IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Scheme Based on AICTE Flexible Curriculum

Department of Computer Science & Engineering

Bachelor of Technology (B. Tech.)

[Data Science]

IV- Semester (Scheme)

S.No.	Course Type	Course Code	Course Title	Hrs./Week			Credits
				L	T	P	
1	BSC	MA04	Statistical Principles of Data Science	2	1	-	3
2	PCC	DS05	Computer Network	2	1	-	3
3	PCC	DS06	Object Oriented Programming	2	1	-	3
4	PCC	DS07	Data Ethics	3	-	-	3
5	HSMC	HS03	Innovation and Creativity	-	-	2	1
6	IFC	CB01	Interdisciplinary Foundation Course-I	2	-	-	2
7	LC	DS05(P)	Computer Network Lab	-	-	2	1
8	LC	DS06(P)	Object Oriented Programming	-	-	4	2
9	LC	DS08(P)	R-Based Statistical Analysis	-	-	2	1
10	LC	DS09(P)	Data Visualization and Business	-	-	2	1
11	SBC	DS02(P)	Web Development Technologies	-	-	2	1
12	LLC	LLC02	Liberal Learning Course –II	-	-	2	1
13	MLC	MLC02	Constitution of India	1	-	-	Audit
Total Academic Engagement & Credits				12	3	16	22
				31			

- **Interdisciplinary Foundation Course-I, IFC-CB01**

(Offered by Cyber Security IOT including Blockchain Technology Branch.)

- Blockchain Technology

Note:

- **Liberal Learning Course-II, LLC02(Any One Course from NCC/NSO/NCA)**

A. NCC

B. NSO

- Any one Sports at State Level

C. NCA

- Music
- Dance
- Photography
- Cinematography
- Podcasting
- Theatre
- Painting

IPS Academy
Institute of Engineering & Science
Department of Computer Science & Engineering (Data Science)
IV-Semester (Syllabus)

BSC- MA04	**Statistics Principles of Data Science**	**2L: 1T: 0P (3 hrs.)**	**Credits:03**

Prerequisite: Engineering Mathematics.

Course Content: (40 Hrs.)

Module 1: **(08 hrs.)**
Set Theory, Relation, Function, Theorem Proving Techniques: Set theory: definition of sets, Venn Diagram, proofs of some general identities on set, Relation: Definition, Types of relation Composition of relation, Equivalence relation, Partial ordering relation, POSET, Hasse diagram and Lattice.

Module 2: **(08 hrs.)**
Algebraic structure: Definition, Properties, types: Semi Group, Monoid, Groups, Abelian Group, Properties of group, cyclic group, Normal subgroup, Ring and Fields: definition and standard result, Introduction to Recurrence Relation and Generating Functions.

Module 3: **(08 hrs.)**
Propositional logic: Proposition, First order Logic, Basic logical operation, Truth tables, Tautologies and Contradiction, algebra of proposition, logical implication, logical equivalence ,predicates, Normal Forms, Quantifiers Graph theory: Introduction and basic terminology of graph, types of graph, Path, Cycles, Shortest path in weighted graph, graph colorings.

Module 4: **(08 hrs.)**
Matrices: Determinant and Trace, Cholesky Decomposition, Eigen decomposition, Singular Value decomposition (SVD), Gradient of a matrix: Useful identities For computing Gradient.

Module 5: **(08 hrs.)**
Test of Hypothesis: Concept and Formulation, Type-I and Type-II Errors, Time Series Analysis, Analysis of Variance (ANOVA)

Course Outcome:

1. Describe sets, relations, functions and mathematical induction.
2. Formulate and solve Groups and Rings problems.
3. Apply Propositional logic and finite state automata to solve problems.
4. Apply the Concepts of Graph theory to Solve real world problems.
5. Formulate and solve Poset and recurrence relations.

List of Reference Books/ Text Books:

1. C.L.Liu, “Elements of Discrete Mathematics” Tata Mc Graw-Hill Edition.
2. Trembley, J.P & Manohar; “Discrete Mathematical Structure with Application CS”, McGraw Hill.
3. Kenneth H. Rosen, “Discrete Mathematics and its applications”, McGraw Hill.
4. Bisht, “Discrete Mathematics”, Oxford University Press
5. Biswal, “Discrete Mathematics & Graph Theory”, PHI
6. Mathematics For Machine Learning- Marc Peter Deisenroth, A. Aldo Faisal, Cheng soon ong
7. Statistical Method- S.P. Gupta

PCC-DS05	Computer Network	2L: 1T: 0P (3 Hrs.)	Credits:03

Prerequisite: Data Communication

Course Objective: This course provides foundation to understand computer networks using layered architectures.

Course Contents: (43 Hrs.)

Module 1: **(08 hrs.)**

Introduction to computer networks: Network – Component and Categories – Topologies Reference Models: ISO/OSI Model and TCP/IP Protocol suite. Principals of physical layer: Transmission Media, Bandwidth, Multiplexing, Switching, X.25, ISDN.

Module 2: **(08 hrs.)**

Data Link Layer: Need, Services Provided, Framing, Flow Control, Error control. Data Link Layer Protocol: Elementary & Sliding Window protocol: 1-bit, Go-Back-N, Selective Repeat, Hybrid ARQ. Protocol verification: Finite State Machine Models & Petri net models. HDLC, ARP/RARP, Error detection & correction technique.

Module 3: **(09 hrs.)**

MAC Sublayer: MAC Addressing, Binary Exponential Back-off (BEB) Algorithm, Distributed Random Access Schemes/Contention Schemes: for Data Services (ALOHA and Slotted- ALOHA), for Local-Area Networks (CSMA, CSMA/CD, CSMA/CA), Collision Free Protocols: Basic Bit Map, Binary Count Down, Adaptive Tree Walk, Performance Measuring Metrics. IEEE Standards 802 series & their variant.

Module 4: **(08 hrs.)**

Network Layer: Need, Services Provided, Design issues, Routing algorithms: Least Cost Routing algorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing, Broadcast Routing, Multicast Routing. IP Addresses, Header format, Packet forwarding, Fragmentation and reassembly, ICMP, Comparative study of IPv4 & IPv6.

Module 5: **(10 hrs.)**

Transport Layer: Design Issues, UDP: Header Format, Per-Segment Checksum, Carrying Unicast/Multicast Real-Time Traffic, TCP: Connection Management, Reliability of Data Transfers, TCP Flow Control, TCP Congestion Control, TCP Header Format, TCP Timer Management. Application Layer: WWW and HTTP, FTP, SSH, Email (SMTP, MIME, IMAP), DNS, Network Management (SNMP).

Course Outcome:

1. Describe basics of computer network, network architecture, TCP/IP protocol suite, OSI reference models & fundamentals of physical layer.
2. Classify data link protocol like flow control, error control, bit-oriented protocol.
3. Paraphrase multi-channel access protocol, IEEE 802 standards & use Ethernet standards.
4. Explain routing & congestion algorithm. State IP protocol, addressing & subnet.
5. Distinguish various transport & application layer protocols.

List of Text / Reference Books:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks" Pearson New International Edition, 5th Edition, 2013.
2. Douglas E Comer, "Internetworking with TCP/IP Principles, Protocols, and Architecture -Volume I" 6 th Edition, Prentice Hall of India.
3. Dimitri Bertsekas, Robert Gallager, "Data Networks", PHI Publication, Second Edition.
4. Kaveh Pahlavan, Prashant Krishnamurthy, "Networking Fundamentals", Wiley Publication. First Edition,2009
5. Uyless Black, "Computer Networks", PHI Publication, Second Edition.
6. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGrawHill.2011.
7. Behrouz A. Forouzan, "Data Communication and Networking", McGrawHill, 5th Edition, 2013.
8. William Stallings, "Data and Computer Communication" 8th Edition, 2007.
9. W. Richard Stevens. "TCP/IP Illustrated, Volume 1", Addison-Wesley, United States of America.

PCC-DS06	Object Oriented Programming & Methodology	2L: 1T: 0P (3 hrs.)	Credits:03

Prerequisite: Foundation of C/C++ language

Course Objective:

The course is designed to provide complete knowledge of Object-Oriented Programming through and to enhance the programming skills of the students by giving practical assignments to be done in labs. Its main objective is to teach the basic concepts and techniques which form the object-oriented programming paradigm.

Course Content: (42 Hrs.)

Module 1: **(08 hrs.)**

Introduction to Object Oriented Programming, Comparison with Procedural Programming, features of Object-oriented paradigm, merits and demerits of OO methodology; Introduction to Java Development Kit (JDK) & Java virtual machine (JVM); Linker & Loader; Data Encapsulation: Concept of Classes & Objects; State, Behavior & Identity of an object.

Module 2: **(08 hrs.)**

Data Abstraction and Message Passing: Methods, calling of constructors, Decision making constructs, Control loops, Keywords: this, static; Access modifiers, Arrays within a class, String Class.

Module 3: **(10 hrs.)**

Relationship between classes: Generalization- Inheritance, Types of Inheritance, Ambiguity in multiple inheritances, Concept of interfaces; Specialization- Association, Aggregation and Composition; Static and Dynamic Binding: Polymorphism, Method Overriding & Overloading; Keywords: super, abstract, final.

Module 4: **(08 hrs.)**

Concept of Packages, Need of package; Basic idea of exception handling, stack-based execution and exception propagation, Exception types: Exception Handling Try, Catch, Finally, Throw statement, Assertions.

Module 5: **(08 hrs.)**

Overview of Simple threads, Basic idea of Multithreaded Programming, Thread synchronization: Locks, synchronized methods, synchronized block, thread scheduling, Producer-consumer relationship, Daemon thread.

Course Outcome:

1. Understand object oriented programming concepts, core JAVA and apply them in solving Problems.
2. Develop skill in data abstraction and message passing.
3. Understand fundamentals of relationship amongst objects.
4. Learn about the need of exception and errors.
5. Develop ability to write a computer program to solve specified problems.

List of Text Books / Reference Books:

1. G. Booch, “Object Oriented Analysis & Design”, Pearson.
2. Barbara Liskov, Program Development in Java, Addison-Wesley, 2001.
3. James Martin, “Principles of Object Oriented Analysis and Design”, Prentice Hall/PTR.
4. Peter Coad and Edward Yourdon, “Object Oriented Design”, Prentice Hall/PTR.
5. Herbert Schildt, “Java 2: The Complete Reference”, 7th Edition, McGraw-Hill.

PCC- DS07	Data Ethics	3L: 0T: 0P (3 hrs.)	Credits:03

Prerequisite: Concepts of Data Science and related Programming

Course Objectives:

To make the students aware regarding the ethics they must inculcate in themselves in order to make effective use of data science techniques while safeguarding the interests of the people serving as the sources of data.

Course Content: (40 Hrs.)

Module 1: **(08 Hrs.)**

What are ethics: Simple utilitarian ethics, agreement about right or wrong, arguments & counter arguments, Need of ethics in Data Science, History & concept of informed consent, welfare of human subjects, limitations of informed consent, examples of Human subject research

Module 2: **(09 Hrs.)**

Data Ownership & Privacy: Personal data, copyrights, ownership of content on the internet, limits of recording & use of data. Significance of Privacy, History of privacy, degrees of privacy, modern privacy risks, relationship between services & data, data vs metadata. Anonymity, its significance, applications & drawbacks.

Module 3: **(08 Hrs.)**

Data Validity: choice of attributes & measures, Population & representative samples, errors in data processing, errors in model design, managing changes in the process.

Algorithmic Fairness: Need of a fair analysis, Kinds of biases & their effects, Case study: High throughput biology & geopricing.

Module 4: **(09 Hrs.)**

Societal Consequences: Societal impact, ossification, surveillance, Understanding status quo: current state of the world, Information asymmetry, Code of ethics & morality.

Module 5: **(06 Hrs.)**

Case Study:

Examining real-world ethical dilemmas in data usage. Ethical decision-making frameworks applied to case studies. Open data and its ethical implications. Ethical challenges in data visualization.

Course Outcomes:

1. Understand the meaning & need of ethics in data science.
2. Knowing about significance of privacy & ownership of content.
3. Evaluating validity & fairness of data & algorithms.
4. Learning about the social aspects of Ethics.

List of Resources:

1. Ethics and Data Science by Mike Loukides (Author), Hilary Mason (Author), D. J. Patil (Author)
2. Data Science Ethics: Course from Coursera
3. Data Ethics & Challenges by Sameeksha Shukla, 2022

CB01	Blockchain Technology	2L: 0T: 0P (2 hrs.)	Credits: 02

Prerequisite: NA

Course Objectives:

To understand the concept of Blockchain and its platforms- Bitcoin, Ethereum, Hyperledger and Multichain. The course provides an overview of the structure and mechanism of Blockchain.

Course Content: (40 Hrs.)

Module 1: Blockchain **(06 hrs.)**

Introduction and crypto foundation: Elliptic curve Cryptography, ECDSA, encryption and decryption. Introduction to Blockchain Technology with its Applications, Blockchain Network, Hashing Algorithm, SHA-256, Immutable Ledger, Centralized and Distributed P2P Network.

Module 2: Blockchain Mining **(10 hrs.)**

Blockchain Mining, Byzantine General Problem, Consensus Protocol and its types- Proof of work (PoW) and proof-of-stake (PoS) algorithm.

Module 3: Cryptocurrency **(08 hrs.)**

Bitcoin, Bitcoin addresses, Bitcoin Ecosystem, Bitcoin's Monetary Policy, The Halving Problem, Block frequency, The Nonce, difficulty adjustment algorithm, mining pools, transactions, Ethereum, overview of differences between Ethereum and bitcoin, block format, mining algorithm, account management, contracts, Solidity language, decentralized application using Ethereum.

Module 4: Smart Contract **(08 hrs.)**

Introduction to Smart Contracts, Different Blockchains and Consensus mechanisms. Smart contacts (escrow, micropayments, and decentralized lotteries), payment channels.

Module 5: Application Areas of Blockchain **(08 hrs.)**

Blockchain and its application with IOT and Cybersecurity, Blockchain and Security R3, CORDA and Hyperledger System architecture, ledger format, chain code, transaction flow and ordering, private channels, membership service providers, case studies.

Course Outcomes:

After Completing the course student should be able to:
1. Describe the basic concepts blockchain technology.
2. Understand several types of consensus protocols.
3. Illustrate the concepts of Bitcoin along with different types of cryptocurrencies.
4. Understand the working and importance of smart contracts.
5. Analyze the block chain applications in a structured manner.

List of Text / Reference Books:

1. Mastering Bitcoin: Unblocking Digital Cryptocurrencies, by Andreas Antonopoulos.
2. Mastering Ethereum, Antonopoulos, Andreas M. and Wood, O'Reilly Media, Inc.,2018
3. An Introduction to Bitcoin, V. Saravanan, Lecture Notes.
4. Bitcoin and Cryptocurrencies Technologies: A Comprehensive Introduction, Arvind Narayanan, Princeton University Press (July 19,2016) ISBN-10:0691171696.

LC- DS05(P)	Computer Network Lab	0L: 0T: 2P (2 hrs.)	Credits:01

Prerequisite: Data Communication

Course Objective:

The course is designed to provide Basic knowledge of Computer Network. Computer Networking is intended for Network engineers, Network designers and Network administrators who wish to aim for telecommunication domain. Learning Outcomes - Understanding of computer network, Network designing and troubleshooting.

Course Content: (41 Hrs.)

Module 1: **(07 hrs.)**

Introduction to computer networks: Networking Devices, Network – Component and Categories, Local area networks and Wide area networks. Color coding standard of CAT 5, 6, 7 and crimping of cable in RJ-45, Principals of physical layer: Transmission Media, Bandwidth.

Module 2: **(10 hrs.)**

Introduction to packet tracer simulator, Network topologies, Data Link Layer Protocol: Elementary &Sliding Window protocol: 1-bit, Go-Back-N, Selective Repeat, Error control, framing. ARP.

Module 3: **(08 hrs.)**

Network Layer: Routing algorithms: Dijkstra's algorithm, Bellman-ford algorithm, IP Addresses, classful & classless addressing, IP routing, Subnetting and supernetting, ICMP.

Module 4: **(08 hrs.)**

Transport Layer: TCP service protocols, UDP: Header Format, Per-Segment Checksum, Socket programming.

Module 5: **(08 hrs.)**

Introduction to the various internetworking devices and their basic configuration, Study of various application layer protocols.

Course Outcome:

1. Describe basics of computer network, network architecture, TCP/IP protocol suite, OSI reference models & fundamentals of physical layer.
2. Classify data link protocol like flow control, error control, bit oriented protocol.
3. Paraphrase multi-channel access protocol, IEEE 802 standards & use Ethernet standards.
4. Explain routing & congestion algorithm. State IP protocol, addressing & subnet.
5. Distinguish various transport & application layer protocols.

List of Text / Reference Books:

1. Andrew S.Tanenbaum, David J. Wetherill, "Computer Networks" Pearson New International Edition, 5thEdition, 2013.
2. Douglas E Comer, "Internetworking with Tcp/Ip Principles, Protocols, and Architecture-Volume I" 6th Edition, Prentice Hall of India.
3. Dimitri Bertsekas, Robert Gallager, "Data Networks", PHI Publication, Second Edition.
4. Kaveh Pahlavan, Prashant Krishnamurthy, "Networking Fundamentals", Wiley Publication.FirstEdition,2009
5. Uyless Black, "Computer Networks", PHI Publication, Second Edition.
6. Ying-DarLin, Ren-Hung Hwang, FredBaker,"Computer Networks: An Open Source Approach", McGrawHill.2011.
7. Behrouz A. Forouzan, "Data Communication and Networking", McGrawHill, 5th Edition, 2013.
8. William Stallings,"Dataand Computer Communication"8thEdition,2007.
9. W. Richard Stevens. "TCP/IP Illustrated, Volume 1", Addison-Wesley, United States of America.

List of Experiments:

1. Study of different types of LAN & Network Equipments. (CO1)
2. Study of various transmission media (CO1)
3. LAN installations and Configurations. (CO1)
4. Installation of Cisco Packet Tracer. (CO2)
5. Design various Network Topologies using packet tracer .(CO2)
6. Implement various types of error detection and correcting techniques. (CO2)
7. Write a program to implement Bit stuffing. (CO2)
8. Write a program implement Dijkstra's shortest path algorithm. (CO3)
9. Configuring IP addresses and Subnet Mask Using CICSO Packet Tracer (CO3)
10. Simulate TCP: Transmission Control Protocol 3-way handling using Wire shark.(CO4)
11. Study of application layer protocols- DNS, FTP, SMTP, SNMP and HTTP. (CO5)
12. Configure various networking devices using CISCO Packet Tracer (CO 5)

LC- DS06 (P)	Object Oriented Programming & Methodology Lab	0L: 0T: 4P (4 hrs.)	Credits:02

Prerequisite: Programming for Problem Solving

Course Objective:

This course designed to provide knowledge of Object Oriented Programming. It introduces object-oriented programming using the Java programming language. The course is designed to enhance the programming skills of the students by giving practical assignments to be done in labs. Its main objective is to teach the basic concepts and techniques of object oriented programming paradigm. Students will learn how to program in Java and use some of its most important APIs.

Course Content: (40 Hrs.)

Module 1: **(08 hrs.)**

Introduction to Object Oriented Programming, Basics of Java programming, Data types, Variables, Operators, Control structures, looping; Introduction to Java Development Kit (JDK) & Java virtual machine (JVM); Linker & Loader; Data Encapsulation: Concept of Classes & Objects.

Module 2: **(08 hrs.)**

Data Abstraction and Message Passing: Methods, constructors, Keywords: this, static; Access modifiers, Arrays within a class, String Class.

Module 3: **(08 hrs.)**

Relationship between classes: Inheritance, Types of Inheritance, Ambiguity in multiple inheritances, Concept of interfaces; Specialization- Association, Aggregation and Composition; Static and Dynamic Binding: Polymorphism, Method Overriding & Overloading; Keywords: super, abstract, final.

Module 4: **(08 hrs.)**

Concept of Packages, Need of package; Basic idea of exception handling, Exception types: Exception Handling Try, Catch, Finally, Throw statement, Assertions.

Module 5: **(08 hrs.)**

Overview of Simple threads, Thread life cycle and methods, Runnable interface, Thread synchronization, Basic idea of Multithreaded Programming.

Course Outcome:

1.Understand object-oriented programming principles and apply them in solving Problems.
2.Develop skill in data abstraction and message passing
3.Understand fundamentals of relationship amongst objects
4.Learn about the need of exception and errors
5.Understand the concept of threads.

List of Text Books / Reference Books:

1. G. Booch, "Object Oriented Analysis & Design", Pearson.
2. Barbara Liskov, Program Development in Java, Addison-Wesley, 2001.
3. James Martin, "Principles of Object Oriented Analysis and Design", Prentice Hall/PTR.
4. Peter Coad and Edward Yourdon, "Object Oriented Design", Prentice Hall/PTR.
5. Herbert Schildt, "Java 2: The Complete Reference", 7th Edition, McGraw-Hill.

List of Experiments:

1. Write a program to show Concept of CLASS in JAVA.
2. Write a program to show Concept of Constructor in JAVA.
3. Write a program to show Concept of Arrays in JAVA.
4. Write a Program to show Inheritance.
5. Write a program to show Polymorphism (method overloading and overriding)
6. Write a program to show Interfacing between two classes.
7. Write a program to show Exception handling.
8. Write a program to Add a Class to a Package
9. Write a program to show Life Cycle of a Thread

LC- DS08(P)	R–Based Statistical Analysis	0L: 0T: 2P (2 hrs.)	Credits:01

Prerequisite: Programming for Problem Solving

Course Objective:

The objective of this course is to find application in Data Analysis and Data Science: statistical modeling, and machine learning tasks.

Course Content: (40 Hrs.)

Module 1: **(08 hrs.)**

R Basics, what R is, what Rstudio is, an R script help file(s) for a function or package create a project in Rstudio, use of #comments to annotate my R scripts, assign an object a value in R, print an object value to the R Console data types of R objects find the data type of an object define an element in R define a vector, create a vector.

Module 2: **(08 hrs.)**

Working with Data, Data file into Rstudio, subset a vector, define Boolean operators, WID5 I can subset a vector using, WID6 create a data frame, assign column names to a data frame, data frame by indices, NA from objects (e,g,, data frame, matrix, or list), create a matrix, data frame or matrix, define an array, create an array, create a list, convert a data frame into a list, replace elements in an object (e,g,, data frame, matrix, or list), create a factor.

Module 3: **(08 hrs.)**

Plotting Data ,use the x and y arguments of plot() to create a plot, label the x- and y-axes and title of a plot, change the point characteristics (pch) or line type (lty) on a plot, change the character expansion (cex) or line width (lwd) of data on a plot, add an accurate legend to a plot, call to plot(),create custom axes for a plot (e,g,, axis(), xaxp and yaxp arguments), change the type of plot (e,g,, points, lines, etc,), add additional lines() or points() to a plot use par(mfrow) or par(mfcol) to create a multi-panel plot, use par(mar) or par (oma) to manipulate the margins of a multi-panel plot, use mtext() to add text to the outside of a plot, use layout() to create a multi-panel plot, create a boxplot, create a barplot, save plots as a pdf().

Module 4: **(08 hrs.)**

Data manipulation DM, unique elements in an object, duplicated elements in an object built-in constants in R, use subset() to subset an object, use apply() to use an arithmetic function on a matrix, identify the difference between sort() and order(),apply sort() and order() to objects, use system,time() combine two objects using merge(),assign an object a Date or POSIXtclass, extract components of dates, arithmetic functions to objects of Date class, package in Rstudio, load a package in Rstudio.

Module 5: **(08 hrs.)**

Statistics in R STAT, differentiate between the functions for finding the probability, density, quantile, or random numbers from a given probability distribution, locate the built-in probability distributions in R, define pseudorandom generation, use set,seed() to create reproducible random number generation, use sample() to randomly draw elements from an object, locate functions for data summarization: summary(), fivenum(), sd(), range(),plot data using pairs(), hist(), boxplot(), or density(),locate functions for basic statistical tests.

Course Outcomes:

CO 1: Show the installation of R Programming Environment.
CO 2: Utilize and R Data types for developing programs.
CO 3: Make use of different R Data Structures.
CO 4: Develop programming logic using R Packages.
CO 5: Analyze the datasets using R programming capabilities.

List of Text Books / Reference Books:

1. Jared P. Lander, R for Everyone: Advanced Analytics and Graphics,
2 nd Edition, Pearson Education, 2018. 2. S. R. Mani Sekhar and T. V. Suresh Kumar, Programming with R,1 st Edition,, CENGAGE, 2017.

List of Experiments:

1. Download and install R-Programming environment and install basic packages using install.packages() command in R.
2. Learn all the basics of R-Programming (Data types, Variables, Operators etc.)
3. Implement R-Loops with different examples.
4. Learn the basics of functions in R and implement with examples.
5. Implement data frames in R. Write a program to join columns and rows in a data frame using cbind() and rbind() in R.
6. Implement different String Manipulation functions in R.
7. Implement different data structures in R (Vectors, Lists, Data Frames).
8. Write a program to read a csv file and analyze the data in the file in R
9. Create pie charts and bar charts using R.
10. Create a data set and do statistical analysis on the data using R.

LC-DS09(P)	Data Visualization & Business Intelligence Lab	0L: 0T: 2P (2 hrs.)	Credits:01

Prerequisite: Python & its libraries (Numpy and Pandas)

Course Objective:

This course is designed to provide knowledge regarding how the data stored in a dataset can be visualized to provide better understanding of data. Also to impart knowledge on how data impacts business decisions and how data visualization can be used in the benefit of the business.

Course Content: (40 Hrs.)

Module 1: **(08 hrs.)**

Matplotlib: Installation & introduction to matplotlib & pyplot, Basic graphs- bar graph, pie chart, histogram, line graph & scatterplot, multiple plots in a graph & formatting, Advanced matplotlib plotting: contour plots, 3-D graphs

Module 2: **(08 hrs.)**

Seaborn: Download & installation of seaborn, overview of seaborn plotting functions, visualization of distribution of data, statistical plotting of data, visualizing categorical data. Plots like distplot, boxplot, violinplot, heatmaps; color palettes

.

Module 3: **(08 hrs.)**

Power BI-I: Introduction to Business Intelligence, Installation of Power BI, Why Power BI, Power BI vs Tableau, Importing data, Basic charts, creating a map, tables and matrix, matrix calculations, cards & filters, KPIs, slicers, creating hyperlinks.

Module 4: **(08 hrs.)**

Power BI-II: Advanced charts in Power BI- Drill down charts, Sankey graphs, Animated bar chart race, wordcloud, sunburst; Other actions, Introduction to Power BI service, Power Query: Basic DAX, DAX functions, date functions & number functions.

Module 5: **(08 hrs.)**

Hands on Data Visualization tools: Working with matplotlib and seaborn to perform data visualisation on realworld datasets, Dashboarding: Creating Dashboard in Power BI & presenting it on Power BI service

Course Outcomes:

1. Getting to know the basics & importance of Data Visualisation through matplotlib
2. Learning advanced visualisation tools through seaborn
3. Learning the basic visuals on Power BI.
4. Working with advanced features of Power BI.
5. Creating reports & dashboards & publishing them online.

List of Reference Books/Text Books:

1. Hands-On Data Visualization: O'Reilly Publications:
2. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015.
3. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython",;Reilly Media, 2012.
4. Mastering Microsoft Power Bi: Expert techniques for effective data analytics and business intelligence
5. Microsoft Power BI Dashboards Step by Step| First Edition| By pearson.

List of Experiment:

1. Using pandas create a simple Data frame.
2. Write a program in python using pandas libraries Load the CSV into Data frame
3. Write a program using pandas and numpy to print first 10 row of the data frame and also use tail method.
4. Write a program in python using matplotlib to draw a line.
5. Write a program in python a simple scatter plot.
6. Using the matplotlib libraries to draw histogram.
7. Write a program in python using numpy to generate a random normal distribution.
8. Using the seaborn libraries plotting the displot without the histogram.
9. Using the matplotlib draw a simple pie chart.
10. Cases study of all python libraries.

SBC-DS02(P)	Web Development Technologies	0L: 0T: 2P (2 hrs.)	Credits:01

Prerequisite: NA

Course Contents: (40 Hrs)

Module 1: **(08 hrs.)**

Web Development Introduction, HTML Tags and Attributes, HTML Tag vs. Element, HTML Attributes, HTML Formatting Tags, CSS Introduction CSS 3.

Module 2: **(08 hrs.)**

Introduction JavaScript Overview, JavaScript Syntax, Type of JavaScript, Embedding Script In HTML, File Variable, Operators Arithmetic, Logical, Comparison, Assignment, Conditional, Conditional Statement & Looping Statement If, If. Else, Switch, While, Do/while, For, Function & Object Passing Parameter to, function Returning a value from, function Creating Object.

Module 3: **(08 hrs.)**

Database Connectivity with MySql Introduction to RDBMS, Connection with MySql Database, Performing basic database operation (DML) (Insert, Delete, Update, and Select).

Module 4: **(08 hrs.)**

Introduction to PHP, Decisions and loop, Function, Array, Handling Html Form with Php, Working with file and Directories,. Session and Cookie, Exception Handling,

Module 5: **(08 hrs.)**

Introduction to PHP framework Codeigniter, Laravel, Magneto, Case study – E-commerce website

Course Outcomes:

1. Develop program using control statement
2. Perform operation based on arrays and graphics
3. Develop programs by applying various object oriented concepts.
4. Use form controls with validation to collect user's input.
5. Perform database operations in PHP.

List of Text Books / Reference Books:

1. Learning PHP, MySQL, books by ‘ O’ riley Press
2. HTML & CSS: The Complete Reference, Fifth Edition Thomas A Powell
3. The Complete Reference, Second Edition by Thomas Powell and Fritz Schneider.
4. Nerdy recursive acronym: PHP: Hypertext Preprocessor (originally named Personal Home Page Tools)
5. Invented by Rasmus Lerdorf in 1994 and is now under the Apache Software Foundation. Licensed under the GPL and is free. Current version as of October 2012 is PHP 5.4.8.

List of Experiment:

1. Create a static website showing details of the food item /clothing & host on local LAN.(Hint:- Use Xmapp and htdocs folder) (HTML iframe minimum 5 html page)
2. Create the Registration form for the customer.(on submit button print all details on next page)
3. Create the login page using CSS3 and Bootstrap.
4. Apply Java Script and validation on the website created above.
5. Using Java Script apply the color theme on your website.
6. Using Java Script create an E-greeting website (Minimum 3 page).
7. Create a php file for Registration and Login page of your website.
8. Perform complete working of your website using Data Base connectivity of MYSQL.