DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/B.Sc.Data Sci/CBC&GS/21/2024

It is hereby inform to all concerned that, the syllabus prepared by the Ad-hoc Board and recommended by the Dean, Faculty of Science & Technology, the Academic Council at its meeting held on 08 April 2024 has accepted the Syllabus of **B.Sc. Data Science (Degree) Second & Third Year (IIIrd, IVth & Vth, VIth semester) under the Faculty of Science & Technology as per Choice Based Credit Grading System** run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

This is Progressively Effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar -
431 004.
REF.NO.SU/2024/ 2503-11
Date:- 29.06.2024.

★ ★ ★ ★ ★★★★★

Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasahcb Ambcdkar Marathwada University,
2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

Three Year Undergraduate Bachelor Degree Program

B.Sc.(Data Science)

under Science and Technology

Curriculum Structure and Scheme of Examination
(IIIrd and IVth semester)

Choice Based Credit System

(Effective from Academic Year 2024-25)

Choice Based Credit System (CBCS) Curriculum

For

Faculty of Science and Technology

Course Structure (Second Year)

B. Sc. Data Science Three Year Under Graduate Degree Program

Second Year

Course Type	Semester – III		Course Type	Semester - IV	
	Name of Paper	**Credit**		**Name of Paper**	**Credit**
Core Courses VII (DSC-I C) 7 Credits	Cloud Computing	**2**	**Core Courses X (DSC-I D) 7 Credits**	Internet of Things	**2**
	RDBMS	**2**		Data Warehouse	**2**
	Lab Course	**1.5**		Lab Course	**1.5**
	Lab Course	**1.5**		Lab Course	**1.5**
Core Courses VIII (DSC-II C) 7 Credits	Introduction to Data Science	**2**	**Core Courses XI (DSC-II D) 7 Credits**	Machine Learning	**2**
	Web Fundamental	**2**		J-Query	**2**
	Lab Course	**1.5**		Lab Course	**1.5**
	Lab Course	**1.5**		Lab Course	**1.5**
Core Courses IX (DSC-III C) 7 Credits	Python Programming Basics	**2**	**Core Courses XII (DSC-III D) 7 Credits**	Advanced Python for Data Science	**2**
	Data Communication Network	**2**		Data Visualization	**2**
	Lab Course	**1.5**		Lab Course	**1.5**
	Lab Course	**1.5**		Lab Course	**1.5**
Skill Enhancement Compulsory Courses(SEC-I) 1 Course, 2 Credits each	**A) Entrepreneurship Development Or B) Cyber Security**	**2**	**Skill Enhancement Compulsory Courses(SEC-II) 1 Course, 2 Credits each**	**C) Business Correspondence in Social Media Or D) Ethics in Data Science**	**2**
Ability Enhancement Compulsory Courses(AECC-I) 2 Courses, 3 Credits each	Communication Skills in English- III	**3**	**Ability Enhancement Compulsory Courses(AECC-I) 2 Courses, 3 Credits each**	Communication Skills in English- IV	**3**
	Marathi/ Hindi/ Urdu/ Arabic (SL-III) A Student can Opt any one of these three languages	**3**		**Marathi/ Hindi/ Urdu/ Arabic (SL-IV)** A Student can Opt any one of these three languages	**3**
Non-Credit Course	------	----	**Non- Credit Course**	Environment Studies	---
Total Credit		**29**			**29**

Choice Based Credit System (CBCS) Curriculum

For

Faculty of Science and Technology

Course Structure and Scheme of Examination

B.Sc. Data Science Three Year Under Graduate Degree Program

Semester-III								
Course Type	**Course Code**	**Course Title**	**Total Periods (Teaching Periods / Week)**	**Credits**	**Scheme of Examination**			
					SEE	**IA**	**Max Marks**	**Min Marks**
Core Courses VII (DSC-I C)	DS311-T	Cloud Computing	45 (3/per week)	**2**	**40**	**10**	**50**	**20**
	DS312-T	RDBMS	45 (3/per week)	**2**	**40**	**10**	**50**	**20**
	DS321-P	Lab Course based on DS311-T	45 (3/per week)	**1.5**	**40**	**10**	**50**	**20**
	DS322-P	Lab Course based on DS312-T	45 (3/per week)	**1.5**	**40**	**10**	**50**	**20**
Core Courses VIII (DSC-II C)	DS313-T	Introduction to Data Science	45 (3/per week)	**2**	**40**	**10**	**50**	**20**
	DS314-T	Web Fundamental	45 (3/per week)	**2**	**40**	**10**	**50**	**20**
	DS323-P	Lab Course based on DS313-T	45 (3/per week)	**1.5**	**40**	**10**	**50**	**20**
	DS324-P	Lab Course based on DS314-T	45 (3/per week)	**1.5**	**40**	**10**	**50**	**20**
Core Courses IX (DSC-III C)	DS315-T	Python Programming Basics	45 (3/per week)	**2**	**40**	**10**	**50**	**20**
	DS316-T	Data Communication Network	45 (3/per week)	**2**	**40**	**10**	**50**	**20**
	DS325-P	Lab Course based on DS315-T	45 (3/per week)	**1.5**	**40**	**10**	**50**	**20**

	DS326-P	Lab Course based on DS316-T	45 (3/per week)	**1.5**	**40**	**10**	**50**	**20**
Skill Enhancement Course (SEC-I)	DS341	SEC-I(Any one of the skill to be choosen out of two) **A) Entrepreneurship Development** **B) Cyber Security**	45 (3/per week)	**2**	**-**	**50**	**50**	**20**
Ability Enhancement Compulsory Courses(AECC-III)	DS331-T	Communication Skill in English- III	45 (3/per week)	**3**	**40**	**10**	**50**	**20**
	DS332-T	Marathi/ Hindi/ Urdu/ Arabic (SL-III) Student can opt for one of these languages	45 (3/per week)	**3**	**40**	**10**	**50**	**20**
		45 Periods Per week		**29**	**560**	**190**	**750**	**300**
Total Credit for Semester I : 29 (Theory : 20 : Laboratory : 9)								

Choice Based Credit System (CBCS) Curriculum
For
Faculty of Science and Technology
Course Structure and Scheme of Examination
B.Sc. Data Science Three Year Under Graduate Degree Program

Semester-IV

Course Type	Course Code	Course Title	Total Periods (Teaching Periods / Week)	Credits	Scheme of Examination			
					SEE	IA	Max Marks	Min Marks
Core Courses X (DSC-I D)	DS411-T	Internet of Things	45 (3/per week)	2	40	10	50	20
	DS412-T	Data Warehouse	45 (3/per week)	2	40	10	50	20
	DS421-P	Lab Course based on DS411-T	45 (3/per week)	1.5	40	10	50	20
	DS422-P	Lab Course based on DS412-T	45 (3/per week)	1.5	40	10	50	20
Core Courses XI (DSC-II D)	DS413-T	Machine Learning	45 (3/per week)	2	40	10	50	20
	DS414-T	J-Query	45 (3/per week)	2	40	10	50	20
	DS423-P	Lab Course based on DS413-T	45 (3/per week)	1.5	40	10	50	20
	DS424-P	Lab Course based on DS414-T	45 (3/per week)	1.5	40	10	50	20
Core Courses XII (DSC-III D)	DS415-T	Advanced Python for Data Science	45 (3/per week)	2	40	10	50	20
	DS416-T	Data Visualization	45 (3/per week)	2	40	10	50	20
	DS425-P	Lab Course based on DS415-T	45 (3/per week)	1.5	40	10	50	20
	DS426-P	Lab Course based on DS416-T	45 (3/per week)	1.5	40	10	50	20

Skill Enhancement Course (SEC-II)	DS441	SEC-I(Any one of the skill to be choosen out of two) **C) Business Correspondence in Social Media** **D) Ethics in Data Science**	45 (3/per week)	**2**	**-**	**50**	**50**	**20**
Ability Enhancement Compulsory Courses(AEC C-IV)	DS431-T	Communication Skill in English- IV	45 (3/per week)	**3**	**40**	**10**	**50**	**20**
	DS432-T	Marathi/ Hindi/ Urdu/ Arabic (SL-IV) Student can opt for one of these languages	45 (3/per week)	**3**	**40**	**10**	**50**	**20**
Non Credit Course	DS471-T	Environment Studies	45 (3/per week)					
		45 Periods Per week		**29**	**560**	**190**	**750**	**300**
Total Credit for Semester I : 29 (Theory : 20 : Laboratory : 9)								

B.Sc. (Data Science)

Semester - III

Curriculum for semester III

Course Code: DS311-T	**Course Title: Cloud Computing**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

There are no prerequisites for attending this course

Learning Objectives

The primary objective of the "Cloud Computing" course is to provide students with a comprehensive understanding of cloud computing concepts, technologies, and practices. The course aims to equip students with the knowledge and skills necessary to design, deploy, and manage cloud-based solutions.

Learning Outcomes

After Successful completion of this course student will able to:

1.Understand Cloud Computing Fundamentals

2.Explore Cloud Service Providers

3.Cloud Infrastructure Design and Deployment

4.Security and Compliance in Cloud Computing

UNIT – I:

Cloud Computing Fundamentals: Introduction, Layers of Cloud Computing, Types of Cloud Computing: Public, Private, Hybrid cloud.

Cloud Services: Infrastructure as a Service(IAAS), Platform as a Service(PAAS), Software as a Service (SAAS).

Enabling Technologies, Cloud Computing Features, Cloud Computing platform, Cloud Computing Challenges, first movers in the cloud, when you use the cloud computing, Benefits, Limitations.

UNIT – II:

Cloud Computing Technologies and Applications: Cloud Computing: IT as a Service, Cloud Computing Security, Cloud Computing Model Application Methodology, Cloud Computing in Development/Test,

Key Enabling Technologies for Virtual Private Clouds: Virtual Private Clouds, Virtual Data Centers and Applications**.**

UNIT – III:

Role of Networks in Cloud Computing: Introduction, Cloud Deployment Models and the Network, Network Architectures for Clouds: Data Center Network & Data Center Interconnect Network, Foundation: Virtualization, Automation and Standards,

UNIT – IV:

Data-Intensive Technologies for Cloud Computing: Data-Intensive Computing Applications, Data-Parallelism, The "Data Gap",Characteristics of Data-Intensive Computing Systems: Processing Approach, Grid ComputingData-Intensive System Architectures: Google Map Reduce & Hadoop

Unit-V: Test and Tutorials

Textbook

1.Handbook of Cloud Computing, Editors: BorkoFurht • Armando Escalante, Springer

2.Cloud Computing A Practical Approach, Anthony T. Velte, Toby J.Velte, Robert Elsenpeter, McGraw Hill Education (India) Private Limited.

References:

1.Cloud Computing Bible , Barrie Sosinsky, WILAY India Pvt. Ltd

2.CLOUD COMPUTING, Miichael Miller, PEARSON Publication.

3.ClOUD COMPUTING Principles and Paradigms, RajkumarBuyya, James Broberg, AndrzehjGoscinski, WILAY India Pvt. Ltd.

4.Hybrid Cloud for DUMMIES, Judith Hurwitz, Marcia Kaufman, Dr. Fern Halper, Danies Kirsch, WILAY India Pvt. Ltd

Course Code: DS312-T	**Course Title: RDBMS**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

Basic Concepts of Database Management System

Learning Objectives

l. Understand the basic concepts of Relational Database Management System (RDBMS).

2. Learn to design and create relational database schema using SQL.

3. Explore the functionalities of RDBM Sand learn to implement them for data manipulation and, retrieval.

4. Understand the concepts or normalization and apply the mote laminate data

Improve data integrity.

Learning Outcomes

After Completion of the Course students will be able to
l. Design and create a relational database schema using SQL.
2. Implement various RDBMS functionalities such as data insertion, deletion, modification, and retrieval.
3. Demonstrated be ability to use SQL to write complex queries for data analysis and reporting.
4. Understand the principles of database normalization and apply them to ensure data integrity and optimize database performance.

UNIT – I:

Relational Model: CODD's Rue –Relational Data Model-Key-Integrity-Relational Algebra Operations Advantages and limitations Relational Calculus Domain Relational Calculus QBE.

UNIT – II:

Structure of Relational Database. Introduction to Relational Database Design-Objectives-Tools-Redundancy and Data Anomaly-Functional Dependency- Normalization INF-2NF-3NF-BCNF.Transaction Processing –Database Security.

UNIT – III:

SQL: Command Data types DDL-Selection,Projection,JoinandSet Operations Aggregate Functions
DML Modification-Truncation Constraints Sub query.

UNIT – IV:

PUSQL:Structure-Elements-OperatorsPrecedence-ControlStructure-IterativeControl-Cursors-Procedure-Function-Packages-ExceptionalHandling-Triggers.

Unit-V: Test and Tutorials

In addition to CIA, Tutorial,Seminars,Assignments&case studies arc Lobe given for building proficiency in the course. (Respective course in-charge should maintain therecordsforthe same).

Textbook

1.S.Sumathi .S. Esakkirajan,”FundamentalsofRelationalDatabaseManagementSystem".Springer internationalEdition2007

References:

1.Abraham Silberehatz,lHenryF.Korth,S.Sudarshan,''Database System Concepts'',McGrawHill2019,7th Edition.
2.AlexisLeon &MathewsLeon,"Fundamentals ofDBMS",Vijay Nicole Publications2014.
2nd Edition.

E-Resources

Course Code: DS313-T	**Course Title:** Introduction to Data Science
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

There are no prerequisites for attending this course

Learning Objectives

1. Understand and articulate the definition and scope of data science.
2. Explain basic statistical concepts and their relevance to data science.
3. Perform Exploratory Data Analysis (EDA) to understand data distributions, patterns, and trends.

Learning Outcomes

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

1. Students will be able to articulate a clear definition of data science, including its scope and applications in various domains.

2.Apply exploratory data analysis (EDA) techniques to analyze and interpret datasets, identifying patterns, trends, and potential outliers.

UNIT – I: Introduction

What is Data Science?, Components of Data Science, Big Data, Types of Big Data, Data Science vs Data Analytics, Data Scientist and its role, Data Analyst and its role, Datafication, Skills required for Data Science. Opportunities in Data Science.

UNIT – II: Statistics and mathematics for Data Science

Data Collection, Data Organization, Data Analysis, Data Interpretation, Data Presentation, Examples of Statistical Data. Descriptive Statistics: Characteristics of descriptive analysis, Examples of Descriptive Data, Measures of central tendency, mean, median, mode, measures of Data Spread, Relative Standing. Statistical Variables.

UNIT – III: Exploratory Data Analytics and Visualization

Exploratory Data Analysis (EDA) techniques- Histogram, Box Plot, Scatter Plots, Pair Plots, Corelationanalysis.Categorical plots, corelation plots, time series plots. Data collection, cleaning and processing.

UNIT – IV: Model Development and Evaluation

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search

Unit-V: Test and Tutorials

Textbook

1.Jojo Moolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.

2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.

3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013

4. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

References:

Course Code: DS314-T	**Course Title: Web Fundamental**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

There are no prerequisites for attending this course

Learning Objectives

1. Understand the basic concept and principle software web technologies, including HTML, CSS and Java Script.
2. Gain practical skills in creating response vend accessible web designs.
3. Learn how to validate web pages and follow web standards set by the W3C.
4. Develop proficiency in manipulating the Document Object Model(DOM) using Java Script.

Learning Outcomes

After Completion of the Course students will be able to

J. Develop functional and visually appealing web pages using HTML and CSS.

2. Design responsive web layouts that adapt to different devices and screen sizes.

3. -Implement client-side scripts using Java Script Lo add interactivity and dynamic behavior to web pages.

4. Validate and optimize web pages for accessibility, performance,and compliance with web standards.

UNIT – I: Introduction

1.Web Browsers: Introduction co web browsers, types or web browsers, how they work.

2.Web Servers: Introduction to web servers, types or web servers, how they work.

3.Client-side vs Server-side: Understanding The difference between client-side and server-side processing.

4.Web Standards: introduction to web standards, W3C,HTML validation, CSS validation.

5.HTML Syntax and Basic Tags: study be basic syntax of an HTML document, including the doc type declaration, opening and closing tags, and nesting of element. We will also explore fundamental HTML tags like <head>, <body>, <h1>- <h6>,<p>,<a>,and <img>.

6.Structure of an HTML Document:delve in to the standard structure or an HTML document, including the <! DOCTYPE>declaration, the <html>element, and the <head>and <body>sections .how to use comment sand the proper organization of elements within the document.

7.HTML Elements and Attributes: learn about the different types of HTML elements, including block-level and in linear elements. cover how to use attributes to provide additional information about an element, such as the 'src 'attribute for images or the 'hr attribute for links.

8.Semantic HTML: explore the importance of using semantic elements in HTMLS, such as <article>, <section>,<header>,<nav>,and<footer>,and how these elements can enhance .

9. HTMLS: study the new features and improvements introduced in llTML5,including multimedia elements like<video>and<audio>,new form input types and attributes, and Java Script APIs for advanced functionality.

10.Lists: learn how to create ordered and unordered list using the <ol> and <ul> elements,

11.Links and Navigation:study how to create different types of links using the <a> element, including internal, external, and anchor link ",as-well as-email and telephone links.

UNIT – II: CSS Fundamentals

1. Introduction to CSS:

Applying CSS: inline,internal, and external style sheets

Linking a CSS fi1e to an HTML document using the <link> element

2.Basic Selectors:

Element, class, and ID selectors, Universal and attribute selectors ,Grouping and chaining selectors Understanding selector specificity

3.Advanced Selectors and Combinators: Descendant,child, and sibling combinators.

Pseudo-classes:however,active,:visited,:first-child,:last-child,and:nth-childPseudo-elements:::before, ::after, and::first-letter

Attribute selectors with various matching patterns

4.Box Model: Basics Understanding the CSS box model (content, padding, border, margin) Setting width and height of elements Managing overflow and scrollbars

5. Box Model: Padding, Margin, and Border Setting padding, margin, and border properties Using short hand notation for padding, margin, and border Box-sizing property and its values (content-box, border-box) •

6. Layout and Positioning: Display Property

Understanding the display property (block, in Jinee, in line-b Jock) Using the display property to create layouts Controlling element visibility with display: none and visibility: hidden

7. Layout and Positioning: Floats and Positioning Creating multi-column layouts with float Clearing floats with the clear property Static, relative, absolute, and fixed positioning

8. Layout and Positioning: Flex box

Introduction to the CSS Flex system Defining a flex container and flex Hems

Controlling the direction, alignment, and order of flex items Handling flexible sizes and growing/shrinking of items

9. Layout and Positioning: CSS Grid Introduction to the CSS Grid layout system Defining a grid container and grid items setting upgrade columns, rows, and gaps Positioning grid items and controlling their size

10.Review and Best Practices

Review of key concept covered in the course Organizing and structuring CSS code

CSS naming conventions and methodologies (e.g., BEM) Tips for writing maintain able and efficient CSS

UNIT – III: Advanced HTML and CSS Techniques

1. Advanced HTML: Tables, forms, multimedia, accessibility, SEO.

2.Responsive Web Design: Understanding responsive, media queries, fluid grids,

Responsive images.

'-3.CSS3: Advanced CSS3 techniques, transition; animations, transforms, and gradients.

UNIT – IV: Javascript Fundamentals

1. Introduction to Java Script:Basic concepts, syntax, and usage.

2.Control Structures and Functions: Variables,data types, operators, control structures, functions, and arrays.

3. DOM Manipulation: Accessing and manipulating the Document Object Model (DOM) using JavaScript.

4. Events and Event Handling: Handling user events, event propagation, and delegation.

Unit-V: Test and Tutorials

In addition to CIA,Tutorial,Seminars,Assignments&case studies arc Lobe given for building proficiency in the course. (Respective course in-charge should maintain therecordsforthe same).

Textbook

1.WEBTECHNOLOGIES2010byUttamK.

2.Learning Web Design: A Beginner's Guide to HTML, CSS, Java Script ,and Web Graphics"51 Edition by Jennifer Niederst Robbins

3."Responsive Web Design with HTML5 and CSS" by Ben Frain

https://vdoc.pub/download/responsive-web-design-with-html5-and-css3-5vk0jcsnmd v0

References:

Course Code: DS315-T	**Course Title:** Python Programming Basics
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

There are no prerequisites for attending this course

Learning Objectives

1.Introduce students to the basic concepts of programming, including variables, data types, control structur functions.
2.Familiarize students with the syntax and structure of the Python programming language, including variabl types, and control statements.
3.Teach students how to write simple Python programs, covering input/output, arithmetic operations, and decision-making constructs.
4.Introduce fundamental data structures in Python, such as lists, dictionaries, and tuples, and how to work them.
5.Teach the creation and use of functions and modules to promote code reusability and organization.

Learning Outcomes

By the end of the course, students should be able to:
1.Write Basic Python Programs
2.Understand Python Syntax
3.Implement Data Structures
4.Develop Functions and Module

UNIT – I: Introduction to Python
What is Python?
History and Evolution of Python
Installing Python and Setting Up the Environment
Your First Python Program
Variables, Data Types, and Basic Input/Output

UNIT – II:
Control Structures: if Statements, Loop Statements
Functions and Modular Programming
Lists and Tuples

UNIT – III:
Dictionaries and Sets
File Input/Output (I/O)
Exception Handling

UNIT – IV:

Modules and Libraries
Working with Modules and Libraries
Object-Oriented Programming (OOP) in Python
Classes and Objects
Inheritance and Polymorphism

Unit-V: Test and Tutorials

Textbook

1. **"Python Crash Course" by Eric Matthes (for beginners)**
2. **"Python for Data Analysis" by Wes McKinney**

References:

Course Code: DS316-T	**Course Title: Data Communication Network**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

There are no prerequisites for attending this course

Learning Objectives

1.Define the basic concepts of data communication.

2.Explain the fundamental concepts of computer networks.

3.Describe the OSI and TCP/IP reference models.

4.Explore various methods of data transmission.

5.Identify and explain the roles of networking devices (routers, switches, hubs).

Learning Outcomes

After Successful Completion of this course student will able to understand

1.Understanding of Networking Concepts

2.Protocol Implementation

3.Network Design and Configuration

4.Wireless Networking Skills

UNIT – I:

Introduction:Data Communication System and its components, Computer network and its goals. Protocols, Standards, Standards Organizations,Data Flow, broadcast and point to point networks, Network topologies.

Data and Signals: Analog and Digital Data, Analog and Digital Signals, Periodic and Non periodic Signals, periodic analog signals, Sine Wave, Phase, Wavelength, Time and Frequency Domains, Composite Signals, Bandwidth, Digital Signals, Bit Rate, Bit Length, Digital Signal as a Composite Analog Signal, Transmission of Digital Signals. Transmission of impairment: Attenuation, Distortion, Noise.

Transmission Media: Guided Media: Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable, Unguided Media: Radio Waves, Microwaves, Infrared.

UNIT – II:

Digital Transmission: Line Coding, Line Coding Schemes, Block Coding, Scrambling, Pulse Code Modulation, Delta Modulation, Transmission modes: Parallel & Serial Transmission.

UNIT – III:

Analog Transmission: Aspects of Digital to Analog Conversion, Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, Quadrature Amplitude Modulation, Amplitude Modulation, Frequency Modulation, Phase Modulation.

UNIT – IV:

Multiplexing: Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing.

Switching: Circuit switching: Circuit switching networks switching concepts, Datagram networks, Virtual circuit networks, Routing in circuit switched networks, Packet switching principles, - Routing in packet switching,

Unit-V: Test and Tutorials

In addition to CIA ,Tutorial,Seminars,Assignments&case studies arc Lobe given for building proficiency in the course.(Respective course in-charge should maintain therecordsforthe same).

Textbook

1) Data Communication &Networking (Forouzan), Tata McGraw-Hill Education.

References:

1)Computer Networks and Internets-Douglas Comer, Prentice Hall
2) Computer Networks-Andrew Tanenbaum, Prentice Hall
3) William Stallings, Data and Computer Communications Fifth Edition, Prentice Hall of India, 1997.

Course Code: DS341-A	**Course Title: Entrepreneurship Development**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

There are no prerequisites for attending this course

Learning Objectives

1. Define and explain the concept of entrepreneurship, emphasizing its role in economic development and societal progress.

2. Develop the ability to recognize and evaluate entrepreneurial opportunities through market analysis, trend identification, and creative thinking.

3.Learn the importance of a well-structured business plan, including its components, financial projections, and strategic alignment.

Learning Outcomes

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

1.Clearly articulate the concept of entrepreneurship and its significance in various economic and social contexts.

2.Demonstrate the ability to identify and evaluate entrepreneurial opportunities by applying market analysis, creative thinking, and feasibility assessments.

3.Create a comprehensive business plan, including executive summaries, financial projections, and a well-defined value proposition.

4.Apply effective leadership and management skills in entrepreneurial settings, fostering teamwork, making informed decisions, and adapting to uncertainties.

UNIT – I: Introduction to Entrepreneurship

Definition and scope of entrepreneurship,Historical evolution of entrepreneurship,Importance of entrepreneurship in economic development,Role of entrepreneurs in society,Characteristics of successful entrepreneurs,Essential skills for entrepreneurs

dentifying and nurturing entrepreneurial qualities,Self-assessment for entrepreneurial potential,Small business entrepreneurship,Corporateentrepreneurship,Socialentrepreneurship,Technological entrepreneurship

UNIT – II: Opportunity Identification and Evaluation

Sources of entrepreneurial opportunities,Industry analysis and market trends,Spotting gaps and needs in the market,Innovation and creativity in opportunity identification,Techniques for idea generation,Feasibilityanalysis,Market research and validation,Lean startup principles,Developing a business model,Value proposition design,Prototyping and minimum viable roduct (MVP),Feedback and iteration

UNIT – III: Business Planning and Strategy

Importance of a business plan,Components of a business plan,Writing an executive summary,Financial projections and budgeting

Formulating a business strategy,SWOTanalysis,Competitive advantage and differentiation,Adapting strategies to market changes

Financial planning and forecasting,Funding options for startups,Managing cash flow,Financial risk assessment,Assessment: Draft Business Plan Submission

UNIT – IV: Entrepreneurial Leadership and Growth

Leadership styles for entrepreneurs,Team building and management,Decision-making under uncertainty,Handling failures and setbacks,Scaling a startup,Franchising and licensing,Partnerships and collaborations,Global expansion Ethical considerations in entrepreneurship,Corporate social responsibility (CSR),Sustainable business practices Balancing profit and social impact learning.

Unit-V: Test and Tutorials

Textbook

1."The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries

2."Zero to One: Notes on Startups, or How to Build the Future" by Peter Thiel and Blake Masters

3."The E-Myth Revisited: Why Most Small Businesses Don't Work and What to Do About It" by Michael E. Gerber

4."The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail" by Clayton M. Christensen

References:

Course Code: DS341-B	**Course Title: Cyber Security**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

There are no prerequisites for attending this course

Learning Objectives

Course Objectives:

1. Understanding Cyber Threat Landscape
2. Foundations of Cybersecurity
3. Security Architecture and Design
4. Network Security

Learning Outcomes

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

1. Identify and analyze various types of cyber threats and attacks.
2. Apply foundational principles of cybersecurity to assess and enhance system security.
3. Evaluate and design secure architectures for systems and networks.
4. Implement effective network security measures and countermeasures.

UNIT – I:

Basic Concepts of Technology and Law, Understanding the Technology of Internet, Scope of Cyber Laws , Cyber Jurisprudence.
Law of Digital Contracts The Essence of Digital Contracts. The System of Digital Signatures the Role and Function of Certifying Authorities. E-Governance Cyber Crimes and Cyber Laws

UNIT – II:

Introduction: Cyber Security and its problem-Intervention Strategies: Redundancy, Diversity and Autarchy. The Ethics of Computer Security

UNIT – III:

Intellectual Property &Security : Piracy, Insider Threat.
Defensive Information; Computer Network Security, Computer Break-Ins, Cryptographic Techniques

UNIT – IV:

Information Technology Act 2000 Cyber Law

Issues in E-Business Management Major issues in Cyber Evidence Management Cyber Law Compliancy Audit.

Unit-V: Test and Tutorials

In addition to CIA,Tutorial,Seminars,Assignments&case studies arc Lobe given for building proficiency in the course. (Respective course in-charge should maintain therecordsforthe same).

Textbook

1. Godbole,“ Information Systems Security”, Willey
2. Mark F Grady, FransescoParisi, “The Law and Economics of Cyber Security”, Cambridge University Press, 2006
3. Merkov, Breithaupt,“ Information Security”, Pearson Education
4. Yadav, “Foundations of Information Technology”, New Age, Delhi
5. Schou, Shoemaker, “ Information Assurance for the Enterprise”, Tata McGraw Hill
6. Sood,“Cyber Laws Simplified”, Mc Graw Hill
7. Furnell, “Computer Insecurity”, Springer

References:

Course Code:DS321-P	**Course Title :**Practical based on Lab Course based on DS311-T

Total Credit: 1.5	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 Periods per week	
Experiments to be carried out based on the course DS311-T Note : Implement any three programs from each unit.	

Course Code: DS322-P	**Course Title :**Practical based on Lab Course based on DS312-T
Total Credit: 1.5	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 Periods per week	
Experiments to be carried out based on the course DS312-T Note : Implement any three programs from each unit.	

Course Code: DS323-P	**Course Title :**Practical based on Lab Course based on DS313-T
Total Credit: 1.5	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 Periods per week	
Sample List of experiments to be carried out based on the course DS313-T Note : Implement any three programs from each unit.	

Course Code: DS324-P	**Course Title :**Practical based on Lab Course based on DS314-T
Total Credit: 1.5	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 Periods per week	
Experiments to be carried out based on the course DS314-T Note : Implement any three programs from each unit.	

Course Code: DS325-P	**Course Title :**Practical based on Lab Course based on DS315-T
Total Credit: 1.5	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 Periods per week	
Experiments to be carried out based on the course DS315-T Note : Implement any three programs from each unit.	

Course Code: DS326-P	**Course Title :**Practical based on Lab Course based on DS316-T
Total Credit: 1.5	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 Periods per week	
Experiments to be carried out based on the course DS316-T Note : Implement any three programs from each unit.	

B.Sc. (Data Science)

Semester - IV

Curriculum for semester IV

Course Code: DS411-T	Course Title: Internet of Things

Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

There are no prerequisites for attending this course

Learning Objectives

1.Understanding IoT Fundamentals

2.IoT Architecture and Technologies

3. Security in IoT

4. IoT Data Management and Analytics

Learning Outcomes

By the end of the course, participants will be able to:

1. Demonstrate a Solid Understanding of IoT Concepts

2. Analyze IoT Architecture and Technologies

3. Implement Security Measures in IoT

4. Manage and Analyze IoT Data

UNIT – I: Fundamentals of IOT

Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M.

UNIT – II: Sensors Networks

Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node,Networking Nodes, WSN and IoT.

UNIT – III: Wireless Technologies for IOT

WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols

UNIT – IV: Data Handling& Analytics and Applications of IoT

Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications

Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.

Unit-V: Test and Tutorials

Textbook

1. HakimaChaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications
3. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014.
4. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media,2016.
5. Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016

References:

1. Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press

3. https://onlinecourses.nptel.ac.in/noc17_cs22/course

4. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html.

Course Code: DS412-T	**Course Title: Data Warehouse**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

1. Basic RDBMS Course DS -T
2. Fundamentals of SQL

Learning Objectives

1.To understand the fundamental concepts and terminology of data warehousing.
2. To learn the techniques for data modeling and designing a data warehouse.
3.To gain practical knowledge of the ETL process and its various components.
4.To gain an understanding of Business Intelligence (BI) and its importance in decision making

Learning Outcomes

After Completion of the Course students will be able to

1. Design and implement a data warehouse using appropriate modeling techniques.
2. Perform ETL processes and loading data into a data warehouse.
3. Perform OLAP and multidimensional analysis to support decision making.
4. Create visualizations and reports using BI tools.

UNIT – I: Introduction to Data Warehousing

Definition of Data Warehousing, Key concepts and terminology Overview of Data Warehousing Architecture ,Advantages and disadvantages of Data.

UNIT – II: Data Modeling and Design

Conceptual, logical, and physical modeling Star Schema and Snowflake Schema Normalization and denormalization Data warehouse design process.

UNIT – III: ETL Processes

Extract, Transform, and Load (ETL) process, Data extraction techniques, Data transformation techniques, Data loading techniques.

UNIT – IV: Business Intelligence and Reporting

Introduction to Business Intelligence(BI), Types of BI systems, OLAP and multidimensional analysis, Data visualization and reporting tools.

Unit-V: Test and Tutorials

Addition to CIA Tutorial, Seminars, Assignments & case studies are to be given for building proficiency in the course.(Respective course in-charge should maintain the records for the same).

Textbook

1."Data Warehousing Fundamentals for IT Professionals "by PaulrajPonniah

2. "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling" by Ralph Kimball and MargyRoss

3. "Data Ware housing, Data Mining, and OLAP" by Alex Berson and Stephen J. Smith.

4. "Data Warehousing and Business Intelligence: Concepts,Methodologies, Tools, and Applications "edited by Jorge E. Galvan-Tejada, et al.

5. "Business Intelligence Guidebook :From Data Integration to Analytics "by Rick Sherman.

References:
1."Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals "by PaulrajPonniah
2."Building the Data Warehouse "byW.H.Inmon
3."MasteringDataWarehouseAggregates:SolutionsforStarSchemaPerformance"byChristopherAdamson
4."Data Warehouse Design: Modern Principles and Methodologies "by Golfarelli and Rizzi
5."DataWarehousing :Using the Wal-MartModel "by Paul Westerman
6."Data Warehousing with MySQL "by AlexDavies
7."Data Warehousing :Architecture and Implementation "by Mark W. Humphries.

Course Code: DS413-T	**Course Title: Machine Learning**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

There are no prerequisites for attending this course

Learning Objectives

1.Develop a strong understanding of the fundamental concepts and terminologies associated with machine learning.

2.Acquire proficiency in using programming languages, especially Python, for implementing machine learning algorithms.

Develop hands-on coding skills using popular machine learning libraries such as scikit-learn and TensorFlow.

3.Learn techniques for handling missing data, scaling features, and encoding categorical variables.

4.Master the concepts and applications of linear regression, logistic regression, decision trees, and ensemble methods.

Understand model evaluation metrics and their significance

Learning Outcomes

By the end of the course, students should be able to:

1.Students will demonstrate proficiency in writing and implementing machine learning algorithms in Python.

2.Students will be able to preprocess and transform data effectively, making it suitable for machine learning tasks.

UNIT – I: Introduction to Machine Learning

What is Machine Learning?, Machine Learning in real life, Types of learning- Supervised, Unsupervised, reinforcement, Applications of Machine learning in Data Science. Data Preprocessing and feature engineering- Handling missing data,feature scaling and normalization, one hot encoding and categorical variable handling, feature extraction and transformation.

UNIT – II: Supervised and Unsupervised Learning Algorithms

Linear Regression Single variable,Linear Regression with multiple variables,Gradient Descent and Cost function, Training and Testing Data,Logistic regression for Binary classification problem, Logistic regression for multiclass classification, Decision Tree, Support Vector Machine, Random Forest, K Fold Cross Validation, Naive Bayes,K-Means clustering,KNN Classification

UNIT – III:Hyper Parameter Tuning

Hyper Parameter Tuning, GridSearchCV, L1 and L2 Regularization, Principal Component Analysis(PCA),Bias Variance, model evaluation matrix and techniques.

UNIT – IV: Reinforcement Learning

Basics of Reinforcement learning, The Temporal difference learning (Predicting the value function), Q- Learning, Introducing the gym frozen environment.

Unit-V: Test and Tutorials

Textbook

1. "Introduction to Machine Learning" by Alpaydin, Ethem
2. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy
3. "Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto

References:

Course Code: DS414-T	**Course Title: Jquery**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	
Prerequisites: There are no prerequisites for attending this course	

Learning Objectives

1.Understand the role of jQuery in web development.

2.Explore advanced jQuery topics such as AJAX and working with plugins.

3.Introduce the principles of responsive web design

Learning Outcomes

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

1.Demonstrate a clear understanding of the role of jQuery in web development.

2.Write jQuery code to select and manipulate DOM elements.

3.Implement AJAX requests and integrate jQuery plugins into web projects.

tices.

UNIT – I:

Overview of Web Development Technologies

Understanding client-side vs. server-side scripting

Evolution of JavaScript and its role in web development

Introduction to jQuery

Origins and history of jQuery

Advantages and features of jQuery

Setting Up jQuery

Downloading and linking jQuery library

Integration with HTML documents

Basic jQuery Syntax

Selectors and filters

UNIT – II:

DOM manipulation using jQuery

Handling Events with jQuery

Event binding and delegation

Commonly used events in jQuery

jQuery Effects and Animations

Creating animations

Applying visual effects to elements

jQuery AJAX

Understanding asynchronous communication

Performing AJAX requests with jQuery

UNIT – III:

Working with jQuery Plugins

Introduction to plugins and their importance
Integration and implementation of jQuery plugins
Overview of jQuery UI library
Creating interactive user interfaces with UI widgets

Data Manipulation with jQuery

Retrieving and manipulating data
Working with JSON in jQuery

UNIT – IV:

Responsive Web Design with jQuery

Introduction to Responsive Web Design
Understanding the need for responsiveness
Overview of media queries

jQuery and CSS Manipulation

Dynamically modifying CSS properties
Implementing responsive design with jQuery

Cross-Browser Compatibility

Dealing with browser inconsistencies
Writing cross-browser compatible jQuery code

Mobile-Friendly Development

Touch events and gestures in jQuery
Adapting jQuery for mobile devices

Unit-V: Test and Tutorials

Textbook

1. "jQuery in Action" by Bear Bibeault and Yehuda Katz
2. "Learning jQuery: A Hands-on Guide to Building Rich Interactive Web Front Ends" by Ralph Steyer
3. "jQuery Pocket Reference" by David Flanagan

References:

Course Code: DS415-T	**Course Title: Advance python for Data Science**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

There are no prerequisites for attending this course

Learning Objectives

1.Introduce students to the basic concepts of programming, including variables, data types, control structu
functions.
2.Familiarize students with the syntax and structure of the Python programming language, including variabl
types, and control statements.
3.Teach students how to write simple Python programs, covering input/output, arithmetic operations, and
decision-making constructs.
4.Introduce fundamental data structures in Python, such as lists, dictionaries, and tuples, and how to work
them.
5.Teach the creation and use of functions and modules to promote code reusability and organization.

Learning Outcomes

By the end of the course, students should be able to:
1.Write Basic Python Programs
2.Understand Python Syntax
3.Implement Data Structures
4.Develop Functions and Module

UNIT – I:

Advanced Data Types (e.g., sets, dictionaries, namedtuples)
List Comprehensions and Generator Expressions
Decorators and Metaprogramming
Context Managers and the `with` Statement
Iterators and Generators

UNIT – II:

Functional Programming in Python
Concurrency and Parallelism (e.g., multiprocessing, threading)
Profiling and Optimization Techniques
Regular Expressions in Python
Advanced Python Standard Library Module

UNIT – III:

Object-Oriented Programming and Design Patterns
Review of OOP Principles in Python
Inheritance and Polymorphism
Design Patterns (e.g., Singleton, Factory, Observer)
Building Python Classes and Modules
Exception Handling and Custom Exception Classes
Advanced Topics in Object-Oriented Programming
Pythonic Design and Code Patterns
Testing and Test-Driven Development (TDD)
Introduction to Code Documentation (e.g., Docstrings)

UNIT – IV:

Python Web Development and Data Science
Web Development Frameworks (e.g., Flask, Django)
Building RESTful APIs with Python
Database Integration and ORMs
Web Security and Authentication
Data Manipulation with NumPy and Pandas
Data Visualization with Matplotlib and Seaborn
Machine Learning with Scikit-Learn

Unit-V: Test and Tutorials

Textbook

1."Fluent Python" by Luciano Ramalho

2."Python Crash Course" by Eric Matthes (for beginners)

3."Python for Data Analysis" by Wes McKinney

References:

Course Code: DS416-T	**Course Title: Data Visualization**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

1. Basic understanding of statistics and Data Analysis Concepts
2. Familiarity with spreadsheet software
3. Basic Programming Knowledge

Learning Objectives

1. Understanding the fundamental principles and techniques of data visualization
2. Gain proficiency in selecting appropriate visualization techniques for different types of data
3. Develop skills in creating visually appealing and effective data visualizations
4. Learn to design interactive and engaging visualizations to facilitate data exploration.
5. apply data visualization concepts to real world case studies and datasets

Learning Outcomes

By the end of the course student should able to:

1.Demonstrate a Comprehensive understanding of Data Visualization Principles and Techniques.

2. Evaluate and select appropriate visualization techniques based on data types and objectives.

3. Design and create visually compelling and informative data visualizations.

4. Develop interactive visualization to facilitate data exploration and user engagement.

5. Apply data visualization skills to analyze and present complex datasets effectively.

UNIT – I:

Introduction to Data Visualization, Definition and importance of Data Visualization, Types of Data Visualization Techniques, overview of data visualization tools and software, Principles of effective Data visualization, Gestalt principles and visual perception, Color theory and best practices, Layout and composition guidelines, Data storytelling and narrative techniques.

UNIT – II:

Data Types and Visualization techniques- Visualizing numerical data, line chart, bar chart scatter plots etc, visualizing categorical data: pie chart, stacked bar chart, treemapsetc, visualizing temporal data: time series plots, heatmaps, calendars etc , visualizing spatial data: maps, choloropeth maps, cartograms etc. Interactive Data Visualization: Introduction to interactive visualization tools, adding interactive using tooltips, filters and selections, Creating interactive dashboard and exploratory visualizations, Designing for user engagement and ease of use.

UNIT – III:

Advanced Data Visualization Techniques- Network visualization and graph based data, Hierarchical and tree based visualizations, 3D and multidimensional visualizations, Geospatial and Geovisualization Techniques, Data Visualization and Story Telling- Communicating insights through effective data visualizations, designing visual narratives and story arcs, integrating text, annotations into visualization, Presenting Data Visualizations to diverse audiences.

UNIT – IV:

Data Visualization Ethics and Best Practices, Ethical Consideration in Data Visualization, Data Accuracy, Integrity and representation, Avoiding bias and misleading visualizations, responsible data storytelling and interpretation.

Unit-V: Test and Tutorials

Textbook

1. "Data Visualization: A Practical Guide" by Andy kirk, SAGE Publications Ltd.2021

References:

Course Code: DS441-A	**Course Title: Business Correspondence in Social Media**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

Fundamentals of Computer

Learning Objectives

The primary objective of the course "Business Correspondence in Social Media" is to enable participants to develop a thorough understanding of effective and professional communication strategies within the context of social media platforms. Through theoretical insights, practical applications, and real-world case studies, students will acquire the skills necessary to navigate the dynamic landscape of digital communication in the business environment

Learning Outcomes

By the end of the course, participants will be able to:

1.Understand the Dynamics of Social Media Platforms

2.Demonstrate Social Media Etiquette and Professionalism:

3.Craft Various Types of Business Correspondence in Social Media:

4.Create an Effective Social Media Content Strategy:

5.Manage Online Reputation:

UNIT – I:

Overview of social media platforms,Importance of effective business communication in the digital age,Key differences between traditional and social media correspondence,Understanding online etiquette,Building a professional online presence, Best practices for engaging with colleagues, clients, and customers,Introduction to various types of social media messages (tweets, posts, messages),Crafting concise and impactful messages,Adapting communication style for different platforms

UNIT – II:

Identifying target audiences,Content planning and scheduling,Creating engaging and shareable content,Importance of online reputation in business,Strategies for handling negative comments and feedback,Building and maintaining a positive online brand image.

UNIT – III:

Recognizing and addressing social media crises,Developing a crisis communication plan,Case studies of successful and unsuccessful crisis management,Overview of legal aspects of social media communication,Privacy issues and data protection

Ethical considerations in online business correspondence,Introduction to analytics tools,Measuring the impact of social media communication,Using data to refine communication strategies

UNIT – IV:

Tools for collaborative online work,Strategies for effective team communication,Managing remote teams through social media,Emerging technologies in social media,Anticipating and adapting to future changes,Continuous learning and professional development in digital communication

Unit-V: Test and Tutorials

Textbook

1. "The Art of Digital Business Communication"** by [Author]
2. "Engage: The Complete Guide for Brands and Businesses to Build, Cultivate, and Measure Success in the New Web"** by Brian Solis
3. "Social Media ROI: Managing and Measuring Social Media Efforts in Your Organization"** by Olivier Blanchard
4. "The Thank You Economy"** by Gary Vaynerchuk

References:

Course Code: DS441-B	**Course Title: Ethics in Data Science**
Total Credit: 2	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 per week (45 Minutes each)	

Prerequisites:

There are no prerequisites for attending this course

Learning Objectives

1.Define and articulate the ethical principles that underlie data science practices.

2. Develop the ability to identify ethical dilemmas in data science projects.

3. Understand and navigate legal and regulatory frameworks relevant to data science.

4. Critically evaluate methods for responsible data collection and storage.

Learning Outcomes

By the end of the course, participants will be able to:

1. Articulate Ethical Principles

2. Navigate Ethical Dilemmas

3. Comply with Legal and Regulatory Standards

4. Implement Responsible Data Practices

UNIT – I: Introduction to Ethics in Data Science

Overview of Data Science Ethics:Definition of ethics in the context of data science, Importance of ethical considerations in data-driven decision-making,Historical Cases and Ethical Failures:Examining historical cases of ethical lapses in data science,Learning from past mistakes and understanding the consequences.Frameworks for Ethical Decision Making:Introduction to ethical decision-making frameworks,Application of frameworks to real-world data science scenarios.Professional Codes of Conduct:Reviewing established codes of conduct in data science,Understanding the responsibilities and expectations of data

UNIT – II: Privacy and Data Protection

Fundamentals of Privacy:Defining privacy in the digital age,Privacy as a human right.Legal and Regulatory Landscape: Overview of data protection laws (e.g., GDPR, CCPA),Implications for data scientists and organizations.Ethical Data Collection and Handling:Principles of ethical data collection,Minimizing data collection, ensuring informed consent.Privacy-Preserving Techniques:Introduction to techniques such as anonymization and differential privacy, Balancing data utility and privacy.

UNIT – III: Bias and Fairness in Data Science

Understanding Bias in Data:Sources of bias in datasets and algorithms,Recognizing unintended consequences.Fairness and Discrimination:Defining fairness in the context of data science,Identifying and mitigating discriminatory impacts.AlgorithmicAccountability:Exploring challenges in holding algorithms accountable,Developing transparent and explainable models.

Addressing Bias in Machine Learning Models:Techniques for detecting and mitigating bias in machine learning models.Case studies on successful bias reduction strategies.

UNIT – IV: Responsible AI and Emerging ethical issues

Responsible AI Development:Principles of responsible AI development,Incorporating ethical considerations into the AI lifecycle.Ethics in Big Data and IoT:Ethical challenges posed by large-scale data and IoTdevices,Balancing innovation with ethical responsibility.Social Impacts of Data Science:Examining the societal implications of data science,Ethical considerations in areas such as healthcare, finance, and social media.Future Trends and Ethical Considerations:Anticipating ethical challenges in emerging technologies (e.g., AI advancements, quantum computing),Preparing for evolving ethical landscapes.

Unit-V: Test and Tutorials
Textbook 1. "Ethics of Big Data" by Kord Davis and Doug Patterson 2. "Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy" by Cathy O'Neil 3. "Data and Goliath: The Hidden Battles to Collect Your Data and Control Your World" by Bruce Schneier 4. "Fairness and Abstraction in Sociotechnical Systems" by Ruha Benjamin
References:

Course Code: DS421-P	**Course Title :**Practical based on Lab Course based on DS411-T
Total Credit: 1.5	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 Periods per week	
Experiments to be carried out based on the course DS-411T. Note : Implement any three programs from each unit.	

Course Code: DS422-P	**Course Title :**Practical based on Lab Course based on DS-412T
Total Credit: 1.5	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 Periods per week	
Experiments to be carried out based on the course DS-412T . Note : Implement any three programs from each unit.	

Course Code: DS423-P	**Course Title :**Practical based on Lab Course based on DS413-T
Total Credit: 1.5	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 Periods per week	
Experiments to be carried out based on the course DS413-T Note : Implement any three programs from each unit.	

Course Code: DS424-P	**Course Title :**Practical based on Lab Course based on DS414-T
Total Credit: 1.5	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 Periods per week	
Experiments to be carried out based on the course DS-414T. Note : Implement any three programs from each unit.	

Course Code: DS425-P	**Course Title :**Practical based on Lab Course based on DS415-T
Total Credit: 1.5	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 Periods per week	
Experiments to be carried out based on the course DS-415T. Note : Implement any three programs from each unit.	

Course Code: DS426-P	**Course Title :**Practical based on Lab Course based on DS416-T
Total Credit: 1.5	Marks: 50 (SEE: 40 + IA: 10)
Periods: 3 Periods per week	
Experiments to be carried out based on the course DS-416T. Note : Implement any three programs from each unit.	

Pattern of Question Paper (Theory)

B.Sc. (Data Science)

Semester ----------

Course Code ----------

Paper Number ----------

Title of Paper ----------

Time : 1.30 Hrs. **Max Marks: 40**

N.B.

1. Attempt All Questions.
2. All questions carry equal marks.
3. Illustrate your answer with suitable labeled diagram.

Q.1. Multiple choice questions / Fill In the Blanks / Terms / Definition / One Line Answer questions. (10 Marks)

1)
2)
3)
4)
5)
6)
7)
8)
9)
10)

Q.2. Long answer question. (10 Marks)

OR

Long Answer question

Q.3. Long answer question (10 Marks)

OR

Short answer questions

a)
b)

Q.4. Short Notes on any TWO of the following:- (10 Marks)

a)
b)
c)
d)

Pattern of Question Paper(Practical)

B.Sc.(Data Science) Semester -III

Course Code ----------

Paper Number ----------

Title Of Paper ----------

Time :3:00 Hrs. **Max Marks : 50 (UA:40 + IA:10)**

N.B.

1. Attempt All Questions.
2. All questions carry equal marks.
3. Illustrate your answer with suitable labelled diagram

Q:1 Practical based on DS-321 P (50 Marks)

a) Question / Experiment– 30 Marks
b) Viva / Oral – 10 Marks (Internal Marks)
c) Record book : 10 Marks