YEAR-WISE AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS

DEPARTMENT OF B.Sc. COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE

FIFTH SEMESTER

ACADEMIC YEAR 2023-24 OF 2021-24 BATCH (CBCS)

Sl. No.	Part	Course Code	Title of the Course	Hours /Week	Duration of Exam (hrs.)	Marks			Credits
						Internal	External	Total	
1	II	CSAI23501A	Software Engineering (DSE-1)	4	3	40	60	100	4
		CSAI23501B	Fuzzy Logic And Expert Systems (DSE-1))						
2	II	CSAI23502	Data Visualization Tools(SEC-3)	3	3	40	60	100	3
3	II	CSAI23503	Data Engineering and Distributed Databases (Core-15)	4	3	40	60	100	4
4	II	CSAI23504	Big data Analytics (Core-16)	4	3	40	60	100	4
5	II	CSAI23505	Natural Language Processing (Core-17)	3	3	40	60	100	3
6	II	CSAI23506	Robotic Process Automation (Core-18)	3	3	40	60	100	3
PRACTICALS									
7	II	CSAI23507	Data Visualization Tools Lab(SEC-3)	2	3	40	60	100	1
8	II	CSAI23508	Big data Analytics Lab (Core-16)	2	3	40	60	100	1
9	II	CSAI23509	Natural Language Processing Lab(Core-17)	2	3	40	60	100	1
10	II	CSAI23510	Robotic Process Automation Lab (Core-18)	2	3	40	60	100	1
	Total			29	-	400	600	1000	25

**Discipline Specific Elective(DSE) * SEC- Skill Enhancement Course

SOFTWARE ENGINEERING
(DISCIPLINE ELECTIVE-1)

Credits:4 **Semester: V**

Coursecode: CSAI23501A **No. of lecture hours: 60**

Course Objective: To enable students learn software engineering principles and to lay emphasis towards the theoretical foundation.

Outcomes: The student will be able to
CO1: **Explain** engineering through various process models.
CO2: **Identify** analyze Requirements, Object Oriented and various modeling's.
CO3Categorize design and architecture
CO4: **Classify** Components, golden rules and design evaluation.
CO5: U**nderstand** testing techniques to evaluate quality metrics

UNIT–I	**12hrs**
1. The evolving role of software, software, changing nature of software	2
2. Legacy Software, Software Myths	2
3. Software engineering-layered technology, Process Framework	2
4. CMMI, Process patterns, Personal and Team Process models	2
5. Process Models: waterfall, incremental, evolutionary process models	1
6. Agile process models	3

UNIT–II	**12hrs**
1. Requirements Engineering tasks, Initiating Requirements Engineering Process	1
2. Eliciting Requirements	
3. Developing Use Cases, Building Analysis Model	2
4. Negotiating and Validating Requirements	1
5. Requirements Analysis, Analysis Modeling Approaches, Data Modeling Concepts	2
6. Object Oriented Analysis, Scenario Based Modeling, Flow Oriented Modeling	1
7. Class Based Modeling, Creating Behavioral Model	1

UNIT–III	**12hrs**
1. Design Process and Quality	2
2. Design Concepts and Design Model	2
3. Pattern Based Software Design	2
4. Software architecture, Data design Architectural styles and Patterns	2
5. Architectural design, Assessing alternative architectural design	2
6. Managing Data flow into Software architecture	2

UNIT-IV	12hrs
1. Introduction to Component, Designing Class Based Components	2
2. Conducting Component Level Design, Object Constraint Language	2
3. Design Conventional Components	2
4. Golden Rules, User Interface Analysis and Design	2
5.Interface Analysis, Interface Design Steps	2
6.DesignEvaluation2	

UNIT–V	12hrs
1. A Single Approach to Software Testing	1
2. Strategic Issues, Test Strategies for Conventional Software	1
3. Validation Testing, System Testing, Testing Fundamentals, Black Box and White Box Testing	2
4. Basis Path Testing, Control Structure Testing	2
5. Software Quality	1
6. Metrics for Analysis Model	2
7. Metrics for Design Model, Metrics for Source	1
8. Metrics for Testing, Metrics for Maintenance	1

ESSENTIALREADING

Pressman, Rogers S. 2019.**Software Engineering,** A practitioner's Approach.8thEdition.Mc Graw Hill Education

SUGGESTEDREADING

Deepak Jain.2009**. Software Engineering.** New Delhi: Oxford University Press.
RajibMall.2009.**Fundamentals of Software Engineering.3rd Edition.** New Delhi: PHI**.**
Sommerville.2007.**Software Engineering.7thEdition.**NewDelhi: Pearson Education

FUZZY LOGIC AND EXPERT SYSTEMS

(DISCIPLINE ELECTIVE-1)

Credits: 4 **Semester: V**
Course Code: CSAI23501B **No. of lecture hours: 60**

Course Objective:
To get exposed to fuzzy logic in building intelligent machines and to understand how expert systems behave like human experts.

Course Outcomes:
CO1: Identify and describe Fuzzy Logic techniques in building intelligent machines
CO2: Apply Fuzzy Logic models to handle uncertainty and solve engineering problems.
CO3: Discuss the architecture of an expert system and its tools.
CO4: Understand the importance of building expert systems.
CO5: Understand various problems with expert systems.

	UNIT-I	**12Hrs**
1.	Introduction to Fuzzy Logic, Classical and Fuzzy Sets	3
2.	Membership Function, Membership Grade, Universe of Discourse	3
3.	Linguistic Variables, Operations on Fuzzy Sets: Intersections, Unions, Negation, Product, Difference	3
4.	Properties of Classical set and Fuzzy sets, Fuzzy vs. Probability, Fuzzy Arithmetic, Fuzzy Numbers.	**3**

	UNIT-II	**12 Hrs**
1.	Essential Elements of Fuzzy Systems, Classical Inference Rule	2
2.	Classical Implications and Fuzzy Implications,	2
3.	Crisp Relation and Fuzzy Relations, Composition of fuzzy relations,	2
4.	Cylindrical Extension and Projection.	2
5.	Fuzzy IF-THEN rules, Inference: Scaling and Clipping Method, Aggregation,	2
6.	Fuzzy rule based Model: Mamdani Model, TSK model, Fuzzy Propositions, Defuzzification: MOM, COA	2

	UNIT-III	**12Hrs**
1.	Introduction to Expert Systems	3
2.	Architecture and role of expert systems	3
3.	Representation and organization of knowledge	3
4.	Basics characteristics and types of problems handled by expert systems.	3

	UNIT-IV	12Hrs
1.	Typical expert systems-MYCIN, Expert system shells	3
2.	Techniques of knowledge representations in expert systems	2
3.	knowledge engineering	3
4.	System-building aids, support facilities	2
5.	Stages in the development of expert systems.	2

	UNIT-V	12Hrs
1.	Building an Expert System: Expert system development, Selection of the tool	3
2.	Acquiring Knowledge, Building process	3
3.	Problems with Expert Systems: Difficulties, common pitfalls in planning	3
4.	Dealing with domain experts, difficulties during development	3

ESSENTIAL READING

Timothy J Ross. 2010**. Fuzzy Logic with Engineering Applications**. 3rd Edition. John Wiley and Sons.
Waterman D.A."A Guide to Expert Systems". Addison Wesley Longman

DATA VISUALIZATION TOOLS

Credits: 3 **Semester: V**

Course Code: CSAI23502 **No. of Lecture Hours:45**

Course Objectives:

1. To familiarize the students with fundamental concepts of Data Visualization.
2. Students will learn and understand the basic tools used for visualizing data.

Course Outcome: Students will be able to

CO1: **Understand** the way of representing visual data and its applications

CO2: Demonstrate data visualization using combination of various charts.

CO3: **Apply** visualizing techniques using matplotlib package.

CO4: **Design** effective graphical analysis in Tableau

CO5: **Implement** Table level Calculations

UNIT-I

DataVisualization-1:	**9hrs**
1. Ways of Representing Visual Data	**1**
2. Techniques Used for Visual Data Representation	1
3. Types of Data Visualization	1
4. Applications of Data Visualization, Visualizing Bi Data	2
5. Tools Used in Data Visualization	2
6. Tableau Products	2

UNIT-II

9hrs

Data Visualization Using Excel:

1. Creating Combination of Charts, Creating a Combo Chart with Secondary Axis	1
2. Discriminating Series and Category Axis	1
3. Chart Elements and Chart Types, Data Labels, Quick Layout ,Using Pictures in Column Charts	2
4. Band Chart ,Thermometer Chart	1
5. Gantt Charts, Water fall Chart	2
6. Spark lines , Pivot Charts, Pivot Charts with Pivot Tables, Pivot Charts without Pivot Tables	2

UNIT-III **9Hrs**

Plotting and Visualization:

1. A Brief Matplotlib API Primer 1
2. Plotting with Pandas and Sea born 1
3. Python Visualization Tools 1

Basic Visualization using Python:

4. Pie Chart, Bar Chart, Histogram ,Line Chart 2
5. Area plot ,Box & Whisker Plot 2
6. Scatter Plot, Heat Maps 2

UNIT-IV **9Hrs**

Creating Your First Visualizations and Dashboards:

1. Connecting to Data ,Foundations for Building Visualizations 1
2. Visualizing Data, Creating Bar Charts, Line Charts, Geographic Visualizations 1
3. Using ShowMe, Bringing Everything Together 1

Working with Data in Tableau:

4. The Tableau Paradigm, Connecting to Data 2
5. Managing Data Source Meta data, Working with Extracts instead of Live Connections 2
6. Tableau File Types, Joins and Blends, Filtering Data 2

UNIT-V **9Hrs**

Moving from Foundational to More Advanced Visualizations:

1. Comparing Values Across Different Dimensions, Visualizing Dates and Times 1
2. Relating Parts of the Data to the Whole, Visualizing Distributions 1
3. Data Analytics in Tableau Public, Visualizing Multiple Axes to Compare Different Measures 1

Using Row-Level, Aggregate, and Level of Detail Calculations:

4. Creating and Editing Calculations. Overview of the three Main Types of Calculations, Level of Detail Calculations 1
5. Parameters, Practical Examples, Adhoc Calculations 1

Table Calculations:

6. Overview of Table Calculations, Quick Table Calculations, Relative versus Fixed, Scope and Direction 2
7. Addressing and Partitioning, Custom Table Calculations, Practical Examples, Data Densification 2

ESSENTIAL READING

1. DT Editorial Services.2016. **Big Data Black Book**. Dream tech Press.
2. Wes, Mc Kinny.2018.**Python for Data Analysis.** 2nd Edition. O'Reilly Media
3. Motwani, Dr. Bharati. 2019.**Data Analytics with R.** Wiley India Pvt. Limited
4. Milligan, Joshua N.2016.**Learning Tableau**.2nd Edition. Packt Publishing Ltd.

SUGGESTED READING

1. White, Tom. 2012. **Hadoop: The Definitive Guide**. 3rdEdition. O'Reilly Media
2. Baldwin, David.2016.Mastering **Tableau**. Packt Publishing Ltd.

DATA ENGINEERING AND DISTRIBUTED DATABASES

Credits: 4 **Semester: V**
Course Code: CSAI23503 **No. of lecture hours: 60**

Course Objectives:

1. Understand the all aspects of computing and information access across multiple Processing elements connected by any form of communication network, either local area, or wide area
2. Understand the steady growth in the development of contemporary applications that demonstrate their efficacy by connecting millions of users/applications/machines across the globe without relying on a traditional client-server approach.
3. To familiarize students with leverage shared resources and massive amounts of data over the Internet. This course aims to provide an understanding of theory and systems aspects of distributed

Course Outcomes

Student will be able to

CO1: Describe the features added to modern database systems to distinguish them from Standard relational systems.

CO 2: Understand different algorithms used in the implementation of query evaluation engine

CO 3: Understand the different concurrency control and commit protocols in distributed databases

CO 4: Demonstrate an understanding of the role and the concepts involved in special purpose databases such as Temporal, Spatial, Mobile and other similar database types

CO 5: Design Advanced Application Development

UNIT-I **12Hrs**

Distributed Data Storage Technology:

Server-centric IT architecture and its limitations, Storage-centric IT architecture and its advantages, Architecture of intelligent disk sub systems, Hard disks and Internal I/O channels and JBOD. 5

Storage virtualization using RAID, Introduction to NAS, SAN and DAS 3

Distributed File Systems & Security:

File Models & Accessing models, File sharing Semantics, File Caching, File Replication, Fault Tolerance, File System Security. 4

UNIT – II	**12Hrs**
Distributed Databases:	
Distributed DBMS, Architectural Models for DDBS, Distributed DBMS Architecture, Distributed Data Sources	3
Distributed Database Design Issues &Integration:	
Framework of Distribution, Distributed Design Issues, Top-Down Design Process	3
Fragmentation, Allocation, Bottom-Up Design Methodology	3
Schema Matching, Schema Integration, Schema Mapping, Data Cleaning	3
UNIT –III	**12Hrs**
Data and Access Control:	
Database Security, Discretionary Access Control, Multilevel Access Control	2
Distributed Access Control, View Management, Views in Centralized DBMSs	3
Views in Distributed DBMSs, Maintenance of Materialized Views	2
Data Replication:	
Consistency of Replicated Databases, Update Management Strategies,	2
Replication Protocols, Replication and failures, Replication Mediator Service.	3
UNIT – IV	**12Hrs**
Parallel Database Systems:	
Parallel Database System Architectures, Parallel Data Placement,	3
Load Balancing, Database Clusters	2
Web Data Management:	
Web Graph Management, Web Search, Web Crawling, Indexing,	3
Ranking and Link Analysis, Keyword Search, Web Querying,	2
Semi-structured Data Approach, Web Query Language Approach	2
UNIT – V	**12Hrs**
Advanced Application Development:	
Performance Tuning, Performance Benchmarks Other Issues in Application Development, Standardization.	4
Spatial and Temporal Data and Mobility:	
Motivation, Time in Databases, Spatial and Geographic Data, Multimedia Databases,	4
Mobility and Personal Databases.	4

References:

1. M. Tamer Özsu • Patrick Valduriez **Principles of Distributed Database Systems** Third Edition

2. Distributed Operating Systems: Concepts And Design By Pradeep K. Sinha

3. "Storage Networks Explained" – by Ulf Troppens, Wolfgang Muller-Freidt, Rainer Wolafka, IBM Storage Software Development, Germany. Publishers: Wiley

4. Abraham Silberschatz, Henry F Korth, S Sudarshan, Database System Concepts, McGrawHill International Edition, 6th Edition, 2010**.**

5. Elmasri Navathe, Somayajulu, Gupta **, Fundamentals of Database Systems,** Pearson Education, 4th Edition, 2006.

6. CJ Date, A Kannan, S Swamynathan**, An Introduction to Database Systems,** Pearson Education, 8th Edition, 2006.

7. Raghu Ramakrishnan, and Johannes Gehrke**, Database Management Systems,** McGraw-Hill International Edition, 3rd Edition, 2002

BIGDATA ANALYTICS

Credits: 4 **Semester: V**

Course code: CSAI23504 **No. of lecture hours: 60**

Objectives:

- To understand and learn about Big Data.
- To learn the analytics of Big Data.
- To understand Map Reduce fundamentals.

Outcome: Students will be able to

CO1: Explain the motivation for big data systems and identify the main sources of Big Data in here al world.

CO2: Develop technical skills in predicative and prescriptive modeling to support business decision-making.

CO3: Implement several Data Intensive tasks using the Map Reduce Paradigm.

CO4: Understand Hadoop ecosystem such as YARN and HIVE-QL for structured databases.

CO5: Demonstrate an ability map-reduce programming using PIG and NoSQL databases for storing purpose and process for Big Data Analytics

UNIT-I

Getting an Overview of Big Data:	**12 Hrs**
1. What is Big Data ?,History of Data Management-Evolution of Big Data	1
2. Structuring Big Data, Elements of Big Data	1
3. Big Data Analytics, Careers and Future of Big Data	1
Exploring the Use of Big Data in Business Context:	
4. Use of Big Data in Social Networking	1
5. Preventing Fraudulent Activities	1
Introducing Technologies for Handling Big Data:	
6. Distributed and Parallel Computing for Big Data	2
7. Introducing Hadoop, Cloud Computing and Big Data	2
Understanding Big Data Technology Foundations:	
8. Exploring the Big Data Stack, Virtualization and Big Data	2
9. Virtualization Approaches	1

UNIT-II **12Hrs**

Understanding Hadoop Ecosystem	
1. Hadoop Ecosystem	2
2.Hadoop Distributed File System	4
3.HBase-Architecture,Regions	2
Understanding Map Reduce Fundamentals andHBase	
4.The Map Reduce Frame work, Uses of Map Reduce	2

5.Role of HBase in Big Data Processing	2

UNIT– III **12hrs**

Processing your Data with Map Reduce

1. Developing Simple Map Reduce Application	2

Customizing Map Reduce Execution and Implementing Map Reduce program

2.Controlling Map Reduce Execution with Input Format	1
3.Reading Data with Custom Record Reader	2
4.Organizing Output Data with Output Format	2
5.Customizing Data with Record Writer	2
6.Optimizing Map Reduce Execution with Combiner	2
7.Controlling Reducer Execution with Partitioner	1

UNIT–IV **12hrs**

Understanding Hadoop YARN Architecture:

1.Background and Advantages of YARN	2
2.YARN Architecture, Working of YARN, YARN Schedulers	2
3.YARN Configurations, YARN Commands, YARN Containers	2

Exploring HIVE:

4. Introducing Hive, Getting started with Hive	2
5. Data Types and Built-in functions in Hive ,Hive DDL	2
6. Data manipulation in Hive, Data Retrieval Queries, Using Joins in Hive	2

UNIT–V **12hrs**

Analyzing Data with Pig

1.Introducing Pig ,Running Pig	1
2.Getting Started with Pig Latin	1
3.Working with Operators in Pig	2
4.Working with Functions in Pig	2
5.Debugging Pig, Error Handling in Pig	1

No SQL Data Management:

6.Introduction to No SQL	1
7.Types of No SQL Data Models	2
8.Schema-Less Databases ,Materialized Views	1
9.Distribution Models ,Shading	1

ESSENTIAL READING

1. DT Editorial Services.2016. **Big Data Black Book**. Dream tech Press.

SUGGESTED READING

1. White, Tom.2012.**Hadoop: The Definitive Guide**.3rd Edition. O'Reilly Media.

NATURAL LANGUAGE PROCESSING

Credits: 3 **Semester: V**

Course Code: CSAI23505 **No. of Lecture Hours: 45**

Course Objective: The main objective of this course is to give a practical introduction to NLP. It deals with morphological processing, syntactic parsing, information extraction, probabilistic NLP and classification of text using Python's NLTK Library.

Course Outcomes:

At the end of the course the student will be able to

CO1: Write Python programs to manipulate and analyze language data

CO2: Understand key concepts from NLP and linguistics to describe and analyze language

CO3: Understand classification of text

CO4:• Create feature based grammar

Unit-I **9Hrs**

1. **Language Processing and Python**: Computing with Language: Texts and Words, A Closer Look at Python: Texts as Lists of Words. 3
2. **Computing with Language:** Simple Statistics, Back to Python: Making Decisions and Taking Control, Automatic Natural Language Understanding 3
3. **Accessing Text Corpora and Lexical Resources**: Accessing Text Corpora, Conditional Frequency Distributions, Lexical Resources, WordNet 3

Unit-II **9Hrs**

1. **Processing Raw Text:** Accessing Text from the Web and from Disk 2
2. **Strings:** Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text 4
3. Regular Expressions for Tokenizing Text, Segmentation, Formatting: From Lists to Strings. 3

Unit-III **9Hrs**

1. Categorizing and Tagging Words: Using a Tagger, Tagged Corpora 3
2. Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging 3
3. Transformation-Based Tagging, How to Determine the Category of a Word 3

Unit-IV **9Hrs**

1. Learning to Classify Text: Supervised Classification, Evaluation, Naive Bayes Classifiers 3

Extracting Information from Text

2. Information Extraction, Chunking, Developing and Evaluating Chunkers, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction. 3
3. Analyzing Sentence Structure Some Grammatical Dilemmas, Use of Syntax. Context-Free Grammar, Parsing with Context-Free Grammar 3

Unit-V **9Hrs**

Building feature-based grammars

1. Graphical features, processing feature, extending a feature based grammar 4

Analyzing the meaning of sentences

2. Natural language understanding, Propostional logic, first order logic 3
3. Semantics of English sentences 2

Essential Reading

1. Steven Bird, Ewan Klein, and Edward Loper. 2009. **Natural Language Processing with Python**. 1st Edition. O'Reily.

Suggested Reading:

1. Natural Language Processing Recipes: Unlocking Text Data with Machine Learning and Deep Learning using Python. Akshay Kulkarni, AdarshaShivananda, Apress, 2019
2. Allen James, Natural Language Understanding, Benjamin/Cumming,1995.
3. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.

ROBOTIC PROCESS AUTOMATION

Credits: 3 **Semester: V**

Course Code: CSAI23506 **No. of Lecture Hrs:45**

Course Objectives

- To understand the fundamental concepts of digital technology
- To recognize the use of Digital technology in various Industries
- To understand the principles of, Automation Anywhere
- To understand and create Bots

Course Outcomes

CO1: Understand the fundamental concepts of digital technology
CO2: Recognize the use of Digital technology in various Industries
CO3: Understand the principles of UI Path
CO4: Understand the principles of Automation Anywhere
CO5: Design bots and understand their various types

Unit I **9Hrs**

DIGITAL PRIMER

1. Why is Digital Different?	1
2. Digital Metaphors On Cloud 9	2
3. A Small Intro to Big Data-Social Media & Digital Marketing	2
4. Artificial Intelligence- Unchain the Block chain	2
5. Internet of Everything and Immersive Technology.	2

Unit II **9 Hrs**

1. Digital For Industries	1
2. Manufacturing and Hi-tech	2
3. Banking and Financial Services	2
4. Insurance and Healthcare, Retail-Travel & Hospitality	2
5. Communications, Media & Information Services-Government.	2

Unit III **9 Hrs**

1. RPA TOOLS : UIPATH	3
2. RPA vs BPM	3
3. RPA Implementations-RPA in Industries-Tools	3

Unit IV	**9 Hrs**
1. AUTOMATION ANYWHERE Architecture	3
2. Exploring AA	3
3. BOTS preparation using Automation Anywhere	3

Unit V	**9 Hrs**
1. Knowing the Bots and its Types	3
2. More About Task Bots	3
3. MetaBots	2
4. IQ Bots	1

ESSENTIAL READINGS:

1. Richard Murdoch. 2020. **Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant**. 1st Edition. **Packt Publishing**Kindle Store
2. Husan Mahey. 2020. **Robotic Process Automation with Automation Anywhere: Techniques to fuel business productivity and intelligent automation using RPA. 1st Edition. Packt Publishing** Kindle Store**.**
3. Kelly Wibbenmeyer, **The Simple Implementation Guide to Robotic Process Automation (RPA): How to Best Implement RPA in an Organization. 1st Edition. Packt Publishing.** Kindle Store**.**
4. Alok Mani Tripathi. 2018. **Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots ... with the leading RPA tool – UiPath. 1st Edition. Packt Publishing.** Kindle Store.

Web sites

1. https://en.wikipedia.org/wiki/Robotic_process_automation
2. https://en.wikipedia.org/wiki/Automatix_(software)
3. https://www.automationanywhereuniversity.com/
4. https://www.automationanywhere.com/in/products/iq-bot

DATA VISUALIZATION TOOLS LAB

Credits: 1 **Semester: V**

Course Code: CSAI23507 **No. of Lecture Hours:30**

S.No.	Program
1.	Create Band chart, Thermometer chart, Gantt chart, Water fall chart and Pivot chart in Excel.
2.	Create Bar charts, Histograms, Pie charts, Logarithmic Plots, Polar Plots in Python.
3.	Create Box plot, Line Graphs and Scatter Plots in Python..
4.	Programs on Perform String calculations, Data calculations and Table calculations in Tableau.
5.	Programs on Creating Bar Charts, Line Charts, And Geographic Visualizations in Tableau.
6.	Programs on Joins and Blends operations in Tableau.
7.	Programs on Level of Detail Calculations, Parameters, Adhoc Calculations in Tableau..
8.	Programs on Addressing and Partitioning, Custom Table Calculations in Tableau.

BIGDATA ANALYTICS LAB

Credits: 1 **Semester: V**

Course Code: CSAI23508 **No. of lecture hours: 30**

S.No.	Program
1.	Implement the following file management tasking Hadoop: a) Adding file and directories b) Creating file, Retrieving file and deleting files
2.	Map Reduce program for basic word count.
3.	Map Reduce program for sorting text data.
4.	Map Reduce program for weather data.
5.	Using Hive to implement DDL Commands
6.	Using Hive to implement DML commands
7.	Using Hive to retrieve data.
8.	Using Hive to implement bucketing and partitioning.
9.	Using Hive to implement built-in functions
10.	Pig Latin script to work with operators
11.	Pig Latin scripts using eval functions to analyze your data.
12.	Pig Latin scripts using math functions to analyze your data.
13.	Pig Latin scripts using string functions to analyze your data.
14.	Pig Latin scripts to create user defined function.

NATURAL LANGUAGE PROCESSING LAB

Credits: 1 **Semester: V**
Course Code: CSAI23509 **No. of lecture hours: 30**

Course Objective: The main objective of this laboratory is to write programs that manipulate and analyze language data using Python
This lab requires mentoring sessions from TCS.
Python Packages
Students are expected to know/ learn the following Python NLP packages
• NLTK (www.nltk.org/ (http://www.nltk.org/))
• Spacy (https://spacy.io/)
• TextBlob (http://textblob.readthedocs.io/en/dev/
• Gensim (https://pypi.python.org/pypi/gensim)
• Pattern (https://pypi.python.org/pypi/Pattern)

Datasets:
1. NLTK includes a small selection of texts from the Project Gutenberg electronic text archive, which contains some 25,000 free electronic books, hosted at http://www.gutenberg.org/.
2. The Brown Corpus contains text from 500 sources, and the sources have been categorized by genre, such as news, editorial, and so on (http://icame.uib.no/brown/bcmlos.html).
3. Wikipedia Articles
Or any other dataset of your choice

Reference:
Jacob Perkins. Python 3 Text Processing with NLTK 3 Cookbook. Packt Publishing. 2014

Exercises:
1. Text segmentation: Segment a text into linguistically meaningful units, such as paragraphs, sentences, or words. Write programs to segment text (in different formats) into tokens (words and word-like units) using regular expressions. Compare an automatic tokenization with a gold standard
2. Part-of-speech tagging: Label words (tokens) with parts of speech such as noun, adjective, and verb using a variety of tagging methods , e.g., default tagger, regular expression tagger, unigram tagger, and n-gram taggers.
3. Text classification: Categorize text documents into predefined classes using Naïve Bayes Classifier and the Perceptron model
4. Chunk extraction, or partial parsing: Extract short phrases from a part-of-speech tagged sentence. This is different from full parsing in that we're interested in standalone chunks, or phrases, instead of full parse trees
Parsing: parsing specific kinds of data, focusing primarily on dates, times, and HTML.
Make use of the following preprocessing libraries:
• dateutil which provides date time parsing and time zone conversion
• lxml and Beautiful Soup which can parse, clean, and convert HTML
• Charade and Unicode Dammit which can detect and convert text character encoding

ROBOTIC PROCESS AUTOMATION LAB

Credits: 1 **Semester: V**
Course Code: CSAI23510 **No. of Practical Hrs: 30Hrs**

Course Objectives:

- To understand the principles of UI Path, Automation Anywhere
- To understand and create Bots

List of programs

1. Creating bots for automatic login to Gmail
2. Creating bots for automatic login to ERP
3. Creating bots to display message along with your name
4. Creating bots to perform addition of two numbers
5. Creating bots to find Factorial of Given Number
6. Creating bots to display details of Employee

YEAR-WISE AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS DEPARTMENT OF B.Sc COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE SIXTH SEMESTER ACADEMIC YEAR 2023-24 OF 2021-24BATCH (CBCS)

Sl. No.	Part	Course Code	Title of the Course	Hours /Week	Duration of Exam (hrs.)	Marks			Credits
						Internal	External	Total	
1	II	CSAI23601A	Software Testing (DSE-2)	4	3	40	60	100	4
		CSAI23601B	Computer Vision (DSE-2)						
2	II	CSAI23602A	Human Computer Interaction (DSE-3)	4	3	40	60	100	4
		CSAI23602B	Data Security (DSE-3)						
3	II	CSAI23603	Deep Learning (Core-19)	4	3	40	60	100	4
PRACTICALS									
4	II	CSAI23604	Deep Learning (Core-19)	2	3	40	60	100	1
5	II	CSAI23605	MajorProject	15	3	40	60	100	6
	Total			**29**	**-**	200	300	500	**19**

**Discipline Specific Elective(DSE)

SOFTWARE TESTING
(Discipline Specific Elective-2)

Credits: 4 **Semester: VI**
Course Code: CSAI23601A **No.ofLectureHours:60**

Course Objectives:

- To help the students understand the importance and need of testing through testing cycles.
- To learn various testing techniques which are required for any software product.
- To introduce Quality assurance concepts and activities.

Course Outcomes: Students will be able to

CO1: **Analyze** importance of testing in software development process, applyglass-boxtesting,black-boxtesting,andhowtoreportandanalyzebugs
CO2: **Identify** problem tracking system, different types of testing and test case design.
CO3: **Understand** how to build testing strategy, establishing software testing methodology and softw are testing techniques.
CO4: **Explain** the definition of quality, metrics for software quality and in section techniques.
CO5: **Classify** software configuration management, software reengineering and software restructuring techniques.

UNIT–I	**12hrs**
1. Example Test Series–First Cycle	1
2. Second Cycle, Subsequent Cycles	1
3. Objectives and Limits of Testing	1
4. Testing in Software Development Process- Planning Process– Planning Stage	2
5. Design Stage Testing	1
6. Glass Box Code Testing	1
7. Black Box Testing	1
8. Software Errors	1
9. Reporting and Analyzing Bugs– Problem Report, Contents Characteristics	1
10. Analysis of Reproducible Bug	1

UNIT–II	**12hrs**
1. Problem Tracking Systems– Objectives, Tasks.	2
2. Overview, Users.	2
3. Mechanics, Further Thought son Problem Reporting	2
4. Test Case Design– Characteristics of Good Test	1
5. Equivalence Classes and Boundary Values	1
6. Visible State Transitions, Race Conditions, Load Testing, Error Guessing	1
7. Function Equivalence Testing	1
8. Regression Testing, Executing the Tests	2

UNIT–III	**12Hrs**
1. Building a Software Testing Strategy	3
2. Establishing a Software Testing Methodology	2
3. Determining a Software Testing Techniques	3
4. Eleven Steps for Software Testing Process – Overview	2
5. Assess Project Management	2

UNIT–IV	**12Hrs**
1. Product Metrics- Software Quality, Framework for Product Metrics	2
2. Metrics for Process and Products-Software Measurement	3
3. Metrics for Software Quality.	2
4. Quality Management–Quality Concepts, Software Quality Assurance	2
5. Software Reviews, Formal Technical Reviews, Software Reliability	3
UNIT–V	**12Hrs**
1. Change Management- Software Configuration Management	3
2. SCM Repository ,SCM Process	3
3. Reengineering –Software Reengineering	3
4. Reverse Engineering, Restructuring	3

ESSENTIALREADING

1. CemKaner, Jack Falk, Hung Quocguyen.1998.**TestingComputerSoftware.** Comdex.
2. WilliamPerry.2000.**EffectiveMethodsforSoftwareTesting**. Wiley
3. Pressman Roger S, **Software Engineering Practioner'sApproach.**6th Edition**.**McGrawHill International Edition

COMPUTER VISION
(Discipline Specific Elective-2)

Credits: 4 **Semester: VI**
Course Code: CSAI23601B **No. of Lecture Hrs: 60**

Objective: Understand and use OpenCV4 in Python and Perform object detection and motion analysis

Course Outcomes
CO1: Understand basics concepts of Images
CO2: Compute manipulation on images
CO3: Differentiating and segmenting images
CO4: Experiment object detection using OpenCV
CO5: Develop Object tracking and motion analysis

UNIT-I **12Hrs**
Basics of Computer Vision and OpenCV

1.	Introduction to images, How images are formed?, Storing images in computers	3
2.	Getting started with Open CV	3
3.	Gray scaling- converting color images to Shades of Gray, Color Spaces	3
4.	Histogram representation of images- Visualizing the components of Images	3

UNIT-II **12Hrs**
Image Manipulations & Processing

1.	Transformations- Affine and Non-Affine	2
2.	Image Translations- Moving Images Up, Down, Left and Right	2
3.	Rotations- spin image around and perform horizontal flipping	2
4.	Scaling, Resizing and Interpolations, How resizing affects quality	2
5.	Image Pyramids, Cropping- Cut out unnecessary portions in Image	1
6.	Arithmetic operations- Brightening and Darkening Images	1
7.	Bitwise operations- How Image Masking works, Blurring, Sharpening	1
8.	Thresholding- Making certain Images Areas Black and White	1

UNIT-III **12Hrs**

1.	Dilation, Erosion, Opening/Closing- Importance of Thickening/Thinning lines	2
2.	Edge Detection using Image Gradients and Canny Edge Detection	2
3.	Perspective and Affine Transforms	2

Image Segmentation and Contours

4.	Segmentation and Contours- Extract Defined Shapes in Image, Sorting Contours	2
5.	Approximating Contours and Finding convex hull- Clean up and Messy Contours	2
6.	Matching Contour Shapes - Match Shapes In Images Even When Distorted	2

UNIT-IV **12Hrs**

Object Detection in OpenCV

1. Object detection Overview, feature description- digitally representing objects 2
2. Finding corners, Ways to get Image features- SIFT, SURF,FAST, BRIEF,ORB 2
3. Histogram of Oriented Gradients - Another Novel Way Of Representing Images 2
4. HAAR Cascade Classifiers- Working, Face and Eye detection 2
5. Face Analysis and Filtering - Identify Face Outline, Lips, Eyes Even Eyebrows 2
6. Merging Faces - Combine Two Faces For Fun & Sometimes Scary Results 2

UNIT-V **12Hrs**

Object Tracking and Motion Analysis

1. Filtering By Color 2
2. Background Subtraction and Foreground Subtraction 2
3. MeanShift for Object Tracking 3
4. CAMShift for Object Tracking 3
5. Tracking Moving Objects in Videos 2

Suggested Reading

1. https://www.udemy.com/course/master-computer-vision-with-opencv-in-python/
2. Jan Erik Solem. 2012. Programming Computer Vision with Python. First Edition. OReilly.

HUMAN COMPUTER INTERACTION
(Discipline Specific Elective-3)

Credits: 4 **Semester: VI**

Course Code: CSAI23602A **No. of Lecture Hrs: 60**

Course Objectives: To gain an overview of Human-Computer Interaction (HCI), with an understanding of user interface design in general, and alternatives to traditional "keyboard and mouse" computing.

Course Outcomes: Students will be able to

CO1: Explain HCI and principles to interaction design.
CO2: Design certain tools for blind or PH people.
CO3: Understand Navigation schemes
CO4: **Evaluation** through user participation
CO5: **Design** Application

UNIT – I **12Hrs**

Introduction:

1. Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design. 4
2. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics. 4
3. Web user Interface popularity, characteristics- Principles of user interface design 4

UNIT – II **12Hrs**

1. **Design process –** Human interaction with computers, importance of human characteristics Human Consideration in the design of business systems, Human interaction speeds 4
2. **Human considerations in interface and screen design**- interface design goals, test for a good design Screen and web page meaning and purpose, organizing elements clearly and meaningfully, Consistency, starting point, ordering of data and content, navigation and flow, visual pleasing composition. 5
3. Window characteristics, components, presentation styles, types of windows 3

UNIT- III **12Hrs**

Proper screen based controls

1. Operable controls, text entry / read only controls, selection controls, combination entry/selection controls, 4
2. Other operable controls, custom controls, presentation controls 4
3. Icons, multimedia, graphics, color- RGB, HSV, Dithering, color uses 4

UNIT- IV **12Hrs**

1. HCI in the software process, The software life cycle Usability engineering Iterative design 3
2. and Prototyping, Design rationale

Design rules

3. Principles to support usability, Standards 3
4. Golden rules and heuristics, HCI patterns 3

Evaluation techniques

5. Goals of evaluation, Evaluation through expert analysis and user participation 3
6. Choosing an evaluation method

UNIT- V **12Hrs**

Communication and collaboration models

1. Introduction, face-to-face communication, conversation, text based communication 4

Dialog notations and design

2. Dialog, dialog design notations, diagrammatic notations, textual dialog notations 4
3. Dialog semantics, dialog analysis and design 4

ESSENTIAL READING:

1. **The Essential Guide To User Interface Design,** Wilbert O Galitz, Wiley Dream Tech. 3rd Edition. Units 1, 2, 3
2. **Human – Computer Interaction.** Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education 3rd Edition.Units 4,5

REFERENCE BOOKS:

1. Designing the user interface. 3rd Edition Ben Shneider mann, Pearson Education Asia.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dream tech.
3. User Interface Design, Soren Lauesen , Pearson Education.
4. Human –Computer Interaction, D. R. Olsen, Cengage Learning.
5. Human –Computer Interaction, Smith - Atakan, Cengage Learning

DATA SECURITY
(Discipline Specific Elective-3)

Credits: 4 **Semester: VI**

Course Code: CSAI23602B **No. of Lecture Hours: 60**

Course Objectives:

- Understanding the significance of privacy, ethics in data environment.
- Analyzing the steps to secure data.

Course Outcomes: Students will be able to

CO1: Identify some of the factors driving the need for data security
CO2: Examine and classify particular examples of attacks
CO3: Classify the terms vulnerability, threat and attack
CO4: Analyze physical points of vulnerability in simple networks
CO5: Compare and contrast symmetric and asymmetric encryption
Systems and their vulnerability to attack, and explain the characteristics of hybrid systems.

UNIT –I **12hrs**

Attacks on Computers and Computer Security:

1. Introduction: The Need for Security, Security Approaches, Principles Of Security, Types of Security Attacks 2
2. Security Services, Plain Text and Cipher Text, Stream Ciphers, Block Ciphers 2
3. Security Mechanisms, A Model for Network Security 2

Cryptography:

1. Encryption and Decryption, Substitution Ciphers, Ceaser Cipher, Mono-Alphabetic Cipher, Play-Fair Cipher, Hill Cipher, Poly-Alphabetic Cipher, Transposition Techniques, One-Time Pads 2
2. Introduction to Symmetric and Asymmetric Key Cryptography and Its Applications 2
3. Crypt analysis, Types of Keys, Key Range and Key Size, Possible Types of Attacks 2

UNIT– II **12hrs**

Symmetric Key Cryptography:

1. Block Cipher Principles, Symmetric Encryption Principles & Algorithm 2
2. DES Algorithm, Strength of DES,Triple DES 2
3. Block cipher modes of operation, Electronic Code Book Mode(ECB), Cipher Block Chaining Mode(CBC), Cipher Feedback Mode(CFB), Counters Mode(CTR) 3

Asymmetric key Cryptography:

1. Principles of Public Key Cryptography, RSA Algorithm 2
2. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys 4

3. Virus Counter Measures, Anti-Virus Approaches, Generic Decryption, Digital Immune System, Behavior-Blocking Software 2
4. Firewall Design Principles, Firewall Characteristics, Types of Firewalls, Firewall Configurations. 2
5. Trusted Systems, Data Access Control, Concept of Trusted Systems, Trojan Horse Defense 2

UNIT–III **12hrs**

Intruders, Virus and Firewalls:

1. Introduction to Intruders, Intrusion Detection Systems 2
2. Password Management, Password Protection, Password Selection Strategies 2
3. Viruses, Threats, Worms, Nature of Viruses, Types of Viruses, Malicious Programs 2
4. Virus Counter Measures, Anti- Virus Approaches, Generic Decryption,
5. Digital Immune System, Behavior-Blocking Software 2
6. Firewall Design Principles, Firewall Characteristics, Types of Firewalls, Firewall Configurations. 2
7. Trusted Systems, Data Access Control, Concept of Trusted Systems, Trojan horse Defense 2

UNIT-IV **12hrs**

Information Hiding:

1. Introduction to Information Hiding, Steganography, and Water marking 2
2. Importance of Digital Water marking, Importance of Steganography 2
3. Applications of Water marking, Applications of Steganography 2
4. Properties of Water marking Systems, Evaluating Water marking Systems 2
5. Properties of Steganography and Steganalysis Systems. Evaluating and Testing Steganographic Systems 2
6. Robust Water marking, Approaches, Robustness to Volumetric Distortions 2

UNIT–V **12hrs**

Case Studies on Cryptography and Security:

1. Secure Inter-branch Payment Transactions 2
2. Cross site Scripting Vulnerability 2
3. Virtual Elections 2
4. Common Criteria for Information Technology Security Evaluation 2

Biometrics:

1. Components,Enrollment,Authentication,Techniques,Accuracy,Applications 2
2. Internet Standards, Internet Society, Internet Organizations, Internet Standard Categories, RFCs 2

ESSENTIALREADING

1. Stallings, William. **Cryptography and Network Security**. 4th Edition. New Delhi: Pearson Education.
2. Forouzan, Behrouz A. **Cryptography and Network Security.** McGraw Hill Edition.
3. Cox, Ingemar. Miller, Matthew. Bloom, Jeffrey and Fridrich, Jessica. **Digital Watermarking and Steganography.** 2nd Edition**.** India: TMH.

DEEP LEARNING

Credits: 4 **Semester: VI**

Course code: CSAI23603 **No. of lecture hours: 60**

Course Objective:

The main objective of this course is to give a practical introduction to Deep Learning using Keras. It covers the concepts of deep learning and their implementation.

Course Outcomes:

At the end of the course the student will be able to

CO1: **Understand** the basics of deep learning

CO2: **Understand** the usage of tensors in deep learning

CO3: **Understand** the LSTM and GRU layers

CO4: **Apply P**ython deep-learning framework Keras, with Tensor-Flow as a backend engine.

CO5: **Apply** Auto encoders

Unit-I	**12Hrs**
1. **Introduction:** History, Hardware, Data, Algorithms Neural Networks, Data representations for neural networks, Scalars (0D tensors),	3
2. Vectors(1D tensors), Matrices (2D tensors), 3D tensors and higher-dimensional tensors, Key attributes.	3
3. Manipulating tensors in Numpy, The notion of data batches, Real-world examples of data tensors	3
4. Vector data, Time series data or sequence data, Image data, Video data	3
Unit-II	**12Hrs**
1. Tensor operations: Element-wise operations	3
2. Broadcasting, Tensor dot, Tensor reshaping	3
3. Geometric interpretation of tensor operations	3
4. A geometric interpretation of deep learning	3
Unit-III	**12Hrs**
1. Gradient-based optimization, Derivative of a tensor operation	3
2. Stochastic gradient descent.	3
3. Chaining derivatives: the Back propagation algorithm	3
4. Neural networks: Anatomy, Layers, Models, Loss functions and optimizers	3
Unit-IV	**12Hrs**
1. Introduction to Keras,Keras, Tensor Flow	3
2. Theano and CNTK.	3
3. Recurrent neural networks: A recurrent layer in Keras	3
4. Understanding the LSTM and GRU layers	3
UNIT V	**12Hrs**
1. Auto encoders: Types of Auto Encoders and its applications	4
2. Generative Adversarial Networks: Generative Adversarial Network	4
3. Deep Convolutional Generative Adversarial Networks	4

Essential reading

1. François Chollet. Deep Learning with Python. Manning Publications, 2018

Suggested Reading:

1. AurélienGéron. Hands on Machine Learning with SciKit-Learn, Keras and Tensor Flow. O'Reily, 2019
2. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016. Link:https://www.deeplearningbook.org
3. Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, Dive into Deep Learning, 2020 link: Dive into Deep Learning — Dive into Deep Learning 0.16.6 documentation (d2l.ai)

Deep Learning Lab

Credits: 1 **Semester: VI**

Course code: CSAI23604 **No. of practical hours: 30**

Course Objectives: The main objective of this lab is to develop deep learning models using Keras Deep Learning Tools

Students are expected to learn Keras deep-learning framework (https://keras.io), which is open source and free to download. They should have access to a UNIX machine; though it's possible to use Windows, too. It is also recommended that they work on a recent NVIDIA GPU

Exercises:

Note: The exercises should following Keras workflow consisting of four steps

1. Define your training data: input tensors and target tensors
2. Define a network of layers (or model) that maps your inputs to your targets
3. Configure the learning process by choosing a loss function, an optimizer, and some metrics to monitor
4. Iterate on your training data by calling the fit() method of your model

Exercise 1:

Dataset:

IMDB dataset, a set of 50,000 highly polarized reviews from the Internet Movie Database. They're split into 25,000 reviews for training and 25,000 reviews for testing, each set consisting of 50% negative and 50% positive reviews. the IMDB dataset comes packaged with Keras

Binary Classification Task:

Build a network to classify movie reviews as positive or negative, based on the text content of the reviews.

Exercise 2:

Dataset:

Reuters dataset, a set of short newswires and their topics, published by Reuters in 1986. It's a simple, widely used toy dataset for text classification. There are 46 different topics; some topics are more represented than others, but each topic has at least 10 examples in the training set. Reuters dataset comes packaged as part of Keras.

Single-label Multi class Classification Task:

Build a network to classify Reuters newswires into 46 mutually exclusive topics. Each data point should be classified into only one category (in this case, topic),. The problem is more specifically an instance of single-label, multiclass classification.

Exercise 3:

Dataset:

The Boston Housing Price dataset has an interesting difference from the two previous examples. It has relatively few data points: only 506, split between 404 training samples and 102 test samples. And each feature in the input data (for example, the crime rate) has a different scale. For instance, some values are proportions, which take values between 0 and 1;

others take values between 1 and 12, others between 0 and 100, and so on.

Regression Task:

The two previous examples were classification problems, where the goal was to predict a single discrete label of an input data point. Another common type of machine-learning problem is regression, which consists of predicting a continuous value instead of a discrete label. You'll attempt to predict the median price of homes in a given Boston suburb in the mid-1970s, given data points about the suburb at the time, such as the crime rate, the local property tax rate, and so on

MAJOR PROJECT
(Discipline Specific Elective-4)

Credits: 6 **Semester: VI**
Course Code: CSAI23605 **No. of Practical Hours: 15**

EVALUATION CRITERIA FOR MAJOR PROJECT

Third year students in the Sixth Semester are required to take up a project work which carries a total of 100 marks i.e. internal 40 marks and external 60 marks.

The criteria for the Internal Evaluation of Project for 40 marks are as follows:

1.Attendance 5 marks

2. Review of weekly report 5 marks

3. Internal Project Presentation–every week end (Presentation & communication skills, objectives, Work submission, methodology, results, and Practical relevance.) 10 marks

4. Final internal presentation- at the end of semester (50% marks Evaluation done by the internal guide, and 50% marks evaluated by other internal lecturers guiding the projects) 15 marks

5. Project Report 5 marks

External Evaluation of the Project (60 marks): The Controller of Examination sends the Project Reports to the External Examiner in advance. The External Examiner evaluates the project for 60 marks based on project work done by the student. (The Project Report is evaluated for 40 marks and Viva-voce for 20 marks.).