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Undergraduate Programme in Computer Science with Data Science

**Syllabus for
B.Sc Computer Science with Data Science
(With effect from the Academic Year 2022 -23)**

Learning Outcome Based Curriculum Framework

Note: The Committee is designed Learning Outcome Based Curriculum Framework of Undergraduate Computer Science Programmes prescribed by UGC

I Preamble

Bachelor of Computer Science with Data Science is a 3 – Year Undergraduate Programme spread over six semesters. The course is designed to achieve a high degree of technical skills in Problem solving and Modern application development. The course develops requisite professional skills and problem solving along with developing the analytical abilities for pursuing a successful career in software industry and forms the required basics for further higher studies in Computer Science specifically in the area of Data Science.

ELIGIBILITY FOR ADMISSION:

Candidates for admission to the first year of the Degree of Bachelor of Science in Computer Science with Data Science Courses should have studied Mathematics at Higher Secondary level.

II Course Objectives

- Acquisition of Knowledge and understanding of systems, various programming languages and tools required for effective computation based problem solving and analysis.
- Utilize emerging technological tools learn, adapt and successfully engage effective procedural coding to meet the needs of technical and societal challenges
- Attain sufficient knowledge related to computer domains, render technical, soft and hard skills to apply them effectively in team work
- Empower the students with competencies in creative thinking and problem solving, interpersonal communication and managerial skills.

III Graduate Attributes

- Computational Knowledge
- Problem analysis & Solving
- Design & Development of Solutions
- Modern tool usage
- Communication skills
- Innovation & Entrepreneurship
- Societal & environmental concern
- Pragmatic Application of tools

IV Course Outcomes

After Completion of the course, the students are expected to

- Understand the basic principles and concepts of Computer Science and Data Science with an integrate the knowledge gained in the domain with practical needs of the society and be an ethically and socially responsible Professional
- Explore latest emerging technologies in diverse areas of Computer Science and inculcate skills for successful career, entrepreneurship and higher studies
- Apply the concepts of Computer and practices via emerging technologies and Software development tools to solve pragmatic social concerns.

Course Structure

B.Sc Computer Science with with Data Science

SYLLABUS

2022 -23

ELIGIBILITY FOR ADMISSION:

Candidates for admission to the first year of the Degree of Bachelor of Science in Computer Science with Data Science Courses should have studied Mathematics at Higher Secondary level.

S.NO.	PART	SUBJECT NAME	CREDITS	Lecture Hours	MAXIMUM MARKS		
SEMESTER I					EXT. MKS	INT. MKS	TOTAL
1	I	Tamil/ Other languages – I	3	6	75	25	100
2	II	BP2-ENG01- Communicative English I	3	3	75	25	100
3	III	Core I : Introduction to Data Science	4	6	75	25	100
4	III	Practical I : Data Science using Python Lab	3	5	60	40	100
5	III	BMA-CSA01-Allied I: Mathematics-I@	5	6	75	25	100
6	IV	Basic Tamil/Advanced Tamil/NME I*	2	-	75	25	100
7	IV	BP4-EPSC01- English for Physical Science I	3	4	50	50	100
		Total Credits	23				
SEMESTER II			CREDITS	Lecture Hour	EXT. MKS	INT. MKS	TOTAL
8	I	Tamil/ Other languages – II	3	6	75	25	100
9	II	BP2-ENG02- Communicative English II	3	3	75	25	100
10	III	Core II : Java and Data Structures@	4	6	75	25	100
11	III	Practical II : Data Structures using Java Lab@	3	5	60	40	100
12	III	BMA-CSA02-Allied II: Mathematics II@	5	6	75	25	100
13	IV	Basic Tamil/Advanced Tamil/NME-II*	2	-	75	25	100
14	IV	BP4-EPSC02- English for Physical Science II	3	4	50	50	100
		Total Credits	23				
SEMESTER III			CREDITS	Lecture Hour	EXT. MKS	INT. MKS	TOTAL
15	I	Tamil/ Other languages – III	3	6	75	25	100
16	II	BP2-ENG03-Language Through Literature- I	3	6	75	25	100
17	III	Core III : Relational Database Management System@	4	5	75	25	100
18	III	Practical III : PL/SQL Lab@	3	3	60	40	100
19	III	BST-CSA01-Allied III-Statistics I@	5	8	75	25	100
20	IV	Soft Skill	3	2	50	50	100
21	IV	Environmental Studies	Examination will be held in Semester IV				
		Total Credits	21				
SEMESTER IV			CREDITS	Lecture Hour	EXT. MKS	INT. MKS	TOTAL
22	I	Tamil/ Other languages – IV	3	6	75	25	100
23	II	BP2-ENG04- Language Through Literature - II	3	6	75	25	100
24	III	Core IV : Data Analytics	4	5	75	25	100
25	III	Practical IV : Data Analytics Lab	3	3	60	40	100
26	III	BST-CSA02- Allied IV- Statistics II@	5	8	75	25	100
27	IV	Soft Skill	3	2	50	50	100
28	IV	Environmental Studies	2	-	75	25	100
		Total Credits	23				

SEMESTER V			CREDITS	Lecture Hour	EXT. MKS	INT. MKS	TOTAL
29	III	Core V: Operating Systems@	4	5	75	25	100
30	III	Core VI: Computer Networks@	5	5	75	25	100
31	III	Core VII: Data Visualization	4	5	75	25	100
32	III	Practical V: Data Visualization Lab	3	4	60	40	100
33	III	Elective I-Choose any one from the list@	5	5	60	40	100
34	III	Practical VI :Elective 1 Lab@	3	4	75	25	100
35	IV	Value Education	2	2	75	25	100
		Total Credits	26				
SEMESTER VI			CREDITS	Lecture Hour	EXT. MKS	INT. MKS	TOTAL
36	III	Core VIII: Cloud Computing@	4	6	75	25	100
37	III	Core IX:Internet Of Things@	5	6	75	25	100
38	III	Core X: Machine Learning@	4	6	75	25	100
39	III	Practical VII:Machine Learning Lab@	3	3	60	40	100
40	III	Elective II-Choose any one from the list@	5	5	75	25	100
41	III	Core Practical-VIII – Mini Project@	5	4**	60	40	100
42	V	Extension Activities	1				
		Total Credits	27				
		Total credits (Core, Elective, SBS)	143				
Non Major Elective I - I Semester							
*NME: Choose Any one From the Other Department							
Non Major Elective II – II Semester							
*NME: Choose Any one From the Other Department							
Elective I							
Natural Language processing + Lab Mobile Application Development for Machine Learning + Lab Introduction to Reinforcement Learning + Lab							
Elective II							
Information Security Network Security Block chain Technology							

@ - Common subject of other course/s.

** (Lab Hours for Development of Mini Project [External project optional])

INTRODUCTION TO DATA SCIENCE**OBJECTIVES:**

- Provide a strong foundation for data science and application areas related to it.
- Understand the underlying core concepts and emerging technologies in data science.
- Learn the process of working with data on large scale.
- Explore the concepts of Data Processing.
- Learn basic concepts of Machine Learning.
- Prepare students for advanced courses in Data Science.

OUTCOMES:

- Understand the fundamental concepts of data science.
- Evaluate the data analysis techniques for applications handling large data and Demonstrate the data science process.
- Understand the concept of machine learning used in the data science process.
- Visualize and present the inference using various tools.
- Learn to think through the ethics surrounding privacy, data sharing.

OBJECTIVES:

- Provide a strong foundation for data science and application areas related to it.
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UNIT - I

Data Types: Understanding data - Types of data - Data Evaluation - Data Sources - Preparing and Gathering data - Digital Data - Introduction to Big Data - Sources of Big Data - Characteristics of Big Data

UNIT - II

Python fundamentals : Python program execution environment - Statements - Expressions - Flow of Control statements - Functions - Scope of Variables .

UNIT - III

Special Data Formats - List - List Methods - Tuples - Tuple Methods - Arrays - Dictionaries - - Sets - Related Methods - String - String Processing Methods

UNIT - IV

Numpy and Pandas - Features of Numpy - Mathematical functions - Statistical functions - nd-Arrays - Features of Pandas - series data structure - data frames - creation and manipulation of data frames

UNIT - V

Data Visualization - Matplotlib package - plotting graphs - legends - colors - labels - seaborn - package -plotly and dash packages

TEXT BOOK:

1. Joel grus, “Data Science from Scratch”, O’Reilly,2015
2. Mark Lutz, “ Programming in Python”, O’Reilly,2010

REFERENCES:

1. Wes Mckinney, “Python for data Analysis”, O’Reilly,2012
2. Shai vaingast,”Beginning Python on visualization, A Press 2014

WEB REFERENCES

1. NPTEL online course– Data Science for Engineers - <https://nptel.ac.in/courses/106106179/>

DATA SCIENCE USING PYTHON LAB**OBJECTIVES**

- Know the fundamentals of programming.
- Understand the importance of different data types in programming
- Analyze how data extraction is possible using regular expression
- Use file concepts when retrieving or storing data is required in python
- Know how object oriented concepts helps in organizing the coding structure.

OUTCOMES

- Demonstrate proficiency in handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving regular expressions and file system.
- Interpret the concepts of Object-Oriented Programming as used in Python

LIST OF EXERCISES:

1. Editing and executing Programs involving Flow Controls.
2. Editing and executing Programs involving Functions.
3. Program in String Manipulations
4. Creating and manipulating a Tuple
5. Creating and manipulating a List
6. Creating and manipulating a Dictionary
7. Object Creation and Usage
8. Program involving Inheritance
9. Program involving Overloading
10. Reading and Writing with Text Files and Binary Files
11. Combining and Merging Data Sets
12. Program involving Regular Expressions
13. Data Aggregation and GroupWise Operations

BOOKS:

1. Python Crash Course, 2nd Edition, By Eric Matthes, May 2019
2. NumPy Essentials, By Leo Chin and Tanmay Dutta, April 2016
3. Joel Grus, "Data Science from scratch", O'Reilly, 2015.
4. Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media, 2012.
5. *Kenneth A. Lambert, (2011), "The Fundamentals of Python: First Programs", Cengage Learning*
6. Jake Vanderplas. Python Data Science Handbook: Essential Tools for Working with Data 1st Edition.

JAVA AND DATA STRUCTURE**OBJECTIVES:**

- ☐ To enable the students to learn the basic concepts of Java programming
- ☐ To use class and objects to create applications
- ☐ To have an overview of interfaces, packages, multithreading and exceptions.
- ☐ To familiarize students with basic data structures and their use in algorithms.

OUTCOMES:

- ☐ Students will be able to develop Java Standalone applications and Applets.
- ☐ Choose the appropriate data structure for modeling a given problem.

UNIT - I

History and Evolution of Java - Features of Java - Object Oriented Concepts – Bytecode - Lexical Issues - Data Types – Variables- Type Conversion and Casting- Operators - Arithmetic Operators - Bitwise - Relational Operators - Assignment Operator - The conditional Operator - Operator Precedence- Control Statements – Arrays.

UNIT - II

Classes - Objects - Constructors - Overloading method - Static and fixed methods - Inner Classes - String Class- Overriding methods - Using super-Abstract class - this keyword – finalize() method – Garbage Collection.

UNIT - III

Packages - Access Protection - Importing Packages - Interfaces - Exception Handling - Throw and Throws- The Java Thread Model- Creating a Thread and Multiple Threads - Thread Priorities Synchronization-Inter thread Communication - Deadlock
- Suspending, Resuming and stopping threads – Multithreading-I/O Streams - File Streams - Applets .

UNIT - IV

Abstract Data Types(ADTs)-List ADT-Array based implementation-linked list implementation-singly linked list-doubly linked list-circular linked list-Stack ADT operations-Applications-Evaluating arithmetic expressions-Conversion of infix to postfix expression-Queue ADT-operations-Applications of Queues.

UNIT - V

Trees-Binary Trees- representation - Operations on Binary Trees- Traversal of a Binary Tree -Binary Search Trees, Graphs- Representation of Graphs - Traversal in Graph -Dijkstra's Algorithm, Depth-First vs Breadth-First Search.

TEXT BOOKS:

1. E.Balagurusamy," *Programming with Java: A Primer*", Tata McGraw Hill 2014, 5th Edition.
2. Mark Allen Weiss, "*Data Structures and Algorithms Analysis in C++*", Person Education 2014, 4th Edition.

REFERENCES:

1. Herbert Schildt, "*JAVA 2: The Complete Reference*", McGraw Hill 2018, 11th Edition.
2. Aho, Hopcroft and Ullman, "*Data Structures and Algorithms* ", Pearson Education 2003.
3. S. Sahni, "*Data Structures, Algorithms and Applications in JAVA*", Universities Press 2005, 2nd Edition

WEB REFERENCES:

- ☐ NPTEL & MOOC courses titled Java and Data Structures
- ☐ <https://nptel.ac.in/courses/106106127/>
- ☐ <https://nptel.ac.in/courses/106105191/>

DATA STRUCTURES USING JAVA LAB**OBJECTIVES:**

- ☐ To implement linear and non-linear data structures
- ☐ To understand the different operations of search trees
- ☐ To implement graph traversal algorithm

OUTCOMES:

- ☐ Write functions to implement linear and non-linear data structure operations.
- ☐ Suggest appropriate linear and non-linear data structure operations for solving a given problem.
- ☐

LIST OF EXERCISES:

1. Write a Java program to implement the Stack ADT using a singly linked list.
2. Write a Java program to implement the Queue ADT using a singly linked list.
3. Write a Java program for the implementation of circular Queue.
4. Write a Java program that reads an infix expression, converts into postfix form
5. Write a Java program to evaluate the postfix expression (use stack ADT).
6. Write a Java program to Insert an element into a binary search tree.
7. Write a Java program to delete an element from a binary search tree.
8. Write a Java program to search for a key element in a binary search tree.
9. Write a Java program for the implementation of BFS for a given graph.
10. Write a Java program for the implementation of DFS for a given graph

RELATIONAL DATABASE MANAGEMENT SYSTEM**OBJECTIVES:**

- Gain a good understanding of the architecture and functioning of Database Management Systems
- Understand the use of Structured Query Language (SQL) and its syntax.
- Apply Normalization techniques to normalize a database.
- Understand the need of transaction processing and learn techniques for controlling the consequences of concurrent data access.

OUTCOMES:

- Describe basic concepts of database system
- Design a Data model and Schemas in RDBMS
- Competent in use of SQL
- Analyze functional dependencies for designing robust Database

UNIT - I

Introduction to DBMS– Data and Information - Database – Database Management System – Objectives - Advantages – Components - Architecture. ER Model: Building blocks of ER Diagram – Relationship Degree – Classification – ER diagram to Tables – ISA relationship – Constraints – Aggregation and Composition – Advantages

UNIT - II

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

UNIT - III

Structure of Relational Database. Introduction to Relational Database Design - Objectives – Tools – Redundancy and Data Anomaly – Functional Dependency - Normalization – 1NF – 2NF – 3NF – BCNF. Transaction Processing – Database Security.

UNIT - IV

SQL: Commands – Data types – DDL - Selection, Projection, Join and Set Operations – Aggregate Functions – DML – Modification - Truncation - Constraints – Subquery.

UNIT - V

PL/SQL: Structure - Elements – Operators Precedence – Control Structure – Iterative Control - Cursors - Procedure

- Function - Packages – Exceptional Handling - Triggers.

TEXT BOOK:

1. S. Sumathi, S. Esakkirajan, “*Fundamentals of Relational Database Management System*”, Springer International Edition 2007.

REFERENCE BOOKS:

1. Abraham Silberchatz, Henry F. Korth, S. Sudarshan, “*Database System Concepts*”, McGrawHill 2019, 7th Edition.
2. Alexis Leon & Mathews Leon, “*Fundamentals of DBMS*”, Vijay Nicole Publications 2014, 2nd Edition.

WEB REFERENCES:

- ☐ NPTEL & MOOC courses titled Relational Database Management Systems
- ☐ <https://nptel.ac.in/courses/106106093/>
- ☐ <https://nptel.ac.in/courses/106106095/>

PRACTICAL - III :

II YEAR / III SEM

PL/SQL LAB**OBJECTIVES:**

- ☐ Learn the various DDL and DML commands
- ☐ Understand queries in SQL to retrieve information from database
- ☐ Understand PL/SQL statements: Exception Handling, Cursors, and Triggers.
- ☐ Develop database applications using front-end and back-end tools.

OUTCOMES:

- ☐ Implement the DDL , DML Commands and Constraints
- ☐ Create, Update and query on the database.
- ☐ Design and Implement simple project with Front End and Back End.

LIST OF EXERCISES

- 1) DDL commands with constraints.
- 2) DML Commands with constraints.
- 3) SQL Queries: Queries, sub queries, Aggregate function
- 4) PL/SQL : Exceptional Handling
- 5) PL/SQL : Cursor
- 6) PL/SQL : Trigger

- 7) PL/SQL : Packages
- 8) Design and Develop Application for Library Management
- 9) Design and Develop Application for Student Mark Sheet Processing
- 10) Design and Develop Application for PayRoll Processing

CORE - IV :

II YEAR / IV SEM

DATA ANALYTICS

OBJECTIVES:

- This course introduces the methods for data preparation and data understanding.
- It covers essential exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods.
- Supports to Summarize the insurers use of predictive analytics, data science and Data Visualization

OUTCOME:

- Handle missing data in the real world data sets by choosing appropriate methods.
- Summarize the data using basic statistics. Visualize the data using basic graphs and plots.
- Identify the outliers if any in the data set. 4. Choose appropriate feature selection and dimensionality reduction
- Techniques for handling multi-dimensional data

Unit I:

Introduction:

Big Data - Characteristics of Big Data - Types of Data: Structured, Unstructured and Semi structured - Measurement Scales: Nominal, Ordinal, Interval scale and ratio - Scope of Exploratory Data Analysis-Steps involved in Exploratory Data Analysis.

Unit II:

Univariate Graphical and Statistical Analysis:

Bar chart, Pie chart, Histogram, Stem and leaf plot, Box Whisker Plot-Measures of Averages, Mean, Median and Mode- Measures of dispersion, Range, Mean Deviation, Quartile Deviation, Standard deviation and variance-Skewness and Kurtosis.

Unit III:

Bivariate Graphical and Statistical Analysis:

Scatter Plot- Covariance and Correlation Coefficient-Assumptions-Karl Pearson's correlation coefficient-Spearman's Correlation coefficient- Regression coefficients and fitting of Regression lines.

Unit IV:

Data Pre-processing:

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning: Dealing with missing values and outliers – Data Integration and Transformation – Data Reduction – Data Discretization.

Unit – V:

Model Development:

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Measures for In-sample Evaluation –Over fitting and Cross Validation- Prediction and Decision Making.

TEXT BOOKS:

1. John Tukey, “Exploratory Data Analysis”, Addison-Wesley Series, 2019.

- 2.
3. Gupta. S.C. & Kapoor,V.K. , Fundamentals of Mathematical Statistics, Sultan Chand & Sons Pvt. Ltd. New Delhi,2002.
4. Suresh Kumar Mukhiya and Usman Ahmed,” Exploratory Data Analysis with Python”, PACKT, 2020.

REFERENCE BOOKS:

1. Dr Anil Maheshwari, Data Analytics Made Accessible, Publisher: Amazon.com Services LLC.
2. Joel Grus, Data Science from Scratch: First Principles with Python, O’Reilly, 1st edition, 2015.
3. Cathy O’Neil, Rachel Schutt, Doing Data Science, Straight Talk from the Frontline, O’ Reilly, 1st edition, 2013.
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2nd edition, 2014.
5. Eric Siegel, Predictive Analytics The Power to Predict Who Will Click, Buy, Lie, or Die,2nd Ed., Wiley.

WEB REFERENCES:

1. <https://flowingdata.com/>
2. <https://www.analyticsvidhya.com/>
3. <https://www.r-bloggers.com/>
4. <https://www.datasciencecentral.com/>

PRACTICAL - IV :

II YEAR / IV SEM

DATA ANALYTICS - LAB

OBJECTIVES:

- Aims to equip Students with essential skills in decision science using Python.
- The course will focus on Python and how to achieve the statistical results with Python.
- It is expected to provide some background in basic statistics.

OUTCOMES:

- Will be able to understand and use python data science libraries as a tool for data analytics
- Will be able to create Python codes for the above techniques
- Will be create visualizations using python

LAB EXERCISES:

GENERATING UNIVARIATE & BIVARIATE PLOTS

1. BAR CHART
2. PIE CHART
3. HISTOGRAM
4. STEM AND LEAF PLOT
5. BOX-WHISKER PLOT
6. SCATTER DIAGRAM
7. HEAT MAPS

SUMMARY STATISTICS

8. MEAN, MEDIAN AND MODE
9. STANDARD DEVIATION
10. SKEWNESS AND KURTOSIS

DATA PREPROCESSING

11. IMPUTATION OF MISSING VALUES
12. CODING CATEGORICAL VARIABLES
13. DATA TRANSFORMATION AND DISCRETIZATION

GENERATING MODELS

14. CORRELATION ANALYSIS
15. REGRESSION MODELS WITH EVALUATION METRICS-R SQUARE, MSE, RMSE

CORE - V :

III YEAR / V SEM

OPERATING SYSTEM

OBJECTIVES:

- ☐ To understand the fundamental concepts and role of Operating System.
- ☐ To learn the Process Management and Scheduling Algorithms
- ☐ To understand the Memory Management policies
- ☐ To gain insight on I/O and File management techniques

OUTCOMES:

- ☐ Understand the structure and functions of Operating System
- ☐ Compare the performance of Scheduling Algorithms
- ☐ Analyze resource management techniques

UNIT - I

Introduction: Views - Types of System - OS Structure – Operations - Services – Interface- System Calls- System Structure - System Design and Implementation. Process Management: Process - Process Scheduling - Inter-process Communication. CPU Scheduling: CPU Schedulers - Scheduling Criteria - Scheduling Algorithms.

UNIT - II

Process Synchronization: Critical- Section Problem - Synchronization Hardware Semaphores - Classical Problems of Synchronization - Monitors. Deadlocks: Characterization - Methods for Handling Deadlocks - Deadlock Prevention - Avoidance - Detection - Recovery.

UNIT - III

Memory Management: Hardware - Address Binding – Address Space - Dynamic Loading and Linking – Swapping – Contiguous Allocation - Segmentation - Paging – Structure of the Page Table.

UNIT - IV

Virtual Memory Management: Demand Paging - Page Replacement Algorithms - Thrashing. File System: File Concept -. Access Methods - Directory and Disk Structure - Protection - File System Structures - Allocation Methods - Free Space Management.

UNIT - V

I/O Systems: Overview - I/O Hardware - Application I/O Interface - Kernel I/O Subsystem - Transforming I/O Requests to Hardware Operations - Performance. System Protection: Goals - Domain - Access matrix. System Security: The Security Problem - Threats – Encryption- User Authentication.

TEXT BOOK:

1. Abraham Silberschatz, Peter B Galvin, Greg Gagne, “*Operating System Concepts*”, Wiley India Pvt. Ltd 2018, 9th Edition,.

REFERENCES:

1. William Stallings, “*Operating Systems Internals and Design Principles*”, Pearson, 2018, 9th Edition.
2. Andrew S. Tanenbaum, Herbert Bos, “*Modern Operating Systems*”, Pearson 2014, 4th Edition.

WEB REFERENCES:

- ☐ NPTEL & MOOC courses titled Operating Systems <https://nptel.ac.in/courses/106106144/>

OBJECTIVES:

- ☐ To understand the concept of Computer network
- ☐ To impart knowledge about networking and inter networking devices

OUTCOMES:

- ☐ Analyze different network models
- ☐ Describe, analyze and compare a number of data link, network and transport layer
- ☐ Analysing key networking protocols and their hierarchical relationship in the conceptual model like TCP/IP and OSI

UNIT - I

Introduction – Network Hardware - Software - Reference Models - OSI and TCP/IP Models - Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer - Theoretical Basis for Data Communication - Guided Transmission Media.

UNIT - II

Wireless Transmission - Communication Satellites - Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues - Error Detection and Correction.

UNIT - III

Elementary Data Link Protocols - Sliding Window Protocols - Data Link Layer in the Internet - Medium Access Layer - Channel Allocation Problem - Multiple Access Protocols - Bluetooth.

UNIT - IV

Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms - IP Protocol - IP Addresses - Internet Control Protocols.

UNIT - V

Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection - Simple Transport Protocol - Internet Transport Protocols (ITP) - Network Security: Cryptography.

TEXT BOOK :

1. A. S. Tanenbaum, “*Computer Networks*”, Prentice-Hall of India 2008, 4th Edition.

REFERENCE BOOKS:

1. Stallings, “*Data and Computer Communications*”, Pearson Education 2012, 7th Edition.
2. B. A. Forouzan, “*Data Communications and Networking*”, Tata McGraw Hill 2007, 4th Edition.
3. F. Halsall, “*Data Communications, Computer Networks and Open Systems*”, Pearson Education 2008.
4. D. Bertsekas and R. Gallager, “*Data Networks*”, PHI 2008, 2nd Edition.
5. Lamarca, “*Communication Networks*”, Tata McGraw Hill 2002.

WEB REFERENCES:

- ☐ NPTEL & MOOC courses titled Computer Networks
- ☐ <https://nptel.ac.in/courses/106106091/>

DATA VISUALIZATION

OBJECTIVES:

- Explore how to design and create data visualizations based on data available data modeling, data processing (such as aggregation and filtering)
- Mapping data attributes to graphical attributes
- To learn to evaluate the effectiveness of visualization designs, and think critically about each design decision
- To create their own data visualizations, and learn to use Python visualization tools.

OUTCOMES:

- Design and create data visualizations.
- Conduct exploratory data analysis using visualization.
- Craft visual presentations of data for effective communication.
- Use knowledge of perception and cognition to evaluate visualization design alternatives.
- Design and evaluate color palettes for visualization based on principles of perception.
- Apply data transformations such as aggregation and filtering for visualization.
- Use Python to develop interactive visualizations

UNIT I: INTRODUCTION TABLEAU

Introduction to Tableau: Advantages of Tableau Analytics Platform, Data Preparation Tableau workspace, Working with measures and dimensions. Data types - Data collection - Setting up a Data Connector - Selecting Data Tables – Joins – Unions - Data extracts and live connections - Editing the model's metadata.

UNIT II: CREATING BASIC DATA VISUALIZATIONS

Creating Charts - Chart types -Bar Charts, Legends, Filters and Hierarchies - Line Charts - Highlight Tables - Heat Maps - Bullet Charts - Cumulative Sums with Waterfall Charts.

UNIT IV: CREATING ADVANCED DATA VISUALIZATIONS

Aggregate Functions - Calculated Fields - Aggregations in Calculated Fields - Text Operator - Data fields - Logical functions – Parameters - Types of calculations - Quick Table calculations - Level of detailed expression.

UNIT V: CREATING MAPS

Creating Symbol Maps - Filled Maps - Density Maps - Map Layers - Maps embedded with Pie Charts.

UNIT V: CREATING INTERACTIVE DASHBOARDS

Creating a Dashboard - Dashboard Title - Navigation Buttons - Dashboard Actions - Templates for visualizing Cloud data.

TEXT BOOK:

1. Claus O. Wilke, “Fundamentals of Data Visualization”, O’Reilly, 2019.

REFERENCE BOOK:

1. Alexander Loth, “Visual Analytics with Tableau”, Wiley, 2019.
2. Davy Cielen, Arno D. B. Meysman and Mohamed Ali, “Introducing Data Science”,Manning Publications, 2016.
3. D J Patil, Hilary Mason & Mike Loukides, Ethics and Data Science, O’ Reilly, 2018.

WEB REFERENCES:

1. <https://www.tableau.com/sites/default/files/media/designinggreat-visualizations.pdf>
2. <https://flowingdata.com/2017/01/24/one-dataset-visualized-25-ways/>
3. <https://www.tableau.com/learn/tutorials/ondemand/gettingstarted?playlist=554268&signin=4bec05bc7a876b95af7722b08fff9224>
4. <https://public.tableau.com/en-us/s/resources>

PRACTICAL - V :

III YEAR / V SEM

DATA VISUALIZATION - LAB**OBJECTIVES:**

- The student will be able to:
- To recognize good (and bad) data visualizations
- To interpret a data visualization
- To Use shapes, colors, text and layout appropriately

OUTCOMES:

- Describe the main concepts of data visualization
- Create ad-hoc reports, data visualizations, and dashboards using Tableau Desktop
- Identifying stories and insights in data
- Preparing data for visualization
- Creating several different charts using Tableau

LIST OF EXERCISES:

1. Working with Data Types and Data Connector
2. Working with Tables: Joins, Unions, Data Extracts
3. Building Bar Charts with Legends, Filters and Hierarchies
4. Line Charts
5. Heat Maps
6. Bullet Charts
7. Waterfall Charts.
8. Working with Aggregate Functions
9. Working with Logical Functions
10. Creating Symbol Maps
11. Creating Filled Maps
12. Creating Density Maps
13. Constructing Maps embedded with Pie Charts
14. Creating a Dashboard with Title and Navigation Buttons
15. Working with Dashboard Actions
16. Visualizing Cloud data

BOOKS:

1. Claus O. Wilke, “Fundamentals of Data Visualization”, O’Reilly, 2019.
2. Alexander Loth, “Visual Analytics with Tableau”, Wiley, 2019.
3. Davy Cielen, Arno D. B. Meysman and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
4. D J Patil, Hilary Mason & Mike Loukides, Ethics and Data Science, O’ Reilly, 2018.

ELECTIVE - I :

III YEAR / V SEM

CHOOSE FROM THE GIVEN ELECTIVE - I-A/ELECTIVE - I-B/ELECTIVE - I-C

ELECTIVE - I-A :

III YEAR / V SEM

NATURAL LANGUAGE PROCESSING

OBJECTIVES:

- To grasp the significance of natural language processing in solving real-world problems.
- To map the appropriate processing technique to a problem and implement the technique.
- To demonstrate required design skills for large collection sets.
- To appreciate the theoretical formulation of the natural language processing techniques.

OUTCOMES:

- Describe the fundamental concepts and techniques of natural language processing.
- Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each.
- Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions.
- Analyze large volume text data generated from a range of real-world applications.

Unit – I: Introduction

Overview: Origins and challenges of NLP- Theory of Language -Features of Indian Languages – Issues in Font –Models and Algorithms- NLP Applications.

UNIT II - MORPHOLOGY AND PARTS-OF-SPEECH

Phonology – Computational Phonology - Words and Morphemes – Segmentation – Categorization and Lemmatisation – Word Form Recognition – Valency - Agreement - Regular Expressions – Finite State Automata – Morphology- Morphological issues of Indian Languages – Transliteration.

UNIT III - PROBABILISTIC MODELS

Probabilistic Models of Pronunciation and Spelling – Weighted Automata – N- Grams – Corpus Analysis – Smoothing – Entropy - Parts-of-Speech – Taggers – Rule based – Hidden Markov Models – Speech Recognition.

UNIT IV - SYNTAX

Basic Concepts of Syntax – Parsing Techniques – General Grammar rules for Indian Languages – Context Free Grammar – Parsing with Context Free Grammars – Top Down Parser – Earley Algorithm – Features and Unification - Lexicalised and Probabilistic Parsing.

UNIT V - SEMANTICS AND PRAGMATICS (6 hours) Representing Meaning – Computational Representation – Meaning Structure of Language – Semantic Analysis – Lexical Semantics – WordNet – Pragmatics – Discourse – Reference Resolution – Text Coherence – Dialogue Conversational Agents.

TEXT BOOK:

1. Ronald Hausser, “Foundations of Computational Linguistics”, Springer-Verleg, 1999.

REFERENCES:

2. Daniel Jurafsky and James H. Martin “Speech and Language Processing”, Prentice Hall, 2009.
3. Christopher D.Manning and Hinrich Schutze, “Foundation of Statistical Natural Language Processing”, MIT Press, 1999.
4. James Allen, “Natural Language Understanding”, Benjamin/Cummings Publishing Co. 1995.
5. Applied Natural Language Processing with Python: Implementing Machine Learning and Deep Learning Algorithms for Natural Language Processing, By Taweh Beysolow II, September 2018

WEB REFERENCES:

1. <https://blog.algorithmia.com/introduction-natural-language-processingnlp/>
2. <https://www.udacity.com/course/natural-language-processingnanodegree--nd892>.
<https://www.coursera.org/learn/language-processing>
3. <https://towardsdatascience.com/a-practitioners-guide-to-naturallanguage-processing-part-i-processing-understanding-text-9f4abfd13e72>
4. <https://www.edx.org/course/natural-language-processing>

ELECTIVE - I-B :

III YEAR / V SEM

MOBILE APPLICATION DEVELOPMENT FOR MACHINE LEARNING

OBJECTIVES:

- To Understand Android with Machine Learning
- To envisage outcomes automatically without human interference
- To learn Machine learning serving mobile application
- To analysis user behavior patterns

OUTCOMES:

- Android App Development with Machine Learning
- Targeted user behavior patterns
- Provide suggestions as well as recommendations for search requests
- Suggest apps which will reduce human interference

Unit I:

Mobile App Development:

Mobile App Development – Android Platform – Android SDK – Eclipse Installation – Building simple Android Applications.

Unit II:

Android Application Design Essentials:

Anatomy of an Android Application – Android Terminologies: Application Context, Activities, Services, Intents – Receiving and broadcasting Intents – Intent Filters – Content Providers.

Unit III:

Android User Interface Design Essentials:

User Interface Design Elements – Designing User Interfaces with Layouts – Drawing and working with animation.

Unit IV:

TensorFlow Lite:

Converting a Machine Learning model to TensorFlow Lite – Saving the model – Loading the Model and allocating Tensors – Performing prediction – Optimizing the model.

Unit – V:

TensorFlow Android App Development:

Editing Layout File – Adding TensorFlow Lite dependencies – Adding TensorFlow Lite model – Writing Activity code for getting insights from data - Case Study: Processing Images on a Mobile.

TEXT BOOKS:

1. Ryan Cohen and Tao Wang, “GUI Design for Android Apps”, Apress, 2014.
2. John Horton, “Android Programming for Beginners”, Second Edition, Packt, 2018.

REFERENCES:

1. Ted Hagos, "Learn Android Studio with Kotlin: Efficient Android App Development", Apress, 2018.
2. Laurence Moroney, "AI and ML for Coders", O'Reilly, 2020.
3. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
4. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
5. Android Application Development All in one for Dummies by Barry Burd, Edition: I

WEB REFERENCES:

<http://venturebeat.com/2009/01/01/android-netbooks-on-their-way-likely-by-2010/>

ELECTIVE - I-C :

III YEAR / V SEM

INTRODUCTION TO REINFORCEMENT LEARNING

OBJECTIVES:

- To understand statistical learning techniques where an agent explicitly takes actions and interacts with the world.
- To understand the importance and challenges of learning agents that make decisions.
- To introduce you to the fundamentals of Reinforcement Learning.

OUTCOMES:

- Formalize problems as Markov Decision Processes
- Understand basic exploration methods and the exploration/exploitation tradeoff
- Understand value functions, as a general-purpose tool for optimal decision-making
- Know how to implement dynamic programming as an efficient solution approach to an industrial control problem.
- Will be able to start using RL for real problems,

Unit – I: Monte-Carlo Methods

Monte-Carlo methods: policy evaluation, rollouts, on policy and off-policy learning, importance sampling

Unit – II: Temporal Difference Learning

Temporal Difference learning: TD prediction, Optimality of TD(0), SARSA, Q-learning, Games and after states, Maximization Bias and Double Learning.

Unit – III: Eligibility Traces

Eligibility traces: n-step TD prediction, TD(λ), forward and backward views, Q(λ), SARSA(λ), replacing traces and accumulating traces.

Unit – IV: Function Approximation

Function Approximation: Value prediction, gradient descent methods, linear function approximation, Control algorithms, Fitted Iterative Methods, Deep Q-learning.

Unit – V: Computer Vision

Policy Gradient methods: non-associative learning - REINFORCE algorithm, exact gradient methods, estimating gradients, approximate policy gradient algorithms, actor-critic methods, Asynchronous Advantage Actor-Critic.

Hierarchical RL: MAXQ framework, Options framework, HAM framework, Option discovery algorithms. Case studies: Elevator dispatching, Samuel's checker player, TD-gammon, Acrobot, Helicopter piloting, Alpha Go

BOOKS:

- R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 2nd Edition. 2018.
- Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019

REFERENCES

1. Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 (2018).

2. Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." Adaptation, learning, and optimization 12 (2012)
3. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach." Pearson Education Limited, 2016.
4. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. "Deep learning." MIT press, 2016.

WEB REFERENCES:

1. David Silver's course on Reinforcement Learning (link)
2. Video Lectures by Prof. David Silver
3. Video Lectures by Prof. B.Ravindran

PRACTICAL - VI :

III YEAR / V SEM

CHOOSE PRACTICAL OF ELECTIVE - I-A/ELECTIVE - I-B/ELECTIVE - I-C
WHICH WAS SELECTED IN THEORY

PRACTICAL -VI-A :

III YEAR / V SEM

NATURAL LANGUAGE PROCESSING LAB

OBJECTIVES:

- To understand the algorithms available for the processing of linguistic information and computational properties of natural languages.
- To conceive basic knowledge on various morphological, syntactic and semantic NLP tasks.
- To familiarize various NLP software libraries and datasets publicly available.
- To develop systems for various NLP problems with moderate complexity.
- To learn various strategies for NLP system evaluation and error analysis.

OUTCOMES:

- Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language.
- Demonstrate understanding of the relationship between NLP and statistics & machine learning.
- Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis.
- Develop systems for various NLP problems with moderate complexity

LIST OF EXERCISES

1. How to tokenize a given text?
2. How to get the sentences of a text document ?
3. How to tokenize text with stop words as delimiters?
4. How to remove stop words and punctuations in a text ?
5. How to perform stemming?
6. How to lemmatize a given text ?
7. How to extract usernames from emails ?
8. How to find the most common words in the text excluding stopwords?
9. How to do spell correction in a given text ?
10. How to classify a text as positive/negative sentiment?
11. How to extract Noun and Verb phrases from a text ?
12. How to find the ROOT word of any word in a sentence?
13. Write a Python program to load the iris data from a given csv file into a dataframe and print the shape of the data, type of the data and first 3 rows.
14. Write a Python NLTK program to find the sets of synonyms and antonyms of a given word.
15. Write a Python NLTK program to print the first 15 random combine labeled male and labeled female names from names corpus.

TEXT BOOKS:

1. Jurafsky Dan and Martin James H. "Speech and Language Processing" ,3rd Edition, 2018.

REFERENCE BOOKS:

1. Jurafsky D. and Martin J. H., “Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.
2. Goldberg Yoav “A Primer on Neural Network Models for Natural Language Processing”.
3. Natural Language Processing with Python, Steven Bird, Ewan Klein, and Edward Loper

PRACTICAL -VI-B :

III YEAR / V SEM

MOBILE APPLICATION DEVELOPMENT FOR MACHINE LEARNING - LAB

OBJECTIVES:

- Discuss the components and different Layout for mobile application development framework for android
- Design Simple GUI application with the Use of Built in components and widgets.
- Define a solution for complex problems

OUTCOMES:

- Develop components and different Layout for mobile application development framework for android
- Develop Simple GUI application with the Use of Built in components and widgets.
- Create databases to store application data locally.
- Test and Show the results on emulators or on physical handheld devices

LIST OF EXERCISES:

1. Calculator App – Setting up the UI using Linear Layouts
2. Calculator App – Using OnClick and implementing CLR functionality
3. Calculator App – Adding the OnDecimalPoint and OnOperator functionalities
4. Calculator App – Adding Subtraction using split and substring methods
5. Calculator App – Adding other required operators and finalizing the App
6. Quiz App – Setting up the UI using cardview
7. Quiz App – Creating the Question Model and preparing the Questions
8. Quiz App – Setting up the Question UI and Question Activity
9. Quiz App – Selecting right and wrong answers and displaying subsequent Question
10. Quiz App – Preparing UI for the Result Activity
11. TensorFlow Regression App – Editing the Layout File
12. TensorFlow Regression App – Adding TensorFlow Lite Dependencies
13. TensorFlow Regression App – Adding TensorFlow Lite Model
14. TensorFlow Regression App – Writing Activity code for inference

TEXT BOOKS:

1. Ryan Cohen and Tao Wang, “GUI Design for Android Apps”, Apress, 2014.
2. John Horton, “Android Programming for Beginners”, Second Edition, Packt, 2018.
3. Ted Hagos, “Learn Android Studio with Kotlin: Efficient Android App Development”, Apress, 2018.
4. Laurence Moroney, “AI and ML for Coders”, O’Reilly, 2020.

PRACTICAL -VI-C :

III YEAR / V SEM

REINFORCEMENT LEARNING - LAB

OBJECTIVES:

- To understand basic and advanced reinforcement learning techniques
- To understand application of right technique at different problem situations
- To understand the importance of Domain Knowledge

OUTCOMES:

- Knowledge of basic and advanced reinforcement learning techniques.
- Identification of suitable learning tasks to which these learning techniques can be applied.
- Appreciation of some of the current limitations of reinforcement learning techniques.

- Formulation of decision problems, set up and run computational experiments, evaluation of results from experiments.

LIST OF EXERCISES:

1. Solving Frozen Lake Problem with Value Iteration
2. Solving Frozen Lake Problem with Policy Iteration
3. Every-visit MC Prediction with Blackjack Game
4. First-visit MC Prediction with Blackjack Game
5. Implementing on-policy MC control
6. Computing Optimal Policy using SARSA
7. Computing Optimal Policy using Q Learning
8. Implementing epsilon-greedy algorithm
9. Implementing Softmax Exploration strategy
10. Implementing Upper Confidence Bound Algorithm
11. Implementing Thomson Sampling strategy
12. Finding the Best Advertisement Banner using Bandits

BOOKS:

1. R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 2nd Edition. 2018.
2. Sudharsan Ravichandran, Deep Reinforcement Learning with Python, PACKT, 2020.
3. Video Lectures by Prof. David Silver
4. Video Lectures by Prof. B.Ravindran

CORE - VIII :

III YEAR / VI SEM

CLOUD COMPUTING

OBJECTIVES:

- To understand the concepts in Cloud Computing and its Security
- To understand the evolving computer model, cloud computing.
- To introduce the various levels of services that can be achieved by cloud.

OUTCOMES:

- To explain and apply levels of services of Cloud
- To describe the security aspects in the cloud.

UNIT - I

Cloud Computing Foundation: Introduction to Cloud Computing – Move to Cloud Computing – Types of Cloud – Working of Cloud Computing

UNIT - II

Cloud Computing Architecture : Cloud Computing Technology – Cloud Architecture – Cloud Modeling and Design - Virtualization : Foundation – Grid, Cloud and Virtualization – Virtualization and Cloud Computing

UNIT - III

Data Storage and Cloud Computing : Data Storage – Cloud Storage – Cloud Storage from LANs to WANs – Cloud Computing Services : Cloud Services – Cloud Computing at Work

UNIT - IV

Cloud Computing and Security : Risks in Cloud Computing – Data Security in Cloud – Cloud Security Services – Cloud Computing Tools : Tools and Technologies for Cloud – Cloud Mashups – Apache Hadoop – Cloud Tools

UNIT - V

Cloud Applications – Moving Applications to the Cloud – Microsoft Cloud Services – Google Cloud Applications – Amazon Cloud Services – Cloud Applications

TEXT BOOK:

- 1.A.Srinivasan and J.Suresh, “*Cloud Computing – A Practical Approach for Learning and Implementation*”, Pearson India Publications 2014.

REFERENCE BOOK:

1. Rajkumar Buyya, James Broberg, Andrzej , “*Cloud Computing: Principles and Paradigms*”, Wiley India Publications 2011.
2. Arshdeep Bahga and Vijay Madisetti , “*Cloud Computing – A Hands on Approach*”, Universities Press (India) Pvt Ltd. 2014.

WEB REFERENCES:

1. NPTEL & MOOC courses titled Cloud computing <https://nptel.ac.in/courses/106105167/>

CORE - IX :

III YEAR / VI SEM

INTERNET OF THINGS

OBJECTIVES:

- ☐ To understand the concepts of Internet of Things and the application of IoT.
- ☐ To Determine the Market Perspective of IoT.
- ☐ To Understand the vision of IoT from a global context

OUTCOMES:

- ☐ Use of Devices, Gateways and Data Management in IoT.
- ☐ Design IoT applications in different domain and be able to analyze their performance
- ☐ Implement basic IoT applications on embedded platforms.

UNIT – I

IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

UNIT - II

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT - III

IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-

Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

UNIT - IV

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

UNIT - V

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

TEXT BOOK:

1. Vijay Madiseti and Arshdeep Bahga, “*Internet of Things: (A Hands-on Approach)*”, Universities Press (INDIA) Private Limited 2014, 1st Edition.

REFERENCE BOOKS:

1. Michael Miller, “*The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World*”, Pearson Education 2015.
2. Francis da Costa, “*Rethinking the Internet of Things: A Scalable Approach to Connecting Everything*”, Apress Publications 2013, 1st Edition.
3. Waltenegus Dargie, Christian Poellabauer, “*Fundamentals of Wireless Sensor Networks: Theory and Practice*”, Wiley 2014.
4. Cuno Pfister, “*Getting Started with the Internet of Things*”, O’Reilly Media 2011.

WEB REFERENCES:

1. <https://github.com/connectIOT/iottoolkit>
2. <https://www.arduino.cc/>
3. <http://www.zettajs.org/>

CORE - X :

III YEAR / VI SEM

MACHINE LEARNING

OBJECTIVES

- To understand basic concepts of machine learning
- Understand how to evaluate models generated from data
- Discover how to build machine learning algorithms, prepare data, and use different techniques using Python

OUTCOMES

- Implement different machine learning algorithm techniques .
- Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
- Apply appropriate data sets to the Machine Learning algorithms.
- Identify and apply Machine Learning algorithms to solve real world problems.

UNIT – I: Introduction

Machine Learning Foundations – Overview – Design of a Learning System – Types of Machine Learning – Supervised Learning and Unsupervised Learning – Applications of Machine Learning – Tools Overview for ML.

UNIT – II: Supervised Learning - I

Simple Linear Regression – Multiple Linear Regression – Polynomial Regression – Ridge Regression – Lasso Regression – Evaluating Regression Models – Model Selection – Bagging – Ensemble Methods.

UNIT – III: Supervised Learning - II

Classification – Logistic Regression – Decision Tree Regression and Classification – Random Forest Regression and Classification – Support Vector Machine Regression and Classification - Evaluating Classification Models.

UNIT – IV: Unsupervised Learning

Clustering – K-Means Clustering – Density-Based Clustering – Dimensionality Reduction – Collaborative Filtering.

UNIT – V: Association Rule Learning

Association Rule Learning – Concepts related to ARL – ARL Algorithms - Apriori – Eclat – Concepts and Algorithms.

TEXT BOOK:

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.

REFERENCE BOOK:

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
2. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
3. Sebastian Raschka, Vahid Mirjalili, ” Python Machine Learning and deep learning”, 2nd edition, kindle book, 2018
4. Carol Quadros, ” Machine Learning with python, scikit-learn and Tensorflow”, Packet Publishing, 2018
5. Gavin Hackeling, ” Machine Learning with scikit-learn”, Packet publishing, O'Reilly, 2018

WEB REFERENCES:

1. Stanford Lectures of Prof. Andrew Ng on Machine Learning

PRACTICAL - VII

III YEAR / VI SEM

MACHINE LEARNING - LAB

OBJECTIVES:

- Understand the mathematical and statistical perspectives of machine learning algorithms through python programming.
- Understand the basic concepts of deep neural network models and design the same.

OUTCOMES:

- Design and evaluate the unsupervised models through python in built functions.
- Evaluate the machine learning model algorithms by python programming.
- Design and apply various reinforcement algorithms to solve real time complex problems.
- Design and develop the code for the recommender system using Natural Language processing.

LIST OF EXERCISES:

1. Write a program to implement the Simple and Multiple Linear Regression
2. Write a program to implement the Polynomial Regression
3. Write a program to implement the Bagging Technique
4. Write a program to implement the Adaboost Methods
5. Write a program to implement Logistic Regression algorithm
6. Write a program to demonstrate the workflow of Decision Tree Classification
7. Write a program to implement the Random Forest Classification
8. Write a program to implement the SVM Classification
9. Write a program to perform the K Means Clustering
10. Write a program to perform the Density based Clustering
11. Write a program to implement the Apriori algorithm for market basket analysis
12. Write a program to compare the Supervised Machine Learning algorithms.

REFERENCE BOOK:

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
3. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
4. Sebastian Raschka, Vahid Mirjalili, "Python Machine Learning and deep learning", 2nd edition, kindle book, 2018
5. Carol Quadros, "Machine Learning with python, scikit-learn and Tensorflow", Packet Publishing, 2018
6. Gavin Hackeling, "Machine Learning with scikit-learn", Packet publishing, O'Reilly, 2018
7. Stanford Lectures of Prof. Andrew Ng on Machine Learning

ELECTIVE - II :

III YEAR / VI SEM

CHOOSE FROM THE GIVEN ELECTIVE - II-A/ELECTIVE - II-B/ELECTIVE - II-C

ELECTIVE - II-A :

III YEAR / VI SEM

INFORMATION SECURITY

OBJECTIVES:

- To acquire knowledge of cryptography and network security
- To acquire knowledge of security management and incident response
- To acquire knowledge of security in software and operating systems
- To acquire knowledge of data security and secure system development
- To acquire knowledge of privacy and data protection

OUTCOMES:

- Test and evaluate security in systems and networks
- Use methods for planning and designing secure systems
- Apply techniques and tools for secure system deployment and operation
- Perform continuous testing, assessment and updating of system security

Unit I

Introduction to Information Security : Attacks, Vulnerability, Security Goals, Security Services and mechanisms - Conventional Cryptographic Techniques : Conventional substitution and transposition ciphers, One-time Pad

Unit II

Block cipher and Stream Cipher, Steganography - Symmetric and Asymmetric Cryptographic Techniques : DES, AES, RSA algorithms

Authentication and Digital Signatures : Use of Cryptography for authentication,

Unit III

Secure Hash function, Key management – Kerberos - Program Security : Nonmalicious Program errors – Buffer overflow, Incomplete mediation, Time-of-check to Time-of-use Errors, Viruses, Trapdoors

Unit IV

Salami attack, Man-in-the-middle attacks, Covert channels - Security in Networks : Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong

Unit V

Authentication , Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP,S/MIME

TEXT BOOKS:

1. "Information Systems Today, Managing in the Digital World", Third Edition by Leonard
2. M. Jessup; Joseph S. Valacich, Publisher: Prentice Hall
3. "Introduction to Information Technology", V. Rajaraman, PHI

REFERENCE BOOKS:

1. "Information Systems Management in Practice" Barbara C. McNurlin, Ralph H. Sprague,
2. and Publisher: Pearson Education.

3. Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education
4. Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson
5. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall.
6. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall.

ELECTIVE - II-B :

III YEAR / VI SEM

NETWORK SECURITY

OBJECTIVES:

- Understand security issues related to networking vulnerabilities, firewalls, intrusion detection systems
- Identify infrastructure components including devices, topologies, protocols, systems software, management and security
- Design and develop solutions for technical issues related to networking and security problems.
- Apply footprinting, scanning, enumeration and similar techniques to discover network and system vulnerabilities
- Analyze performance and risk factors of enterprise network systems

OUTCOMES:

- Describe network security services and mechanisms.
- Symmetrical and Asymmetrical cryptography.
- Data integrity, Authentication, Digital Signatures.
- Various network security applications, IPSec, Firewall, IDS, Web security, Email security, Malicious software etc.

Unit-I

Introduction: Attack - Services and Mechanism - Model for Internetwork Security - Cryptography - Notion of Plain Text- Encryption Key - Ciphertext - Decryption and Cryptanalysis - Public Key Encryption - Digital Signatures and Authentication

Unit-II

Network Security: Authentication Application - Kerberos - Directory Authentication Service - Pretty Good Privacy

Unit-III

IP Security Architecture: Authentication header - Encapsulating Security Payload combining Security Associations - Key Management

Unit-IV

Web Security: Requirement - Secure Sockets Layer - Transport Layer Security - Secure Electronic Transactions, Network Management Security: Overview of SNMP Architecture - SMMPV11 Communication Facility - SNMPV3

Unit-V

System Security: Intruders - Viruses and Related Threats - Firewall Design Principles - Comprehensive examples using available software platforms/case tools - Configuration Management

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security, Principles and Practices", Pearson Education, Third Edition
2. Charlie Kaufman, Radia Perlman and Mike speciner, "Network security, Private communication in a Public World"
3. Atul Kahate, "Cryptography and Network Security", TMH, Third Edition.
4. V. K. Pachghare "Cryptography and Information Security", PHI

REFERENCE BOOKS:

1. Christopher M. King, "Security architecture, design deployment and operations", Curtis patton and RSA Press.
2. Stephen Northcatt, Leny Zeltser, "INSIDE NETWORK Perimeter Security", Pearson Education Asia.
3. Robert Bragge, Mark Rhodes, Heith straggberg, "Network Security the Complete Reference", Tata McGraw Hill Publication.

WEB RESOURCES:

1. <http://nptel.iitm.ac.in/courses/106105031/>
2. <http://www.cert.org/>
3. http://www.howard.edu/csl/research_crypt.htm
4. http://www.cs.purdue.edu/homes/ninghui/courses/426_Fall10/lectures.html
5. <http://www.cs.uwp.edu/staff/lincke/infosec/>
6. <http://www.cisa.umbc.edu/courses/cmssc/426/fall06/>
7. <http://www.cs.northwestern.edu/~ychen/classes/cs395-w05/lectures.html>

ELECTIVE - II-C :

III YEAR / VI SEM

BLOCKCHAIN TECHNOLOGY

OBJECTIVES:

- To understand the concepts of block chain technology
- To understand the consensus and hyper ledger fabric in block chain technology.

OUTCOMES:

- State the basic concepts of block chain
- Paraphrase the list of consensus and Demonstrate and Interpret working of Hyper ledger Fabric
- Implement SDK composer tool and explain the Digital identity for government

UNIT - I

History: Digital Money to Distributed Ledgers -Design Primitives: Protocols, Security, Consensus, Permissions, Privacy- : Block chain Architecture and Design-Basic crypto primitives: Hash, Signature-Hash chain to Block chain-Basic consensus mechanisms.

UNIT - II

Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Block chain consensus protocols: Permissioned Block chains-Design goals-Consensus protocols for Permissioned Block chains.

UNIT - III

Decomposing the consensus process-Hyper ledger fabric components-Chain code Design and Implementation: Hyper ledger Fabric II:-Beyond Chain code: fabric SDK and Front End-Hyper ledger composer tool.

UNIT - IV

Block chain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital markets-Insurance-Block chain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting.

UNIT - V

Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems: Block chain Cryptography: Privacy and Security on Block chain.

TEXT BOOKS:

1. Mark Gates, “*Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of money*”, Wise Fox Publishing and Mark Gates 2017.
2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, “*Hands-On Block chain with Hyper ledger: Building decentralized applications with Hyperledger Fabric and Composer*”, 2018.
3. Bahga, Vijay Madisetti, “*Block chain Applications: A Hands-On Approach*”, Arshdeep Bahga, Vijay Madisetti publishers 2017.

REFERENCE BOOKS :

1. Andreas Antonopoulos, “*Mastering Bitcoin: Unlocking Digital Crypto currencies*”, O'Reilly Media, Inc. 2014.
2. Melanie Swa, “*Block chain*”, O'Reilly Media 2014.

WEB REFERENCES:

1. NPTEL & MOOC courses titled blockchain technology
2. blockgeeks.com/guide/what-is-block-chain-technology
3. <https://nptel.ac.in/courses/106105184/>

PRACTICAL - VIII

III YEAR / VI SEM

MINI PROJECT

OBJECTIVES:

The aim of the mini project is that the student has to understand the real time software development environment. The student should gain a thorough knowledge of the problem he/she has selected and the language / software he/she is using.

Project planning:

B.Sc (Computer Science / Software Application)/BCA Major Project is an involved exercise, which has to be planned well in advance. The topic should be chosen in the beginning of the final year itself. Related reading training and discussions of the first internal project viva voce should be completed in the first term of the final year.

I Selection of the project work

Project work could be of three types.

a) Developing solution for real life problem

In this case a requirement for developing a computer-based solution already exists and the different stages of the system development life cycle is to be implemented successfully. Examples are accounting software for a particular organization, computerization of administrative functions of an organization, web based commerce etc.

b) System Software Project

Projects based on system level implementation. An example is a Tamil language editor with spell checker, compiler design.

b) Research level project

These are projects which involve research and development and may not be as structured and clear cut as in the above case. Examples are Tamil character recognition, neural net based speech recognizer etc. This type of project provides more challenging opportunities to students.

II Selection of team

To meet the stated objectives, it is imperative that a major project is done through a team effort. Though it would be ideal to select the team members at random and this should be strongly recommended, due to practical consideration students may also be given the choice of forming themselves into teams with three members. A team leader shall be selected. Team shall maintain the minutes of meeting of the team members and ensure that tasks have been assigned to every team member in writing. Team meeting

minutes shall form a part of the project report. Even if students are doing projects as groups, each one must independently take different modules of the work and must submit the report.

III Selection of Tools

No restrictions shall be placed on the students in the choice of platform/tools/languages to be utilized for their project work, though open source is strongly recommended, wherever possible. No value shall be placed on the use of tools in the evaluation of the project.

IV Project management

The Head of the Department / Principal of the college should publish the list of the student's project topic, internal guide and external organization and teams agreed before the end of July. Changes in this list may be permitted for valid reasons and shall be considered favorably by the Head of the department / Principal of the college any time before commencement of the project. Students should submit a fortnightly report of the progress, which could be an indication of percentage of completion of the project work. The students should ideally keep a daily activity book. Team meetings should be documented and the same should be submitted at the end of the project work.

V Documentation

Three copies of the project report must be submitted by each student (one for the department library, one for the organization where the project is done and one for the student himself/herself). The final outer dimensions of the project report shall be 21cm X 30 cm. The color of the flap cover shall be light blue. Only hard binding should be done. The text of the report should be set in 12 pt, Times New Roman, 1.5 spaced.

Headings should be set as follows: CHAPTER HEADINGS 16 pt, Arial, Bold, All caps, Centered.

1. Section Headings 14 pt Bookman old style, Bold, Left adjusted.

1.1 Section Subheading 12 pt, Bookman old style.

Title of figures tables etc are done in 12 points, Times New Roman, Italics, centered.

Content of the Project should be relevant and specific particularly with reference to the work. The report should contain the requirement specification of the work, Analysis, Design, Coding, testing and Implementation strategies done.

- Organizational overview (of the client organization, where applicable)
- Description of the present system
- Limitations of the present system
- The Proposed system - Its advantages and features
- Context diagram of the proposed system
- Top level DFD of the proposed system with at least one additional level of expansion
- Program List (Sample code of major functions used)
- Files or tables (for DBMS projects) list. List of fields or attributes (for DBMS projects) in each file or table.
- Program – File table that shows the files/tables used by each program and the files are read, written to, updated, queried or reports were produced from them.
- Screen layouts for each data entry screen.
- Report formats for each report.

Some general guidelines on documentation are:

1. Certificate should be in the format: **"Certified that this report titled... is a bonafide record of the project work done by Sri/ Kum under our supervision and guidance, towards partial fulfillment of the requirement for award of the Degree of B.Sc Computer Science/B.Sc Computer Science with Artificial Intelligence /B.Sc Computer Science with Data Science /BCA of XXXXXXXX College"** with dated signature of internal guide, external guide and also Head of the Department/ College.

2. If the project is done in an external organization, another certificate on the letterhead of the organization is required: **"Certified that his/her report titledis a bonafide**

**record of the project work done by Sri/Kum.....under my supervision and guidance, at thedepartment of.....
(Organization) towards partial fulfillment of the requirement for the award of the Degree of B.Sc (Computer Science)/B.Sc Computer Science with Artificial Intelligence /B.Sc Computer Science with Data Science /BCA of XXX College.**

3. Page numbers shall be set at right hand bottom, paragraph indent shall be set as 3.
4. Only 1.5 spaces need be left above a section or subsection heading and no space may be left after them.
5. References shall be IEEE format (see any IEEE magazine for detail) While doing the project keep note of all books you refer, in the correct format and include them in alphabetical order in your reference list.

VI Project Evaluation:

Internal Assessment

There shall be six components that will be considered in assessing a project work with weightage as indicated.

1. Timely completion of assigned tasks as evidenced by team meeting minutes 20%
2. Individual involvement, teamwork and adoption of industry work culture 10%
3. Quality of project documentation (Precision, stylistics etc) 10%
4. Achievement of project deliverables 20%
- 5 Effective technical presentation of project work 10%
6. Viva 30%

Based on the above 6 components, internal marks (40) can be awarded.

External Assessment

Dissertation/Project submitted at the end of third year shall be valued by two examiners appointed by the Controller for the conduct of practical exams. The board of examiners shall award 40 marks based on the following components.

1. Achievement of project deliverables - 20 Marks
2. Effective technical presentation of project work - 20 Marks
3. Project Viva - 20 Marks

There shall be a common written examination conducted for all the candidates in each group together for a minimum of 10 minutes.

- (i) Requirement Specification of Project
- (ii) Design of Project
- (iii) Testing and Implementation of Project