SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS),

Reaccredited with 'B++' Grade by NAAC

Affiliated to Periyar University

Fairlands, SALEM- 636 016.

OUTCOME BASED SYLLABUS

PG & RESEARCH DEPARTMENT OF COMPUTER SCIENCE

M.Sc. DATA SCIENCE

(Self-Financing)

(For the students admitted in 2024-2025 onwards)

(I & II Semester)

PROGRAMME OUTCOMES

PO1	**Problem Solving Skill** Apply knowledge of Management theories and Human Resource practices to solve business problems through Research in Global Context
PO2	**Decision Making Skill** Foster analytical and critical thinking abilities for data-based decision-making.
PO3	**Individual and Team Leadership Skill** Capability to lead themselves and the team to achieve organizational goals.
PO4	**Employability Skill** Inculcate contemporary business practices to enhance employability skills in the competitive environment.
PO5	**Entrepreneurial Skill** Equip with skills and competencies to become an entrepreneur

SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS), SALEM-16

PG & RESEARCH DEPARTMENT OF COMPUTER SCIENCE

M.Sc. DATA SCIENCE

PROGRAMME STRUCTURE UNDER CBCS

(For the students admitted in 2024-2025 onwards)

Total Credits: 92 + Extra Credits (Maximum 16)

SEMESTER – I				
Course	**Course Title**	**Code**	**Hrs./ Week**	**Credits**
Core Course- I	Fundamentals of Data Science	24PDSCC1	6	5
Core Course - II	Mathematics for Data Science	24PDSCC2	7	5
Core Course- III	Statistics-1	24PDSCC3	7	4
Elective – I	Internet of Things / Research Methodology for Computer Science	24PDSDSEC1A / 24PDSDSEC1B	5	3
Elective -II	Web Programming/ Java Programming	24PDSDSEC2A/ 24PDSDSEC2B	5(3L+2P)	3
Total			**30**	**20**
Extra Skills	** Articulation and Idea Fixation* ** Physical Fitness Practice* ** Productive Preparation for UGC NET/SET/JRF/TRB Competitive Examinations-I (24PDSSC1)(Self-Study - 1 Extra Credit)* ** Extra credits are given for extra skills and courses qualified in MOOC/NPTEL*			

SEMESTER – II				
Course	**Course Title**	**Code**	**Hrs./Week**	**Credits**
Core Course – IV	Python Programming	24PDSCC4	5	5
Core Course - V	Statistics-II	24PDSCC5	5	4
Core Practical - 1	Python Programming - Practical	24PDSCCQ1	6	5
Elective – III	Information Security and Ethics / Software Engineering for Data Science	24PDSDSEC3A / 24PDSDSEC3B	4	3
Elective - IV	Optimization Techniques / Applied Probability	24PDSDSEC4A/ 24PDSDSEC4B	4	3
EDC	Fundamentals of Computers and Communications	24PDSEDC1	4	2
Part - IV	Human Rights	24PHRSC	2	1
Total			**30**	**23**
Extra Skills	** Articulation and Idea Fixation* ** Physical Fitness Practice* ** Productive Preparation for UGC NET/SET/JRF/TRB Competitive Examinations-II (24PDSSC2)(Self-Study - 1 Extra Credit)* ** Extra credits are given for extra skills and courses qualified in MOOC/NPTEL* ** Extension Activity (1 Extra Credit)* ** Internship / Industrial Visit During Summer Vacation*			

Programme Title	:	**M.Sc. Data Science**
Course Title	:	**CORE COURSE-I: FUNDAMENTALS OF DATA SCIENCE**
Course Code	:	**24PDSCC1** **Hours/Week:6**
Semester	:	**I** **Credit:5**

COURSE OBJECTIVES:

To introduce the concepts and fundamentals of data science and its life cycle

COURSE OUTCOME:

On Completion of the Course the students will be able to

CO1: Understand the types of data and analytics, data science process, and its life cycle.

CO2: Apply math in data science

CO3: Analyze the various data intensive operations and tools

CO4: Evaluate the tools and methods for analyzing the data

CO5: Investigate the recent potential applications and development of data science with real time case studies

SYLLABUS

Unit – I: **Hours: 16**

Introduction of Data Science: Data Science - Data Science Venn diagram - Basic Terminology – Data Science Case Studies- Types of Data – Levels of data- Types of Data Analytics - Descriptive Analytics - Diagnostic Analytics- Predictive Analytics- Prescriptive Analytics- Five Steps of Data Science.

Unit – II: **Hours:20**

Mathematical Preliminaries - Basic Maths – Mathematics as discipline – Basic Symbols and terminology –Linear algebra - Basic Probability – Definitions- Probability – Bayesian vs frequentist – Compound events – Conditional probability – Rules of probability.

Unit – III: **Hours: 18**

Data Mining and Data Warehousing **-** Introduction to Data Warehousing – Design consideration of Data Warehouse - Data Loading Process – Case Study – Data Mining – Data Mining techniques – Tools and platforms – Case study.

Unit - IV: **Hours: 18**

Visualizing Data - Exploratory Data Analysis – Developing the visual aesthetic – Chart types – Great Visualizations – Reading graphs – Interactive visualizations.

Unit - V: **Hours: 18**

Data Science – Recent Trends **-** Applications of Data Science, recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

BOOKS FOR STUDY:

1. Ozdemir, Sinan. Principles of Data Science. Packt Publishing Ltd, 2016. (Unit 1- Chapter 1,2,3 Unit 2 – Chapters 4, 5)

2. Maheshwari, Anil." Data analytics made accessible". Seattle: Amazon Digital Services, 2nd edition (2023). (Unit 3 – Chapters 3, 4)

3. Skiena, Steven S. The Data Science Design Manual. Springer, 2017. (Unit 4- Chapter 6)

BOOKS FOR REFERENCE:

1. Hadrien Jean. Education, C. (2023). Data Science. Certybox Education.

2. Pierson, Lillian. Data Science for dummies. John Wiley & Sons, 2021.

3. Grus, Joel. Data Science from Scratch: First principles with python. O'Reilly Media, 2019.

4. Blum, Avrim, John Hopcroft, and Ravindran Kannan. Foundations of Data Science. Cambridge University Press, 2020.

WEB RESOURCES :

1. https://www.analyticsvidhya.com/
2. https://www.simplilearn.com
3. https://www.ibm.com/in-en/topics/data-science
4. https://www.mygreatlearning.com/blog/what-is-data-science/

Mapping of COs with POs:

CO/ PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	3	2	2	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	2	3	3
Weightage of course contributed to each PO	15	10	12	15	15

Strong – 3   **Medium – 2**   **Low - 1**

Programme Title : **M.Sc. Data Science**

Course Title : **CORE COURSE -II: MATHEMATICS FOR DATA SCIENCE**

Course Code : **24PDSCC2**   **Hours/Week:7**

Semester : **I**   **Credit:5**

COURSE OBJECTIVES:

To build the mathematical background necessary to understand and implement in data science practical/research work.

COURSE OUTCOME:

On Completion of the Course the students will be able to

CO1: Demonstrate understanding of basic mathematical concepts in data science, relating to linear algebra

CO2: Describe properties of linear systems using vectors, perform and matrix operations.

CO3: Describe and compute orthogonality and determinants

CO4: Solve linear differential equations

CO5: Understand and apply the concept of Linear transformations

SYLLABUS

UNIT-I   **Hours: 15**

Vectors and Matrices **-** Vectors and Linear Combinations-Lengths and Angles from Dot Products-Matrices and Their Column Spaces-Matrix Multiplication AB and CR -Solving Linear Equations $Ax = b$-Elimination and Back Substitution-Elimination Matrices and Inverse Matrices-Matrix Computations and $A = LU$-Permutations and Transposes.

UNIT-II: **Hours: 22**

The Four Fundamental Subspaces **-** Vector Spaces and Subspaces-Computing the Nullspace by Elimination: $A = CR$- The Complete Solution to $Ax = b$- Independence, Basis, and Dimension-Dimensions of the Four Subspaces–Introduction to Partial Differential Equations.

UNIT-III: **Hours: 22**

Orthogonality **-** Orthogonality of Vectors and Subspaces-Projections onto Lines and Subspaces-Least Squares Approximations-Orthonormal Bases and Gram-Schmidt-The Pseudoinverse of a Matrix Determinants – 3 by 3 Determinants and Cofactors-Computing and Using Determinants-Areas and Volumes by Determinants.

UNIT-IV : <div align="right">**Hours: 23**</div>

Eigenvalues and Eigenvectors-Introduction to Eigenvalues : $Ax = \lambda x$ - Diagonalizing a Matrix-Symmetric Positive Definite Matrices-Complex Numbers and Vectors and Matrices-Solving Linear Differential Equations

UNIT-V: <div align="right">**Hours: 23**</div>

The Singular Value Decomposition (SVD)-Singular Values and Singular Vectors-Image Processing by Linear Algebra-Principal Component Analysis (PCA by the SVD) - Linear Transformations-The Idea of a Linear Transformation-The Matrix of a LinearTransformation-The Search for a Good Basis.

BOOK FOR STUDY

1.Gilbert Strang, Introduction to Linear Algebra, Wellesley - Cambridge Press, Sixth Edition, 2023.

BOOKS FOR REFERENCE

1. David Lay, Steven Lay, Judi McDonald, Linear Algebra and Its Applications 5th Edition, Pearsons.

2. Sheldon Axler, Linear Algebra Done Right (UndergraduateTexts in Mathematics) 3rd Edition, Springer, 2015 Edition

3. Jim Hefferon, Linear Algebra, Fourth edition

4. Jeff M Philips, Mathematical Foundations for Data Analysis

WEB RESOURCE :

- https://joshua.smcvt.edu/linearalgebra/

Mapping of COs with POs:

CO/ PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	3	3	2	3	3
CO3	3	2	3	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3
Weightage of course contributed to each PO	15	13	11	15	15

<div align="center">**Strong – 3   Medium – 2   Low - 1**</div>

Programme Title : **M.Sc. Data Science**

Course Title : **CORE COURSE -III: STATISTICS-1**

Course Code : **24PDSCC3** Hours/Week:7

Semester : **I** Credit:4

COURSE OBJECTIVES:

To develop knowledge and understand fundamental concepts in probability and statistics.

COURSE OUTCOME:

On Completion of the Course the students will be able to

CO1: Organize, manage and present data.

CO2: Understand, describe, and calculate the measures of data and correlation.

CO3: Recognize and understand various probability distribution functions, calculate and interpret expected results

CO4: Apply the methods of estimating a parameter.

CO5: Understand the concept of probability and apply for simple events.

SYLLABUS

UNIT-I Hours: 15

Introduction to Statistics-Introduction-Data Collection and Descriptive Statistics-Inferential Statistics and Probability Models-Populations and Samples-A Brief History of Statistic-Organization and Presentation of Data-Origin and development of Statistics, Scope, limitation and misuse of statistics. Types of data: primary, secondary, quantitative and qualitative data. Types of Measurements: nominal, ordinal, discreteand continuous data. Presentation of data by tables: construction of frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions.

UNIT-II: Hours:22

Descriptive statistics-Introduction-Describing Data Sets-Frequency Tables and Graphs-Relative Frequency Tables and Graphs-Grouped Data, Histograms,Ogives, and Stem and Leaf Plots-Summarizing Data Sets-Sample Mean, Sample Median, and Sample Mode-Sample Variance and Sample Standard Deviation-Sample Percentiles and Box Plots- Chebyshev's Inequality-Normal Data Sets-Paired Data Sets and the Sample Correlation Coefficient-

Correlation-Scatter plot, Karl Pearson coefficient of correlation, Spearman's rank correlation coefficient, multiple and partial correlations (for 3 variates only).

UNIT-III: **Hours:22**

Random variables and expectation-Random Variables-Types of Random Variables-Jointly Distributed Random Variables-Independent Random Variables-Conditional Distributions-Expectation-Properties of the Expected Value- Expected Value of Sums of Random Variables-Variance- Covariance and Variance of Sums of Random Variables-Moment Generating Functions-Chebyshev's Inequality and the Weak Law of Large Numbers-Special random variables-The Bernoulli and Binomial Random Variables-Computing the Binomial Distribution Function-The Poisson Random Variable- Computing the Poisson Distribution Function-The Hypergeometric Random Variable-The Uniform Random Variable- Normal Random Variables-Exponential Random Variables-The Poisson Process-The Gamma Distribution-Distributions Arising from the Normal-The Chi-Square Distribution-The t-Distribution-The F Distribution-The Logistics Distribution.

UNIT-IV: **Hours:23**

Distributions of sampling statistics-Introduction-The Sample Mean-The Central Limit Theorem- Approximate Distribution of the Sample Mean, How Large a Sample Is Needed?-The Sample Variance-Sampling Distributions from a Normal Population-Distribution of the Sample Mean, Joint Distribution of X and S-Sampling from a Finite Population-Parameter estimation-Introduction-Maximum Likelihood Estimators-Interval Estimates- Confidence Interval for a Normal Mean When the Variance is Unknown-Confidence Intervals for the Variance of a Normal Distribution - Estimating the Difference in Means of Two Normal Populations-Approximate Confidence Interval for the Mean of a Bernoulli Random Variable-Confidence Interval of the Mean of the Exponential Distribution-The Bayes Estimator.

UNIT-V :   **Hours:23**

Basics and Elements of Probability-Random experiment, sample point and sample space, event, algebra of events. Definition of Probability: classical, empirical and axiomatic approaches to probability, properties of probability .Theorems on probability, conditional probability and independent events, Laws of total probability, Baye's theorem and its applications-Introduction-Sample Space and Events-Venn Diagrams and the Algebra of Events-Axioms of Probability-Sample Spaces Having Equally Likely Outcomes.

BOOKS FOR STUDY

1. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers And Scientists, Elsevier Academic Press, UK, Fifth Edition, 2023

2. Rohatgi V.K and Saleh E, An Introduction to Probability and Statistics, 3rd edition, John Wiley & Sons Inc., New Jersey, 2015.

3. Gupta S.C and Kapoor V.K, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand & Sons, New Delhi, 2014

BOOK FOR REFERENCE

1. Jim Frost, Introduction to Statistics: An Intuitive Guide for Analyzing Data and Unlocking Discoveries

WEB RESOURCES :

1. https://onlinestatbook.com/2/
2. https://www.simplilearn.com/tutorials/statistics-tutorial
3. https://towardsdatascience.com/fundamentals-of-statistics-for-data-scientists-and-data-analysts-69d93a05aae7

Mapping of COs with POs:

CO/ PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	2	3	3	3	3
CO3	2	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	2	3	3
Weightage of course contributed to each PO	13	15	13	15	15

Strong – 3   **Medium – 2**   **Low - 1**

Programme Title	:	**M.Sc. Data Science**	
Course Title	:	**ELECTIVE I: INTERNET OF THINGS**	
Course Code	:	**24PDSDSEC1A**	**Hours/Week:5**
Semester	:	**I**	**Credit:3**

COURSE OBJECTIVE:

- To understand the concepts, data, framework, standards, protocols, reliability, security and privacy involved in IoT

COURSE OUTCOME:

On Completion of the Course the students will be able to

CO1: Describe the concepts of IoT

CO2: Know the essentials IoT data and framework

CO3: Learn IoT protocols

CO4: Design a basic IoT system

CO5: Examine the reliability, security and privacy of an IoT system

SYLLABUS

UNIT-I   **Hours : 12**

IoT Ecosystem Concepts and Architectures - Introduction – IoT definition and evolution – IoT Architectures – OpenIoT Architecture for IoT/Cloud Convergence - Resource Management – IoT Data Management and Analytics - Communication Protocols – Internet of Things applications-Scheduling Process and IoT Services Lifecycle - IoT enabling technologies – IoT levels and Deployments templates – Introduction to M2M - Difference between IoT and M2M – SDN and NFV for IoT.

UNIT-II   **Hours : 12**

IoT Data and Framework Essentials - Introduction - Programming framework for IoT– The foundation of Stream processing in IoT- Continuous Logic processing system – Challenges and Future directions – Anomaly detection – Problem statement and definitions – Efficient incremental local modelling – IoT Governance.

UNIT-III   **Hours: 20**

RF Protocols RFID, NFC:IEEE 802.15.4 **-** ZigBee - ZWAVE, THREAD - Bluetooth Low Energy (BLE) - IPv6 for Low Power and Lossy Networks (6LoWPAN) - Routing Protocol for Low power and lossy networks (RPL) - CoAP- XMPP - Web Socket- AMQP – MQTT –

WebRTC - PuSH Architectural Considerations in Smart Object Networking - TinyTO Protocol. 3.2 Introduction to IoT based applications – Scenarios – Architecture overview – Sensors – The gateway – Data Transmission – Internet of Vehicles (IoV) – IoV Characteristics, technologies and its application.

UNIT-IV :   **Hours: 16**

Developing Internet of Things - Introduction – IoT Design Methodology – Case study on IoT system for Weather monitoring – IoT Device - IoT physical devices and endpoints - Exemplary Device: Raspberry Pi - Linux on Raspberry Pi - Raspberry Pi interfaces – Programming Raspberry Pi and with python – Other IoT devices.

UNIT-V: **Hours: 15**

IoT Reliability, Security and Privacy - Introduction - Concepts - IoT Security Overview – Security Frameworks for IoT – Privacy in IoT networks – IoT characteristics and reliability issues - Addressing reliability.

BOOKS FOR STUDY:

1   Arshdeep Bahga, Vijay Madisetti, "Internet of Things, A Hands -on Approach", 1st Edition 2015, University Press, ISBN: 978-81-7371- 954-7

2. Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

3. Hersent, Olivier, David Boswarthick, and Omar Elloumi. The internet of things: Key applications and protocols. John Wiley & Sons, 2011.

BOOKS FOR REFERENCE:

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978- 3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer

2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

3. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI.

WEB RESOURCES:

1   https://thingsee.com/blog/quality-hardware-list-for-your-iot-projects

2   https://tools.ietf.org/html/rfc7452. http://dret.net/lectures/iot-spring15/protocols

3   http://iot.intersog.com/blog/overview-of-iot-development-standards-andframeworks.

Mapping of COs with POs:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	2	2
CO2	3	3	1	2	2
CO3	3	3	1	2	2
CO4	3	3	3	2	2
CO5	3	3	1	2	2
Weightage of course contribute to each PO	**15**	**15**	**7**	**10**	**10**

Strong – 3   **Medium – 2**   **Low - 1**

Programme Title   **: M.Sc. Data Science**

Course Title   **: ELECTIVE I: RESEARCH METHODOLOGY FOR**
                     COMPUTER SCIENCE

Course Code   **: 24PDSDSEC1B**   **Hours/Week:5**

Semester   **: I**   **Credit:3**

COURSE OBJECTIVE:

- To develop an understanding of the research methods relevant to effectively address a research problem

COURSE OUTCOME:

On Completion of the Course the students will be able to

CO1: Develop an understanding of Research methods

CO2: Formulate a Research problem

CO3: Collect and Analyse data

CO4: Effectively write a research paper

CO5: Present the Paper more professionally.

SYLLABUS

UNIT-I: **Hours:12**

Introduction to Research-Meaning, Objectives and Characteristics of research - Research Methods Vs. Methodology - Types of research- Research process - Criteria of good research - Research Project-Shaping a Research Project-Research Planning-Students and Advisors – Checklist.

UNIT-II: **Hours:12**

Literature Review -Reading and Reviewing - Hypotheses, Questions, and Evidence.

UNIT-III: **Hours:20**

Experiments for Computing-Experimentation-Statistical Principles - Writing a Paper-Organization-Good Style-Style Specifics-Punctuation-Mathematics-Algorithms- Graphs, Figures, and Tables -Other Professional Writing.

UNIT-IV: **Hours:16**

Presentation -Editing- Presentations-Slides-Posters-Ethic

UNIT-V: **Hours:15**

Report writing-Report writing using LATEX for a research problem

BOOKS FOR STUDY:

1. Kothari C. R. Research Methodology Methods and Techniques. 2nd ed. New Delhi: New Age, 2004.
2. Justin Zobel. Writing for Computer Science.3rd ed. Springer-Verlag,2014

BOOKS FOR REFERENCE:

1. Ranjit Kumar. Research Methodology -a step-by-step guide for beginners. 3rd ed. SAGE Publications India Pvt Ltd, 2011.
2. Panneerselvam R. Research Methodology. 2nd ed. New Delhi: Prentice Hall, 2014.

WEB RESOURCES:

1. https://www2.le.ac.uk/offices/red/rd/research-methods-and-methodologies
2. http://www.socscidiss.bham.ac.uk/methodologies.html

Mapping of COs with POs:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	1
CO2	3	3	3	2	1
CO3	3	3	3	2	1
CO4	3	3	3	2	1
CO5	3	3	3	2	1
Weightage of course contribute to each PO	15	15	15	10	5

Strong – 3 **Medium – 2** **Low - 1**

Programme Title	:	**M.Sc. Data Science**
Course Title	:	**ELECTIVE II: WEB PROGRAMMING**
Course Code	:	**24PDSDSEC2A** Hours/Week:5
Semester	:	**I** Credit:3

COURSE OBJECTIVE:

- To introduce students about web application and state management.

COURSE OUTCOME:

On Completion of the Course the students will be able to

CO1: Comprehend.NET Framework and Windows Application

CO2: Know about presentation controls and namespaces

CO3: Connect with backend using ADO.NET

CO4: Get the knowledge about web application and state management

CO5: Gain knowledge on connecting XML, LINQ and AJAX

SYLLABUS

UNIT-I: Hours :13

Overview of .NET Framework-CLR-CTS- Metadata and Assemblies-.NET Framework Class Library – BCL- Windows Forms – ASP.NET and ASP.NET AJAX-ADO.NET – Tools in the .NET Framework- New Features of .NET Framework: Portable Class Libraries **-** Introducing Windows Application**-**Introduction – Creating Windows Forms- Customizing a Form - Collecting User Input in windows Forms and Events**-**Buttons-Text Boxes- Check Boxes-Radio Buttons –Combo Boxes –Date and TimePicker – Calendar-List Boxes –Checked List Box –List View – Tree View.

UNIT-II: Hours : 15

Presentation and Informational Controls in Windows Forms and Events**-**Labeling-Labeling- Link Label- Status Bar- Picture Box-Image List-Progress Bar-Tool Tip –MDI and Menus Creation - Data Types in C# **-**Type Conversions – Boxing and Unboxing - Namespace **-** Introduction – Adding a reference to the Namespace – Accessing a predefined Namespace through the using Directive - Introducing to ADO.net**-**Understanding ADO.NET-Creating Connection Strings –Creating a Connection to a Database- Creating a Command Object- Working with DataAdapters –Using DataReader work with Database.

UNIT-III: **Hours : 17**

 ASP.NET-Life cycle- Specifying a Location for a Web Application -Single-File Page Model - Code- Behind Page Model- Adding controls to web form - Web Server Controls-The Control Class - The WebControl Class - The Button Control - The TextBox Control -The Label Control - The HyperLink Control -The LinkButton Control -The PlaceHolder Control - The HiddenField Control - The CheckBox Control -The RadioButton Control -The ListBox Control -The DropDownList Control -The Image Control -The ImageButton Control - The Table Control - Menus - Validation Server Controls - Master Page - Web.Config.

UNIT-IV: **Hours : 15**

State Management-Understanding the session object Sessions and the Event Model, Configuring, In-Process Session State, Out-of-Process Session state Application Object, Query strings, Cookies, ViewState, Global.asax- XML and .NET-Basics of XML, Create XML Document - Reading XML with XmlReader – Reading XML with XmlDocument - Working with XmlNode - Animations-Understanding WPF's Animation services – The Role of the Animation class types-The To, From and by properties – The Role of the Timeline Base Class – Authoring and Animation in C# Code – Controlling the pace of an animation – Reversing and Looping an Animation – The Role of StoryBoards.

UNIT-V: **Hours : 15**

LINQ-Introducing LINQ Queries- Standard Query Operators- Introducing LINQ to Dataset, SQL and XML- The LinqDataSource Control. Data Binding – Grid View, Details view, Forms view - ASP. NET AJAX-Understanding the need for AJAX, Building a simple ASP.NET page without AJAX, Building a simple ASP.NET page with AJAX.

BOOKS FOR STUDY:

1. C# 2012 Programming Covers .NET 4.5 Black Book. Dreamtech press, Kogent Learning Solutions, 2013.
2. Liberty, Jesse, and Dan Hurwitz. Programming. NET Windows Applications. " O'Reilly Media, Inc.", 2004.
3. Troelsen, Andrew, and Philip Japikse, C# 6.0 and the .NET 4.6 Framework. Apress, 2015.

BOOKS FOR REFERENCE:

1. Albahan Joseph, and Ben Albahari. C# 5.0 in a NutShell: The Definitive Reference. "Orielly Media Inc", 2012.

2. Anne Boehm . Joel. Murach's C# 2015. United States of America: Murach's,2016. Delamater. Mary. Anne Boehm. ASP.NET 4.5 Web Programming with C# 2012. United States of America: Murach's, 2013.

3. John Sharp. Microsoft Visual C# Step by Step. United States of America: Pearson Edition,2018.

4. Price, Jason, and Mike Gunderlov. Mastering Visual C#.Net. John Wiley & Sons, 2006

WEB RESOURCES:

1. http://www.w3schools.com/aspnet/aspnet.asp
2. http://csharp.net-tutorials.com/xml/introduction/
3. http://ajax.net-tutorials.com/basics/introduction/
4. http://www.c-sharpcorner.com/

Mapping of COs with POs:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	1
CO2	3	3	3	2	1
CO3	3	3	3	2	1
CO4	3	3	3	2	1
CO5	3	3	3	2	1
Weightage of course contribute to each PO	**15**	**15**	**15**	**10**	**5**

Strong – 3   Medium – 2   Low - 1

Programme Title : **M.Sc. Data Science**

Course Title : **ELECTIVE II: JAVA PROGRAMMING**

Course Code : **24PDSDSEC2B**   **Hours/Week:5**

Semester : **I**   **Credit:3**

COURSE OBJECTIVE:

- To enable the students to understand and appreciate the need for Object Oriented Programming.

COURSE OUTCOME:

On Completion of the Course the students will be able to

CO1 Understand the concepts of object-oriented programming

CO2 Use Java programming language at a basic level and construct simple software applications

CO3 Understand classes, objects and implementing inheritance

CO4 Analyze and understand the functionality of Inheritance, Interface and develop simple applications

CO5 To develop software applications and services using Java code

SYLLABUS

UNIT-I: **Hours:15**

Introduction to Java-Overview – Features - Fundamental OOPS concepts – JDK – JRE – JVM -Structure of a Java program - Data types – Variables – Arrays – Operators –Keywords - Naming Conventions - Control statements, Type conversion and Casting - Scanner - String - equals(), equalsIgnoreCase(), length().

UNIT-II: **Hours:13**

Classes and Objects-Class – Objects – Methods - Method Overloading - Constructors – Constructor Overloading - this keyword - usage of static with data and methods – Garbage Collection - Access Control - Inheritance-Concept – extends keyword - Single and Multilevel Inheritance – Composition – super keyword - Method Overriding - Abstract Classes - Dynamic Method Dispatch – Usage of final with data, methods and classes – Packages and Interfaces-Concepts - package and import keywords - Defining, Creating and Accessing a Package – Interfaces - Multiple Inheritance in Java, Extending and Initialising fields in Interfaces.

UNIT-III: **Hours:17**

Exception Handling**-**Exception handling- Types of Exceptions- try, catch, throw, throws and finally keywords - User defined Exceptions - JDBC**-**Database Connectivity- Types of JDBC drivers- Executing statements- Prepared statements- Callable statements - Mapping SQL types to Java- ResultSet Metadata.

UNIT-IV : **Hours:15**

Multithreading**-**Introduction - Life Cycle of a Thread, Thread class and Runnable Interface, Thread Priorities, Synchronisation. GUI Programming with JavaFX**-**JavaFX Basic Concepts – Packages - Stage and Scene Classes - Nodes and Scene Graphs – Layouts - The Application Class and the Lifecycle Methods - Launching a JavaFX Application - JavaFX Application Skeleton - Compiling and Running -Application Thread - JavaFX Controls**-**Label – Button – Image – RadioButton – CheckBox – ListView- ComboBox- TextField ScrollPane.

UNIT-V: **Hours:15**

Event**-**Event Handling – Input Event, Action Event and Window Event - Java Library**-**java.util – List, ArrayList.

BOOK FOR STUDY:

1. Schildt, Herbert. Java: The Complete Reference. McGraw-Hill Education Group, 2014.

BOOKS FOR REFERENCE:

1. Eckel, Bruce. Thinking in Java. 4th ed. Pearson Education, 2006.

2. Liang, Y. Daniel. Intro to Java Programming, Brief Version. Pearson Higher Ed, 2015.

3. Holmes, J. Barry, Joyce, T. Daniel. Object-oriented Programming with Java. Jones & Bartlett Learning. 2001

WEB RESOURCES:

1. http://docs.oracle.com/javase/tutorial/java/index.html/

2. http://www.java2s.com/Tutorial/Java/CatalogJava.htm/

3. https://www.edureka.co/blog/object-oriented-programming/

Mapping of COs with POs:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	1
CO2	3	3	3	2	1
CO3	3	3	3	2	1
CO4	3	3	3	2	1
CO5	3	3	3	2	1
Weightage of course contribute to each PO	15	15	15	10	5

Strong – 3   **Medium – 2**   **Low - 1**

Programme Title : **M.Sc. Data Science**

Course Title : **Core Course – IV: PYTHON PROGRAMMING**

Course Code : **24PDSCC4** Hours/Week:5

Semester : **II** Credits:5

COURSE OBJECTIVES:

To be able to think logically and develop interactive programs using the python constructs, functions, data structures, classes and objects, files.

COURSE OUTCOME:

CO1: Recall the components of a computer, demonstrate the appropriate use of data types, mathematical functions and strings in a program.

CO2: State the use of selection and looping constructs, compare and choose an appropriate construct for a given problem.

CO3: Define Functions, Classes and Objects, defend the use of functions, classes and objects in a given problem.

CO4: Define Strings and Lists, implement Lists and Strings appropriately, design new problems using appropriate data structures.

CO5: Define Tuples, sets, dictionaries and files, compare programs with and without files, develop applications using the different data structures science with real time case studies.

SYLLABUS

UNIT-I : Hours : 15

Introduction - Computer and its components - Programming Languages - Operating Systems - The history of Python - Introduction to python programming - Programming Style and Documentation - Programming Errors - Introduction to Graphics Programming - Input - Output - Identifiers - Variables, Assignment Statements and Expressions - Simultaneous Assignments - Named Constants - Numeric Data Types and Operators - Evaluating Expressions and Operator Precedence - Augmented Assignment Operators - Type Conversion and Rounding - Common Python Functions - Strings and Characters - Introduction to Objects and Methods - Formatting Numbers and Strings - Drawing various shapes with Colors and Fonts.

UNIT-II : Hours : 15

Boolean Types, Values and Expressions - Generating Random Numbers - Different forms of if statements - Logical Operators - Conditional Expressions - Operator Precedence and Associativity- while, for , Nested Loops - break and continue.

UNIT-III : Hours : 15

Defining and calling a function - Return single and multiple values - Positional, Keyword and Default Arguments - Passing Arguments by Reference Values - Modularizing Code - Function Abstraction and Stepwise Refinement - Recursion- Defining Classes for Objects - UML Class Diagrams - Immutable vs Mutable Objects - Hiding Data Fields - Class Abstraction and Encapsulation - Object Oriented Thinking - Superclasses and Subclasses - Overriding methods - Object class - Polymorphism and Dynamic binding

UNIT-IV: Hours: 15

Str class - Operator Overloading and Special Methods - List Basics - Copying Lists - Passing Lists to Functions - Returning a List from a Function - Searching, Sorting Lists - Processing Two - Dimensional Lists - Passing Two - Dimensional Lists to Functions - Multidimensional Lists

UNIT-V: **Hours: 15**

Tuples - Sets - Comparing the Performance of Sets and Lists - Dictionaries - Text Input and Output - File Dialogs - Retrieving Data from Web - Exception Handling - Raising Exceptions - Processing Exceptions using Exception Objects - Defining Custom Exception Classes - Binary IO Using Pickling - Case Studies related to the above topics given in the Text Book to be solved.

BOOK FOR STUDY:

1. Y. Daniel Lang, Introduction to Programming using Python, 2nd Edition, Pearson Education Inc., 2013.

BOOKS FOR REFERENCE:

1. Allen B. Downey. Think Python. How to Think Like a Computer Scientist, 2nd Edition, O'Reilly Publishers, 2016.
2. Corey Wade, et al : *The Python Workshop*, 2nd Edition, Packt, 2022.
3. David Beazley, Brian K. Jones. Python Cookbook: Recipes for Mastering Python 3, 3rd Edition, 2013 Harsh Bhasin. Python for Beginners. New Age International Publishers,2018.
4. Martin C. Brown. Python: The Complete Reference. McGraw Hill Education; Fourth edition, 2018.

WEB RESOURCES:

- https://realpython.com
- http://docs.python.org
- http://diveintopython.org/
- https://www.w3schools.com/python/
- https://www.tutorialspoint.com/python/index.html

Mapping of Cos with Pos:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	2	3	3	3	3
CO3	2	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	2	3	3
Weightage of course contributed to each PO	13	15	13	15	15

Strong – 3   Medium – 2   Low - 1

Programme Title	:	**M.Sc. Data Science**
Course Title	:	**CORE COURSE -V: STATISTICS - II**
Course Code	:	**24PDSCC5** **Hours/Week:5**
Semester	:	**II** **Credits:4**

COURSE OBJECTIVES:

To develop knowledge and understand fundamental concepts in probability and statistics.

COURSE OUTCOME:

CO1: Identify the four steps of hypothesis testing.

CO2: Gain a thorough understanding of applied principles of statistics.

CO3: To develop knowledge and skills in theoretical, computational and application-oriented statistics.

CO4: Apply the methods of analysis of variance

CO5: Understand and apply the concept of non-parametric tests

SYLLABUS

UNIT-I: **Hours : 15**

Introduction**-** Population and Statistics – Finite and Infinite population – Parameter and Statistics – Types of sampling - Sampling Distribution – Sampling Error - Standard Error – Test of significance –concept of hypothesis – types of hypothesis – Errors in hypothesis-testing – Critical region – level of significance - Power of the test – p-value - Hypothesis testing - Significance Levels-Tests Concerning the Mean of a Normal Population-Case of Known Variance-Case of Unknown Variance: The t-Test-Testing the Equality of Means of Two Normal Populations-Case of Known Variances-Case of Unknown Variances-Case of Unknown and Unequal Variances-The Paired t-Test- Hypothesis Tests Concerning the Variance of a Normal Population-Testing for the Equality of Variances of Two Normal Populations-Hypothesis Tests in Bernoulli Populations-Testing the Equality of Parameters in Two Bernoulli Populations-Tests Concerning the Mean of a Poisson Distribution-Testing the Relationship Between Two Poisson Parameters.

UNIT-II: **Hours : 15**

Hypothesis Testing-II **-**Students t-distribution and its properties (without proofs) – Single sample mean test – Independent sample mean test – Paired sample mean test – Tests of proportion (based on t distribution) – F distribution and its properties (without proofs) – Tests of equality of two variances using F-test – Chi-square distribution and its properties (without proofs) – chisquare test for independence of attributes – Chi-square test for goodness of fit.

UNIT-III: **Hours : 15**

Least Squares Estimators of the Regression Parameters-Distribution of the Estimators-Statistical Inferences About the Regression Parameters-Inferences Concerning β -Inferences Concerning α- Inferences Concerning the Mean Response $\alpha+\beta x 0$ - Prediction Interval of a

Future Response-Summary of Distributional Results- The Coefficient of Determination and the Sample Correlation Coefficient-Analysis of Residuals: Assessing the Model-Transforming to Linearity- Weighted Least squares-Polynomial Regression - Multiple Linear Regression-Predicting Future Responses - Logistic Regression Models for Binary Output Data.

UNIT-IV: **Hours : 15**

Analysis of variance -An Overview-One-Way Analysis of Variance-Multiple Comparisons of Sample Means-One-Way Analysis of Variance with Unequal Sample Sizes-Two-Factor Analysis of Variance: Introduction and Parameter Estimation-Two-Factor Analysis of Variance: Testing Hypotheses-Two-Way Analysis of Variance with Interaction - Goodness of fit tests and categorical data analysis-Goodness of Fit Tests When All Parameters Are Specified-Determining the Critical Region by Simulation-Goodness of Fit Tests When Some Parameters Are Unspecified-Tests of Independence in Contingency Tables -Tests of Independence in Contingency Tables Having Fixed Marginal Totals-The Kolmogorov–Smirnov Goodness of Fit Test for Continuous Data

UNIT-V : **Hours : 15**

Nonparametric hypothesis tests -The Sign Test-The Signed Rank Test-The Two-Sample Problem-The Classical Approximation and Simulation-Wilcoxon Signed Rank Test for one and paired samples-The Runs Test for Randomness -Median test and Mann-Whitney-Wilcoxon tests for two samples.

BOOKS FOR STUDY:
1. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Elsevier Academic Press, UK, Fifth Edition, 2023
2. Gupta S.C and Kapoor V.K, Fundamentals of Mathematical Statistics, 12th edition, Sultan Chand & Sons, New Delhi, 2020.
3. Brian Caffo, Statistical Inference for Data Science, Learnpub, 2016.

BOOKS FOR REFERENCE:
1. Allen B. Downey,Think Stats- Exploratory data analysis, O'Reilly, 2nd Edition
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Publications, Tenth Edition
3. Jim Frost, Introduction to Statistics: An Intuitive Guide for Analyzing Data and Unlocking Discoveries.

WEB RESOURCES:
- https://onlinestatbook.com/2/
- https://www.simplilearn.com/tutorials/statistics-tutorial
- https://towardsdatascience.com/fundamentals-of-statistics-for-data-scientists-and-data-analysts-69d93a05aae7

Mapping of Cos with Pos:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	1	1	2
CO2	3	3	2	2	2
CO3	3	2	2	3	2
CO4	3	2	2	2	2
CO5	3	3	2	3	2
Weightage of course contributed to each PO	14	13	9	11	10

Strong – 3　　　　　Medium – 2　　　　　Low - 1

Programme Title : **M.Sc. Data Science**

Course Title : **CORE PRACTICAL -I: PYTHON PROGRAMMING - PRACTICAL**

Course Code : **24PDSCCQ1** **Hours/Week:6**

Semester : **II** **Credits:5**

COURSE OBJECTIVES:

To be able to apply appropriately the python programming knowledge gained and develop computer-based solutions for a given problem.

COURSE OUTCOME:

CO1: Recall the components of a computer, demonstrate the appropriate use of data types, mathematical functions and strings in a program.

CO2: State the use of selection and looping constructs, compare and choose an appropriate construct for a given problem.

CO3: Develop modular programming using functions, Design program using OO constructs.

CO4: Demonstrate Strings and Lists, implement Lists and Strings appropriately, design new problems using appropriate data structures.

CO5: Demonstrate Tuples, sets, dictionaries and files, compare programs with and without files, develop applications using different data structures.

SYLLABUS

1. Programs using basic data types and operators
2. Programs involving Mathematical functions
3. Program in String Manipulations
4. Programs using different forms of if statement
5. Drawing various shapes using turtle
6. Programs involving repeated execution of a set of statements
7. Programs using break and continue
8. Modular programming using functions
9. Programs using positional, keyword and default argument
10. Programs using pass by value, pass by reference
11. Programs using classes and objects
12. Programs using Inheritance
13. Programs on Str class and special methods
14. Programs using Lists and List manipulation
15. Programs using Two-Dimensional Lists
16. Programs using Tuple and its methods
17. Programs with Set and Set manipulation

18. Programs using Dictionaries
19. Program comparing the performance of Sets and Lists
20. Programs handling Text Files
21. Programs handling Binary Files
22. Programs handling exceptions

BOOK FOR STUDY:
1. Y. Daniel Lang, *Introduction to Programming using Python*, 2nd Edition, Pearson Education Inc., 2013.

BOOKS FOR REFERENCE:
1. Allen B. Downey. Think Python. How to Think Like a Computer Scientist, 2nd Edition, O'Reilly Publishers, 2016.
2. Corey Wade, et al : *The Python Workshop*, 2nd Edition, Packt, 2022.
3. David Beazley, Brian K. Jones. Python Cookbook: Recipes for Mastering Python 3, 3rd Edition, 2013 Harsh Bhasin. Python for Beginners. New Age International Publishers,2018.
4. Martin C. Brown. Python: The Complete Reference. McGraw Hill Education; Fourth edition, 2018.

WEB RESOURCES:
- https://realpython.com
- http://docs.python.org
- http://diveintopython.org/
- https://www.w3schools.com/python/
- https://www.tutorialspoint.com/python/index.html

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CO1	3	3	1	3	3
CO2	3	3	3	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	3	3	3
Weightage of course contributed to each PO	15	15	11	15	15

Strong – 3   **Medium – 2**   **Low - 1**

Programme Title	:	**M.Sc. Data Science**
Course Title	:	**ELECTIVE -III: INFORMATION SECURITY AND ETHICS**
Course Code	:	**24PDSDSEC3A** **Hours/Week:4**
Semester	:	**II** **Credits:3**

COURSE OBJECTIVE:

To introduce and familiarize the students to security issues in computing, core concepts and vocabulary of computer security

COURSE OUTCOME:

CO1: Understand all aspects of computer security, including users, software, devices, operating systems, networks, law, and ethics.

CO2: Apply cryptography an essential tool that is critical to computer security.

CO3: Analyse the different aspects of computer security and privacy.

CO4: Evaluate the aspects of computer security.

CO5: Develop a system that uses user authentication, prevents malicious code execution, encrypts the data, protects privacy, implements firewall, detects intrusion, and more.

SYLLABUS

UNIT-I: **Hours : 15**

Security Problem in Computing - Meaning of "Secure" – Attacks - Meaning of Computer and information Security - Computer Criminals - Methods of Defense – Cryptography – Terminology and Background - Principles of Cryptography - Cryptography tools - Substitution Ciphers - Transpositions (Permutations) – Making "Good" Encryption Algorithms - The Data Encryption Standard (DES) – The AES Encryption Algorithm - Public Key Encryption - The Uses of Encryption - Digital Signatures and Certificates - Hybrid Cryptography Systems - Steganography - Protocols for secure communication.

UNIT-II: **Hours : 10**

Program Security- Secure Programs - Nonmalicious Program Errors - Viruses and Other Malicious Code - Targeted Malicious Code - Controls against Program Threats- Security Issues in Social Networking - Acceptable Use Policies - Reasons for social media being hazardous to the corporate network - Balancing Security and Social Networking in business - Precautions that can be taken to secure the private information.

UNIT-III: **Hours : 10**

Database and Data Mining Security- Introduction to Databases - Security Requirements - Reliability and Integrity – Sensitive Data - Inference - Multilevel Databases - Proposals for Multilevel Security – Data Mining - Security in Networks - Network Concepts - Threats in Networks - Network Security Controls - Firewalls – Intrusion Detection Systems - Secure E-Mail.

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UNIT-IV: **Hours : 10**

Administering Security - Security Planning - Risk Analysis - Organisational Security Policies - Physical Security - The Economics of Cyber security - Making a Business Case - Quantifying Security - Modeling Cyber security

UNIT-V: **Hours : 15**

Privacy in Computing Privacy Concepts - Privacy Principles and Policies - Authentication and Privacy – Data Mining - Privacy on The Web - E-Mail Security - Impacts on Emerging Technologies - Legal and Ethical Issues in Computer Security - Protecting Programs and Data - Information and the Law - Rights of Employees and Employers - Redress for Software Failures - Computer Crime - Ethical Issues in Computer Security - Case Studies of Ethics

BOOK FOR STUDY:

1. Pfleeger ,Charles P and Shari Lawrence Pfleeger. Security in Computing, Released January 2015, Pearson, ISBN: 9780134085074

BOOKS FOR REFERENCE:

1. Bahadur ,Gary. Securing the Clicks Network Security in the Age of Social Media. 1st ed. McGraw-Hill, 2012.

2. Daswani, Neil, Christoph Kern and Anita Kesavan. Foundations of Security: What Every Programming Needs to Know. Apress, 2007

WEB RESOURCES:

*   http://www.trendmicro.fr/media/wp/securityguide-social-networks-whitepaper-en.pdf

*   http://paper.ijcsns.org/07_book/201306/20130619.pdf

Mapping of Cos with Pos:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	1
CO2	3	3	3	2	1
CO3	3	3	3	2	1
CO4	3	3	3	2	1
CO5	3	3	3	2	1
Weightage of course contributed to each PO	**15**	**15**	**15**	**10**	**5**

                    Strong – 3   **Medium – 2**   **Low - 1**

Programme Title	:	**M.Sc. Data Science**
Course Title	:	**ELECTIVE -III: SOFTWARE ENGINEERING FOR DATA SCIENCE**
Course Code	:	**24PDSDSEC3B** **Hours/Week:4**
Semester	:	**II** **Credits:3**

COURSE OBJECTIVE:

      To understand the software engineering principles and ensure software quality

COURSE OUTCOME:

CO1: To describe the Software Engineering Principles.

CO2: To apply Software Life Cycle Models for Software Development.

CO3: To use Requirements Engineering skills and gather Requirements.

CO4: To develop a quality Software.

CO5: To apply appropriate testing methodologies.

SYLLABUS

UNIT-I: **Hours : 10**

Software and Software Engineering **-** The nature of software - Software Engineering - The Software Process - Software Engineering Practice - Software Myths- Process Models**:** A Generic Process Model - Process Assessment and Improvement - Prescriptive Process Models - Product and Process -Agile Development - Introduction - Agility and Cost of Change - Agile Process - Scrum - Other Agile Frameworks.

UNIT-II: **Hours : 15**

Recommended Process Model**:** Requirements Definition - Preliminary Architectural Design - Resource Estimation - First Prototype Construction - Prototype Evaluation - Prototype Evolution - Prototype Release - Maintain Release Software - Human Aspects of Software Engineering**:** Characteristics of a Software Engineer - The Psychology of Software Engineer - The Software Team - Team Structures - The impact of Social Media - Global Teams- Principles that guide practice: Core Principles - Principles that guide each Framework Activity - Communication Principles - Planning Principles - Modeling Principles - Construction Principles - Deployment Principles.

UNIT-III: **Hours : 15**

Understanding Requirements: Requirements Engineering - Establishing the groundwork - Requirements Gathering - Developing Use Cases -Building the Analysis Model - Negotiating Requirements - Requirements Monitoring - Validating Requirements-Requirements Modeling - A Recommended Approach: Requirements Analysis - Scenario-Based Modeling - Class-Based Modeling - Functional Modeling - Behavioural Modeling.

UNIT-IV: **Hours : 10**

Design Concepts: Design within the context of Software Engineering - The Design Process -

Design Concepts - The Design Model - Quality and Security: Introduction - Software Quality - The Software Quality Dilemma - Achieving Software Quality -Software Quality Assurance: Background Issues - Elements of Software Quality Assurance - SQA Process and Product Characteristics - SQA Tasks, Goals and Metrics - Formal Approaches - Statistical SQA - Software Reliability - ISO 9000 Quality standards - SQA Plan

UNIT-V: **Hours : 10**
Software Testing -Component Level: A Strategic Approach to Software Testing - Planning and RecordKeeping - Test-Case Design - White-box Testing - Black-Box Testing - Object-oriented Testing -Software Testing - Integration Level: Software Testing Fundamentals - Integration Testing - Artificial Intelligence and Regression Testing - Integration Testing in the OO context - Validation Testing - Testing Patterns

BOOK FOR STUDY:
1. Pressman, Roger S., and Bruce R. Maxim. Software Engineering: A Practitioner's Approach, Ninth Edition, 2020.

BOOKS FOR REFERENCE:
1. Martin, Robert C. Agile software development: principles, patterns, and practices. Prentice Hall, 2002.

2. Schach, Stephen R. Object-oriented software engineering. McGraw-Hill, 2008.

3. Sommerville, Ian. "Software engineering 9th Edition." ISBN-10 137035152 (2011).

WEB RESOURCES:

- https://www.d.umn.edu/~gshute/softeng/principles.html

Mapping of Cos with Pos:

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CO1	3	3	1	2	2
CO2	3	3	1	2	2
CO3	3	3	1	2	2
CO4	3	3	3	2	2
CO5	3	3	1	2	2
Weightage of course contributed to each PO	**15**	**15**	**7**	**10**	**10**

Strong – 3   **Medium – 2**   **Low - 1**

Programme Title	:	**M.Sc. Data Science**	
Course Title	:	**ELECTIVE -IV: OPTIMIZATION TECHNIQUES**	
Course Code	:	**24PDSDSEC4A**	**Hours/Week:4**
Semester	:	**II**	**Credits:3**

COURSE OBJECTIVE:

To study of model formulation and apply the mathematical results and numerical techniques of optimization theory to real world problems

COURSE OUTCOME:
 CO1: Explain the fundamental knowledge of Linear Programming.
 CO2: Use classical optimization techniques and numerical methods of optimization.
 CO3: Enumerate fundamentals of Integer programming technique and apply different
 techniques to solve various optimization problems.
 CO4: Describe the basics of different Heuristic algorithms and solve dynamic
 programming problems.
 CO5: Understand Queuing systems and understand constrained and unconstrained
 problems.

SYLLABUS

UNIT-I: **Hours : 10**
Modelling with Linear programming - Two variable LP model – Graphical LP solution – Applications-Simplex method and sensitivity analysis **-** Simplex method- Artificial starting solution - Special cases in simplex method- Graphical sensitivity analysis.

UNIT-II: **Hours : 10**
Duality and post-optimal Analysis **-** Definition of Dual problem - Primal-Dual Relationships-Additional Simplex algorithms- Post optimal analysis - Advanced Linear Programming - Simplex method fundamentals-Revised Simplex Method, Bounded-Variable Algorithm, Duality, Parametric programming

UNIT-III: **Hours : 10**
Goal Programming -Goal programming formulation - Goal Programming algorithms - Integer Programming -Formulation and Applications-Cutting Plane Algorithm-Branch and Bound Method

UNIT-IV: **Hours : 15**
Heuristic Programming - Greedy Heuristics- Meta heuristic - Tabu Search algorithm - Constraint programming - Deterministic dynamic programming -Recursive nature of Dynamic programming computations - Forward and backward recursion- Selected DP applications - Knapsack/Fly-away kit/cargo-loading model- Investment models-Inventory models.

UNIT-V: **Hours : 15**
Queuing Systems -Pure birth and Pure death models- Generalized Poisson queuing model, single server models-Classical optimization theory -Unconstrained problems - Constrained

problems.

BOOK FOR STUDY:

1. Hamdy A.Taha, Operations Research- An Introduction, 10th Edition, Pearson Education – 2017.

BOOKS FOR REFERENCE:

1. L.R.Foulds, Optimization Techniques , Springer ,Utm , 1981
2. Garrido José M. Introduction to Computational Models with Python. CRC Press, 2016.

WEB RESOURCES:

- https://www.pre-scient.com/knowledge-center/optimization-problems/optimization-problems.html
- https://www.shsu.edu/~eco_dgf/web_chapter_a.pdf

Mapping of Cos with Pos:

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CO3	3	3	3	2	1
CO4	3	3	3	2	1
CO5	3	3	3	2	1
Weightage of course contributed to each PO	**15**	**15**	**15**	**10**	**5**

Strong – 3   Medium – 2   Low - 1

Programme Title   : **M.Sc. Data Science**

Course Title   : **ELECTIVE– IV :APPLIED PROBABILITY**

Course Code   : **24PDSDSEC4B**   **Hours/Week:4**

Semester   : **II**   **Credits:3**

COURSE OBJECTIVE:

To develop knowledge and understand fundamental concepts and applications of probability

COURSE OUTCOME:

CO1: Define the principal concepts about probability.

CO2: Understand combinatorics and convexity

CO3: Understand the nature and properties of density functions and hence determine the moments and moment generating functions of any random variable

CO4: Obtain the value of the point estimators using the method of moments and method of maximum likelihood

CO5: Define and formulate discrete-time and continuous-time Markov chains.

UNIT-I: **Hours : 10**

Basic Notions of Probability Theory-Probability and Expectation-Sample Spaces and Events-Random Experiments, Sample Spaces, Events, Counting Techniques-Interpretations and Axioms of Probability-Addition Rules-Conditional Probability-Multiplication and Total Probability Rules-Independence-Bayes'Theorem-Random Variables,Distributions, Densities, and Moments-Convolution-Random Vectors-Multivariate Normal Random Vectors - Calculation of Expectations -Indicator Random Variables and SymmetryConditioning-Moment Transforms-Tail Probability Methods-Moments of Reciprocals and Ratios-Reduction of Degree-Spherical Surface Measure.

UNIT-II: **Hours : 10**

Convexity and Combinatorics-Convex Functions-Minimization of Convex Functions-The MM Algorithm-Moment Inequalities-Combinatorics-Introduction-Bijections-Inclusion-Exclusion - Applications to Order Statistics-Catalan Numbers-Pigeonhole Principle-Combinatorial Optimization-Introduction-Quick Sort-Data Compression and Huffman Coding-Graph Coloring.

UNIT-III: **Hours : 10**

Discrete Random Variables Probability Distributions and Probability Mass Functions-Cumulative Distribution Functions-Mean and Variance of a Discrete Random Variable-Discrete Uniform Distribution-Binomial Distribution-Geometric and Negative Binomial Distributions-Hypergeometric Distribution-Poisson Distribution- Continuous Random Variables Probability Distributions and Probability Density Functions - Cumulative Distribution Functions-Mean and Variance of a Continuous Random Variable-Continuous Uniform Distribution-Normal Distribution - Normal Approximation to the Binomial and Poisson Distributions-Exponential Distribution-Erlang and Gamma Distributions-Weibull Distribution-Lognormal Distribution-Beta Distribution.

UNIT-IV: **Hours : 15**
Two or More Random Variables Joint Probability Distributions-Marginal Probability Distributions-Conditional Probability Distributions-Independence-More Than Two Random Variables-Covariance and Correlation-Common Joint Distributions-Multinomial Distribution-Bivariate Normal Distribution-Linear Functions of Random Variables-General Functions of Random Variables - Sampling Distributions and Point Estimation of Parameters Point Estimation-Sampling Distributions and the Central Limit Theorem-General Concepts of Point Estimation-Unbiased Estimators-Variance of a Point Estimator -Standard Error: Reporting a Point Estimate-Mean Squared Error of an Estimator-Methods of Point Estimation-Method of Moments-Method of Maximum Likelihood-Bayesian Estimation of Parameters.

UNIT-V: **Hours : 15**
 Discrete-Time Markov Chains -Definitions and Elementary Theory-Examples-Coupling-Convergence Rates for Reversible Chains-Hitting Probabilities and Hitting Times-Markov Chain Monte Carlo-simulated annealing- Continuous-Time Markov Chains-Finite-Time Transition Probabilities-Derivation of the Backward Equations-Equilibrium Distributions and Reversibility-Examples-Calculation of Matrix Exponentials-Kendall's Birth-Death-Immigration Process.

BOOKS FOR STUDY:
1. Lange, Kenneth. Applied probability. Vol. 224. New York: Springer, 2003.
2. Douglas C. Montgomery, George C. Runger,Applied Statistics and Probability for Engineers, Fifth Edition, John Wiley & Sons, Inc.

BOOKS FOR REFERENCE:
1. Mario Lefebvre, Applied Probability and Statistics, Springer Newyork, 2006.
2. Michael Mitzenmacher Eli Upfal, Probability and Computing Randomized Algorithms and Probabilistic Analysis, Cambridge University press, 2005.

Mapping of Cos with Pos:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	1
CO2	3	3	3	2	1
CO3	3	3	3	2	1
CO4	3	3	3	2	1
CO5	3	3	3	2	1
Weightage of course contributed to each PO	**15**	**15**	**15**	**10**	**5**

Strong – 3 **Medium – 2** **Low - 1**

Programme Title	:	**M.Sc. Data Science**	
Course Title	:	**EDC: FUNDAMENTALS OF COMPUTERS AND COMMUNICATIONS**	
Course Code	:	**24PDSEDC1**	**Hours/Week:4**
Semester	:	**II**	**Credits:2**

COURSE OBJECTIVE:

   To know the basics of computers, understand the OS and basics of networks and internet.

COURSE OUTCOME:
 CO1: Know the basics and internal parts of Computers
 CO2: Gain the knowledge on OS and its types
 CO3: Understand the basics of networks and Internet
 CO4: Learn the databases and DBMS concepts
 CO5: Understand the role of RDBMS in IT

UNIT -I: **Hours :12**
Introduction: What is computer – Components of Computers – Advantages and Disadvantages of using computers – Computer Software – Categories of Computers - Elements of information systems. The Components of the Systems Unit: Processor – Data representation – Memory – Mobile Computers and Devices.

UNIT -II: **Hours :12**
Input and Output Device: What is input – what are input devices – keyboard – pointing device – mouse – other pointing devices – Voice input –Digital Cameras – Video input – Scanners and Reading devices Terminals – Biometric input - Input devices for physically challenged users-Output: What is output – display devices – Monitors – Printers –Speakers, Headphones and Ear phones – output device for physically challenged users – Storage devices.

UNIT -III: **Hours :12**
Operating Systems and Utility Programs: System software – Operating system – Operating system functions – types of operating systems – standalone operating systems–network operating systems – embedded operating system. Application Software: Application software – Business software – Graphics and Multimedia Software–Application software for Communication.

UNIT -IV: **Hours :12**
Internet and World Wide Web: Internet – History of the Internet – How the Internet works – WWW– E-commerce–Communications and Networks: Communications – Uses of Computer Communications – Networks – Communication software – Communication devices – Communications Channel – Physical transmission media and Wireless transmission media.

UNIT-V: **Hours :12**
Database Management: Databases, Data and Information, The Hierarchy of data–Maintaining data – File processing versus databases – database management systems–relational, object oriented and multi-dimensional databases – web databases – database administration. Computer Security: Computer security risks – Internet and network attacks –Unauthorized

access and use.

BOOK FOR STUDY:
1. Gary B. Shelly, Thomasj. Cashman, Misty E.Vermaat, "Introduction to Computers,"Cengage Learning, 2008.

BOOKS FOR REFERENCE:

1.Reema Thareja, ―Fundamentals of Computers‖, Oxford Univ. Press,2015.
2.Deborah Morley, Charles S.Parker, ―Understanding Computers-Today andTomorrow",14th Edition, Thomson Course Technology, 2012.
3.Alexis Leon, Mathew's Leon, ―Fundamentals of Computer Science and Communication Engineering‖, Vikas Publishing House, New Delhi, 1998.

Mapping of Cos with Pos:

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	1
CO2	3	3	3	2	1
CO3	3	3	3	2	1
CO4	3	3	3	2	1
CO5	3	3	3	2	1
Weightage of course contributed to each PO	**15**	**15**	**15**	**10**	**5**

Strong – 3   Medium – 2   Low - 1

Programme Title : **M.Sc. Data Science**

Course Title : **HUMAN RIGHTS**

Course Code : **24PHRSC** **Hours/Week:2**

Semester : **II** **Credit:1**

COURSE OBJECTIVE:

To enlighten the students about the different rights.

UNIT – I: **Hours : 6**

Human rights- Definition- characteristics of human rights-classification of rights- The Universal declaration of human rights-international covenants on economic, social and cultural rights

UNIT – II: **Hours : 6**

Constitutional guarantee on human rights - Fundamental rights -Part III of constitution- Directive principles Part IV of the constitution.

UNIT – III: **Hours : 6**

Civil and political rights- right to work, right to personal freedom, right to freedom of expression, right to property, right to education, right to equality, right to religion, right to form association and unions, right to family, right to contract, right to constitutional remedies, right to contest in election, right to hold public office, right to petition, right to criticize government.

UNIT – IV: **Hours : 6**

Economic rights: Right to work, right to adequate wages, right to reasonable hours of work, right to self-government in industry.

UNIT -V: **Hours : 6**

Women's Rights: Right to inheritance, right to divorce, right to remarry, right to education, right to employment and career advancement.

BOOKS FOR STUDY:

1. Human Rights UNESCO.1982
2. Desai A.R.-Violation of democratic rights in India.1986.
3. Pandey- Constitutional Law
4. Human Rights - A selected bibliography, USIS.
5. Singh K.S Indian Social Instituition.1983