entries

Question Paper Pattern (Academic Year: 2025-2026)

Foundation of Data Science - I

Semester End Examination and Practical Examination – 100 Marks

Semester I

A] Semester End Examination (SEE)- 60 Marks

Maximum Marks: 60

Duration: 2 Hours

Note: 1. All questions are compulsory.
2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q2.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q3.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
	Total	**75**	**60**

B] Practical Examination - 40 Marks

A Certified copy journal is essential to appear for the practical examination.

1.	**Practical Work**	**20**
2.	**Journal**	**10**
3.	**Viva Voce**	**10**

Books and References:

- "Data Science for Business" by Foster Provost & Tom Fawcett
- "The Elements of Data Analytic Style" by Jeff Leek
- "SQL for Data Scientists" by Renee M. P. Teate
- "Database Systems: Design, Implementation, & Management" by Carlos Coronel & Steven Morris
- "Data Science from Scratch" by Joel Grus

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
2. Minor
2.A.a Mathematics for Data Science (3 Credits)
Semester I

2. Minor	
2.A.a Mathematics for Data Science	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	To provide a thorough understanding of limits, continuity, differentiation, and their applications.
CObj 2	To master techniques of integration, understand definite and indefinite integrals and apply them to solve complex problems.
CObj 3	To develop skills in approximating derivatives and integrals of functions using numerical methods.
Course Outcomes	
COut 1	Learners will be able to evaluate limits, analyze continuity, and master differentiation techniques.
COut 2	Learners will comprehend definite and indefinite integrals, use integration techniques like substitution, parts, and partial fractions, and apply them to solve real-world problems.
COut 3	Learner will implement interpolation techniques and numerical differentiation/ integration formulas to analyze functions.

Modules at a Glance

Mathematics for Data Science		
Sr. No.	**Modules**	**No. of Lectures**
1	Differential Calculus	15
2	Integral Calculus	15
3	Numerical Methods	15
Total		**45**

Sr. No.	Modules
1	**Differential Calculus**
	Limit & Continuity: Definition, Properties, Standard Examples **Differentiation:** Definition, examples of differentiable and non-differentiable functions. Differentiable functions are continuous, but the converse is not necessarily true. Algebra of differentiable functions, chain rule, higher-order derivatives, Leibniz rule. Derivative of inverse and implicit functions. **Applications of Derivatives:** Local maxima and minima, necessary conditions, stationary points. Second derivative test, concavity and convexity, points of inflection. Graphing of functions using first and second derivatives. Mean Value Theorems: Rolle's Theorem, Lagrange's and Cauchy's Mean Value Theorems with applications. L'Hôpital's Rule (without proof) and examples of indeterminate forms.
2	**Integral Calculus**
	Definite and Indefinite Integrals: Antiderivatives and indefinite integration. Area under curves, Riemann sums, and definite integrals. Continuity implies integrability, properties of definite integrals. The Fundamental Theorem of Calculus, the Mean Value Theorem for Integrals, Average Value of a function. The Second Fundamental Theorem of Calculus the Net Change Theorem. **Techniques of Integration:** Integration by substitution, integration by parts, integration by partial fractions. Improper integrals, Introduction to Double Integral.
3	**Numerical Methods**
	Multivariate Calculus: Functions of several variables, partial derivatives, and the chain rule. Maxima and minima: second derivative test for extrema of functions of two variables. **Iteration methods:** Bisection method, Regula Falsi Method, Newton-Raphson method, Secant method for roots of polynomials. **Numerical Integration**:Trapezoidal rule, Simpson's one-third and three-eighth rules.

	Initial-Value Problem: Taylor's series method.

Practical Work (20 Marks)

List of Practicals to be Conducted	
1	**Limits and Continuity** **Aim:** Evaluate limits numerically and graphically, verify left-hand and right-hand limits.
2	**Differentiation and Its Properties** **Aim:** Compute derivatives of functions, analyze differentiability using graphs and numerical techniques.
3	**Implicit and Inverse Differentiation** **Aim:** Compute derivatives of implicit and inverse functions, apply Leibniz rule for higher-order derivatives.
4	**Applications of Derivatives: Maxima, Minima & Curve Sketching** **Aim:** Identify local maxima, minima, and stationary points, analyze concavity using the second derivative test.
5	**Mean Value Theorems & L'Hôpital's Rule** **Aim:** Verify Rolle's, Lagrange's, and Cauchy's Mean Value Theorems graphically and numerically, apply L'Hôpital's Rule to evaluate limits.
6	**Indefinite and Definite Integration** **Aim:** Compute indefinite integrals using substitution, integration by parts, and partial fractions; evaluate definite integrals.
7	**Applications of Integration** **Aim:** Compute the area under curves, determine the average value of a function, and apply the Net Change Theorem.
8	**Numerical Integration Techniques** **Aim:** Implement Trapezoidal Rule, Simpson's 1/3 Rule, and Simpson's 3/8 Rule; compare results with exact integration.
9	**Multivariate Calculus: Partial Derivatives & Extrema** **Aim:** Compute partial derivatives, apply the second derivative test for extrema, use Lagrange multipliers for constrained optimization.

10	**Numerical Root-Finding Methods** **Aim:** Implement Bisection Method, Regula Falsi Method, Newton-Raphson Method, and Secant Method to find roots of equations.
11	**One-Step Numerical Methods for Differential Equations** **Aim:** Solve differential equations using Taylor's Series Method and compare numerical solutions with exact solution.

Question Paper Pattern (Academic Year: 2025-2026)

Mathematics for Data Science

Semester End Examination and Practical Examination – 100 Marks

Semester I

A] Semester End Examination (SEE)- 60 Marks

Maximum Marks: 60

Duration: 2 Hours

Note: 1. All questions are compulsory.

2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 2)** A. Numerical/ Theory Based question B. Numerical/ Theory Based question C. Numerical/ Theory Based question	 **10** **10** **10**	**20**
Q2.	**Answer the following questions (Any 2)** A. Numerical/ Theory Based question B. Numerical/ Theory Based question C. Numerical/ Theory Based question	 **10** **10** **10**	**20**
Q3.	**Answer the following questions (Any 2)** A. Numerical/ Theory Based question B. Numerical/ Theory Based question C. Numerical/ Theory Based question	 **10** **10** **10**	**20**
	Total	**90**	**60**

Note: Each 10-mark question may be split into 5+5 if required.

B] Internal Evaluation - 40 Marks

Method of Evaluation	Marks
Written test 1	**20**
Written test 2	**20**
Total	**40**

Books and References:

- Earl A. Coddington, An introduction to ordinary differential equations, Dover Publications, 1989.
- Ron Larson and Bruce H. Edwards, Calculus: Early transcendental functions, Cengage Learning, 2020.
- Elliott Mendelson, Schaum's outline of calculus, McGraw-Hill Education, 2012.
- George F. Simmons, Differential equations with applications and historical notes, McGraw-Hill, 1991.
- James Stewart, Calculus, Cengage Learning, 2019.
- George B. Thomas Jr., Maurice D. Weir, and Joel R. Hass, Thomas' Calculus, Pearson, 2020.

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
3.General Elective/ Open Elective
3.A.a Web Technology (3 Credits)
Semester I

3. General Elective/ Open Elective	
3.A.a Web Technology	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	Introducing the basic concepts of Internet ,web design and HTML5 to learners.
CObj 2	Giving insight of the Page layout and navigation with HTML5.
CObj 3	Making students aware about the use of Tables, Forms and Media with HTML5.
CObj 4	Providing knowledge of web page design using CSS and giving knowledge of JavaScript.
Course Outcomes	
COut 1	Learners will be able to understand the use of HTML5 concepts.
COut 2	Learners will be able to understand and use the Page layout, Navigation features of HTML5.
COut 3	Learners able to understand and use Tables, Forms and Media features of HTML5.
COut 4	Learners are able to understand and use Cascading Style sheets for the web pages.
COut 5	Learners will understand graphics concepts in HTML5.
COut 6	Learners are able to understand the basic requirements of web design.
COut 7	Learner will analyze a web page and identify its elements and attributes.
COut 8	Learners will be able to understand JavaScript Language programming concepts and techniques.

Modules at a Glance

Web Technology		
Sr. No.	**Modules**	**No. of Lectures**
1	Introduction to Web Technology, Basics of HTML and CSS	15
2	JavaScript for Front-End Development and Advanced Front-End Technologies	15
3	Server-Side Web Development and Database Integration	15
Total		**45**

Sr. No.	Modules
1	**Introduction to Web Technology, Basics of HTML and CSS**
	History and Evolution of the Web, Web Architecture: Client-Server Model, HTTP/HTTPS, Protocol, Domain Names and DNS, Overview of Web Browsers and Servers **HTML Fundamentals:** Elements, Tags, Attributes, Forms, Tables, Multimedia (Audio, Video), Semantic HTML **CSS Fundamentals:** Selectors, Box Model, Layouts (Flexbox, Grid), Styling Forms and Tables, Media Queries for Responsive Design
2	**JavaScript for Front-End Development and Advanced Front-End Technologies**
	JavaScript Basics: Variables, Data Types, Operators, Functions, Events, DOM Manipulation **Advanced JavaScript:** ES6+ Features: Arrow Functions, Template, Literals, Modules Asynchronous JavaScript: Callbacks, Promises, Async/Await, Error Handling **Introduction to Web Frameworks and Libraries:** React.js Basics: Components, Props, State, Lifecycle Methods, State Management (Redux or Context API), Single Page Applications (SPA), Bootstrap or Tailwind CSS for Responsive UI Design
3	**Server-Side Web Development and Database Integration**
	Introduction to Server-Side Programming: Node.js Basics, Setting up a Node.js server, Handling Requests and Responses, Using Express.js for Routing Middleware, REST APIs, and Authentication **Introduction to Databases in Web Development:** SQL and NoSQL Databases, SQL (MySQL/PostgreSQL), CRUD Operations, Joins NoSQL (MongoDB), Collections,

	Documents, Aggregation **Database Connectivity:** Connecting Node.js with MySQL or MongoDB, Using ORMs (e.g., Sequelize, Mongoose)

Practical Work (20 Marks)

List of Practicals to be Conducted	
1	Create a static webpage using HTML and CSS with proper structure and styling.
2	Create a responsive webpage that adapts to different screen sizes using CSS media queries.
3	Implement interactive features using JavaScript (e.g., dynamic content updates, form validation).
4	Work with API requests using Fetch, Promises, and Async/Await.
5	Build a basic React.js SPA with state management and routing.
6	Manage state efficiently in a React application using Context API or Redux.
7	Create a basic Node.js server with Express.js to handle API requests.
8	Connect Node.js backend to a MongoDB database and perform CRUD operations.
9	Implement user authentication with JWT for secure login/logout functionality.
10	Develop a full-stack web application integrating frontend (React.js), backend (Node.js), and database (MongoDB/MySQL).

Question Paper Pattern (Academic Year: 2025-2026)

Web Technology

Semester End Examination and Practical Examination – 100 Marks

Semester I

A] Semester End Examination (SEE)- 60 Marks

Maximum Marks: 60

Duration: 2 Hours

Note: 1. All questions are compulsory.

2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q2.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q3.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
	Total	**75**	**60**

B] Practical Examination - 40 Marks

A Certified copy journal is essential to appear for the practical examination.

1.	**Practical Work**	**20**
2.	**Journal**	**10**
3.	**Viva Voce**	**10**

Books and References:

- HTML5 Step by Step, Faithe Wempen, Microsoft Press, 2011
- Web Design The Complete Reference, Thomas Powell, TMH, 2009
- Head First HTML 5 programming, Eric Freeman, O'Reilly, 2013

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
4.Vocational & Skill Enhancement Courses
4.A. Skill Enhancement Course
4.A.a Office Automation (2 Credits)
Semester I

4.Vocational & Skill Enhancement Courses	
4.A. Skill Enhancement Course	
4.A.a Office Automation	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	To build an understanding of how to use excel from scratch and then gradually scale up to higher levels of competence
CObj 2	To equip the students with MS Excel features which will develop their foundation of using spreadsheets
CObj 3	To provide insights into the data analysis tools in Excel so that they can extract meaningful information from vast arrays of data
CObj 4	To familiarize students with the important functions and data visualization features available in Excel which help in performing data mining
Course Outcomes	
COut 1	The learner can prevent unintended or malicious intrusions over the workings.
COut 2	The learners are able to assign validations and protections excel based templates and Files
COut 3	Learners are able to create Pivot Tables and Pivot Charts
COut 4	The learner acquires knowledge about Conditional formatting
COut 5	The learners can analyze Charts of various kinds
COut 6	Learners is able to analyze more about Data Validation

COut 7	The learner knows how to Protect Workbook and Worksheet
COut 8	The learner learns to assign read /write access passwords to files
COut 9	Learner creates and opens workbooks
COut 10	The learner is aware of modification of columns, rows and cells

Modules at a Glance

Office Automation		
Sr. No.	**Modules**	**No. of Lectures**
1	Introduction to Excel	10
2	Essential Functions	10
3	Data Analysis, validation, and Visualizations	10
4	Flash (2D Animation)	Only for Practicals
Total		**30**

Sr. No.	Modules
1	**Introduction to Excel**
	• Creating and opening workbooks • Cell basics • Modifying columns, rows and cells • Worksheet basics • Introduction to formulas • Freeze Panes • Formatting features of cells • Sort • Filters • Fill Handle • Copy a sheet • Find and Replace • Relative and Absolute Cell Referencing • Text to columns • Paste Special • Subtotals • Comments
2	**Essential Functions**
	• Sum, Count, Min, Max, Average, Median, Subtotal • Date, Today, Now • If, And, Or • Vlookup and Hlookup • Round, Roundup and Rounddown • Sumif and Sumifs

	● Countif and Countifs ● Averageif and Averageifs ● Concatenate and Trim ● Data tables, scenarios manager, goal seek and Solver
3	**Data Analysis, validation and Visualizations**
	● Pivot Tables and Pivot Charts ● Remove Duplicates ● Conditional formatting ● Charts of various kinds ● Data Validation ● Protect Workbook ● Protect Worksheet ● Assigning read /write access passwords to files
4	**Flash (2 D Animation)**
	(Not to be tested for the semester end examination - Only for Practical's)

Question Paper Pattern (Academic Year: 2025-2026)

Office Automation

Semester End Examination and Internal Evaluation – 50 Marks

Semester I

A] Semester End Examination (SEE)- 30 Marks

Maximum Marks: **3**0
Duration: 1 Hour
Note: 1. All questions are compulsory.
2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 2)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question	 **5** **5** **5**	**10**
Q2.	**Answer the following questions (Any 2)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question	 **5** **5** **5**	**10**
Q3.	**Answer the following questions (Any 2)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question	 **5** **5** **5**	**10**
	Total	**45**	**30**

B] Internal Evaluation - 40 Marks

Method of Evaluation	Marks
Practical Examination	**20**
Total	**20**

Books and References:

- Slaying Excel Dragons, Mike Girvin, Holy Macro! Books
- 2 Ctrl+Shift+Enter Mastering Excel, Array Formulas, Mike Girvin, Holy Macro! Books
- 3 Excel for Beginners (Excel Essentials Book 1), M.L. Humphrey, Independently Published

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
5. Ability & Value Enhancement Courses/Indian Knowledge System
5.A. Ability Enhancement Course
5.A.a Language and Literature- I (3 Credits)
Semester I

5. Ability & Value Enhancement Courses/Indian Knowledge System	
5.A. Ability Enhancement Course	
5.A.a Language and Literature - I	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	To understand the effective use of power point presentation, relevance and importance of interpersonal communication skills
CObj 2	To enhance written communication skills
CObj 3	To enable the learners to adapt to the requirements of the industry.
Course Outcomes	
COut 1	The learners learn to use statistical tools in PowerPoint presentations, write letters of enquiry and letters of complaint.
COut 2	Practical application of preparing flyers and leaflets help the learners demonstrate their creativity.
COut 3	Nonverbal communication skills of learners are enhanced.
COut 4	The learner is able to analyze the components of letter writing.
COut 5	Learners can understand the theories of communication.
COut 6	Learners can differentiate between the different modes of communication.
COut 7	Learners is trained to apply ethics at workplace.
COut 8	Learners is able to create a resume and face job interviews with ease.

COut 9	Learners can relate to the barriers of communication and are able to cope with the same.
COut 10	Learners can apply the most appropriate and effective mode of communication.

Modules at a Glance

Language and Literature - I		
Sr. No.	**Modules**	**No. of Lectures**
1	Theory of Communication & Obstacles to Communication in Business World	15
2	Business Correspondence	15
3	Language and Writing Skills	15
Total		**45**

Sr. No.	Modules
1	**Theory of Communication & Obstacles to Communication in Business World**
	● Concept of Communication: Meaning, Definition, Process, Need, Feedback Emergence of Communication as a key concept in the Corporate and Global world ● Interpersonal communication: Team dynamics and collaboration ● Impact of technological advancements and AI on Communication Channels ● Objectives of Communication: Channels- Formal and Informal- Vertical, Horizontal, Diagonal, Grapevine Objectives of Communication: Information, Advice, Order and Instruction, Persuasion, Motivation, Education, Warning, and Boosting the Morale of Employees (A brief introduction to these objectives to be given) ● Methods and Modes of Communication: Methods: Verbal and Nonverbal, Characteristics of Verbal Communication Characteristics of Non-verbal Communication, Business Etiquette, Computers and E- communication. ● Problems in Communication /Barriers to Communication: Physical/ Semantic/Language / Socio-Cultural / Psychological/ Barriers, Ways to Overcome these Barriers ● Listening: Types, Process and Importance of Listening Skills, Cultivating good Listening Skills. Ethics in communication
2	**Business Correspondence**
	● Theory of Business Letter Writing: Parts, Structure, Layouts—Full Block, Principles of Effective Letter Writing ● Principles of effective Email Writing, Personal Correspondence: Statement of

	Purpose, Job Application Letter, Resume, LinkedIn profile, Letter of Acceptance of Job Offer, Letter of Resignation [Letter of Appointment and Promotion, Letter of Recommendation]
3	**Language and Writing Skills**
	● Business Communication Paragraph Writing: Developing an idea, using appropriate linking devices, etc ● Cohesion and Coherence, etc [Interpretation of technical data, Composition on a given situation, a short informal report & improvisation Activities] Listening, Comprehension, Speaking Skills: Presenting a News Item, Dialogue and Speeches ● Paragraph Writing: Preparation of the first draft, Revision and Self Editing, Rules of spelling. Reading Comprehension: Analysis of texts from the fields of Commerce and Management

Question Paper Pattern (Academic Year: 2025-2026)

Language and Literature - I

Semester End Examination and Internal Evaluation – 100 Marks

Semester I

A] Semester End Examination (SEE)- 60 Marks

Maximum Marks: 60
Duration: 2 Hours
Note: 1. All questions are compulsory.
2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q2.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q3.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
	Total	**75**	**60**

B] Internal Evaluation - 40 Marks

Method of Evaluation	Marks
Book Review/ Synopsis of Biography/ Film/Theatre Review	**20**
Assignment/Activity/Reading of management Data/Picture Talk	**20**
Total	**40**

Books and References:

- Agarwal, AnjuD(1989) A Practical Handbook for Consumers, IBH.
- Alien, R.K.(1970) Organisational Management through Communication. Podar : Nurturing Intellect Creating Personalities
- Ashley,A(1992) A Handbook Of Commercial Correspondence, Oxford University Press.
- Aswathapa, K (1991)Organisational Behaviour, Himalayan Publication, Mumbai.
- Atreya N and Guha (1994) Effective Credit Management, MMC School of Management, Mumbai.
- Bahl,J.C. and Nagamia,S.M. (1974) Modern Business Correspondence and Minute Writing.
- Balan,K.R. and Rayudu C.S. (1996) Effective Communication, Beacon New Delhi.
- Bangh, Lsue, Fryar,Maridell and Thomas David A. (1998) How to Write First Class Business Correspondence, N.T.C. Publishing Group USA
- Banerjee, Bani P (2005) Foundation of Ethics in Mangement Excel Books
- Businessworld Special Collector's Issue: Ethics and the Manager
- Barkar, Alan(1993) Making Meetings Work, Sterling Publications Pvt. Ltd., New Delhi.
- Basu,C.R.(1998) Business Organisation and Management, T.M.H.New Delhi.
- Benjamin, James (1993) Business and Professional Communication Concepts and Practices, Harper Collins College Publishers, New York.
- Bhargava and Bhargava91971) Company Notices, Meetings and Regulations
- Black, Sam (1972) Practical Public Relations, E.L.B.S. London.
- BoveeCourtland, L and Thrill, John V(1989) Business Communication, Today McGraw Hill, New York, Taxman Publication.
- Burton, G and Thakur, (1995) Management Today- Principles and Practices. T.M.H.,New Delhi.
- Darrow, Richard, Forrstal, Dan and Coolman, Aubrey (1967) Public Relations Handbook, TheDartwellCo., Chicago.
- Dayal, Ishwar(9810) Managing Large Organizations: A Comparative Study.
- Drucher,P.F.((1970) Technology, Management and Society, Pan Books London.
- Drucher,P.F.(1974)Management Responsibilities Practices, Heinemann, London.
- Eyre, E.C. (1985), Effective Communication Made Simple, Rupa and Co.Calcutta
- Ecouse Barry, (1999), Competitive Communication: A Rhetoric for Modern Business, OUP.
- Ecouse Barry, (1999), Competitive Communication: A Rhetoric for Modern Business, OUP.
- Fisher Dalmar, (1999), Communication in Organisation, Jaico Pub House, Mumbai, Delhi.
- Frailley, L.E. (1982) Handbook of Business Letters, Revised Edn. Prentice Hall Inc.
- French, Astrid (1993) Interpersonal Skills. Sterling Publishers, New delhi.
- Fritzsche, David J (2005) Business Ethics: A Global and Managerial Perspective McGraw Hill

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
5. Ability & Value Enhancement Courses/Indian Knowledge System
5.B. Value Enhancement Course
5.B.a Cyber Laws (3 Credits)
Semester I

5. Ability & Value Enhancement Courses/Indian Knowledge System	
5.B Value Enhancement Course	
5.B.a Cyber Laws	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	Understand the legal framework governing cyber activities, digital security, and data protection in India.
CObj 2	Analyze the implications of the Information Technology (IT) Act and new cyber laws (Bhartiya Naya Sanhita, Bharatiya Nagarik Suraksha Sanhita, Bharatiya Sakshya Adhiniyam) on data science.
CObj 3	Examine copyright and intellectual property rights in the digital age and their impact on AI-generated content.
CObj 4	Develop awareness of ethical, forensic, and compliance aspects related to cybersecurity and data governance.
Course Outcomes	
COut 1	Explain key cyber laws, including the IT Act, Bhartiya Naya Sanhita, Bharatiya Nagarik Suraksha Sanhita, and Bharatiya Sakshya Adhiniyam.
COut 2	Apply knowledge of copyright laws to intellectual property in digital and AI-generated content.
COut 3	Interpret legal provisions related to cybercrimes, digital evidence, and data security.
COut 4	Assess cybersecurity frameworks, including ISO 27001, NIST, and GDPR compliance, and their relevance to data science.
COut 5	Evaluate real-world case studies on cyber law enforcement and data privacy violations.

COut 6	Demonstrate understanding of ethical considerations in AI, data collection, and digital evidence handling.
COut 7	Analyze the impact of cross-border data regulations and compliance requirements for data-driven enterprises.
COut 8	Investigate corporate cybersecurity policies, incident response planning, and forensics in cybercrime cases

Modules at a Glance

Cyber Laws		
Sr. No.	**Modules**	**No. of Lectures**
1	Introduction to Cyber Laws & The IT Act	15
2	Copyright in Data Science	15
3	New Laws in India and Their Impact on Data Science	15
Total		**45**

Sr. No.	Modules
1	**Introduction to Cyber Laws & The IT Act**
	Overview of Cyber Laws: Definition, importance, and scope of cyber laws, Evolution of cyber laws in India and globally, Cyber laws and their role in digital governance **The Information Technology (IT) Act, 2000:** Objectives and key provisions of the IT Act, Cybercrimes and punishments under the IT Act, Role of CERT-In (Indian Computer Emergency Response Team), Electronic contracts and digital signatures **Cybersecurity and Data Protection under IT Act:** Provisions related to cybersecurity, hacking, and identity theft, Legal obligations for data protection and privacy, Role of intermediaries and liability of service providers, Penalties and offenses related to data breaches
2	**Copyright in Data Science**
	Overview of the Copyright Act, 1957: Definition and scope of copyright protection, Copyright in digital content: software, AI-generated works, and databases, Copyright infringement and remedies **Intellectual Property in the Digital Era:** Trademarks, patents, and copyrights in data-driven industries, Ownership of data and digital assets, Licensing models: open-source, proprietary, and creative commons, Ethical considerations in AI-generated content **Case Studies on Copyright Violations:** Copyright infringement in digital media and software, AI and copyright: Who owns AI-generated content?, Global perspectives on copyright protection in technology, Legal frameworks for protecting digital innovations
3	**New Laws in India and Their Impact on Data Science**
	Bhartiya Naya Sanhita and Its Relevance to Cyber Laws: Overview of Bhartiya Naya Sanhita and its connection to cybercrimes, Digital evidence handling and admissibility under new laws, Strengthening legal frameworks for cyber frauds and

	financial crimes, Provisions for online harassment, identity theft, and digital defamation, Case studies on legal enforcement of cybercrimes under new laws. **Bharatiya Nagarik Suraksha Sanhita & Digital Security:** Digital security aspects covered under Bharatiya Nagarik Suraksha Sanhita, Strengthening cyber law enforcement with updated legislation, Data security and protection of citizens in cyberspace, Regulations on cyber terrorism, unauthorized data access, and hacking, Legal recourse available for individuals and organizations. **Bharatiya Sakshya Adhiniyam & Digital Evidence in Data Science:** Role of Bharatiya Sakshya Adhiniyam in digital forensics, Legality of electronic records and admissibility in court, Authentication of digital signatures and blockchain-based evidence, Use of AI-generated evidence in legal proceedings, Case studies on the role of digital evidence in high-profile cybercrime cases.

AC: 10/03/2025

Question Paper Pattern (Academic Year: 2025-2026)

Cyber Laws

Semester End Examination and Internal Evaluation – 100 Marks

Semester I

A] Semester End Examination (SEE)- 60 Marks

Maximum Marks: 60
Duration: 2 Hours
Note: 1. All questions are compulsory.
2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q2.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q3.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
	Total	**75**	**60**

B] Internal Evaluation - 40 Marks

Method of Evaluation	Marks
Case Study Analysis/ Research based assignment	**20**
Group Discussion/ Debate/ Role play activity/ MCQ/ Written test	**20**
Total	**40**

Books and References:

- Solove, Daniel J., and Paul M. Schwartz. Information Privacy Law. Wolters Kluwer, 2020.
- Brenner, Susan W. Cybercrime: Criminal Threats from Cyberspace. Praeger, 2010.
- Kesan, Jay P. Cybersecurity and Privacy Law Handbook. LexisNexis, 2011.
- Singh, Pavan Duggal. Cyber Laws in India: IT Act 2000 & IT Act 2008. Pearson Education India, 2018.
- Jajodia, Sushil, and Pierangela Samarati. Handbook of Data Privacy and Cybersecurity. Springer, 2011.
- Goodman, Marc. Future Crimes: Inside the Digital Underground and the Battle for Our Connected World. Anchor Books, 2015

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
5. Ability & Value Enhancement Courses/Indian Knowledge System
5.C Indian Knowledge System
5.C.a Indian traditional approach in conservation and sustainability (2 Credits)
Semester I

5. Ability & Value Enhancement Courses/Indian Knowledge System	
5.C Indian Knowledge System	
5.C.a Indian traditional approach in conservation and sustainability	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	The course will enable the learner to understand the scientific and moral value of traditional ancient Indian knowledge.
CObj 2	The course is expected to convert the ancient wisdom to the applied aspects of the modern scientific paradigm.
CObj 3	The course is expected to create interest and excitement in the learner to explore more on the specific area of knowledge.
CObj 4	The course is expected to empower the learner to inspire others in learning our own traditional practices of sustainability.
CObj 5	The course is expected to develop the interest in the learner to do further research in the specific area of knowledge.
Course Outcomes	
COut 1	The learners shall be able to acknowledge the contribution of traditional Indian wisdom in various commercial fields.
COut 2	The learner should be able to draw connections between the trade & commercial activities along with their influence on the environment and the efforts to address the same.
COut 3	The learners shall be able to identify traditional eco-friendly options for current modes of transportation.

COut 4	The learner should be able to understand the ancient practices of resource conservation and to have a holistic approach towards sustainable development in modern times.
COut 5	The learners should be able to analyze the current practices of land management with respect to ancient Indian practices for the conservation of the same.
COut 6	The syllabus shall enable the learners to correlate the conventional practices of water conservation with special reference to ancient wisdom in the same regards.
COut 7	The learners shall be able to suggest measures for forest conservation through various ancient Indian solutions.
COut 8	The learners should be able to evaluate the Indian contribution in various contemporary fields of social sciences and technologies
COut 9	The learners should be able to describe the case studies to illustrate the significant contribution of Indian scholars in various conventional fields of social sciences.
COut 10	The learners should be able to examine the future perspectives and possibilities of various aspects of the Indian Knowledge System to enrich the society

Modules at a Glance

Indian traditional approach in conservation and sustainability		
Sr. No.	**Modules**	**No. of Lectures**
1	Conventional trade & commerce and environment	15
2	Resource conservation and sustainability	15
3	Significant Indian contributions to the world	Internal Assessment
Total		**30**

Sr. No.	Modules
1	**Conventional trade & commerce and environment**
	A. Introduction and overview of Indian Knowledge System. Indian disciplinary knowledge system in different fields like, architecture, science & technology, nature, astronomy, agriculture, health & medicine, Defense (case study of Rani Abbakka Chowta who defeated Portuguese) B. Traditional commercial activities & trade practices with reference to environmental conservation: Agricultural trade, Silk, Cotton, Spices, Metallurgy, Textile industry, etc. C. Transportation and its modes: Grand Trunk road, Boat & ship-building, Energy efficiency in the transport sector: a current scenario, Eco mobility. Impact of transport on climate, impact of climate on transport.
2	**Resource conservation and sustainability**
	A. Land Management & Conservation: Ancient & traditional agricultural activities, Conservation strategies, Harappan civilization-town planning, etc. B. Water Management & Conservation: Harappan civilization, ancient practices of irrigation, Tanks, Lakes, Stepwells, Traditional rain-water harvesting, Community involvement. C. Forest & Wildlife Conservation: Sacred forests, sacred groves, sacred hills, Social forestry, Agroforestry, Animal worshiping, Worshiping natural forces. Women and conservation- Ecofeminism.
3	**Significant indian contributions to the world (Module for internal assessment)**

	A. Contribution in the field of agriculture: Food crops, Cotton, Animal husbandry, etc. B. Contribution in the field of science & technology: Invention of zero, etc. C. Contributions in the field of health & medicine: Ayurveda, Meditation, Yoga, etc. D. Case studies on Indian Knowledge System on any particular/ specific area of knowledge: Ayurveda, Agriculture, Astronomy, Architecture, Economics, Mathematics, Philosophy, Yoga, Medicine, Nature, Politics, Weaponry, Military science, Literature, Poetics or any other area of knowledge. Indian Knowledge System- Future perspectives: Challenges and Opportunities.

Question Paper Pattern (Academic Year: 2025-2026)

Indian traditional approach in conservation and sustainability
Semester End Examination and Practical Examination – 50 Marks
Semester I
A] Semester End Examination (SEE)- 30 Marks

Maximum Marks: 30
Duration: 1 Hour
Note: 1. All questions are compulsory.
2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)
Q-1	Attempt **any one** of the following. A. Full length question. B. Full length question	**10**
Q-2	Attempt **any one** of the following. A. Full length question. B. Full length question	**10**
Q-3	Attempt **any two** of the following. A. Short answer. B. Short answer C. Short answer D. Short answer.	**10**
	Total	**30**

B] Internal Evaluation - 20 Marks
MODULE-III is given for internal assessment. Students will be writing assignments on the selected topics.

AC: 10/03/2025

CRITERIA FOR EVALUATING POWERPOINT PRESENTATION/ CASE STUDY/ APPLICATION BASED ACTIVITY:

MARKS: 20 FY/SY/TY BSc: Division A/B Semester:

Name of the Topic Date of Presentation:

Sr. No	Roll No	Name of the student	Content (5)	Team building (5)	Presentation skills		Total (20)
					Verbal (5)	Non Verbal (5)	
1							
2							
3							
4							

Sign: 1_____2._____3._____4._____Faculty Sign:_____

Name of the Topic Date of Presentation:

Sr. No	Roll No	Name of the student	Content (5)	Team building (5)	Presentation skills		Total (20)
					Verbal (5)	Non Verbal (5)	
1							
2							
3							
4							

Sign: 1_____2._____3._____4._____Faculty Sign:_____

Name of the Topic Date of Presentation:

Sr. No	Roll No	Name of the student	Content (5)	Team building (5)	Presentation skills		Total (20)
					Verbal (5)	Non Verbal (5)	
1							
2							
3							
4							

Sign: 1_____2._____3._____4._____Faculty Sign:_____

AC: 10/03/2025

S P Mandali's
R. A. PODAR COLLEGE OF COMMERCE AND ECONOMICS
(EMPOWERED AUTONOMOUS),
Matunga, Mumbai-400019

Course Structure

Bachelor of Science (Data Science and Analytics)

Semester I and II

College Website: www.rapodar.ac.in

AC: 10/03/2025

S P Mandali's
R. A. PODAR COLLEGE OF COMMERCE AND ECONOMICS
(EMPOWERED AUTONOMOUS),
Matunga, Mumbai-400019

Bachelor of Science (Data Science and Analytics)
FYBSc Semester II

Syllabus
And
Question paper pattern of Course

As per National Education Policy 2020
To be implemented from Academic Year 2025- 2026

College Website: www.rapodar.ac.in

Bachelor of Science (Data Science and Analytics) Programme
Syllabus as per National Education Policy 2020
Course Structure
F.Y.B.Sc. (Data Science and Analytics) (Level 4.5)
(To be implemented from Academic Year 2025-26)

No of Courses	Course Code	Semester II	Credits
1	**Major (09 credits)**		
1.A	**Discipline Specific Core**		
1.A.a		Database Management Systems	**03**
1.A.b		Fundamentals of Data Science - II	**03**
2	**Minor (03 credits)**		
2.A.a		Statistics for Data Science	**03**
3	**General Elective (GE)/ Open Elective (OE) (03 Credits)**		
3.A.a		Data Structure and Algorithm using C	**03**
4	**Vocational & Skill Enhancement Courses (VSEC) (03 credits)**		
4.A	**Vocational Enhancement Course**		
4.A.a		Discrete Mathematics	**03**
4.B	**Skill Enhancement Course**		
4.B.a		R Programming	**02**
5	**Ability & Value Enhancement Courses/Indian Knowledge System (AVEC/ IKS) (04 credits)**		
5.A	**Ability Enhancement Course**		
5.A.a		Language and Literature - II	**03**
5.B	**Value Enhancement Course**		
5.B.a		Intellectual Property Rights	**02**
TOTAL CUMULATIVE CREDITS			**22**

Exit option at the end of the First year (on completion of Semester I and semester II):
Under Graduate Certificate in Data Science and Analytics will be awarded to a learner on fulfillment of the following conditions:
1. The learner should have acquired 44 credits in Semester I and II considered together.

2. The learner should acquire an additional 4 credits as per norms by completing recognized courses under the National Skill Qualification Framework (NSQF) such as a certificate course on Foundations of Data Science, a Course on Mathematics and Statistics for Data Science.

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
1. Major
1.A. Discipline Specific Core Courses
1.A.a Database Management Systems (3 Credits)
Semester II

1. Major	
1.A Discipline Specific Core	
1.A.a Database Management Systems	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	To understand Organizing, structuring and storing data
CObj 2	Understand Database as Relational model
CObj 3	To understand SQL to retrieve data and concept of redundancy
CObj 4	To understand creation, manipulation and querying of data in databases
Course Outcomes	
COut 1	Learners will able to understand the basic concepts and the applications of database systems
COut 2	Learners will be able to apply data models in business sectors.
COut 3	Learners understand how to create Entity relationship models for databases.
COut 4	Learners understand concepts of Advanced data models
COut 5	Learners understand concepts of Normalization of Database Tables
COut 6	Learners understand basic SQL
COut 7	Learners able to construct queries in SQL
COut 8	Learners understand advanced SQL

Modules at a Glance

Database Management Systems		
Sr. No.	**Modules**	**No. of Lectures**
1	Introduction to Database Concepts and Data Modelling	15
2	Relational Model and Algebra	15
3	Relational Database and Transactions Management	15
Total		**45**

Sr. No.	Modules
1	**Introduction to Database Concepts and Data Modelling**
	Data, Information, and Databases, File-based systems vs. DBMS, Characteristics and advantages of DBMS, Database users and roles: DBA, developers, end-users Overview of database models: Hierarchical, Network, Relational, and Object-Oriented Conceptual Design: Entity-Relationship (ER) Model, Entities, Attributes, Keys (Primary, Candidate, Foreign, Composite) Relationships: 1:1, 1:N, N:M, Enhanced ER Model (EER): Generalization, Specialization, Aggregation, Mapping ER/EER to relational schema.
2	**Relational Model and Algebra**
	Introduction to the Relational Model, relational schema and concept of keys. Mapping the ER and EER Model to the Relational Model, Relational Algebra-operators, Relational Algebra Queries. Overview of SQL, Data Definition Commands, Integrity constraints: key constraints, Domain Constraints, Referential integrity, check constraints, Data Manipulation commands, Data Control commands, Set and string operations, aggregate function-group by, having, Views in SQL, joins, Nested and complex queries, Triggers
3	**Relational Database and Transactions Management**
	Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, Armstrong Axioms of functional dependency, Closure set of attributes, Equivalence of Functional dependency, First Normal Form, 2NF, 3NF, BCNF Transaction concept, Transaction states, ACID properties, Transaction Control Commands, Concurrent Executions, Serializability-Conflict and View, Concurrency Control: Lock- based, Timestamp-based protocols, Recovery System: Log based recovery, Deadlock handling

AC: 10/03/2025

Practical Work (20 Marks)

List of Practicals to be Conducted	
1	**For given scenario** Draw E-R diagram and convert entities and relationships to table.
2	**Write SQL query for given problem statement:**
	Viewing all databases
	Creating a Database
	Viewing all Tables in a Database
3	**Perform the following Operations:**
	Creating Tables (With and Without Constraints)
	Inserting/Updating/Deleting Records in a Table
	Saving (Commit) and Undoing (rollback)
4	**Perform the following Operations:**
	Altering a Table
	Dropping/Truncating/Renaming Tables
	Backing up / Restoring a Database
5	**Perform following:**
	Simple Queries with Where Operators
	Where with Keywords and Logical Operators
	Simple Queries with Aggregate functions
	Queries with Aggregate functions (group by and having clause)
6	**Perform Queries involving:**
	Date Functions
	String Functions
	Math Functions

7	**Retrieving Data from Multiple Table:**
	Joining Tables (Inner Joins, Outer-Joins)
	Aliases for Table Names
8	**Views:**
	Creating Views
	Dropping Views
	Selecting from view

Question Paper Pattern (Academic Year: 2025-2026)

Database Management Systems

Semester End Examination and Practical Examination – 100 Marks

Semester II

A] Semester End Examination (SEE)- 60 Marks

Maximum Marks: 60
Duration: 2 Hours
Note: 1. All questions are compulsory.
2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q2.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q3.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
	Total	**75**	**60**

B] Practical Examination - 40 Marks

A Certified copy journal is essential to appear for the practical examination.

1.	**Practical Work**	**20**
2.	**Journal**	**10**
3.	**Viva Voce**	**10**

Books and References:

- Fundamentals of Database Systems, Elmasri Ramez and Navathe Shamkant B, Pearson Education, 6th Edition, 2010.
- Database System Concepts, Silberschatz, Korth, Sudarshan, McGraw Hill, 5th Edition, 2006.
- Database Management Systems, Ramakrishnam, Gehrke, McGraw‐ Hill, 2007.
- Murach's MySQL, Joel Murach, Murach, 2012.

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
1.Major
1.A. Discipline Specific Core Courses
1.A.b Foundation of Data Science - II (3 Credits)
Semester II

1. Major	
1.A Discipline Specific Core	
1.A.b Foundation of Data Science - II	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	Expand knowledge in data manipulation and transformation using R.
CObj 2	Develop competency in exploratory data analysis (EDA) and visualization techniques.
CObj 3	Introduce learners to real-time data processing methodologies.
CObj 4	Equip Learners with skills to analyze and work with large-scale datasets and APIs.
Course Outcomes	
COut 1	Manipulate and transform datasets using R.
COut 2	Perform exploratory data analysis and feature selection.
COut 3	Create interactive visualizations using ggplot2.
COut 4	Interpret statistical summaries and identify data patterns.
COut 5	Work with streaming data and real-time processing techniques.
COut 6	Utilize API-based data retrieval for real-world applications.
COut 7	Understand cloud-based data processing concepts.
COut 8	Develop the ability to integrate multiple data sources for analysis.

Modules at a Glance

Foundation of Data Science - II		
Sr. No.	**Modules**	**No. of Lectures**
1	Data Manipulation & Transformation	15
2	Exploratory Data Analysis & Visualization	15
3	Real-Time Data Processing & Applications	15
Total		**45**

Sr. No.	Modules
1	**Data Manipulation & Transformation**
	Data Manipulation using R: Importing/exporting datasets in R, Data manipulation using dplyr and tidyr, Cleaning and structuring data in R **Data Transformation in SQL:** Implementing joins and subqueries for data merging, Optimizing SQL queries for performance improvement, Working with structured and semi-structured data in SQL **Data Wrangling Techniques:**Handling missing values and inconsistencies in datasets, Data reshaping using pivoting and melting techniques, Merging and concatenating datasets efficiently, Formatting data for predictive analytics, Understanding best practices in large-scale data preprocessing
2	**Exploratory Data Analysis & Visualization**
	Introduction to Exploratory Data Analysis: Definition and scope of EDA, Difference between EDA vs. Classical & Bayesian Analysis, Goals & importance of EDA in data science, Graphical vs. Numerical approaches to data exploration, Data exploration process, Identifying and handling missing values & noisy data, Techniques for imputing missing values (mean, median, mode, regression-based imputation), Handling outliers & leverage data (Box Plots, Z-score, IQR), Dealing with non-numerical data and categorical data encoding, Univariate Analysis, Descriptive statistics: Mean, Median, Mode, Quartiles, Percentiles, Confidence Intervals for the Mean, Bivariate Analysis, Association between two categorical variables (Contingency Tables, Chi-Square Test, Phi Coefficient), Understanding correlation & regression coefficients. **Data Visualization Techniques:** Box plots, histograms, density plots, Scatter plots for visualizing relationships between continuous variables, Causal interpretation of scatter plots, Best practices for effective data representation, Understanding and implementing different chart types, Identifying insights through multivariate analysis, Case studies on EDA and its impact on decision-making.

3	**Real-Time Data Processing & Applications**
	Introduction to Streaming Data & APIs: Understanding real-time data sources and their applications, Fetching and processing real-time data using APIs, Managing time-sensitive data efficiently, Implementing event-driven analytics, Case studies on real-time analytics in different industries. **Processing Large-Scale Datasets:** Handling large datasets efficiently using SQL and R, Introduction to distributed data processing, Implementing batch and real-time processing techniques, Apache Flink, Apache Kafka, Challenges in big data analytics, Industry best practices in large-scale data handling.

Practical Work (20 Marks)

List of Practicals to be Conducted	
1	Loading CSV files into R and performing basic statistics
2	Using dplyr package for data wrangling (filtering, sorting, grouping)
3	Performing factor analysis for categorical data
4	Creating Contingency Tables & computing Chi-square tests.
5	Generating scatter plots & computing correlation coefficients.
6	Creating Bar Charts, Line Charts, and Scatter Plots in R (ggplot2)
7	Performing summary statistics & outlier detection in R
8	Performing text analysis on web-scraped data in R
9	Analyzing stock market trends using time-series forecasting in R
10	Building interactive dashboards using R Shiny

Question Paper Pattern (Academic Year: 2025-2026)

Foundation of Data Science - II

Semester End Examination and Practical Examination – 100 Marks

Semester II

A] Semester End Examination (SEE)- 60 Marks

Maximum Marks: 60

Duration: 2 Hours

Note: 1. All questions are compulsory.
2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q2.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q3.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
	Total	**75**	**60**

B] Practical Examination - 40 Marks

A Certified copy journal is essential to appear for the practical examination.

1.	**Practical Work**	**20**
2.	**Journal**	**10**
3.	**Viva Voce**	**10**

Books and References:

- "Practical Statistics for Data Scientists" by Peter Bruce & Andrew Bruce
- "Data Wrangling with R" by Hadley Wickham
- "R for Data Science" by Garrett Grolemund & Hadley Wickham
- "The Art of Data Science" by Roger D. Peng & Elizabeth Matsui
- "Data Visualization: A Practical Introduction" by Kieran Healy

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
2. Minor
2.A.a Statistics for Data Science (3 Credits)
Semester II

2. Minor	
2.A.a Statistics for Data Science	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	To define and identify different types of data, methods of data collection, and basic data representation techniques apply measures of central tendency and dispersion in analyzing data.
CObj 2	To explain basic probability concepts, random variables, probability distributions, and their properties.
CObj 3	To classify and analyze standard probability distributions and their applications.
Course Outcomes	
COut 1	Learners will be able to describe different data types and use graphical methods to represent data.
COut 2	Learners will be able to calculate and interpret measures like mean, median, and standard deviation to summarize data.
COut 3	Learners will apply standard probability distributions to solve problems and interpret results.

Modules at a Glance

Statistics for Data Science		
Sr. No.	**Modules**	**No. of Lectures**
1	Introduction to Statistics, Measures of Central Tendency and Dispersion	15
2	Probability theory and Random variables	15
3	Probability Distributions	15
Total		**45**

Sr. No.	Modules
1	**Introduction to Statistics, Measures of Central Tendency and Dispersion**
	Introduction to Statistics: Meaning of Statistics, Importance, Scope, and Applications in various fields. Concept of Population and Sample. The importance of Sampling in statistics. **Types of Data:** Qualitative vs Quantitative Data. Discrete and Continuous Data. Types of Scales: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale. Data Collection Methods: Primary Data, Secondary Data. **Data Representation:** Univariate Frequency Distribution, Cumulative Frequency Distribution. Graphs and Diagrams: Histogram, Frequency Polygon, Ogives. **Measures of Central Tendency:** Concept of Central Tendency, Mathematical Averages: Arithmetic Mean (Simple, weighted mean, combined mean), Geometric Mean and Harmonic Mean and Mode. Location Parameters: Median, Quartiles, Deciles, Percentiles. Empirical Relation Between Mean, Median, and Mode. Merits and Demerits. **Measures of Dispersion:** Concept of Dispersion, Range, Interquartile Range (IQR), Variance, Standard Deviation. Mean Absolute Deviation (MAD), Combined Variance. **Moments, Skewness and Kurtosis:** Raw Moments and Central Moments. Methods of measuring skewness (Karl Pearson and Bowley's). Overview of Kurtosis, its measure, and significance.
2	**Probability theory and Random variables**
	Concepts of trial, random experiment, sample point, and sample space. Definition and operations of events: union, intersection, complement, mutually exclusive, and exhaustive events. Addition and Multiplication theorems of probability. Independence of events: pairwise and mutual independence (for three events). Conditional probability and Bayes' theorem with applications. **Random Variables**: Definition, discrete and continuous random variables, Probability distribution function (PDF), and cumulative distribution function (CDF) for discrete and

	continuous random variables. Joint Distributions, properties, and independence. **Mathematical Expectation**: Expectation of a random variable and a function of a random variable, addition, and multiplication theorems of expectation, expectation of a linear combination of random variables.Variance and Covariance, variance of a linear combination of random variables.
3	**Probability Distributions**
	Discrete Distributions: Discrete Uniform, Bernoulli, Binomial, Poisson, Geometric distributions. Mean and variance for all the above distributions. Poisson approximation to the Binomial distribution. **Continuous Distributions:** Rectangular, Exponential, Gamma (single and double parameter). Measures: Mean, median, mode, and standard deviation. **Normal Distribution and Limit Theorems:** Normal distribution and its properties (without proof). Normal curve and use of normal tables. Normal approximation to Binomial and Poisson distributions. Central Limit Theorem for i.i.d. random variables.

Practical Work (20 Marks)

List of Practicals to be Conducted	
1	**Data Representation** **Aim:** To understand and apply various methods of representing data, including frequency distributions, histograms, and other graphical tools.
2	**Central Tendency** **Aim:** To compute and interpret different measures of central tendency such as arithmetic mean, geometric mean, harmonic mean, median, mode and percentiles for data analysis.
3	**Dispersion** **Aim:** To measure and analyze the data spread using range, interquartile range, standard deviation, and mean absolute deviation (MAD). To explore the distribution shape through skewness and kurtosis.
4	**Basic Probability** **Aim:** To apply the concepts of probability, including trial, random experiments, sample space, and operations on events like union, intersection, and complement.
5	**Random Variables and Probability Distributions** **Aim:** To explore discrete and continuous random variables, and compute their probability distribution functions (PDF), cumulative distribution functions (CDF), and graphical representations.
6	**Discrete Probability Distributions** **Aim:** To compute the mean, variance, and recurrence relations for discrete distributions like Bernoulli, Binomial, Poisson, etc.

7	**Continuous Probability Distributions** **Aim:** To calculate mean, variance, and standard deviation for continuous distributions like Exponential, Gamma, and Beta distributions.
8	**Normal Distribution and Limit Theorems** **Aim:** To apply the properties of the normal distribution, compute probabilities using the normal curve, and explore the Normal approximation to Binomial and Poisson distributions.

Question Paper Pattern (Academic Year: 2025-2026)

Statistics for Data Science

Semester End Examination and Practical Examination – 100 Marks

Semester II

A] Semester End Examination (SEE)- 60 Marks

Maximum Marks: 60

Duration: 2 Hours

Note: 1. All questions are compulsory.

2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 2)** A. Numerical/ Theory Based question B. Numerical/ Theory Based question C. Numerical/ Theory Based question	 **10** **10** **10**	**20**
Q2.	**Answer the following questions (Any 2)** A. Numerical/ Theory Based question B. Numerical/ Theory Based question C. Numerical/ Theory Based question	 **10** **10** **10**	**20**
Q3.	**Answer the following questions (Any 2)** A. Numerical/ Theory Based question B. Numerical/ Theory Based question C. Numerical/ Theory Based question	 **10** **10** **10**	**20**
	Total	**90**	**60**

Note: Each 10-mark question may be split into 5+5 if required.

B] Practical Examination - 40 Marks

A Certified copy journal is essential to appear for the practical examination.

1.	**Practical Work**	**20**
2.	**Journal**	**10**
3.	**Viva Voce**	**10**

Books and References:

- B.L. Agarwal, Basic statistics, New Age International Ltd, 2022.
- S.C Gupta and V.K. Kapoor, Fundamentals of applied statistics, Sultan Chand & Sons, 2007.
- S.C. Gupta and V.K. Kapoor, Fundamentals of mathematical statistics, Sultan Chand & Sons, 2020.
- C.R. Kothari, Research methodology: Methods and techniques, Wiley Eastern Limited, 2019.
- Spiegel M.R.: Theory and Problems of Statistics, Schaum's Publications series, Tata McGraw-Hill.

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
3.General Elective/ Open Elective
3.A.a Data Structure and Algorithm using C (3 Credits)
Semester II

3. General Elective/ Open Elective	
3.A.a Data Structure and Algorithm using C	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	To learn the essential C data structures.
CObj 2	To learn the significant C implementation of popular data structures
CObj 3	To learn about various data structure algorithms and design paradigms
CObj 4	To acquire knowledge of how to create complex data structures.
CObj 5	To acquire basic understanding of complex data structures such as trees and graphs and their applications
Course Outcomes	
COut 1	Learners will able to understand concepts of data structures using C language
COut 2	Learner is able to evaluate appropriate data structure in C for specified problems and algorithms
COut 3	Learner is able to apply Linked list and Stack data structure in various domains
COut 4	Learners are able to apply Tree and Queue data structures and use their operation.
COut 5	Learner has ability to apply Hashing techniques, Symbol Table and Graph algorithms Appropriately.
COut 6	Learner understand to handle sorting, searching and pattern matching on various data structures

Modules at a Glance

Data Structure and Algorithm using C		
Sr. No.	**Modules**	**No. of Lectures**
1	Introduction to Data Structures and Arrays	15
2	Linked Lists, Queue and Stack	15
3	Tree, Hash, Graph and Sorting & Searching Techniques	15
Total		**45**

Sr. No.	Modules
1	**Introduction to Data Structures and Arrays**
	Data Structures and Notations: Data and Information, Data Structure, Classification of Data Structures, Primitive Data Types, Abstract Data Types, Data structure vs. File Organization, Operations on Data Structure, Algorithm, Importance of Algorithm Analysis, Complexity of an Algorithm, Asymptotic Analysis and Notations, Big O Notation, Big Omega Notation, Big Theta Notation, Rate of Growth and Big O Notation. **Array:** Introduction, One Dimensional Array, Memory Representation of One Dimensional Array, Traversing, Insertion, Deletion, Searching, Sorting, Merging of Arrays, Multidimensional Arrays, Memory Representation of Two Dimensional Arrays, General MultiDimensional Arrays, Sparse Arrays, Sparse Matrix, Memory Representation of Special kind of Matrices, Advantages and Limitations of Arrays.
2	**Linked Lists, Queue and Stack**
	Linked List: One-way Linked List, Traversal of Linked List, Searching, Memory Allocation and De-allocation, Insertion in Linked List, Deletion from Linked List, Copying a List into Other List, Merging Two Linked Lists, Splitting a List into Two Lists, Reversing One way linked List, Circular Linked List, Applications of Circular Linked List, Two way Linked List, Traversing a Two way Linked List, Searching in a Two way linked List, Insertion of an element in Two way Linked List, Deleting a node from Two way Linked List, Header Linked List, Applications of the Linked list, Representation of Polynomials, Storage of Sparse Arrays, Implementing other Data Structures. **Queue and Stack:** Operations on the Stack Memory Representation of Stack, Array Representation of Stack, Applications of Stack, 12 15 Evaluation of Arithmetic Expression, Matching Parenthesis, infix and postfix operations, Recursion. Queue: Introduction, Queue, Operations on the Queue, Memory Representation of Queue, Array representation of queue, Linked List Representation of Queue, Circular Queue,

	Some special kinds of queues, Deque, Priority Queue, Application of Priority Queue, Applications of Queues
3	**Tree, Hash, Graph and Sorting & Searching Techniques**
	Tree: Tree, Binary Tree, Properties of Binary Tree, Memory Representation of Binary Tree, Operations Performed on Binary Tree, Reconstruction of Binary Tree from its Traversals, Huffman Algorithm, Binary Search Tree, Operations on Binary Search Tree, Heap, Memory Representation of Heap, Operation on Heap, Heap Sort. Advanced Tree Structures: Red Black Tree, Operations Performed on Red Black Tree, AVL Tree, Operations performed on AVL Tree, 2-3 Tree, B-Tree. **Hash functio**n: Address calculation techniques, Common hashing functions Collision resolution, Linear probing, Quadratic, Double hashing, Bucket hashing, Deletion and rehashing **Graph:** Introduction, Graph, Graph Terminology, Memory Representation of Graph, Adjacency Matrix Representation of Graph, Adjacency List or Linked Representation of Graph, Operations Performed on Graph, Graph Traversal, Applications of the Graph, Reachability, Shortest Path Problems, Spanning Trees. **Sorting and Searching Techniques:** Bubble, Selection, Insertion, Merge Sort. Searching: Sequential, Binary, Indexed Sequential Searches.

Practical Work (20 Marks)

List of Practicals to be Conducted	
1	Program to implement array in ascending order
2	Program to merge two and reverse the array
3	Program to add two matrices
4	Program to detect and remove loop in linked list
5	Program to implement stack and queue
6	Program to implement bubble sort
7	Program to implement selection sort and sequential search
8	Program to store and display graph data structure using adjacency matrix
9	Program to implement graph traversal (BFS/DFS)

Question Paper Pattern (Academic Year: 2025-2026)

Data Structure and Algorithm using C

Semester End Examination and Internal Examination – 100 Marks

Semester II

A] Semester End Examination (SEE)- 60 Marks

Maximum Marks: 60

Duration: 2 Hours

Note: 1. All questions are compulsory.
2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q2.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q3.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
	Total	**75**	**60**

B] Practical Examination - 40 Marks

A Certified copy journal is essential to appear for the practical examination.

1.	**Practical Work**	**20**
2.	**Journal**	**10**
3.	**Viva Voce**	**10**

Books and References:

- Hands-On Data Structures and Algorithms with C, Basant Agarwal, Benjamin Baka, Packt Publishing, 2018
- Data Structure and algorithm using C, Rance D. Necaise, Wiley India Edition, 2016
- Data Structure and Algorithm in C, Michael T. Goodrich, Roberto Tamassia, Wiley India Edition, 2016
- Data Structure and AlgorithmicThinking with C, Narasimha Karumanchi, Careermonk Publications, 2015

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
4.Vocational & Skill Enhancement Courses
4.A. Vocational Skill Course
4.A.a Discrete Mathematics (3 Credits)
Semester II

4.Vocational & Skill Enhancement Courses	
4.A. Vocational Skill Course	
4.A.a Discrete Mathematics	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	To apply mathematical concepts to solve real-world problems, demonstrating critical thinking and analytical skills.
CObj 2	To develop the ability to reason abstractly, and apply logic.
CObj 3	To understand the complexity of algorithms, analyze their efficiency, and apply algorithmic thinking to problem-solving.
Course Outcomes	
COut 1	Learners will be able to perform algebraic operations on complex numbers and polynomials.
COut 2	Learners will apply counting principles and combinatorial techniques to solve problems, including recurrence Relations.
COut 3	Learners will develop an attitude to solve problems based on graphs and trees, which are widely used in software.

Modules at a Glance

Discrete Mathematics		
Sr. No.	**Modules**	**No. of Lectures**
1	Set Theory and Logic	15
2	Counting Techniques and Recurrence Relations	15
3	Graph Theory	15
Total		**45**

Sr. No.	Modules
1	**Set Theory and Logic**
	Set Theory: Introduction, Subsets and Power Sets, Venn Diagrams, Algebra of Sets, Counting Principle, Partitions, Mathematical Induction. **Relations:** Introduction, Product Sets, Types of Relations (including Equivalence and Partial Ordering), Composition of Relations, Closure Properties, Hasse Diagrams, Lattices. **Functions and Algorithms:** Functions (Injective, Surjective, Bijective), Exponential and Logarithmic Functions, Cardinality, Complexity of Algorithms. **Logic and Boolean Algebra:** Basic Logic operations, Truth Tables, Logical Equivalences. Quantifiers, Domain of discourse. Boolean functions, Simplification of Boolean expressions, Boolean operations. Applications.
2	**Counting Techniques and Recurrence Relations**
	Counting Techniques: Countable and uncountable sets with examples, Basic Counting Principles (Sum and Product Rule), Permutations and Combinations (with and without repetition), Pigeonhole Principle, Inclusion-Exclusion Principle, Binomial and Multinomial Theorem, Pascal's Identity, Circular Permutations. **Recurrence Relations:** Homogeneous, Non-Homogeneous, Linear, and Non-Linear Recurrence Relations. Obtaining recurrence relations in counting problems. Solving recurrence relations using algebraic methods for second-order homogeneous cases, iterative methods, and ordinary generating functions. Applications in combinatorial counting, divide-and-conquer algorithms, and dynamic programming.
3	**Graph Theory**
	Graphs: Definition, Graph Models, and Basic Properties; Graph Terminologies (including Special Types of Graphs and Graph Isomorphism); Representing Graphs (Adjacency and Incidence Matrices, Linked Representation); Connectivity (Walks, Trails, and Paths); Euler and Hamilton Paths; Planar Graphs; Graph Coloring and

	Chromatic Numbers. **Trees:** Definition and Tree Terminologies; Ordered Rooted Trees and Binary Trees (including Complete and Extended Binary Trees); Expression Trees; Binary Search Trees (Operations: Searching, Insertion, and Deletion); Huffman's Algorithm; Binary Tree Traversals. **Graph Algorithms:** Breadth-First Search (BFS), Depth-First Search (DFS), Dijkstra's Algorithm (Shortest Path in Weighted Graphs), Prim's Algorithm (Minimum Spanning Tree), Kruskal's Algorithm (Minimum Spanning Tree).

Practical Work (20 Marks)

List of Practicals to be Conducted	
1	**Set Operations and Venn Diagrams** **Aim:** Perform set operations (union, intersection, difference, complement) and visualize them using Venn diagrams. Verify set identities, including De Morgan's Laws.
2	**Relations, Functions, and Hasse Diagrams** **Aim:** Construct and analyze relations, determine equivalence and partial order relations, compute Cartesian products, and generate Hasse diagrams.
3	**Boolean Algebra and Logic Simplification** **Aim:** Construct truth tables, verify logical equivalences, and simplify Boolean expressions using Boolean algebra laws and Karnaugh maps.
4	**Counting Principles and Applications** **Aim:** Apply the sum and product rules for counting, compute permutations and combinations (with/without repetition), and verify the binomial theorem.
5	**Inclusion-Exclusion Principle and Pigeonhole Applications** **Aim:** Solve set-counting problems using the inclusion-exclusion principle and demonstrate applications of the pigeonhole principle.
6	**Solving Recurrence Relations Using Iterative and Algebraic Methods** **Aim:** Compute recurrence sequences iteratively and solve second-order homogeneous recurrence relations algebraically.
7	**Generating Functions for Recurrence Relations** **Aim:** Use generating functions to solve recurrence relations and apply them in combinatorial problems.
8	**Graph Representation and Isomorphism** **Aim:** Construct adjacency and incidence matrices, represent graphs using linked structures, and check for graph isomorphism.

9	**Eulerian and Hamiltonian Paths, Graph Coloring** **Aim:** Determine if a graph contains Eulerian or Hamiltonian paths and compute its chromatic number using graph coloring algorithms.
10	**Binary Trees and Tree Traversals** **Aim:** Construct binary search trees, implement insertion and deletion operations, and perform inorder, preorder, and postorder traversals.
11	**Huffman Encoding Algorithm** **Aim:** Implement Huffman encoding for data compression, generate Huffman trees, and analyze encoding efficiency.
12	**Graph Algorithms (BFS, DFS, Dijkstra, Prim, Kruskal)** **Aim:** Implement BFS and DFS for graph traversal, apply Dijkstra's algorithm for shortest paths, and compute minimum spanning trees using Prim's and Kruskal's algorithms.

Question Paper Pattern (Academic Year: 2025-2026)

Discrete Mathematics

Semester End Examination and Practical Examination – 100 Marks

Semester II

A] Semester End Examination (SEE)- 60 Marks

Maximum Marks: 60

Duration: 2 Hours

Note: 1. All questions are compulsory.
2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 2)** A. Numerical/ Theory Based question B. Numerical/ Theory Based question C. Numerical/ Theory Based question	 **10** **10** **10**	**20**
Q2.	**Answer the following questions (Any 2)** A. Numerical/ Theory Based question B. Numerical/ Theory Based question C. Numerical/ Theory Based question	 **10** **10** **10**	**20**
Q3.	**Answer the following questions (Any 2)** A. Numerical/ Theory Based question B. Numerical/ Theory Based question C. Numerical/ Theory Based question	 **10** **10** **10**	**20**
	Total	**90**	**60**

Note: Each 10-mark question may be split into 5+5 if required.

B] Practical Examination - 40 Marks

A Certified copy journal is essential to appear for the practical examination.

1.	**Practical Work**	**20**
2.	**Journal**	**10**
3.	**Viva Voce**	**10**

Books and References:

- N.L. Biggs, Discrete Mathematics, OUP Oxford, 2002.
- Richard A. Brualdi, Introductory Combinatorics, Pearson, Upper Saddle River, NJ, 2010.
- S. Lipschutz and M. Lipson, Schaum's outline of discrete mathematics, 3rd ed., Schaum's Outline Series, McGraw-Hill Education, 2007.
- K.H. Rosen, Discrete Mathematics and its Applications, McGraw-Hill Education, 2011.
- Narsing Deo- Graph Theory with Applications to Computer Science and Engineering; Prentice Hall, India
- Dr. K. D. Joshi, Foundations of Discrete Mathematics‖, New Age International Limited, Publishers, January 1996.

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning

Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
4.Vocational & Skill Enhancement Courses
4.B. Skill Enhancement Course
4.B.a R Programming (2 Credits)
Semester II

4.Vocational & Skill Enhancement Courses	
4.B. Skill Enhancement Course	
4.B.a R Programming	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	Provide foundational knowledge of R programming for data science applications.
CObj 2	Enable students to write efficient R scripts for basic computation & data handling.
CObj 3	Introduce essential R programming concepts like functions, control structures, and debugging.
CObj 4	Familiarize students with industry-relevant certifications and use cases of R.
Course Outcomes	
COut 1	Understand and use R syntax, functions, and control structures effectively.
COut 2	Write, execute, and debug R scripts efficiently.
COut 3	Handle different data structures (vectors, lists, matrices, data frames).
COut 4	Work with packages and libraries in R for data science applications.
COut 5	Optimize code performance using built-in functions and apply-family functions.
COut 6	Develop R programs for data storage and retrieval.
COut 7	Utilize R for basic automation and workflow optimization.
COut 8	Gain exposure to industry applications of R in various domains.

Modules at a Glance

R Programming		
Sr. No.	**Modules**	**No. of Lectures**
1	Fundamentals of R Programming	15
2	File Handling, Packages & Automation in R	15
Total		**30**

Sr. No.	Modules
1	**Fundamentals of R Programming**
	Introduction to R & RStudio: Setting up R & RStudio environment, Writing & executing basic R scripts, Understanding syntax, variables, and operators **Data Structures in R:** Working with vectors, matrices, lists, and data frames, Indexing & subsetting techniques, Handling missing values & NA types **Control Structures & Functions:** Conditional statements (if-else, switch), Loops (for, while, repeat) & apply functions, Writing custom functions & debugging code
2	**File Handling, Packages & Automation in R**
	File Handling in R: Reading & writing data from CSV, JSON, Excel, and text files, Data import/export using readr, readxl, jsonlite, Working with databases in R (SQLite, MySQL basics) **Using R Packages & Libraries:** Installing, loading, and managing R packages, Understanding dependencies and package development, Introduction to commonly used packages in data science **Automation & Optimization in R:** Writing efficient R scripts, Using apply, lapply, sapply, tapply functions, Debugging and profiling R scripts for performance tuning

Practical Work (20 Marks)

List of Practicals to be Conducted	
1	Get familiar with RStudio environment and execute basic R scripts
2	Explore vectors, matrices, lists, and data frames in R
3	Learn methods to detect, handle, and replace missing values (NA) in datasets
4	Implement conditional statements, loops, and switch cases for automation.

5	Develop custom functions, use debugging tools, and optimize execution.
6	Work with CSV, JSON, and Excel files in R.
7	Connect R with databases and perform basic CRUD operations.
8	Install and use popular R packages for data science.(dplyr, ggplot2, tidyr, and lubridate)
9	Optimize data operations using apply(), lapply(), sapply(), and tapply().
10	Optimize R scripts for better performance using profiling and debugging.

Question Paper Pattern (Academic Year: 2025-2026)

R Programming

Semester End Examination – 50 Marks

Semester I

A] Semester End Examination (SEE)- 50 Marks

Maximum Marks: 50

Duration: 2 Hour

Note: 1. All questions are compulsory.

Question No.	Particulars (Nature of Questions)	Marks (Given)
Q1.	Practical Question I (Module I)	**15**
Q2.	Practical Question I (Module II)	**15**
Q3.	Journal	**10**
Q4.	Viva	**10**
	Total	**50**

Books and References:

- Wickham, Hadley, and Garrett Grolemund. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data. O'Reilly Media, 2017.
- Kabacoff, Robert I. R in Action: Data Analysis and Graphics with R. Manning Publications, 2015.
- Crawley, Michael J. The R Book. Wiley, 2012.
- Dalgaard, Peter. Introductory Statistics with R. Springer, 2008.
- Field, Andy, Jeremy Miles, and Zoe Field. Discovering Statistics Using R. SAGE Publications, 2012.

Teaching Pedagogy:

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Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
5. Ability & Value Enhancement Courses/Indian Knowledge System
5.A. Ability Enhancement Course
5.A.a Language and Literature- II (3 Credits)
Semester II

5. Ability & Value Enhancement Courses/Indian Knowledge System	
5.A. Ability Enhancement Course	
5.A.a Language and Literature - II	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	To understand the effective use of powerpoint presentation, relevance, and importance of conducting meetings
CObj 2	To teach the formats of letter writing
CObj 3	To enable the learners to adapt to the requirements of the industry.
Course Outcomes	
COut 1	Learners learn to use statistical tools in powerpoint presentations, write letters of enquiry and letters of complaint.
COut 2	Learners can prepare flyers and leaflets help the learners demonstrate their creativity
COut 3	Learners are able to write different types of reports.
COut 4	Learners can analyse all forms of group communication and are able to appropriately use them.
COut 5	Learners understand the importance of following the steps to conduct the meetings.
COut 6	Learners are able to apply the steps taught for effective communication.
COut 7	Learners understand the role and the scope of work of a chairman.
COut 8	Data is analysed and the learner is able to present the same in the form of a

	report.
COut 9	Learners are able to create effective presentations.
COut 10	Learners are able to evaluate and seek redress under RTI.

Modules at a Glance

Language and Literature - II		
Sr. No.	**Modules**	**No. of Lectures**
1	Presentation Skills & Group Communication	15
2	Business Correspondence	15
3	Language and Writing Skills	15
Total		**45**

Sr. No.	Modules
1	**Presentation Skills & Group Communication**
	• **Presentations:** (to be tested in tutorials only) 4 Principles of Effective Presentation Effective use of PPT Effective use of statistical tools, How to make a Power-Point Presentation • **Interviews:** Group Discussion Preparing for an Interview, Types of Interviews – Selection, Appraisal, Grievance, Exit • **Meetings:** Need and Importance of Meetings, Conduct of Meeting and Group Dynamics Role of the Chairperson, Role of the Participants, Drafting of Notice, Agenda and Resolutions • **Conference:** Meaning and Importance of Conference Organizing • **Public Relations:** Meaning, Functions of PR Department, External and Internal Measures of PR. Writing a corporate communication (log writing, News article)
2	**Business Correspondence**
	• **Trade Letters:** Purchase Order, Credit and Status Enquiry, Collection Explain in detail along with the specimens. • **Only following to be taught in detail:** Letters of Inquiry, Letters of Complaints, Claims, Sales Letters, promotional leaflets and fliers Consumer Grievance Letters, Letters under Right to Information (RTI) Act
3	**Language and Writing Skills**

	● **Reports:** Parts, Types of Reports, Format of Report writing ● **Summarization**: Identification of main and supporting/sub points Presenting these in a cohesive manner

Question Paper Pattern (Academic Year: 2025-2026)

Language and Literature - II

Semester End Examination and Internal Evaluation – 100 Marks

Semester II

A] Semester End Examination (SEE)- 60 Marks

Maximum Marks: 60

Duration: 2 Hours

Note: 1. All questions are compulsory.

2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q2.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
Q3.	**Answer the following questions (Any 4)** A. Theory/Concept Based question B. Theory/Concept Based question C. Theory/Concept Based question D. Theory/Concept Based question E. Theory/Concept Based question	 **5** **5** **5** **5** **5**	**20**
	Total	**75**	**60**

B] Internal Evaluation - 40 Marks

Method of Evaluation	Marks
Group discussion/ Mock Interviews / Presentation techniques / Word Bank	**20**
Report Writing	**20**
Total	**40**

Books and References:

- Agarwal, AnjuD(1989) A Practical Handbook for Consumers, IBH.
- Alien, R.K.(1970) Organisational Management through Communication. Podar : Nurturing Intellect Creating Personalities
- Ashley,A(1992) A Handbook Of Commercial Correspondence, Oxford University Press.
- Aswathapa, K (1991)Organisational Behaviour, Himalayan Publication, Mumbai.
- Atreya N and Guha (1994) Effective Credit Management, MMC School of Management, Mumbai.
- Bahl,J.C. and Nagamia,S.M. (1974) Modern Business Correspondence and Minute Writing.
- Balan,K.R. and Rayudu C.S. (1996) Effective Communication, Beacon New Delhi.
- Bangh, Lsue, Fryar,Maridell and Thomas David A. (1998) How to Write First Class Business Correspondence, N.T.C. Publishing Group USA
- Banerjee, Bani P (2005) Foundation of Ethics in Mangement Excel Books
- Businessworld Special Collector's Issue: Ethics and the Manager
- Barkar, Alan(1993) Making Meetings Work, Sterling Publications Pvt. Ltd., New Delhi.
- Basu,C.R.(1998) Business Organisation and Management, T.M.H.New Delhi.
- Benjamin, James (1993) Business and Professional Communication Concepts and Practices, Harper Collins College Publishers, New York.
- Bhargava and Bhargava91971) Company Notices, Meetings and Regulations
- Black, Sam (1972) Practical Public Relations, E.L.B.S. London.
- BoveeCourtland, L and Thrill, John V(1989) Business Communication, Today McGraw Hill, New York, Taxman Publication.
- Burton, G and Thakur, (1995) Management Today- Principles and Practices. T.M.H.,New Delhi.
- Darrow, Richard, Forrstal, Dan and Coolman, Aubrey (1967) Public Relations Handbook, TheDartwellCo., Chicago.
- Dayal, Ishwar(9810) Managing Large Organizations: A Comparative Study.
- Drucher,P.F.((1970) Technology, Management and Society, Pan Books London.
- Drucher,P.F.(1974)Management Responsibilities Practices, Heinemann, London.
- Eyre, E.C. (1985), Effective Communication Made Simple, Rupa and Co.Calcutta
- Ecouse Barry, (1999), Competitive Communication: A Rhetoric for Modern Business, OUP.
- Ecouse Barry, (1999), Competitive Communication: A Rhetoric for Modern Business, OUP.
- Fisher Dalmar, (1999), Communication in Organisation, Jaico Pub House, Mumbai, Delhi.
- Frailley, L.E. (1982) Handbook of Business Letters, Revised Edn. Prentice Hall Inc.
- French, Astrid (1993) Interpersonal Skills. Sterling Publishers, New delhi.
- Fritzsche, David J (2005) Business Ethics: A Global and Managerial Perspective McGraw Hill

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Syllabus of courses of FYBSc (Data Science & Analytics) Programme
(With effect from the Academic Year 2025-2026)
5. Ability & Value Enhancement Courses/Indian Knowledge System
5.B. Value Enhancement Course
5.B.a Intellectual Property Rights (2 Credits)
Semester II

5. Ability & Value Enhancement Courses/Indian Knowledge System	
5.B Value Enhancement Course	
5.B.a Intellectual Property Rights	
Course Objectives and Course Outcomes	
Course Objectives	
CObj 1	To recognize the importance of IP and to educate the pupils on basic concepts of Intellectual Property Rights.
CObj 2	To make the learners understand the statutory provisions of different types of IPRs in simple forms.
CObj 3	To learn the procedure of obtaining Patent, Copyright, Geographical Indication, Trademark, Industrial Design and Trade Secret.
Course Outcomes	
COut 1	Distinguish and explain various forms of IPRs.
COut 2	Identify criteria to fit one's own intellectual work in particular form of IPRs.
COut 3	Apply statutory provisions to protect particular forms of IPRs.
COut 4	Be familiar with intellectual property protection mechanisms.
COut 5	Explain why something is or is not entitled to intellectual property protection.
COut 6	Discover the new developments in IPR.
COut 7	Learners shall be able to look for IPR protection primarily before the conventional mode of protection like scientific publication.

Modules at a Glance

Intellectual Property Rights		
Sr. No.	**Modules**	**No. of Lectures**
1	Introduction to Intellectual Property Rights	10
2	Types of Intellectual Property Rights	10
3	Application and Emerging Trends	10
Total		**30**

Sr. No.	Modules
1	**Introduction to Intellectual Property Rights**
	Meaning of Intellectual Property and Property Rights: Basic concepts of Intellectual Property; Nature, Scope and Significance of Intellectual Property
2	**Types of Intellectual Property Rights**
	Patent, Copyright, Geographical Indication, Trademark, Industrial Design and Trade Secret
3	**Application and Emerging Trends**
	Technology and Legal developments in Intellectual Property; Advantages and Disadvantages of IPR; Recent changes in IPR laws; Registration procedure

AC: 10/03/2025

Question Paper Pattern (Academic Year: 2025-2026)

Intellectual Property Rights

Semester End Examination and Internal Evaluation – 50 Marks

Semester II

A] Semester End Examination (SEE)- 30 Marks

Maximum Marks: 30

Duration: 1 Hour

Note: 1. All questions are compulsory.

2. All questions carry equal marks.

Question No.	Particulars (Nature of Questions)	Marks (Given)	Marks (To be Attempted)
Q1.	**Answer the following questions (Any 2)** A. Practical/ Case study Based question B. Practical/ Case study Based question C. Practical/ Case study Based question	 **5** **5** **5**	**10**
Q2.	**Answer the following questions (Any 2)** A. Practical/ Case study Based question B. Practical/ Case study Based question C. Practical/ Case study Based question	 **5** **5** **5**	**10**
Q3.	**Answer the following questions (Any 2)** A. Practical/ Case study Based question B. Practical/ Case study Based question C. Practical/ Case study Based question	 **5** **5** **5**	**10**
	Total	**45**	**20**

B] Internal Evaluation - 20 Marks

Method of Evaluation	Marks
Case Study Analysis/ Assignments	**20**
Total	**20**

Books and References:

- “Law Relating to Intellectual Property Rights” by V K Ahuja
- “Law Relating To Intellectual Property Rights” by by R Radhakrishnan and S Balasubramanian
- “Law Relating to Intellectual Property, 2011 (Reprint)” by B L Wadehra

Teaching Pedagogy:

Lectures/ tutorials/ field work/ outreach activities/ project work/ vocational training/ viva/ seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.

AC: 10/03/2025

CRITERIA FOR EVALUATING POWERPOINT PRESENTATION/ CASE STUDY/ APPLICATION BASED ACTIVITY:

MARKS: 20 FY/SY/TY BSc: Division A/B Semester:

Name of the Topic Date of Presentation:

Sr. No	Roll No	Name of the student	Content (5)	Team building (5)	Presentation skills		Total (20)
					Verbal (5)	Non Verbal (5)	
1							
2							
3							
4							

Sign: 1_____2._____3._____4._____Faculty Sign:_____

Name of the Topic Date of Presentation:

Sr. No	Roll No	Name of the student	Content (5)	Team building (5)	Presentation skills		Total (20)
					Verbal (5)	Non Verbal (5)	
1							
2							
3							
4							

Sign: 1_____2._____3._____4._____Faculty Sign:_____

Name of the Topic Date of Presentation:

Sr. No	Roll No	Name of the student	Content (5)	Team building (5)	Presentation skills		Total (20)
					Verbal (5)	Non Verbal (5)	
1							
2							
3							
4							

Sign: 1_____2._____3._____4._____Faculty Sign:_____