Date: 20-08-2025

# Minutes of the Second Board of Studies(BoS) Meeting

**The Second Meeting of BOS for B.Tech. CSE(DS)** was held at 2.00pm through online mode on 02.08.2025 (Saturday) using the following link:

https://us06web.zoom.us/j/81340926115

**The following members attended the meeting:**

| S.No. | Name of the Member | Designation | Role |
|---|---|---|---|
| 1. | Dr. Loshma Gunisetti | Professor, HOD-AIML, SVEC | Chairperson |
| 2. | Prof. L Sumalatha | Professor, Department of CSE, UCEK, Kakinada | University Nominee |
| 3. | Prof. R B V Subrahmanyam | Professor, Department of CSE, NIT Warangal | Academic Expert |
| 4. | Dr. K Himabindu | Dean, Student Welfare, NIT-AnP, Andhra Pradesh | Academic Expert |
| 5. | Mr. Pavan Kumar Chowdarapu | Enterprise Architect, TCS Hyderabad | Industry Expert |
| 6. | Mr. Sattibabu Nimmakayala | Solution Architect (Salesforce), EPAM, Hyderabad | Industry Expert |
| 7. | Dr Aswani K Eedara | Professor | Member |
| 8. | Mr. R.L. Phani Kumar | Sr. Asst. Professor | Member |
| 9. | Mr. M. Subba Rao | Sr. Asst. Professor | Member |
| 10. | Mr. P V V Satyanarayana | Sr. Asst. Professor | Member |
| 11. | Mrs. K. Durga Saranya | Assistant Professor | Member |
| 12. | Mr. Shaik Moulali | Assistant Professor | Member |

| | | | |
|---|---|---|---|
| 13. | Mrs. M. Kiranmai | Assistant Professor | Member |
| 14. | Dr. M Vishnuvardhan | Assistant Professor | Member |
| 15. | Mrs. Balaji Rohitha | Assistant Professor | Member |
| 16. | Mr. Jewaliddin Shaik | Assistant Professor | Member |
| 17. | Ms. Sneha Pradhan | Assistant Professor | Member |

**Item No. 1:** Welcome note by the Chairperson BOS.

The HOD extended a formal welcome and introduced the members.

**Item No. 2:** Approval of Proposed Course Structure and Syllabi for III to VI Semesters of B.Tech. CSE(DS) Programme under V23 Regulation.

- The Course Structure for III to VI Semesters of B.Tech. CSE(DS) Programme under V23 Regulation was approved with following suggested changes:

| Sem | Course Code | Course Name | Suggestions | Inclusions / Modifications |
|---|---|---|---|---|
| V | V23DSTPE01 | Information Retrieval | • Add Information Retrieval Course as an elective | • Added Information Retrieval Course as an elective |
| V | V23DSTPE02 | Data Analytics | • Add Data Analytics Course as an elective to include Web Data Analytics, Video Analytics, Time Series Data Analysis topics | • Added Data Analytics Course as an elective to include Web Data Analytics, Video Analytics, Time Series Data Analysis |
| VI | V23DST03 | Cloud Computing | • Change Cloud Computing Course as | • Changed Cloud Computing Course as a |

| | | | | |
|---|---|---|---|---|
| | | | a Professional Core Course instead of Professional Elective | Professional Core Course instead of Professional Elective and Professional Core Course Operating Systems converted as Professional Elective-II |
| VI | V23DSTPE06 | Text Mining | • Add Text Mining Course as an Professional Elective | • Added Text Mining Course as an Professional Elective –II |
| VI | V23DSTPE08 | Medical Image Analysis | • Add Medical Image Analysis as an Professional Elective | • Add Medical Image Analysis as an Professional Elective-III |

- The Syllabi for III to VI Semesters of B.Tech. CSE(DS) Programme under V23 Regulation was approved with following suggested changes:

| Sem | Course Code | Course Name | Suggestions | Inclusions /Modifications |
|---|---|---|---|---|
| IV | V23DST02 | Data Engineering | • Structured and Unstructured data concepts must be introduced<br>• Data Lake and Data Warehouse concepts should be included<br>• Basic Data Models should be included | • Structured and Unstructured data concepts are included in Data Engineering Course<br>• Structured and Unstructured text data concepts have been included in Text Mining Course<br>• Data Lake and Data Warehouse concepts are included in Data Engineering Course<br>• Basic Data Models are covered in Data Engineering Course |
| V | V23AIT02 | Machine Learning | • Data Mining Concepts should be included | • Data Mining Concepts are included in Machine Learning course |

| | | | | |
|---|---|---|---|---|
| V | V23DSTPE02 | Data Analytics | • Power BI and Tableau tools must be included in a course<br>• Storytelling skills of student should be improved | • Power BI and Tableau tools have been added as a last unit in Data Analytics<br>• Storytelling concepts via Tableau tool is included<br>• Storytelling skills are also included in the Professional Communication Skills course |
| VI | V23DSTPE04 | Cryptography & Network Security | • Data Privacy, Data Protection Laws and Data Compliance Issues topics to be added as two or more units | • Data Privacy, Data Protection Laws and Data Compliance Issues topics to be added as last two units |
| VI | V23DSTPE01 | Information Retrieval | • Distributed Data Systems topics should be included | • Distributed Data Systems concepts have been added in Information Retrieval Course |
| VI | V23DST03 | Cloud Computing | • Distributed Computing topics should be included | • Distributed Computing topics are covered in Cloud Computing Course |
| II | V23CSL02 | IT Workshop | • Student should have Prompt Engineering skills | • Prompt Engineering is included in the IT Workshop Course |

- Details are given in **Annexure-I**

**Item No. 2 :** Review of Suggested Courses for Honors degree.

- Suggested Courses for B.Tech CSE(DS) Honors degree were reviewed and approved. Details are given in **Annexure-II**.

**Item No. 3:** Approval of Proposed Courses for Minors degree in the stream of AI & ML for other branch Students under V23 Regulation.

- Courses for Minors degree in the stream of AI & ML for other branch Students under V23 Regulation were approved. Details are given in **Annexure-III.**

Chairperson of BOS
(Dr. Loshma Gunisetti)

Annexure-I

# Approved

# Course Structure and Syllabi

# III to VI Semester

# B.Tech. CSE(DS) Programme

# V23 Regulation

**B.Tech. III Semester CSE (DS)**

| S.No. | Course Code | Course | | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | V23MAT05 | Discrete Mathematics & Graph Theory | BSC | 3 | 0 | 0 | 3 |
| 2. | V23MBT53 | Universal human values – understanding harmony and Ethical human conduct | BSC | 2 | 1 | 0 | 3 |
| 3. | V23DST01 | Introduction to Data Science | PCC | 3 | 0 | 0 | 3 |
| 4. | V23CST04 | Advanced Data Structures & Algorithm Analysis *(Under CSE BOS)* | PCC | 3 | 0 | 0 | 3 |
| 5. | V23CST05 | Object Oriented Programming through Java *(Under CSE BOS)* | PCC | 3 | 0 | 0 | 3 |
| 6. | V23DSL01 | Data Science Lab | PCC | 0 | 0 | 3 | 1.5 |
| 7. | V23CSL05 | Object Oriented Programming Through Java Lab *(Under CSE BOS)* | PCC | 0 | 0 | 3 | 1.5 |
| 8. | V23CSSE01 | Python Programming Lab *(Under CSE BOS)* | SEC | 0 | 1 | 2 | 2 |
| 9. | V23CEAC01 | Environmental Science | Audit Course | 2 | 0 | 0 | - |
| 10. | V23ENT02 | Professional Communication Skills - I | MNC | 0 | 3 | 0 | 0 |
| | | | **Total** | **16** | **05** | **08** | **20** |

L-Lecture, T-Tutorial, P-Practical, C-Credits

**B.Tech. IV Semester CSE (DS)**

| S.No. | Course Code | Course | | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | V23MAT08 | Statistical methods for Data science | ESC/ BSC | 3 | 0 | 0 | 3 |
| 2. | V23MAT09 | Optimization Techniques | HSS | 2 | 0 | 0 | 2 |
| 3. | V23DST02 | Data Engineering | PCC | 3 | 0 | 0 | 3 |
| 4. | V23CST07 | Database Management Systems *(Under CSE BOS)* | PCC | 3 | 0 | 0 | 3 |
| 5. | V23DST03 | Computer Organization and Architecture | PCC | 3 | 0 | 0 | 3 |
| 6. | V23DSL02 | Data Engineering Lab | PCC | 0 | 0 | 3 | 1.5 |
| 7. | V23CSL07 | Database Management Systems Lab *(Under CSE BOS)* | PCC | 0 | 0 | 3 | 1.5 |
| 8. | V23DSSE01 | Exploratory Data Analysis with Python | SEC | 0 | 1 | 2 | 2 |
| 9. | V23MET09 | Design Thinking & Innovation | BSC | 1 | 0 | 2 | 2 |
| 10. | V23ENT03 | Professional Communication Skills–II | MNC | 0 | 3 | 0 | 0 |
| | | | **Total** | **15** | **04** | **10** | **21** |
| *Mandatory **Community Service Project (V23CSP01)** Internship of 08 weeks duration during summer vacation* | | | | | | | |

L-Lecture, T-Tutorial, P-Practical, C-Credits

**B.Tech. V Semester CSE (DS)**

| S.No. | Course Code | Name of the Course | | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | V23AIT02 | Machine Learning | PCC | 3 | 0 | 0 | 3 |
| 2 | V23AIT04 | Computer Networks *(Under AIML BoS)* | PCC | 3 | 0 | 0 | 3 |
| 3 | V23AIT06 | Software Engineering *(Under AIML BoS)* | PCC | 3 | 0 | 0 | 3 |
| 4 | **Professional Elective-I** | | PEC | 3 | 0 | 0 | 3 |
| | V23CSTPE01 | 1. Object Oriented Analysis and Design *(Under CSE BoS)* | | | | | |
| | V23AITPE01 | 2. Automata Theory & Compiler Design *(Under AIML BoS)* | | | | | |
| | V23AITPE02 | 3. Soft Computing *(Under AIML BoS)* | | | | | |
| | V23DSTPE01 | 4. Information Retrieval | | | | | |
| | V23DSTPE02 | 5. Data Analytics | | | | | |
| | | 6. 12 week MOOC Swayam / NPTEL course | | | | | |
| 5 | **Open Elective -I** | | OEC | 3 | 0 | 0 | 3 |
| | | Offline / 12 week MOOC Swayam / NPTEL course recommended by the BoS | | | | | |
| | | Entrepreneurship Development & Venture Creation | | | | | |
| 6 | V23DSL02 | Machine Learning Lab | PCC | 0 | 0 | 3 | 1.5 |
| 7 | V23CSL09 | Computer Networks Lab *(Under CSE BoS)* | PCC | 0 | 0 | 3 | 1.5 |
| 8 | V23CSSE02 | Full Stack development-I | SEC | 0 | 1 | 2 | 2 |
| | | SWAYAM Plus – Data Engineer / AI Engineer | | | | | |
| 9 | **Engineering Science Course** | | ESC | 0 | 0 | 2 | 1 |
| | V23CSES01 | Master Coding and Competitive Programming - Part-I *(Under CSE BoS)* | | | | | |
| | V23CSES02 | Tinkering Lab (User Interface Design using Flutter) *(Under CSE BoS)* | | | | | |
| 10 | V23CSP01 | Evaluation of Community Service Project Internship | CSI | - | - | - | 2 |
| 11 | V23ENT04 | English for Employability | | - | - | - | - |
| | | **Total** | | **15** | **01** | **10** | **23** |
| | | Student may select from the Same Minor Pool | MC | 3 | 0 | 3 | 4.5 |
| | | Minor Course through SWAYAM / NPTEL (Minimum 12 Week, 3 credit course) | MC | 3 | 0 | 0 | 3 |
| | | Student may select from the Same Honors Pool | HC | 3 | 0 | 0 | 3 |
| | | Student may select from the Same Honors Pool | HC | 3 | 0 | 0 | 3 |

## B.Tech. VI Semester CSE(DS)

| S.No. | Course Code | Name of the Course | | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1 | V23AIT03 | Deep Learning *(Under AIML BoS)* | PCC | 3 | 0 | 0 | 3 |
| 2 | V23DST03 | Cloud Computing | PCC | 3 | 0 | 0 | 3 |
| 3 | V23AIT08 | Data Visualization *(Under AIML BoS)* | PCC | 3 | 0 | 0 | 3 |
| 4 | **Professional Elective-II** | | PEC | 3 | 0 | 0 | 3 |
| | V23DSTPE03 | 1. Social Media Analytics | | | | | |
| | V23DSTPE04 | 2. Cryptography & Network Security | | | | | |
| | V23AITPE04 | 3. Recommender Systems *(Under AIML BoS)* | | | | | |
| | V23MLTPE01 | 4. Operating Systems *(Under AIML BoS)* | | | | | |
| | V23DSTPE05 | 5. Sensor Networks | | | | | |
| | V23DSTPE06 | 6. Text Mining | | | | | |
| | | 7.12-Week SWAYAM / NPTEL Course suggested by the BoS | | | | | |
| 5 | **Professional Elective-III** | | PEC | 3 | 0 | 0 | 3 |
| | V23CSTPE09 | 1.Software Project Management *(Under CSE BoS)* | | | | | |
| | V23CSTPE04 | 2.Quantum Computing *(Under CSE BoS)* | | | | | |
| | V23AITPE05 | 3.Computer Vision *(Under AIML BoS)* | | | | | |
| | V23DSTPE07 | 4. NoSQL databases | | | | | |
| | V23DSTPE08 | 5. Medical Image Analysis | | | | | |
| | | 6.12-Week SWAYAM / NPTEL Course suggested by the BoS | | | | | |
| 6 | **Open Elective - II** | | OEC | 3 | 0 | 0 | 3 |
| | | Offline / 12 week MOOC Swayam / NPTEL course recommended by the BoS | | | | | |
| 7 | V23AIL02 | Deep Learning Lab *(Under AIML BoS)* | PCC | 0 | 0 | 3 | 1.5 |
| 8 | V23AIL04 | Data Visualization Lab *(Under AIML BoS)* | PCC | 0 | 0 | 3 | 1.5 |
| 9 | V23CSSE04 | Master Coding and Competitive Programming - Part-II *(Under CSE BoS)* | SEC | 0 | 1 | 2 | 2 |
| 10 | V23ENT05 | Technical Paper Writing & IPR | Audit Course | 2 | 0 | 0 | - |
| **Total** | | | | **20** | **01** | **08** | **23** |
| | | Minor Course<br>Student may select from the same minors pool | MC | 3 | 0 | 3 | 4.5 |
| | | Minor Course<br>(Student may select from the same specialized minors pool) | MC | 3 | 0 | 0 | 3 |
| | | Honors Course<br>Student may select from the same honors pool | HC | 3 | 0 | 0 | 3 |
| | | Honors Course<br>( Student may select from the honors pool) | HC | 3 | 0 | 0 | 3 |

* Under Industry Internship interested students can pursue SWAYAM Plus courses viz., Hands-on Masterclass on Data Analytics OR Artificial Intelligence for Real-World Application

**B.Tech. III Semester CSE (DS)**

| Semester | III | L | T | P | C | COURSE CODE |
|---|---|---|---|---|---|---|
| **Regulation** | V23 | 3 | 0 | 0 | 3 | V23DST01 |
| **Name of the Course** | Introduction to Data Science | | | | | |
| **Branch** | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After successful completion of the course, the student will be able to:**

CO1: Explain the fundamental concepts, benefits, and processes of Data Science (K2)

CO2: Apply machine learning techniques using Python tools (K3)

CO3: Illustrate the principles of NoSQL databases, the CAP theorem, and the Hadoop framework for distributed processing (K3)

CO4: Use tools such as Neo4j, Cypher, NLTK, and SQLite for graph data and text mining (K3)

CO5: Apply the complete data science process to solve real-world problems through prototype applications. (K3)

**UNIT I :** Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science

**Data Science process:** Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

**UNIT II:** Applications of machine learning in Data Science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning

**Handling large data:** problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

**UNIT III: NoSQL movement for handling Big data:** Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

**UNIT IV: Tools and Applications of Data Science:** Introducing **Neo4j** for dealing with graph databases, graph query language **Cypher**, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts

**UNIT V: Data Visualization and Prototype Application Development:** Data Visualization options, Crossfilter, the JavaScript MapReduce library, Creating an interactive dashboard with dc.js, Dashboard development tools.

Applying the Data Science process for real world problem solving scenarios as a detailed case study.

**Textbooks:**

1) Davy Cielen, Arno D.B. Meysman, and Mohamed Ali, "Introducing Data Science using Python tools", Manning Publications Co, Dreamtech press, 2016
2) Prateek Gupta, "Data Science with Jupyter", BPB publishers,2019

**Reference Books**:

1) Joel Grus, "Data Science From Scratch", OReilly, 2019
2) Doing Data Science:StraightTalkFromTheFrontline,1st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013

| Semester | III | L | T | P | C | COURSE CODE |
|---|---|---|---|---|---|---|
| **Regulation** | V23 | 0 | 0 | 3 | 1.5 | V23DSL01 |
| **Name of the Course** | Data Science Lab | | | | | |
| **Branch** | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After successful completion of the course, the student will be able to:**

CO1: Demonstrate proficiency in creating, manipulating, and transforming NumPy arrays (K3)

CO2: Apply data analysis techniques using Pandas (K3)

CO3: Illustrate feature scaling, encoding, and standardization data preprocessing techniques on real-world datasets (K3)

CO4: Demonstrate basic Natural Language Processing using NLTK and related libraries (K3)

**List of Experiments**

1. Creating a NumPy Array
   a. Basic ndarray
   b. Array of zeros
   c. Array of ones
   d. Random numbers in ndarray
   e. An array of your choice
   f. Imatrix in NumPy
   g. Evenly spaced ndarray
2. The Shape and Reshaping of NumPy Array
   a. Dimensions of NumPy array
   b. Shape of NumPy array
   c. Size of NumPy array
   d. Reshaping a NumPy array
   e. Flattening a NumPy array
   f. Transpose of a NumPy array
3. Expanding and Squeezing a NumPy Array
   a. Expanding a NumPy array
   b. Squeezing a NumPy array
   c. Sorting in NumPy Arrays
4. Indexing and Slicing of NumPy Array
   a. Slicing 1-D NumPy arrays
   b. Slicing 2-D NumPy arrays
   c. Slicing 3-D NumPy arrays
   d. Negative slicing of NumPy arrays
5. Stacking and Concatenating Numpy Arrays
   a. Stacking ndarrays

   b. Concatenating ndarrays
   c. Broadcasting in Numpy Arrays
6. Perform following operations using pandas
   a. Creating dataframe
   b. concat()
   c. Setting conditions
   d. Adding a new column
7. Perform following operations using pandas
   a. Filling NaN with string
   b. Sorting based on column values
   c. groupby()
8. Read the following file formats using pandas
   a. Text files
   b. CSV files
   c. Excel files
   d. JSON files
9. Read the following file formats
   a. Pickle files
   b. Image files using PIL
   c. Multiple files using Glob
   d. Importing data from database
10. Demonstrate webscraping using python
11. Perform following preprocessing techniques on loan prediction dataset
   a. Feature Scaling
   b. Feature Standardization
   c. Label Encoding
   d. One Hot Encoding
12. Perform following visualizations using matplotlib
   a. Bar Graph
   b. Pie Chart
   c. Box Plot
   d. Histogram
   e. Line Chart and Subplots
   f. Scatter Plot
13. Getting started with NLTK, install NLTK using PIP
14. Python program to implement with Python SciKit-Learn & NLTK
15. Python program to implement with Python NLTK/ Spicy/ PyNLPI.

**Web References:**

1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/

3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/
5. https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-exploration-python/6.
6. https://www.nltk.org/book/ch01.html

**B.Tech. IV Semester CSE (DS)**

| **Semester** | **IV** | **L** | **T** | **P** | **C** | **COURSE CODE** |
|---|---|---|---|---|---|---|
| **Regulation** | V23 | 3 | 0 | 0 | 3 | V23DST02 |
| **Name of the Course** | Data Engineering | | | | | |
| **Branch** | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After successful completion of the course, the student will be able to:**

CO1: Explain the role, skills, and responsibilities of a data engineer (K2)
CO2: Illustrate the phases of the Data Engineering Life Cycle (K3)
CO3: Illustrate effective data architectures based on core principles (K3)
CO4: Illustrate different data storage solutions like Data Lakes, Warehouses, and Lakehouses (K3)
CO5: Develop optimized queries and transformation pipelines (K3)

**UNIT-I: Introduction to Data Engineering:** Definition, Data Engineering Life Cycle, Evolution of Data Engineer, Data Engineering Versus Data Science, Data Engineering Skills and Activities,
Data Maturity, Data Maturity Model, Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers and Other Technical Roles.

**UNIT-II: Data Engineering Life Cycle:** Data Life Cycle Versus Data Engineering Life Cycle, Generation: Source System, Storage, Ingestion, Transformation, Serving Data.
**Major under currents across the Data Engineering Life Cycle:** Security, Data Management, DataOps, Data Architecture, Orchestration, Software Engineering.

**UNIT-III: Designing Good Data Architecture:** Enterprise Architecture, Data Architecture**,** Principles of Good Data Architecture, Major Architecture Concepts.
**Data Generation in Source Systems:** Sources of Data, Files and Unstructured Data, APIs, Application Databases (OLTP), OLAP, Change Data Capture, Logs, Database Logs, CRUD, Source System Practical Details.

**UNIT-IV: Storage:** Raw Ingredients of Data Storage, Data Storage Systems, Data Engineering Storage Abstractions, Data warehouse, Data Lake, Data Lakehouse.
**Ingestion:** Data Ingestion, Key Engineering considerations for the Ingestion Phase, Batch Ingestion Considerations, Message and Stream Ingestion Considerations, Ways to Ingest Data

**UNIT-V: Queries, Modeling and Transformation:** Queries, Life of a Query, Query Optimizer, Queries on Streaming Data, Data Modelling, Modeling Streaming Data, Transformations, Streaming Transformations and Processing.

**Serving Data for Analytics, Machine Learning and Reverse ETL**: General Considerations for serving Data, Business Analytics, Operational Analytics, Embedded Analytics, Ways to serve data for analytics and ML, Reverse ETL.

**Textbooks:**

1. Joe Reis, Matt Housley, Fundamentals of Data Engineering, O'Reilly Media Inc., June 2022, ISBN: 9781098108304

**Reference Books:**

1. Paul Crickard, Data Engineering with Python, Packt Publishing, October 2020.
2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Wiley, 3rd Edition, 2013
3. James Densmore, Data Pipelines Pocket Reference: Moving and Processing Data for Analytics, O'Reilly Media, 1st Edition, 2021

| Semester | IV | L | T | P | C | COURSE CODE |
|---|---|---|---|---|---|---|
| Regulation | V23 | 3 | 0 | 0 | 3 | V23DST03 |
| Name of the Course | Computer Organization and Architecture | | | | | |
| Branch | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After successful completion of the course, the student will be able to:**

CO1: Explain number systems, binary codes, data representations, Boolean algebra (K2)
CO2: Illustrate combinational and sequential logic circuits (K3)
CO3: Illustrate the basic structure and instruction cycle of a stored-program computer (K3)
CO4: Explain CPU organization, addressing modes, and program control mechanisms (K2)
CO5: Explain memory hierarchy, cache and associative memory, I/O organization (K2)

**UNIT I: Digital Computers and Data Representation:** Introduction, Numbering Systems, Decimal to Binary Conversion, Binary Coded Decimal Numbers, Weighted Codes, Self- Complementing Codes, Cyclic Codes, Error Detecting Codes, Error Correcting Codes, Hamming Code for Error Correction, Alphanumeric Codes, ASCI Code

**Data Representation**: Data types, Complements, Fixed Point Representation, Floating Point Representation.

**Boolean Algebra and Logical gates:** Boolean Algebra: Theorems and properties, Boolean functions, canonical and standard forms, minimization of Boolean functions using algebraic identities; Karnaugh map representation and minimization using two and three variable Maps; Logical gates ,universal gates and Two- level realizations using gates : AND-OR, OR-AND, NAND-NAND and NOR-NOR structures

**UNIT II: Digital logic circuits:** Combinatorial Circuits: Introduction, Combinatorial Circuit Design Procedure, Implementation using universal gates, Multi-bit adder, Multiplexers, De- multiplexers, Decoders

Sequential Switching Circuits: Latches and Flip-Flops, Ripple counters using T flip-flops;

**Synchronous counters**: Shift Registers; Ring counters

**UNIT III: Computer Arithmetic:** Addition and subtraction, multiplication Algorithms, Booth multiplication algorithm, Division Algorithms, Floating – point Arithmetic Operations.

**Register Transfer language and microinstructions:** Bus memory transfer, arithmetic and logical micro-operations, shift and rotate micro-operations

Basic Computer Organization and Design: Stored program concept, computer Registers, common bus system, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input–Output configuration and program Interrupt.

**UNIT IV: Microprogrammed Control:** Control memory, Address sequencing, microprogram example, design of control unit.
Central Processing Unit: General Register Organization, Instruction Formats,Addressing modes, Data Transfer and Manipulation
**Program Control:** Conditional Flags and Branching

**UNIT V: Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.
**Input-Output Organization:** Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.

**Textbooks:**

1. Digital Logic and Computer Design, Morris Mano, 11th Edition, Pearson.
2. Computer System Architecture,3rd Edition, M.Morris Mano,PHI

**Reference Books:**

1. Digital Logic and Computer Organization, Rajaraman, Radhakrishnan, PHI, 2006
2. Computer Organization,5th Edition, Hamacher, Vranesic, Zaky, TMH, 2002
3. Computer Organization & Architecture: Designing for Performance, 7th Edition, William Stallings, PHI, 2006

| Semester | IV | L | T | P | C | COURSE CODE |
|---|---|---|---|---|---|---|
| **Regulation** | V23 | 0 | 0 | 3 | 1.5 | V23DSL02 |
| **Name of the Course** | Data Engineering Lab | | | | | |
| **Branch** | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After successful completion of the course, the student will be able to:**

**CO1:** Use data engineering tools such as Apache NiFi, Apache Airflow, Elastic search, Kibana, PostgreSQL, and pgAdmin4 for data pipeline development. (K3)

**CO2:** Manipulate data from files and databases using Python, NiFi, and Airflow (K3)

**CO3:** Illustrate data cleaning, transformation, enrichment, and exploratory analysis (K3)

**CO4:** Illustrate version control production-ready data pipelines (K3)

**Experiments:**

1. Installing and configuring Apache NiFi, Apache Airflow
2. Installing and configuring Elastic search, Kibana, PostgreSQL, pgAdmin4
3. Reading and Writing files
    a. Reading and writing files in Python
    b. Processing files in Airflow
    c. NiFi processors for handling files
    d. Reading and writing data to databases in Python
    e. Databases in Airflow
    f. Database processors in NiFi
4. Working with Databases
    a. Inserting and extracting relational data in Python
    b. Inserting and extracting NoSQL database data in Python
    c. Building database pipelines in Airflow
    d. Building database pipelines in NiFi
5. Cleaning, Transforming and Enriching Data
    a. Performing exploratory data analysis in Python
    b. Handling common data issues using pandas
    c. Cleaning data using Airflow
6. Building the Data Pipeline
7. Building a Kibana Dash Board
8. Perform the following operations
    a. Staging and validating data
    b. Building idempotent data pipelines
    c. Building atomic data pipelines
9. Version Control with the NiFi Registry
    a. Installing and configuring the NiFi Registry
    b. Using the Registry in NiFi
    c. Versioning your data pipelines

   d. Using git-persistence with the NiFi Registry
10. Monitoring Data Pipelines
   a. Monitoring NiFi in the GUI
   b. Monitoring NiFi using processors
   c. Monitoring NiFi with Python and the REST API
11. Deploying Data Pipelines
   a. Finalizing your data pipelines for production
   b. Using the NiFi variable registry
   c. Deploying your data pipelines
12. Building a Production Data Pipeline
   a. Creating a test and production environment
   b. Building a production data pipeline
   c. Deploying a data pipeline in production

Reference Books:

1.Paul Crickard, Data Engineering with Python, Packt Publishing, October 2020.

| Semester | IV | L | T | P | C | COURSE CODE |
|---|---|---|---|---|---|---|
| Regulation | V23 | 0 | 1 | 2 | 2 | V23DSSE01 |
| Name of the Course | Exploratory Data Analysis with Python | | | | | |
| Branch | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After Successful completion of the Course, the student will be able to:**

CO1: Apply fundamental EDA concepts and Python libraries to process and manipulate datasets from real-world sources (K3)

CO2: Apply appropriate charts using Matplotlib and Seaborn libraries to effectively represent various data patterns. (K3)

CO3: Demonstrate various data transformation techniques. (K3)

CO4: Apply measures of central tendency, dispersion, and correlation to perform univariate, bivariate, and multivariate analysis on datasets. (K3)

CO5: Apply various performance metrics to assess model effectiveness. (K3)

**UNIT-I: Exploratory Data Analysis Fundamentals:** Understanding data science, The significance of EDA, Steps in EDA, Making sense of data, Numerical data, Categorical data, Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA, Getting started with EDA.

**Sample Experiments:**

1. a) Download Dataset from Kaggle using the following link :
   https://www.kaggle.com/datasets/sukhmanibedi/cars4u
   b) Install python libraries required for Exploratory Data Analysis (Numpy, Pandas, Matplotlib, Seaborn)
2. Perform Numpy Array basic operations and Explore Numpy Built-in functions.
3. Loading Dataset into Pandas dataframe
4. Selecting rows and columns in the dataframe

**UNIT-II: Visual Aids for EDA:** Technical requirements, Line chart, Bar charts, Scatter plot using seaborn, Polar chart, Histogram, Choosing the best chart

**Case Study:** EDA with Personal Email, Technical requirements, Loading the dataset, Data transformation, Data cleansing, Applying descriptive statistics, Data refactoring, Data analysis.

**Sample Experiments:**

1. Apply different visualization techniques using sample dataset
   a. Line Chart b. Bar Chart c. Scatter Plots d.Bubble Plot
2. Generate Scatter Plot using seaborn library for iris dataset
3. Apply following visualization Techniques for a sample dataset
   a. Area Plot b. Stacked Plot c. Pie chart d. Table Chart

4. Generate the following charts for a dataset.
   a. Polar Chart  b. Histogram  c.Lollipop chart

**Case Study:** Perform Exploratory Data Analysis with Personal Email Data

**UNIT-III: Data Transformation**: Merging database-style dataframes, Concatenating along with an axis, Merging on index, Reshaping and pivoting, Transformation techniques, Handling missing data, Mathematical operations with NaN, Filling missing values, Discretization and binning, Outlier detection and filtering, Permutation and random sampling, Benefits of data transformation, Challenges.

**Sample Experiments:**

1. Perform the following operations
   a) Merging Dataframes  b) Reshaping with Hierarchical Indexing
   c) Data Deduplication  d) Replacing Values
2. Apply different Missing Data handling techniques
   a)NaN values in mathematical Operations  b) Filling in missing data
   c) Forward and Backward filling of missing values  d) Filling with index values
   e) Interpolation of missing values
3. Apply different data transformation techniques
   a) Renaming axis indexes  b)Discretization and Binning
   c) Permutation and Random Sampling  d) Dummy variables

**UNIT-IV: Descriptive Statistics**: Distribution function, Measures of central tendency, Measures of dispersion, Types of kurtosis, Calculating percentiles, Quartiles, Grouping Datasets, Correlation, Understanding univariate, bivariate, multivariate analysis, Time Series Analysis

**Sample Experiments:**

1. Study the following Distribution Techniques on a sample data
   a) Uniform Distribution  b) Normal Distribution
   c) Gamma Distribution  d) Exponential Distribution
   e) Poisson Distribution  f) Binomial Distribution
2. Perform Data Cleaning on a sample dataset.
3. Compute measure of Central Tendency on a sample dataset
   a) Mean  b) Median  c) Mode
4. Explore Measures of Dispersion on a sample dataset
   a) Variance  b) Standard Deviation  c) Skewness  d) Kurtosis
5. a) Calculating percentiles on sample dataset
   b) Calculate Inter Quartile Range (IQR) and Visualize using Box Plots
6. Perform the following analysis on automobile dataset.
   a) Bivariate analysis b) Multivariate analysis
7. Perform Time Series Analysis on Open Power systems dataset

**UNIT-V: Model Development and Evaluation:** Unified machine learning workflow, Data pre-processing, Data preparation, Training sets and corpus creation, Model creation and training, Model evaluation, Best model selection and evaluation, Model deployment
Case Study: EDA on Wine Quality Data Analysis

**Sample Experiments:**
1. Perform hypothesis testing using stats models library
    a) Z-Test b)T-Test
2. Develop model and Perform Model Evaluation using different metrics such as prediction score, R2 Score, MAE Score, MSE Score.

**Case Study:** Perform Exploratory Data Analysis with Wine Quality Dataset

**Text Book:**
1. Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python, Packt Publishing, 2020.

**Reference Books:**
1. Ronald K. Pearson, Exploratory Data Analysis Using R, CRC Press, 2020
2. RadhikaDatar, Harish Garg, Hands-On Exploratory Data Analysis with R: Become an expert in exploratory data analysis using R packages, 1st Edition, Packt Publishing, 2019

**Web References:**
1. https://github.com/PacktPublishing/Hands-on-Exploratory-Data-Analysis-with-Python
2. https://www.analyticsvidhya.com/blog/2022/07/step-by-step-exploratory-dataanalysis-eda-using-python/#h-conclusion
3. https://github.com/PacktPublishing/Exploratory-Data-Analysis-with-Python-Cookbook

**B.Tech. V Semester CSE (DS)**

| **Semester** | **V** | **L** | **T** | **P** | **C** | **COURSE CODE** |
|---|---|---|---|---|---|---|
| **Regulation** | V23 | 3 | 0 | 0 | 3 | V23AIT02 |
| **Name of the Course** | Machine Learning | | | | | |
| **Branch** | Common to CSE(DS), CSE(AI), AIML | | | | | |

## Syllabus Details

**Course Outcomes:**

**After Successful completion of the Course, the student will be able to:**

CO1: Illustrate various learning techniques and concepts of model. (K2)
CO2: Demonstrate Nearest Neighbor-Based Models.(K3)
CO3: Illustrate Bayes' Classifier.(K3)
CO4: Demonstrate the concepts of Linear Discriminants and Regression. (K3)
CO5: Illustrate various clustering approaches. (K3)

**UNIT-I:** Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

**UNIT-II:** Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

**UNIT-III:** The Bayes Classifier: Introduction to the Bayes' Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification, Class Conditional Independence and Naive Bayes Classifier (NBC), Regularization Impact of Regularization in ML, Principal Component Analysis Maximum variance formulation, Minimum-error formulation, Applications of PCA , PCA for high- dimensional data

**UNIT-IV:** Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Back propagation for Training an MLP.

**UNIT-V:** Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization, Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering Tutorial.

Textbook:

1. Machine Learning Theory and Practice, M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

Reference Books:

1. Machine Learning, Tom M. Mitchell, McGraw-Hill Publication,2017
2. Machine Learning in Action, Peter Harrington, Dream Tech
3. Introduction to Data Mining, Pang-Ning Tan, Michel Steinbach, Vipin Kumar,7th Edition, 2019.
4. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer
5. Ulrike Von Luxburg, “A tutorial on spectral clustering”, Statistics and computing 17(2007): 395-416.

| Semester | V | L | T | P | C | COURSE CODE |
|---|---|---|---|---|---|---|
| Regulation | V23 | 3 | 0 | 0 | 3 | V23DSTPE01 |
| Name of the Course | **Information Retrieval (Professional Elective-I)** | | | | | |
| Branch | CSE(DS) | | | | | |

**Syllabus Details**

**Course Outcomes:**

**After successful completion of the course, the student will be able to:**

**CO1:** Explain the fundamental concepts of IR, vocabulary construction, and efficient indexing methods.[K2]

**CO2:** Apply classical retrieval models such as the vector space model, probabilistic models [K3]

**CO3:** Illustrate efficient query processing methods, compression techniques.[K3]

**CO4:** Apply language models and classification approaches to IR tasks.[K3]

**CO5:** Illustrate Distributed Data Systems for Information Retrieval.[K3]

**Unit I – Foundations of Information Retrieval**

Introduction to Information Retrieval, The IR Problem and Applications, Basic Concepts of Indexing, The Term Vocabulary and Postings Lists, Dictionaries and Tolerant Retrieval,Wildcard Queries, Spelling Correction, and Phonetic Matching

**Unit II – Retrieval Models and Scoring**

Scoring, Term Weighting, and the Vector Space Model, Term Frequency and Inverse Document Frequency (TF-IDF), Cosine Similarity and Ranking, Probabilistic Information Retrieval, The Binary Independence Model, Relevance Feedback and Query Expansion

**Unit III – Efficient Processing and Web Search Basics**

Efficient Query Processing, Inverted Index Compression -Variable-Length Encoding, Gap Encoding, Dynamic Indexing, Web Crawling and Indexes for Web Search, Link Analysis: PageRank, HITS Algorithm

**Unit IV – Evaluation and Language Models for IR**

Evaluation in Information Retrieval-Precision, Recall, F-measure, MAP, nDCG, Test Collections (TREC, Cranfield Paradigm), Language Models for Information Retrieval-Query Likelihood Model, Smoothing Techniques, Text Classification and Naïve Bayes, Vector Space Classification and kNN

**Unit V – Distributed Data Systems for Information Retrieval**

Distributed File Systems for IR: Google File System (GFS), Hadoop Distributed File System (HDFS), Data Partitioning and Replication Strategies in Large-Scale IR, Consistency Models and CAP Theorem in Search Systems, Distributed Query Processing and Indexing in Search Engines,

NoSQL Systems in IR: Cassandra, DynamoDB, MongoDB, Big Data Frameworks for IR: MapReduce, Apache Spark, and Distributed Graph Processing PageRank at Scale, Recent Trends: Cloud-based IR, Streaming IR Systems Kafka, Flink

**Textbook:**

- Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008

**Reference Books:**

1. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, Modern Information Retrieval: The Concepts and Technology behind Search (2nd Edition),Addison Wesley, 2011
2. Bruce Croft, Donald Metzler, and Trevor Strohman Search Engines: Information Retrieval in Practice

| Semester | V | L | T | P | C | COURSE CODE |
|---|---|---|---|---|---|---|
| Regulation | V23 | 3 | 0 | 0 | 3 | V23DSTPE02 |
| Name of the Course | **Data Analytics (Professional Elective-I)** | | | | | |
| Branch | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After successful completion of the course, the student will be able to:**

**CO1:** Explain the fundamentals of data analytics and data preprocessing techniques for structured and unstructured data (K2)

**CO2 :** Apply web data mining and analytics techniques for insights from online and social media data. (K3)

**CO3:** Illustrate video analytics techniques for object detection, activity recognition, and multimedia applications. (K3*)*

**CO4:** Analyze time series data using statistical and deep learning approaches for real-world applications. (K4)

**CO5:** Use Power BI & Tableau for Business Intelligence applications and Visualization. (K3)

**Unit I: Introduction to Data Analytics**

Fundamentals of data analytics and the data science lifecycle, Types of data: structured, semi-structured, unstructured, Data preprocessing: cleaning, integration, transformation, reduction
Big Data ecosystem and applications

**Unit II: Web Data Analytics**

Web mining: content, structure, usage mining, Social media data analytics, Web personalization and recommender systems, Sentiment analysis and opinion mining

**Unit III: Video Analytics**

Video data representation and feature extraction, Object detection and tracking, Event detection and activity recognition, Applications: surveillance, healthcare, multimedia retrieval

**Unit IV: Time Series Data Analytics**

Basics of time series data and forecasting, Statistical methods: AR, MA, ARIMA, Deep learning methods: RNNs, LSTMs, Transformers, Applications: finance, healthcare, IoT

**Unit V – Business Intelligence and Visualization with Power BI & Tableau**

**Power BI**: Data Import and Cleaning (Power Query), Data Modeling and DAX Functions, Building Interactive Dashboards and Reports, Sharing and Publishing Reports (Power BI Service)
**Tableau**: Connecting to Data Sources, Dimensions, Measures, and Visual Analytics, Creating Interactive Dashboards and Storytelling with Data, Advanced Features: Calculated Fields, Parameters, Filters

**Textbooks:**

1. J. Han, M. Kamber, and J. Pei, Data Mining: Concepts and Techniques, 3rd edition, San Francisco, CA, USA: Morgan Kaufmann, 2011.
2. R. H. Shumway and D. S. Stoffer, *Time Series Analysis and Its Applications: With R Examples*, 4th edition New York, NY, USA: Springer, 2017.

3. Brett Powell – Mastering Microsoft Power BI (2nd Edition), Packt Publishing, 2022
4. Marco Russo & Alberto Ferrari – The Definitive Guide to DAX, Microsoft Press, 2nd Edition, 2019.

**Reference Books:**

1. Provost & Fawcett, Data Science for Business, O'Reilly, 2013.
2. Bing Liu, Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data, Springer, 2011
3. Alan B. Hanan, Practical Video Analytics, Apress, 2020

| Semester | V | L | T | P | C | COURSE CODE |
|---|---|---|---|---|---|---|
| **Regulation** | V23 | 3 | 0 | 0 | 3 | V23DSL02 |
| **Name of the Course** | **Machine Learning Lab** | | | | | |
| **Branch** | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After Successful completion of the Course, the student will be able to:**

CO1: Develop programs for computing central tendency measures and Data Preprocessing techniques (K3)
CO2: Demonstrate KNN, Decision Tree, Random Forest algorithms (K3)
CO3: Apply classification algorithms such as Naïve Bayes, SVM, Multi-Layer Perceptron (K3)
CO4: Apply clustering algorithms such as K-Means, Fuzzy C-Means and Expectation Maximization for a problem (K3)

**Softwares Required: Python/R/Weka**

**List of Experiments:**

1. Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation.
2. Apply the following Pre-processing techniques for a given dataset.
   a. Attribute selection
   b. Handling Missing Values
   c. Discretization
   d. Elimination of Outliers
3. Apply KNN algorithm for classification and regression
4. Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results
5. Demonstrate decision tree algorithm for a regression problem
6. Apply Random Forest algorithm for classification and regression
7. Demonstrate Naïve Bayes Classification algorithm.
8. Apply Support Vector algorithm for classification
9. Demonstrate simple linear regression algorithm for a regression problem
10. Apply Logistic regression algorithm for a classification problem
11. Demonstrate Multi-layer Perceptron algorithm for a classification problem
12. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.
13. Demonstrate the use of Fuzzy C-Means Clustering
14. Demonstrate the use of Expectation Maximization based clustering algorithm

**Reference Books:**

1. Introduction to Machine Learning with Python, Andreas C. Muller and Sarah Guido, First Edition, O'Reilly.
2. Practical Machine Learning with Python, Dipanjan Sarkar, Raghav Bali and Tushar Sharma, First Edition, A Press.
3. Machine Learning, Tom M. Mitchell, McGraw-Hill Publication, 2017
4. Machine Learning in Action, Peter Harrington, Dream Tech

| **Semester** | V | L | T | P | C | COURSE CODE |
|---|---|---|---|---|---|---|
| **Regulation** | V23 | 0 | 1 | 2 | 2 | V23CSSE02 |
| **Name of the Course** | Full Stack Development–I | | | | | |
| **Branch** | Common to CSE(DS), CSE(AI), AIML, CSE, CST | | | | | |

## Syllabus Details

**Course Outcomes:**

**After Successful completion of the Course, the student will be able to:**

CO1: Illustrate HTML elements and their attributes for designing static web pages. (K3)
CO2: Apply appropriate CSS styles to HTML elements. (K3)
CO3: Demonstrate JavaScript Pre-defined and User-defined Objects. (K3)
CO4: Develop dynamic web pages and validate forms using JavaScript. (K3)

**Experiments covering the Topics:**

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events
- Node.js

**Sample Programs:**

1. Lists, Links and Images
   a) Develop a HTML program, to explain the working of lists.
   b) Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
   c) Develop a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.
   d) Develop a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.
   e) Develop a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames
   a) Develop a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>,<td> and attributes: border, rowspan, colspan)
   b) Develop a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
   c) Develop a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
   d) Develop a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame  image, second frame  paragraph, third frame  hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS
   a) Develop a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>,<footer>, <header>, <main>, <nav>, <section>, ,  tags.
   b) Develop a HTML program, to embed audio and video into HTML web page.
   c) Develop a program to apply different types (or levels of styles or style specification formats)- inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms
   a) Develop a program to apply different types of selector forms
      i. Simple selector (element, id, class, group, universal)
      ii. Combinator selector (descendant, child, adjacent sibling, general sibling)
      iii. Pseudo-class selector
      iv. Pseudo-element selector
      v. Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model
   a) Develop a program to demonstrate the various ways you can reference a color in CSS.
   b) Develop a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
   c) Develop a program using the following terms related to CSS font and text:
      i. font-size ii. font-weight iii. font-style
      iv. text-decoration v. text-transformation vi. text-alignment
   d) Develop a program, to explain the importance of CSS Box model using
      i. Content ii. Border iii. Margin iv. Padding

6. Applying JavaScript - internal and external, I/O, Type Conversion
   a) Develop a program to embed internal and external JavaScript in a web page.
   b) Develop a program to explain the different ways for displaying output.
   c) Develop a program to explain the different ways for taking input.
   d) Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

7. Java Script Pre-defined and User-defined Objects
   a) Develop a program using document object properties and methods.
   b) Develop a program using window object properties and methods.
   c) Develop a program using array object properties and methods.
   d) Develop a program using math object properties and methods.
   e) Develop a program using string object properties and methods.
   f) Develop a program using regex object properties and methods.
   g) Develop a program using date object properties and methods.
   h) Develop a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. Java Script Conditional Statements and Loops
   a) Develop a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".
   b) Develop a program to display week days using switch case.
   c) Develop a program to print 1 to 10 numbers using for, while and do-while loops.
   d) Develop a program to print data in object using for-in, for-each and for-of loops
   e) Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,13 + 53+ 33 = 153]
   f) Develop a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)

9. Java Script Functions and Events
   a) Design a appropriate function should be called to display
      i. Factorial of that number
      ii. Fibonacci series up to that number
      iii. Prime numbers up to that number
      iv. Is it palindrome or not
   b) Prepare a HTML file having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
      i. Factorial of that number
      ii. Fibonacci series up to that number

iii. Prime numbers up to that number
iv. Is it palindrome or not

c) Develop a program to validate the following fields in a registration page
i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
ii. Mobile (only numbers and length 10 digits)
iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

**Reference Books:**

1. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson, 2013.
2. Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, A Press, O'Reilly.

**Online Learning Resources:**

1. https://www.w3schools.com/html
2. https://www.w3schools.com/css
3. https://www.w3schools.com/js/
4. https://www.w3schools.com/nodejs
5. https://www.w3schools.com/typescript

| **Semester** | **VI** | **L** | **T** | **P** | **C** | **COURSE CODE** |
|---|---|---|---|---|---|---|
| **Regulation** | V23 | 3 | 0 | 0 | 3 | V23DST03 |
| **Name of the Course** | **Cloud Computing** | | | | | |
| **Branch** | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After Successful completion of the course, the student will be able to:**

**CO1:** Explain the evolving utility computing model called cloud computing. **(K2)**

**CO2:** Explain the different service models of cloud computing, such as IaaS, PaaS and SaaS. **(K2)**

**CO3:** Explain the core concepts of cloud technologies like distributed computing, service-oriented architecture, and virtualization. **(K2)**

**CO4:** Analyze the security and other challenges in cloud computing. **(K4)**

**CO5:** Apply advanced concepts such as containers, serverless computing, and cloud-centric Internet of Things **(K3)**

**UNIT -I**:

Introduction to Cloud Computing Fundamentals Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google App Engine).

**UNIT-II**:

Cloud Enabling Technologies: Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

**UNIT-III**:

Virtualization and Containers: Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware),building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.

**UNIT-IV**:

Cloud computing challenges: Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

**UNIT -V**:

Advanced concepts in cloud computing: Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

**Text Books:**

1. Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, Mc Graw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

**Reference Books:**

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)

| **Semester** | **VI** | **L** | **T** | **P** | **C** | **COURSE CODE** |
|---|---|---|---|---|---|---|
| **Regulation** | V23 | 3 | 0 | 0 | 3 | V23DSTPE03 |
| **Name of the Course** | **Social Media Analytics (Professional Elective-II)** | | | | | |
| **Branch** | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After Successful completion of the Course, the student will be able to:**

CO1: Describe characteristics and types of social media (K2)

CO2: Illustrate Knowledge on layers of social media analytics (K3)

CO3: Apply text analysis tools on social media data (K3)

CO4: Illustrate the significance of action analytics (K3)

CO5: Find viral topics on social media (K3)

**UNIT - I:**

Introduction to Social Media, World Wide Web, Web 1.0, Web 2.0, Web 3.0, Social Media, jCore Characteristics of Social Media, Types of Social Media, Social Networking Sites, Using Facebook for Business Purposes, Content Communities

**UNIT - II:**

Social Media Analytics Overview, Purpose of Social Media Analytics, social media Vs. Traditional Business Analytics, Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Challenges to Social Media Analytics, social media Analytics Tools. Case Study: The Underground Campaign That Scored Big

**UNIT - III:**

Social Media Text Analytics, Types of Social Media Text, Purpose of Text Analytics, Steps in Text Analytics, Social Media Text Analysis Tools. Case Study: Tapping Into Online Customer Opinions

**UNIT - IV:**

Social Media Actions Analytics, Introduction to Actions Analytics, Common Social Media Actions, Actions Analytics Tools. Case Study: Cover-More Group

**Unit - V:**

Social Media Hyperlink Analytics Types of Hyperlinks, Hyperlink Analytics, Types of Hyperlink Analytics, Hyperlink Analytics Tools. Case Study: Hyperlinks and Viral YouTube Videos

**Text Books:**

1. Seven Layers of Social Media Analytics Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, And Location Data by Gohar F. Khan ISBN: 1507823207, Isbn-13: 9781507823200

**Reference Books:**

1. Social Media Analytics: Techniques And Insights for Extracting Business Value Out of Social Media by Matthew Ganis, Avinash Kohirkar, Pearson Education.

2. Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, Marshall Sponder, MGH.
3. Big Data and Analytics, Seema Acharya, Subhasinin Chellappan, Wiley Publications.
4. Big Data, Black Booktm, DreamtechPress,2015Edition.

| **Semester** | **VI** | **L** | **T** | **P** | **C** | **COURSE CODE** |
|---|---|---|---|---|---|---|
| **Regulation** | V23 | 3 | 0 | 0 | 3 | V23DSTPE04 |
| **Name of the Course** | **Cryptography & Network Security (Professional Elective -II)** | | | | | |
| **Branch** | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After Successful completion of the course, the student will be able to:**

**CO1:** Explain fundamentals of security concepts and mathematical support of Cryptography.**(K2)**

**CO2:** Discuss Symmetric cryptosystems. **(K2)**

**CO3:** Discuss Asymmetric cryptosystems.**(K2)**

**CO4:** Illustrate cryptographic hash functions and privacy-preserving techniques.**(K3)**

**CO5:** Illustrate global data protection laws and compliance frameworks **(K3)**

**UNIT – I:**

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Steganography.

**UNIT – II:**

Introduction to Symmetric Cryptography: Algebraic Structures-Groups, Rings, Fields, GF($2^n$) fields, Polynomials. Mathematics of Asymmetric cryptography: Primes, Checking for Primness, Eulers phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation and Logarithm.

**UNIT – III:**

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

**UNIT – IV:**

Cryptographic Hash Functions: Applications, requirements, SHA family, hash functions based on CBC, Data Privacy Concepts: Privacy vs. security, principles of data minimization, pseudonymization, anonymization. Differential privacy basics, Privacy-preserving cryptographic techniques -homomorphic encryption, zero-knowledge proofs - introduction.

**UNIT – V:**

Data Protection Laws & Compliance: Global frameworks: GDPR (Europe), CCPA (California), HIPAA (Healthcare), Indian Data Protection Law (DPDP Act 2023), Compliance challenges in

cross-border data flows, Data Governance & Compliance Mechanisms: Risk management, audit, accountability, Emerging Issues: Cloud data security, IoT privacy, AI/ML data compliance challenges.

**Text Books:**

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2. Nissim, K., & Vadhan, S. (2023). Differential privacy. MIT Press.
3. Voigt, P., & von dem Bussche, A. (2017). The EU General Data Protection Regulation (GDPR): A practical guide. Springer.

**Reference Books:**

1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
2. Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C. Washington, Pearson.

| **Semester** | **VI** | **L** | **T** | **P** | **C** | **COURSE CODE** |
|---|---|---|---|---|---|---|
| **Regulation** | V23 | 3 | 0 | 0 | 3 | V23DSTPE05 |
| **Name of the Course** | **Sensor Networks (Professional Elective-II)** | | | | | |
| **Branch** | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After Successful completion of the Course, the student will be able to:**

**CO1:** Describe the concepts of MANETs (Mobile Ad-hoc Networks) (K2)
**CO2:** Explain the node, network architecture of sensor nodes and execution environment (K2)
**CO3:** Demonstrate concepts of communication, MAC, routing protocols (K3)
**CO4:** Illustrate topology control and clustering in networks with timing synchronization (K3)
**CO5:** Demonstrate the knowledge of Sensor Network Platforms and Tools (K3)

**UNIT-I: Introduction and Overview:**

Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hoc Networks), characterise, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.

**UNIT-II: Architectures:**

Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes, operating systems and execution environments, examples of sensor nodes, sensor network scenarios, types of sources and sinks - single hop vs. multi hop networks, multiple sources and sinks - mobility, optimization goals and figures of merit, gateway concepts, design principles for WNs, service interfaces for WSNs.

**UNIT- III: Communication Protocols**:

Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, low duty cycle protocols and wakeup concepts - S-MAC, the mediation device protocol, wakeup radio concepts, address and name management, assignment of MAC addresses, routing protocols-classification, gossiping, flooding, energy-efficient routing, unicast protocols, multi-path routing, data-centric routing, data aggregation, SPIN, LEACH, Directed-Diffusion, geographic routing.

**UNIT- IV: Infrastructure Establishment:**

Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, properties, protocols based on sender-receiver and receiver-receiver synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and approaches, single-hop localization, positioning in multi-hop environment, range-based localization algorithms - location services, sensor tasking and control.

**UNIT-V: Sensor Network Platforms and Tools**:
Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM.

**Text Books:**

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

**Reference Books:**

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
3. Thomas Haenselmann, "Sensor Networks", available online for free, 2008.
4. Edgar Callaway, "Wireless Sensor Networks: Architectures and Protocols", Auerbach, 2003.

| Semester | VI | L | T | P | C | COURSE CODE |
|---|---|---|---|---|---|---|
| Regulation | V23 | 3 | 0 | 0 | 3 | V23DSTPE06 |
| Name of the Course | **Text Mining (Professional Elective-II)** | | | | | |
| Branch | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After successful completion of the course, the student will be able to:**

CO1: Explain the fundamentals of text mining and challenges in handling unstructured data [K2]

CO2: Apply classification and clustering algorithms for text categorization and grouping [K3]

CO3: Discover hidden topics and patterns from large-scale textual datasets [K3]

CO4: Illustrate sentiment analysis and opinion mining to extract actionable insights.[K3]

CO5: Apply advanced text mining techniques to real-world domains [K3]

**UNIT I: Fundamentals of Text Mining**

Introduction to text mining: concepts, scope, and applications, Structured vs. unstructured text data, Challenges in text mining: high dimensionality, sparsity, noise, Document representation: Vector space model, TF-IDF, Overview of embeddings

**UNIT II: Text Classification & Clustering**

Supervised learning for text classification: Naïve Bayes, SVM, Decision Trees, Neural networks, Feature engineering and dimensionality reduction, Clustering approaches: K-means, Hierarchical clustering, DBSCAN, Evaluation metrics: precision, recall, F1, clustering validity.

**UNIT III: Topic Modeling & Pattern Discovery**

Topic modeling: Latent Semantic Analysis (LSA), Latent Dirichlet Allocation (LDA), Frequent pattern mining in text, Association rule mining for text, Relation and co-occurrence analysis.

**UNIT IV: Sentiment Analysis & Opinion Mining**

Lexicon-based and machine learning-based sentiment analysis, Aspect-based sentiment analysis, Opinion mining from reviews, blogs, and social media, Applications in business intelligence, marketing, and social analytics.

**UNIT V: Advanced Applications**

Text summarization: extractive and abstractive methods,Fraud detection, healthcare analytics, financial text mining,Emerging deep learning approaches: word embeddings (Word2Vec, GloVe), Transformers (BERT, GPT)

**Textbook:**


- Zhai, C., & Massung, S. (2016). Text data management and analysis: A practical introduction to information retrieval and text mining. ACM Books.

**Reference Books**

1. Feldman, R., & Sanger, J. (2007). The text mining handbook: Advanced approaches in analyzing unstructured data. Cambridge University Press.
2. Aggarwal, C. C., & Zhai, C. (Eds.). (2012). Mining text data. Springer.

| **Semester** | **VI** | **L** | **T** | **P** | **C** | **COURSE CODE** |
|---|---|---|---|---|---|---|
| **Regulation** | V23 | 3 | 0 | 0 | 3 | V23DSTPE07 |
| **Name of the Course** | **NoSQL databases (Professional Elective-III)** | | | | | |
| **Branch** | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After Successful completion of the Course, the student will be able to:**

**CO1:** Explain different types of NoSQL Databases (K2)
**CO2:** Compare RDBMS with different NoSQL databases.(K4)
**CO3:** Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.(K3)
**CO4:** Explain the performance tune of Key-Value Pair NoSQL databases (K2)
**CO5:** Apply NoSQL development tools on different types of NoSQL Databases.(K3)

**UNIT - I**

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.

**UNIT - II**

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

**UNIT - III**

NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

**UNIT - IV**

Column-oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

**UNIT - V**

NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases,

Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

**Text Books:**

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition,2019.

**Web References :**

1. https://www.ibm.com/cloud/learn/nosql-databases
2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
3. https://www.geeksforgeeks.org/introduction-to-nosql/
4. https://www.javatpoint.com/nosql-databa

| Semester | VI | L | T | P | C | COURSE CODE |
|---|---|---|---|---|---|---|
| Regulation | V23 | 3 | 0 | 0 | 3 | V23DSTPE08 |
| Name of the Course | **Medical Image Analysis (Professional Elective-III)** | | | | | |
| Branch | CSE(DS) | | | | | |

## Syllabus Details

**Course Outcomes:**

**After successful completion of the course, the student will be able to:**

**CO1:** Explain the fundamentals of digital images and various medical imaging modalities, (K2)

**CO2 :** Apply preprocessing techniques such as noise reduction, contrast enhancement, and registration for medical image quality improvement. (K3)

**CO3:** Illustrate segmentation and feature extraction methods for medical image analysis. (K3)

**CO4:** Apply supervised and unsupervised methods on medical images. (K3)

**CO5:** Illustrate advanced medical image analysis solutions including 3D/4D techniques, deep learning models, and CAD systems for clinical decision support. (K3)

**Unit I**: Introduction to Medical Imaging

Fundamentals of digital images, imaging modalities (X-ray, CT, MRI, Ultrasound, PET), clinical applications, challenges

**Unit II**: Image Preprocessing

Noise sources, noise reduction, contrast enhancement, filtering, histogram equalization, restoration, registration basics

**Unit III**: Segmentation and Feature Extraction

Thresholding, edge & region-based segmentation, active contours, machine learning/deep learning segmentation, feature extraction

**Unit IV**: Image Classification and Quantitative Analysis

Supervised & unsupervised classification, radiomics/biomarkers, quantitative analysis in oncology/neurology/cardiology, evaluation metrics

**Unit V**: Advanced Topics and Applications

3D/4D analysis, multi-modality registration, deep learning (CNN, U-Net, GANs), CAD, treatment planning, surgery guidance

**Textbook:**

- Klaus D. Toennies, Guide to Medical Image Analysis: Methods and Algorithms (Springer, 2017)

**Reference Textbooks:**

1. Bankman, Isaac N. (Ed.). Handbook of Medical Image Processing and Analysis. Academic Press, 2009.
2. Shapiro, Linda G., and George C. Stockman. Computer Vision. Pearson, 2001
3. Deserno, Thomas M. (Ed.). Biomedical Image Processing. Springer, 2011

Annexure-II

# Approved Courses
# for B.Tech CSE(DS) Honors degree
# V23 Regulation

**List of Courses for B.Tech CSE(DS) Honors degree (SWAYAM)**

| S.No. | Course Name | No. of Weeks | Credits |
|---|---|---|---|
| 1* | Foundation of Data Science | 8 | 2 |
| | Data Science for Engineers | | |
| | Data Science and Big Data | 12 | 3 |
| 2 | Introduction to Haskell Programming | 8 | 2 |
| 3 | Introduction to Information Technology | 12 | 3 |
| 4 | Cloud Computing and Distributed Systems | 8 | 2 |
| 5 | Foundation of Cloud IoT Edge ML | 8 | 2 |
| 6 | AI: Constraint Satisfaction | 8 | 2 |
| 7 | Artificial Intelligence using Prolog Programming | 12 | 3 |
| | Artificial Intelligence : Search Methods for Problem Solving | 12 | 3 |
| 8 | Applied Accelerated Artificial Intelligence | 12 | 3 |
| 9 | Responsible & Safe AI Systems | 12 | 3 |
| 10 | Machine Learning Using Python Programming | 12 | 3 |
| 11 | Machine Learning For Soil And Crop Management | 12 | 3 |
| 12 | Essentials of Data Science With R Software-1:Probability and Statistical Inference | 12 | 3 |
| 13 | Essentials of Data Science With R Software -2:Sampling Theory And Linear Regression Analysis | 12 | 3 |
| 14 | Natural Language Processing | 12 | 3 |
| 15 | Deep Learning for Natural Language Processing | 12 | 3 |
| 16 | Reinforcement Learning | 12 | 3 |
| 17* | Computer Vision And Image Processing-Fundamentals And Applications | 12 | 3 |
| | Deep Learning for Computer Vision | | |
| 18* | Modern Computer Vision | 12 | 3 |
| | Deep Learning For Visual Computing | | |
| 19 | Introduction to Cyber Security | 12 | 3 |
| 20 | Privacy and Security in Online Social Media | 12 | 3 |
| 21 | Cyber Security, Tools, Techniques and Counter Measures | 12 | 3 |
| 22 | Blockchain and its Applications | 12 | 3 |
| 23 | Introduction To Internet Of Things | 12 | 3 |
| 24 | Introduction To Industry 4.0 And Industrial Internet Of Things | 12 | 3 |
| 25 | Social Networks | 12 | 3 |
| 26 | Information Security and Cyber Forensics | 12 | 3 |
| 27 | Digital Forensics | 12 | 3 |
| 28* | Web based Technologies and Multimedia Applications | 12 | 3 |
| | Web-designing and multimedia Technology | 12 | 3 |
| 29 | Advanced Computer Networks | 12 | 3 |

***Student can opt for only one course from the corresponding cluster.**

**Note:**

1. A student can do a **maximum of 2 courses** per semester.
2. A student should obtain **18 credits** by the **end of the VII semester** and submit the proofs at the time of **VIII Semester exam registration**.

Annexure-III

# Approved Courses for Minors degree in the stream of Data Science for other branch Students V23 Regulation

# V23 List of Courses for B.Tech. Minors in Data Science

| Course Name | MOOCs (NPTEL) Course Name | No. of Weeks | No. of Credits | |
|---|---|---|---|---|
| Programming in Java | Programming in Java (IITK) | 12 | 3 | Students have to acquire a minimum of 18 credits by completing MOOCs/ NPTEL courses from the Pool |
| | **Fundamentals of Object Oriented Programming** (IIT Roorkee) | 12 | 3 | |
| **Data Analytics** | Data Analytics with Python (IIT Roorkee) | 12 | 3 | |
| | Advanced R Programming for Data Analytics in Business (IIT Kanpur) | 12 | 3 | |
| **Data Science** | Data Science for Engineers | 8 | 2 | |
| | Scalable Data Science | 8 | 2 | |
| Introduction to Machine Learning | Introduction to Machine Learning (IITM) | 12 | 3 | |
| | Introduction to Machine Learning (IITK) | 8 | 2 | |
| | Distributed Optimization and Machine Learning(IITB) | 12 | 3 | |
| Business Intelligence and Analytics | Business Intelligence and Analytics (IITM) | 12 | 3 | |
| Social Networks | Social Networks (IIT Ropar) | 12 | 3 | |
| Human Computer Interaction | Human Computer Interaction (IIIT Delhi) | 12 | 3 | |
| Advanced Data Structures & Algorithm Analysis | Programming, Data Structures and Algorithms Using Python(CMI) | 8 | 2 | |
| **Artificial Intelligence** | An Introduction to Artificial Intelligence (IIT Delhi) | 12 | 3 | |
| | Responsible & Safe AI Systems (IIIT Hyderabad and IITM) | 12 | 3 | |
| **Operating Systems** | Operating Systems Fundamentals | 12 | 3 | |
| **Computer Networks** | Computer Networks And Internet Protocol (IITK) | 12 | 3 | |

| | | | | |
|---|---|---|---|---|
| **Deep Learning** | Deep Learning (IITK) / Deep Learning - IITM | 12 | 3 | |
| | Machine Learning and Deep Learning - Fundamentals and Applications | 12 | 3 | |
| Cloud Computing | Cloud Computing (IITK) | 12 | 3 | |
| Blockchain and its Applications | Blockchain and its Applications (IITK) | 12 | 3 | |
| Games and Information | Games and Information (IIT Bombay) | 12 | 3 | |
| **Software Engineering** | Software Engineering(IITK) | 12 | 3 | |
| Discrete Mathematics | Discrete Mathematics (IIITB)/ Discrete Mathematics (IITR) | 12 | 3 | |
| **Database Management System** | Data Base Management System (IITK) | 8 | 2 | |

**Total Required Credits: 18**

Note: The list is not exhaustive. Before registering for a course, prior approval should be taken from the HOD.