IARE

INSTITUTE OF AERONAUTICAL ENGINEERING

NAAC ACCREDITATION A++ GRADE

NBA NATIONAL BOARD OF ACCREDITATION

nirf INDIA RANKINGS 2024 TOP 200 ENGINEERING RANK 151-200 TOP 50 INNOVATION RANK 11-50

25 2000 2025 YEARS of Excellence

B.TECH

# COMPUTER SCIENCE AND ENGINEERING

# DATA SCIENCE

## Unlocking the Potential: The Vital Role of Data Science in Engineering


ACADEMIC YEAR 2025-26

## VISION AND MISSION OF THE INSTITUTE

### VISION

To bring forth students, professionally competent and socially progressive, capable of working across cultures meeting the global standards ethically.

### MISSION

To provide students with an extensive and exceptional education that prepares them to excel in their profession, guided by dynamic intellectual community and be able to face the technically complex world with creative leadership qualities.

Further, be instrumental in emanating new knowledge through innovative research that emboldens entrepreneurship and economic development for the benefit of wide spread community.

## VISION AND MISSION OF THE DEPARTMENT

### VISION

To produce globally competent young data scientists to serve in one or more application areas of business analysis, supply chain, social media content analysis, bioinformatics, finance, health care and so on towards software development and/or research.

### MISSION

To provide an open environment to foster professional and personal growth with a strong theoretical and practical background having an emphasis on hardware and software development making the graduates industry ready with social ethics.

Further the Department is to provide training and to partner with Global entities in education and research.

# B.Tech

## Program Educational Objectives (PEOs)

PEOs are a promise by the department to the aspiring students about what they will achieve once they join the program.

### PEO-I

The graduates will develop core competence in science, mathematics and fundamentals of Data Science to address everchanging industrial requirements globally.

### PEO-II

To create academically conducive environment to learn engineering skills in the domains such as Data Analytics, Data Modelling, Data Visualization and

### PEO-III

To make students competent for higher studies and employable, to meet industrial requirements.

### PEO-IV

To enrich students with professional ethics, leadership qualities, and entrepreneurial skills.

# Knowledge and Attitude Profile

## WK1

A systematic, theory based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

## WK2

Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

## WK3

A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

## WK4

Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

## WK5

Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

## WK6

Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

## WK7

Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

## WK8

Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

## WK9

Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

# B.Tech Program Outcomes (POs)

## PO-1 Engineering Knowledge

Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

## PO-2 Problem Analysis

Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

## PO-3 Design/Development of Solutions

Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

## PO-4 Conduct Investigations of Complex Problems

Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

## PO-5 Engineering Tool Usage

Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

## PO-6 The Engineer and The World

Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

## PO-7 Ethics

Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

## PO-8 Individual and Collaborative Team work

Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

## PO-9 Communication

Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

## PO-10 Project Management & Finance

Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multi disciplinary environments.

## PO-11 Life-Long Learning

Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

# B.Tech Program Specific Outcomes (PSOs)

## PSO-I

Build suitable statistical models, tools and techniques to analyze large data sets for visualization and interpretation.

## PSO-II

Focus on improving software reliability, network security or information retrieval systems.

## PSO-III

Make use of computing theory, mathematics, statistical methods and the principles of optimization techniques in data analytics for providing solutions.

# ABOUT **Data Science**

Data science is pivotal for innovation, enabling engineers to glean insights from data streams, enhancing system design and optimization. It predicts structural integrity and optimizes manufacturing, fostering efficiency and sustainability.

## WHY STUDY HERE DS@IARE?

→**TOP 2 highest demand Bachelor program.**

→**Well trained experts in areas of Computing, Data Science, Artificial Intelligence, Data Analytics and Internet of Things.**

→**Well-established laboratories and researches in respective specializations.**

→**Established industry linkages for academic quality offering eg. Professional Certificate Award, R & D etc.**

→**International Exposure for students via mobility program and student exchange.**

→**Data science enhances healthcare by predicting diseases and personalizing treatments for improved patient outcomes.**

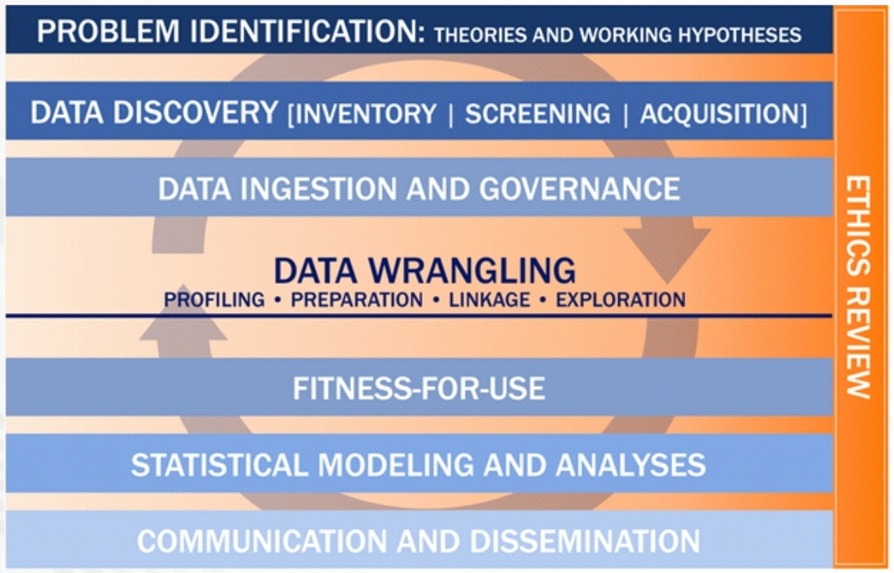
→**Financial institutions utilize data science for fraud detection, risk assessment, and personalized financial services.**

→**E-commerce platforms leverage data science for personalized recommendations, targeted marketing, and supply chain optimization.**

→**Governments employ data science for policy-making, urban planning, and public service optimization to benefit society.**

# Data Science Framework

Data science framework is a structured approach to solving data-driven problems. It encompasses data collection, cleaning, exploration, modeling, and evaluation. The framework ensures systematic and reproducible results, facilitating better decision-making. Key steps include defining objectives, data preprocessing, selecting algorithms, model training, validation, and deployment.

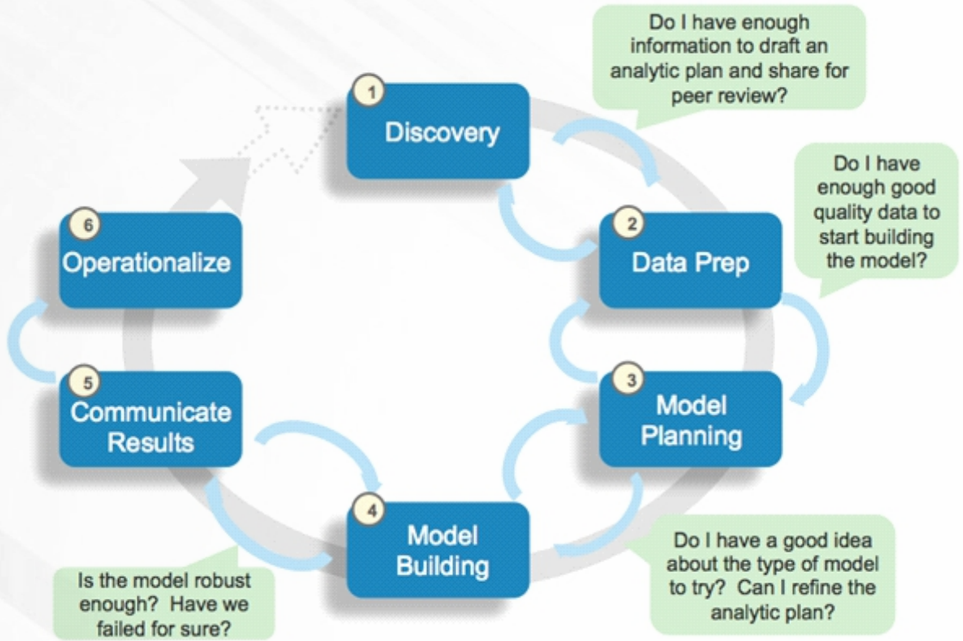



# Data Science Framework:

- **Problem Identification:** Define the problem clearly. Understand business objectives, requirements, and constraints. Identify key questions and success metrics for actionable insights.
- **Data Discovery:** Collect relevant data. Explore available sources, formats, and volumes. Assess data quality, accessibility, and relevance to the problem at hand.
- **Data Ingestion:** Acquire and import data. Use appropriate tools and technologies to collect, store, and integrate data from various sources into a central repository.
- **Data Wrangling:** Clean and transform data. Handle missing values, outliers, and inconsistencies. Prepare data for analysis by structuring and formatting it properly.
- **Fitness for Use:** Validate data quality. Ensure data is accurate, complete, and reliable. Perform data profiling and validation checks to confirm readiness for analysis.
- **Statistical Modelling:** Apply statistical techniques. Develop, train, and validate predictive models. Use algorithms to uncover patterns, trends, and relationships within the data.
- **Communication and Dissemination:** Present findings. Use visualizations and reports to convey insights clearly. Share results with stakeholders, supporting decision-making and actionable strategies.

## Data Analytics Lifecycle

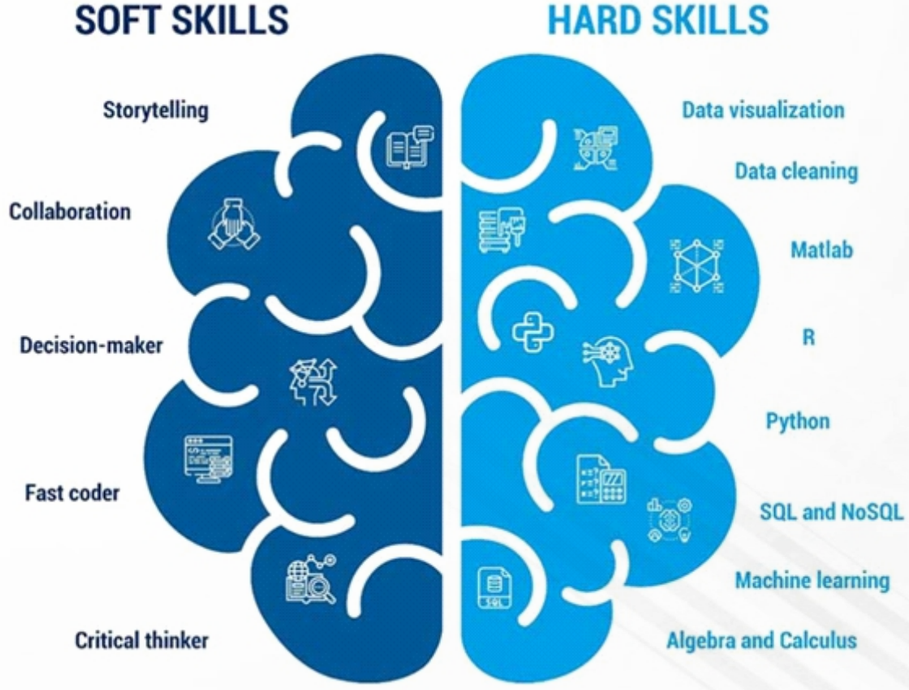
The data analytics lifecycle involves identifying business objectives, collecting and preparing data, analyzing it through various techniques, interpreting results, and communicating insights to stakeholders, leading to informed decision-making and iterative improvements for continuous optimization.




## Possible Applications for Data Science


## Data Science Framework


## Essential Aptitudes for Data Scientist



## Specilized Laboratories
## Cloud Application Development Centre:

IARE has a MoU with Manjra Soft Solution Pty Ltd. to establish an industry support Cloud Application Development Centre. The centre is focused on the creation of innovative software technologies for simplifying the development and deployment of applications on private or public Clouds. Aneka pltform plays the role of Application Platform as a Service for Cloud Computing. Aneka supports various programming models involving Task Programming, Thread Programming and MapReduce Programming and tools for rapid creation of applications and their seamless deployment on private or public Clouds to distribute applications.

**Aneka technology primarily consists of two key components:**

Ÿ SDK (Software Development Kit) containing application programming interfaces (APIs) and tools essential for rapid development of applications. Aneka APIs supports three popular Cloud programming models: Task, Thread, and MapReduce.

Ÿ A Runtime Engine and Platform for managing deployment and execution of applications on private or public Clouds.

IARE has Augment Reality/Virtual Reality center which provides students with hands-on experience in using cutting-edge technologies to visualize complex concepts, conduct experiments, and develop solutions to real-world problems. AR & VR labs can also foster creativity, collaboration, and critical thinking skills, which are essential for success in their careers. The center will engage in research, teaching and services for developing advanced methods and algorithms for near-real 3D user interfaces and exploratory data analysis in virtual environments.

**Highlights of AnekaCenter:**

Ÿ Support of multiple programming and application environments

Ÿ Simultaneous support of multiple run-time environments

Ÿ Rapid deployment tools and framework

Ÿ Simplicity in developing applications on Cloud

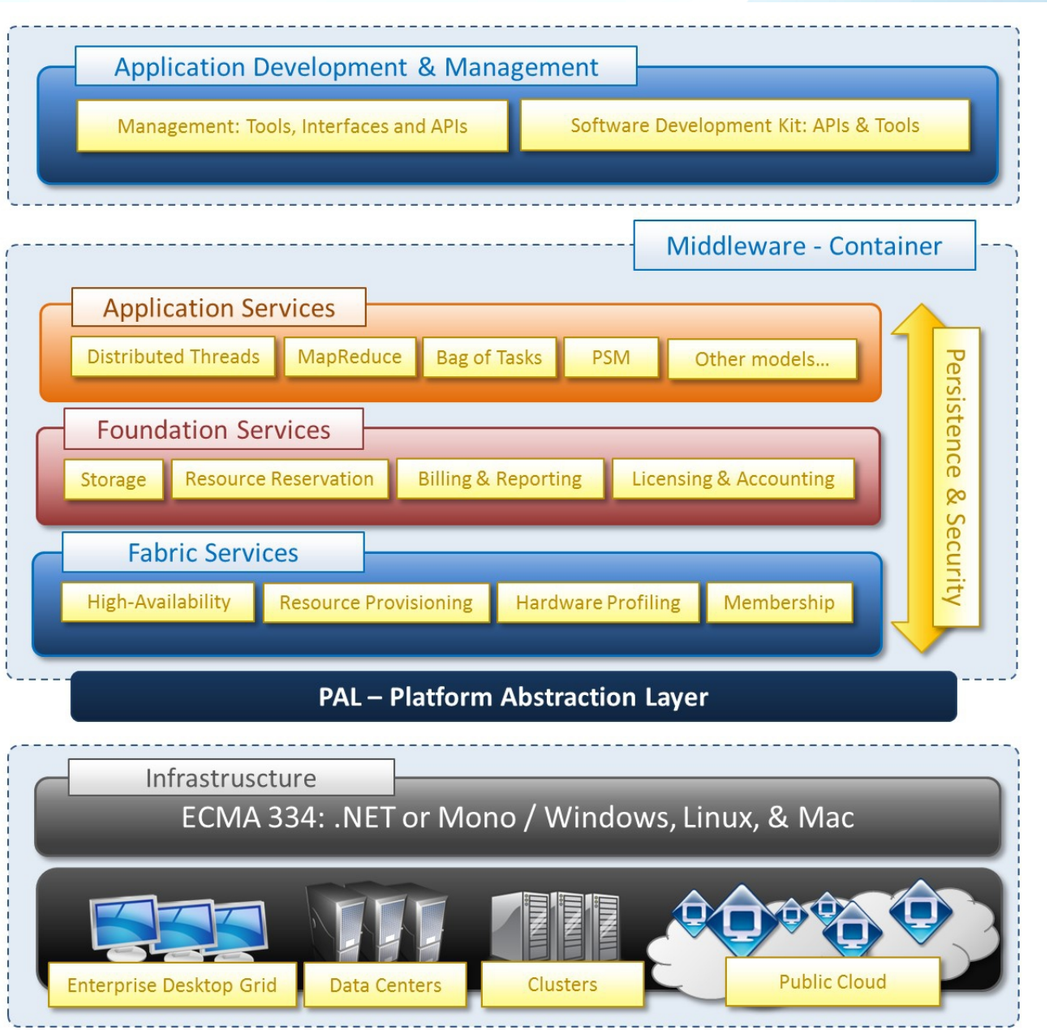
Ÿ Dynamic Scalability

Ÿ Ability to harness multiple virtual and/or physical machines for accelerating application result

Ÿ Provisioning based on QoS/SLA

## Aneka Architecture:

Aneka is a platform and a framework for developing distributed applications on the Cloud. Aneka provides developers with a rich set of APIs for transparently exploiting such resources and expressing the business logic of applications by using the preferred programming abstractions. The Aneka based computing cloud is a collection of physical and virtualized resources connected through a network, which are either the Internet or a private intranet



## Data Science centre

Data Science Lab is configured which not only facilitates students to practice basic programming in C, C++, Python and JAVA; but also learn advanced technologies of computer science such as Machine Learning, Artificial Intelligence, Deep Learning and Data Mining. The Lab facilitates database designing and management through dedicated tools such as Oracle, and MySQL and related computing paradigm and frameworks.

It also provides computing platform for novel languages like Python, R, and OpenCV and other necessary for building coherent set of ideas, fundamental of Machine Learning, Artificial Intelligence and Deep Learning models and algorithms. Each lab sessions is aimed to translate the theory lectures into practical implementation through programming paradigms and tools, platforms provided in the data science lab. Data Science Lab welcomes students, researchers, interns, faculties and everyone from a broad range of disciplines who are fascinated with the possibilities of turning big and complex data to knowledge.

Members of the data science lab seeks cutting edge problem-based solutions to data mining, computer vision and machine learning problems arising in numerous application areas involving data analytics.

### Objectives:

The long-term research agenda of the Data Science Lab is to develop new algorithms and software tools for data management and mining, and to use them for social good.

The Data Science Lab focuses on applying machine learning, data mining, and network analysis to real-world problems in society and industry.

Exploring the creation of novel statistical and computational methods for scalable data mining, machine learning, optimization as well as statistical modelling with complex data sets

We are especially interested in machine learning, data mining and information retrieval. In all of these areas, the combination of well-informed theoretical models empowered by large-scale resources allows for exciting insights and applications.

# Laboratory **Details**

## 1 Statistical Programming Laboratory

Statistical Programming Laboratory provides a fundamental concept in statistics for data science. Students will learn statistical inference including estimation, hypothesis testing and nonparametric tests. Further, students will be introduced to Bayesian inference, linear regression and classification. R will be used to apply these statistical methods. At the end of the course, students should be able to apply the statistical methods to real large data sets.

### Major Equipment

**Computer Systems – 36 Nos**

**Make:** Acer

**Model:** Veriton M200

**Configuration:** 1Intel core-i5-H510, Processor, 16GB DDR4, 512 HDD, Bluetooth, Wi-Fi,22" Monitor, Keyboard, Mouse

**Software:** R-Studio

## 2 Data Structures Laboratory

The Data Structure lab intends to provide the students a practical knowledge of data structures so that the abstractions discussed in lecture classes are made concrete. The lab demonstrates familiarity with major algorithms and data structures and analyzes performance of algorithms. It is used to choose the appropriate data structure and algorithm design method for a specified application and determine which algorithm or data structure to use in different scenarios.

### Major Equipment

**Computer Systems – 36 Nos**

**Make:** Acer

**Model:** Veriton M200

**Configuration:** 1Intel core-i5-H510, Processor, 16GB DDR4, 512 HDD, Bluetooth, Wi-Fi,22" Monitor, Keyboard, Mouse

**Software:** Python, Google Colab and Spyder.

## 3 Data Handling and Visualizations Laboratory

Data handling is the process of collecting, organizing, and presenting the data in a way to analyze, make predictions, draw conclusions, and make decisions. Data visualization is a part of exploratory data analysis, a prior step before a full-pledged data analysis. This laboratory course is intended to offer practical knowledge and skills in both data handling and visualization. In this laboratory python packages such as NumPy, SciPy and Pandas for computations, and the visualization packages such as seaborn and matplotlib. Hands-on exercises are designed to explore the basic data importing, exploration, visualization, preliminary data analysis and data exporting techniques using core python and its packages.

### Major Equipment

**Computer Systems – 36 Nos**

**Make:** Acer

**Model:** Veriton M200

**Configuration:** 1Intel core-i5-H510, Processor, 16GB DDR4, 512 HDD, Bluetooth, Wi-Fi,22" Monitor, Keyboard, Mouse

**Software:** Python, Google Colab and Spyder.

## 4 Database Management Systems Laboratory

A database management system (DBMS) is a collection of programs that enables users to create and maintain databases and control all access to them. Database Management Systems Laboratory provides working on existing database systems, designing of database, creating relational database, analysis of table design. The lab course also provides practical knowledge to understand advanced database concepts such as Datamining and Big Data Analysis.

### Major Equipment

**Desktop Computer Systems – 36 Nos**

**Make:** Acer

**Model:** Veriton M200

**Configuration:** 1Intel core-i5-H510, Processor, 16GB DDR4, 512 HDD, Bluetooth, Wi-Fi,22" Monitor, Keyboard, Mouse

**Software:** MySQL and Oracle

## 5 Data Mining and Warehousing Laboratory

The Data Mining and Warehousing Laboratory is a dynamic research facility focused on exploring and implementing advanced techniques for extracting valuable insights from large datasets. Utilizing cutting-edge tools and methodologies, students investigate patterns, trends, and correlations within data to inform decision-making processes. Additionally, the laboratory specializes in designing efficient data storage and retrieval systems to support the needs of various industries and applications.

### Major Equipment

**Desktop Computer Systems – 36 Nos**

**Make:** Acer

**Model:** Veriton M200

**Configuration:** 1Intel core-i5-H510, Processor, 16GB DDR4, 512 HDD, Bluetooth, Wi-Fi,22" Monitor, Keyboard, Mouse

**Software:** Weka, RapidMiner, Orange.

## 6 Machine Learning Algorithms Laboratory

Machine Learning Algorithms Laboratory provides the application aspects of machine learning in the domains of artificial intelligence, machine learning, deep learning, numerical optimization, and natural language processing. Also, to develop applications in the area of computational biology, object detection in images, video segmentation and summarization, detection of rare topics in text documents and statistical modelling of computer systems.

### Major Equipment

**Desktop Computer Systems – 36 Nos**

**Make:** Acer **Model:** Veriton M200

**Configuration:** 1Intel core-i5-H510, Processor, 16GB DDR4, 512 HDD, Bluetooth, Wi-Fi,22" Monitor, Keyboard, Mouse

**Software:** Jupiter Notebook, Pycham, Google Colab, Spyder and Pytorch

## 5 Big Data Management Laboratory

The Big Data Management laboratory equip students with hands-on experience in handling large datasets, employing technologies like Hadoop, Spark, and NoSQL databases. Through practical exercises, students learn data ingestion, storage, processing, and analysis techniques, crucial for modern data-driven enterprises.

### Major Equipment

**Desktop Computer Systems – 36 Nos**

**Make:** Acer

**Model:** Veriton M200

**Configuration:** 1Intel core-i5-H510, Processor, 16GB DDR4, 512 HDD, Bluetooth, Wi-Fi,22" Monitor, Keyboard, Mouse

**Software:** Apache Hadoop, Spark, MongoDB

## 6 Computer Networks Laboratory

The Computer Networks Laboratory offers students practical experience in configuring, analyzing, and troubleshooting network setups. Through hands-on exercises, students learn about protocols, network architectures, security mechanisms, and data transmission techniques essential for understanding and working with distributed systems, a key aspect of modern data science.

### Major Equipment

**Desktop Computer Systems – 36 Nos**

**Make:** Acer

**Model:** Veriton M200

**Configuration:** 1Intel core-i5-H510, Processor, 16GB DDR4, 512 HDD, Bluetooth, Wi-Fi,22" Monitor, Keyboard, Mouse

**Software:** Python, Wireshark.

## 7 Mobile and Web Application Development Laboratory

Web application development design allows web-based projects to behave and perform like mobile apps. Web applications engage users by focusing on responsive interactions, while accessed over the internet. Web apps come in a variety of shapes and sizes. Web application development provides the process of designing, building, testing and deploying web-based applications that will be installed on remote servers and delivered to users or customers via the internet.

### Major Equipment

**Desktop Computer Systems – 36 Nos**

**Make:** Acer

**Model:** Veriton M200

**Configuration:** 1Intel core-i5-H510, Processor, 16GB DDR4, 512 HDD, Bluetooth, Wi-Fi,22" Monitor, Keyboard, Mouse

**Software:** XAMPP Server and WAMP.

## 8 Distributed Systems Security Laboratory

The Distributed Systems Security Laboratory offers B.Tech data science students practical training in securing distributed computing environments. Through hands-on exercises, students explore authentication, encryption, access control mechanisms, and threat detection techniques. They gain insights into safeguarding data integrity, confidentiality, and availability, crucial for modern data-centric applications.

### Major Equipment

**Desktop Computer Systems – 36 Nos**

**Make:** Acer

**Model:** Veriton M200

**Configuration:** 1Intel core-i5-H510, Processor, 16GB DDR4, 512 HDD, Bluetooth, Wi-Fi,22" Monitor, Keyboard, Mouse

**Software:** Sun RPC, Java RMI

# FACULTY **INFORMATION**

## Dr. K Rajendra Prasad

Professor & Head

**Ph.D (2015)**,
Jawaharlal Nehru Technological University, Anantapur, AP,

**Postgraduate Degree(2004),**
Visvesvaraya Technological University, Belgum, Karnataka,

**Undergraduate Degree**(1999),
Jawaharlal Nehru Technological University, Hyderabad, TS,

**AREA OF SPECIALIZATION**

Data Mining, Pattern Recognition,
Artificial Intelligence,
Speech and Signal Processing,
Soft Computing Techniques,
Information Retrieval Techniques,
Data Visualization Methods

## Dr. B Rama Devi

Professor

**Ph.D (2016)**, Acharya Nagarjuna University, Guntur, AP

**M.Tech (2007),** Vinayaka Missions, University, Tamil Nadu

**B.Tech (1997),** Acharya Nagarjuna University, Guntur, AP

**AREA OF SPECIALIZATION**

Image Processing, Signal Processing

## Dr. M V Krishna Rao

Professor

**Ph.D (2001)**, Osmania University, Hyderabad, TS

**M.Tech (1989),** Indian Institute of Technology, Kharagpur, West Bengal

**B.Tech (1983)** JNTU, Hyderabad, TS

**AREA OF SPECIALIZATION**

Machine Learning, Computer Vision

## Dr. R Obulakonda Reddy

Professor

**Ph.D (2017)**, JNTU, AP

**M.Tech (2009),** JNTU, Hyderabad, TS

**B.Tech (2005),** Sri Krishnadevaraya University, Anantapur, AP

**AREA OF SPECIALIZATION**

Machine Learning,
Deep Learning and Computer Vision

## Dr. Ranjith Kumar Gatla

Associate Professor

**Ph.D (2019)**, Wuhan University of Technology, China

**M.Tech (2011),** SRM (Deemed to be University), Chennai, Tamil Nadu

**B.Tec h (2008),** JNTU, Hyderabad, TS

**AREA OF SPECIALIZATION**

Machine Learning, Computer Vision

## Dr S Sreekanth

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**Ph.D (2020)**, Sri Venkateswara University, Tirupathi, AP

**M.Tech (2009),** Satyabama University, Chennai, Tamilnadu

**B.Tech (1988),** SV University, Tirupathi, AP

**AREA OF SPECIALIZATION**

Machine Learning, Computer Vision

## Dr. P Ramadevi

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**Ph.D (2016)**, JNTU, Hyderabad, TS

**M.Tech (2002),** University of Madras, Chennai, Tamil Nadu

**B.Tech (2000),** IEI, Calcutta, West Bengal

**AREA OF SPECIALIZATION**

Applied Electronics,
Ad hoc Wireless Networks

## Dr. Mahammad Rafi D

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**Ph.D (2020)**, Veltech University Chennai, Tamil Nadu

**M.Tech (2008),** JNTU, Hyderabad, TS

**B.Tech (2005),** JNTU, Hyderabad, TS

**AREA OF SPECIALIZATION**

Data Mining

## Dr. Sajja Suneel

Assistant Professor

**Ph.D (2023)**, Doctoral Degree, VB SP University, Jaunpur

**M.Tech (2010),** Hindustan (DU), Kelambakkam, Chennai

**B.Tech (2008),** Vignan Engineering College, Guntur

**AREA OF SPECIALIZATION**

Machine Learning

## Dr. D Sreenivasulu

Assistant Professor

**Ph.D (2023)**, Doctoral Degree Rayalaseema University, Pasupula

**M.Tech (2006),** JNTUH, Hyderabad

**B.Tech (1994),** Koneru Lakshmaiah C ollege of Engineering, Guntur

**AREA OF SPECIALIZATION**

Machine Learning

## Dr A Naresh Kumar

Assistant Professor

**Ph.D (2021)**, Doctoral Degree, GITAM University, Hyderabad

**M.Tech (2013),** NIT, Raipur, Chhattisgarh

**B.Tech (2011),** JNTU, Jagitial

**AREA OF SPECIALIZATION**

Machine Learning, Computer Vision

## Dr. G Ganapathi Rao

Assistant Professor

**Ph.D (2017)**, Andhra University, Visakhapatnam, AP

**M.Tech (2011),** JNTU, Hyderabad, TS

**B.Tech (2003),** Acharya Nagarjuna University, Guntur, AP

**AREA OF SPECIALIZATION**

Machine Learning,
Deep Learning and Computer Vision

## Dr. B Santhosh Kumar

Assistant Professor

**Ph.D (2025)**, GITAM University, Hyderabad, TS

**M.Tech (2012),** JNTU, Hyderabad, TS

**B.Tech (2005),** JNTU, Hyderabad, TS

**AREA OF SPECIALIZATION**

Machine Learning, Computer Vision

## Assistant **Professors**

- Ms. V Alekhya
- Mr. KS R Sagar
- Ms. G Indu
- Ms. R Tejaswini
- Mr. Y Mallikarjun
- Mr. B Siva Sankar
- Ms. J Sirisha
- Mr. V Koti Reddy
- Ms. C Vanitha Reddy
- Ms. N Lakshmi Deepthi
- Ms. P Aswani
- Mr. Chitte Anil
- Ms. K Praveena
- Ms. Sumangala Pujari
- Ms. Y Sujana
- Ms. S Bhagyashree
- Mr. S Srikanth

# COURSE MENU

CURRICULUM DESIGNED BASED ON PROFESSIONAL MODULES FROM LEADING IT INDUSTRIES

Professional modules from Alibaba, Huawei and Microsoft in several subjects so that students have opportunity to obtain professional certificates from these companies upon graduation.

Microsoft

Alibaba.com

Cognizant

HUAWEI

IEEE

Association for Computing Machinery

**I Semester**

| Course Code | Course Name | Credits | Prerequisites |
|---|---|---|---|
| **THEORY** | | | |
| AHSD02 | Matrices and Calculus | 4 | Mathematics |
| AHSD03 | Engineering Chemistry | 3 | Chemistry |
| AHSD07 | Applied Physics | 3 | Physics |
| ACSD01 | Object Oriented Programming | 3 | -- |
| PRACTICALS | | | |
| AHSD09 | Applied Physics Laboratory | 1 | Applied Physics |
| ACSD02 | Object Oriented Programming with Java Laboratory | 2 | Object Oriented Programming |
| AHSD05 | Engineering Chemistry Laboratory | 1 | Engineering Chemistry |
| AMED03 | Engineering Graphics | 2 | -- |
| **EXPERIENTIAL ENGINEERING EDUCATION (ExEED)** | | | |
| ACSD04 | Mobile Applications Development | 1 | -- |
| | Total Credits | 20 | |
| | Cumulative Credits | 20 | |

**II Semester**

| Course Code | Course Name | Credits | Prerequisites |
|---|---|---|---|
| **THEORY** | | | |
| AHSD01 | Professional Communication | 3 | English |
| AHSD08 | Differential Equations and Vector Calculus | 4 | Mathematics |
| ACSD05 | Essentials of Problem Solving | 3 | -- |
| AEED01 | Elements of Electrical and Electronics Engineering | 3 | Physics |
| PRACTICALS | | | |
| AHSD04 | Professional Communication Laboratory | 1 | Professional Communication |
| ACSD06 | Programming for Problem Solving Laboratory | 2 | Essentials of Problem Solving |
| AMED02 | Manufacturing Practice | 2 | --- |
| AEED03 | Electrical and Electronics Engineering Laboratory | 1 | Elements of Electrical and Electronics Engineering |
| **EXPERIENTIAL ENGINEERING EDUCATION (ExEED)** | | | |
| ACSD03 | Essentials of Innovation | 1 | -- |
| | Total Credits | 20 | |
| | Cumulative Credits | 40 | |

**III Semester**

| Course Code | Course Name | Credits | Prerequisites |
|---|---|---|---|
| **THEORY** | | | |
| AHSD11 | Probability and Statistics | 4 | Mathematics |
| AECD04 | Digital Design and Embedded Systems | 3 | --- |
| ACSD09 | Computer Architecture and Operating Systems | 3 | --- |
| ACDD01 | Discrete Mathematical Structures | 3 | Mathematics |
| ACSD08 | Data Structures | 3 | Essentials of Problem Solving |
| PRACTICALS | | | |
| ACDD02 | Statistical Programming Laboratory | 1 | Probability and Statistics |
| ACSD11 | Data Structures Laboratory | 1 | Data Structures |
| AITD02 | Programming with Objects Laboratory | 1 | Object Oriented Programming |
| **EXPERIENTIAL ENGINEERING EDUCATION (ExEED)** | | | |
| ACSD12 | Prototype and Design Building | 1 | -- |
| | Total Credits | 20 | |
| | Cumulative Credits | 60 | |

**IV Semester**

| Course Code | Course Name | Credits | Prerequisites |
|---|---|---|---|
| **THEORY** | | | |
| ACSD14 | Web Systems Engineering | 3 | Object Oriented Programming |
| ACSD13 | Design and Analysis of Algorithms | 3 | Data Structures |
| AITD03 | Database Management Systems | 3 | Operating Systems |
| ACAD03 | Applied Artificial Intelligence | 3 | --- |
| ACDD03 | Data Handling and Visualizations | 3 | Probability and Statistics |
| PRACTICALS | | | |
| ACSD17 | Web Systems Engineering Laboratory | 1 | Web Systems Engineering |
| AITD05 | Database Management Systems Laboratory | 1 | Database Management Systems |
| ACDD04 | Data Handling and Visualizations Laboratory | 1 | Data Handling and Visualizations |
| **SKILL ENHANCEMENT PROJECT** | | | |
| ACSD18 | DevOps Engineer | 1 | -- |
| | Total Credits | 20 | |
| | Cumulative Credits | 80 | |

**V Semester**

| Course Code | Course Name | Credits | Prerequisites |
|---|---|---|---|
| **THEORY** | | | |
| ACDD05 | Software Engineering | 3 | Object Oriented Programming |
| ACSD30 | Theory of Computation | 3 | Discrete Mathematical Structures |
| ACDD06 | Data Mining and Warehousing | 3 | Database Management Systems |
| ACDD07 | Optimization Techniques | 3 | Mathematics |
| | Program Elective – I | 3 | |
| PRACTICALS | | | |
| ACDD13 | Linux Internals Laboratory | 1 | Operating Systems |
| ACDD14 | Data Mining and Warehousing Laboratory | 1 | Data Mining and Warehousing |
| **SKILL ENHANCEMENT PROJECT** | | | |
| ACSD29 | Engineering Design Project | 1 | -- |
| ACSD30 | Skill # | 2 | -- |
| | Total Credits | 20 | |
| | Cumulative Credits | 100 | |

**VI Semester**

| Course Code | Course Name | Credits | Prerequisites |
|---|---|---|---|
| **THEORY** | | | |
| ACAD06 | Machine Learning Algorithms | 3 | Probability and Statistics |
| AITD04 | Computer Networks | 3 | -- |
| | Program Elective – II | 3 | |
| | Program Elective – III | 3 | |
| | Open Elective – I | 3 | |
| PRACTICALS | | | |
| ACAD11 | Machine Learning Algorithms Laboratory | 1 | Machine Learning Algorithms |
| ACCD03 | Computer Networks Laboratory | 1 | Computer Networks |
| **SKILL ENHANCEMENT PROJECT** | | | |
| ACSD44 | Skill # | 2 | -- |
| ACSD45 | Development Project | 1 | |
| | Total Credits | 20 | |
| | Cumulative Credits | 120 | |

**VII Semester**

| Course Code | Course Name | Credits | Prerequisites |
|---|---|---|---|
| **THEORY** | | | |
| ACDD20 | Distributed Systems and Security | 3 | Operating Systems |
| ACDD21 | Big Data Management | 3 | Database Management Systems |
| | Program Elective - IV | 3 | |
| | Program Elective - V | 3 | |
| | Open Elective - II | 3 | |
| PRACTICALS | | | |
| ACDD29 | Big Data Management Laboratory | 1 | Big Data Management |
| ACDD30 | Distributed Systems Security Laboratory | 1 | Distributed Systems and Security |
| **PROJECT WORK** | | | |
| ACDD31 | Project Work (Phase - I) | 3 | -- |
| **MANDATORY COURSE** | | | |
| AHSD14 | Essence of Indian Traditional Knowledge | - | |
| | Total Credits | 20 | |
| | Cumulative Credits | 140 | |

**VIII Semester**

| Course Code | Course Name | Credits | Prerequisites |
|---|---|---|---|
| **THEORY** | | | |
| AHSD15 | Managerial Economics and Financial Analysis | 3 | -- |
| | Program Elective - VI | 3 | |
| | Open Elective - III | 3 | |
| **PROJECT WORK** | | | |
| ACDD36 | Project Work (Phase - II) | 11 | |
| | Total Credits | 20 | |
| | Cumulative Credits | 160 | |

# ELECTIVE **COURSES**

## PROGRAM ELECTIVES COURSES (PEC)

The below listed courses are Professional electives and the student has to study six courses as professional electives.

| Course Code | Name of the Course | Prerequisites | Preferred Semester | Credits |
|---|---|---|---|---|
| ACDD08 | Image Processing | Computer Organization and Architecture | V | 3 |
| ACDD09 | Mobile Computing | Mobile Application Development | V | 3 |
| ACDD10 | Parallel and Distributed Algorithms | Design and Analysis of Algorithms | V | 3 |
| ACDD11 | Cloud Computing | JAVA and Python Programming Languages | V | 3 |
| ACDD12 | Soft Computing | JAVA and Python Programming Languages | V | 3 |
| | | | | |
| ACSD37 | Advanced Social, Text and Media Analytics | Probability and Statistics | VI | 3 |
| ACAD26 | Augmented Reality and Virtual Reality | JAVA Programming | VI | 3 |
| ACDD15 | NOSQL Databases | Database Management Systems | VI | 3 |
| AITD11 | Natural Language Processing | Artificial Intelligence | VI | 3 |
| ACCD28 | Parallel Computing | Python Programming | VI | 3 |
| ACSD25 | Software Project Management | Database Management Systems | VI | 3 |
| ACCD08 | Principles of IoT | Computer Networks | VI | 3 |
| ACDD16 | Information Security | Computer Networks | VI | 3 |
| ACAD08 | Information Retrieval Systems | Database Management Systems | VI | 3 |
| ACDD17 | Predictive Data Analytics | Probability and Statistics | VI | 3 |
| | | | | |
| ACDD22 | Fuzzy Logic Systems | Probability and Statistics | VII | 3 |
| ACAD15 | Machine Learning for Engineering Applications | Machine Learning | VII | 3 |
| ACDD23 | Reinforcement Learning | Machine Learning | VII | 3 |
| ACDD24 | Applied Natural Language Processing | Artificial Intelligence | VII | 3 |
| ACCD05 | Computer Vision | Image Processing | VII | 3 |
| AITD16 | Agile Development and Scrum Practices | Software Engineering | VII | 3 |
| ACDD25 | Deep Learning Techniques | Machine Learning | VII | 3 |
| ACDD26 | Advanced Data Mining | Data Mining and Warehousing | VII | 3 |
| ACDD27 | Cryptography and Network Security | Computer Networks | VII | 3 |
| ACAD14 | Human Computer Interaction (UI & UX) | - | VII | 3 |
| | | | | |
| ACDD32 | GPU Computing | Computer Architecture and Operating Systems | VIII | 3 |
| ACSD57 | Blockchain Technologies | Data Strucutres, Design and Analysis of Algorithms | VIII | 3 |
| ACSD58 | Digital Visualizations | Operating Systems | VIII | 3 |
| ACCD22 | Edge Computing | Computer Networks | VIII | 3 |
| ACDD33 | Foundations of Cyber Physical Systems | - | VIII | 3 |

## OPEN ELECTIVE COURSES (OEC)

The courses listed below are offered by the Department of CSE (AI&ML) for students of other departments.

| Course Code | Course Name | Credits |
|---|---|---|
| ACDD18 | Business Intelligence | 3 |
| ACDD19 | Modelling and Optimization Techniques | 3 |
| ACDD28 | Cluster Computing | 3 |
| ACSD53 | Ethical Hacking | 3 |
| ACDD34 | Exploratory Data Analysis | 3 |
| ACDD35 | Algorithmic Techniques for Big Data | 3 |

## Value Added Courses

**Objective:**

Value added courses are provided to equip the students with knowledge and skills outside of the curriculum or to meet any specific requirements of the industry. The following are the Value-Added Courses provided to students by various departments in our institution.

**ANY FOUR FROM THE GIVEN BELOW THROUGH IARE ELRV – AKANKSHA / CERTIFICATE - SWAYAM, e-PG pathshala, NPTEL etc.**

- Data Scalability and Distribution (Amazon Web Services, Microsoft Azure, Google Cloud Platform etc.
- Software Developer (Restful webservices / Microservices, Rust programming, MEAN, MERN, MEVN)
- Data Science (Data visualization, Data wrangling, Bigdata Technologies, Business Intelligence etc..)
- Operating Systems (IBM I, Mac OS, Linux, Haiku etc.)
- Debugging
- Testing (Selenium, TestNG)
- Cyber Security (Network Security, Threat Intelligence and Analysis / Risk Assessment and Management
- Software Architect
- Blockchain Technology

# COURSE **SYNOPSIS**

## CORE **COURSES**

### Probability and Statistics

The Probability and Statistics course explores fundamental concepts in probability theory and statistical analysis. Topics include probability distributions, hypothesis testing, confidence intervals, regression analysis, and Bayesian inference. Students learn to analyze data, make predictions, and draw conclusions using statistical methods. Through lectures, problem-solving sessions, and hands-on projects, students develop critical thinking skills and gain proficiency in statistical software.

### Computer Architecture and Operating Systems

This course is designed to explore the fundamental principles underlying the design and function of modern computer systems. The course delves into topics such as processor architecture, memory hierarchy, input/output systems, and parallel computing. Students analyze the relationship between hardware and software, studying how operating systems manage system resources, scheduling processes, and ensuring security. Ultimately, the course equips students with a comprehensive understanding of the intricate interplay between computer architecture and operating systems, preparing them for advanced studies or careers in the field.

### Discrete Mathematical Structures

This course explores foundational concepts crucial in computer science and mathematics. Topics include set theory, logic, proof techniques, relations, functions, combinatorics, and graph theory. Through rigorous analysis, students develop problem-solving skills applicable in algorithm design, cryptography, and database management. Emphasizing abstraction and precision, the course delves into fundamental principles underlying computational processes, enabling students to analyze complex systems with clarity. By learning these discrete structures, students gain a robust framework for tackling real-world challenges in computing and beyond, fostering critical thinking and mathematical maturity essential for success in various fields.

### Data Structures

This course explores fundamental concepts and techniques for organizing, storing, and accessing data efficiently. It covers topics such as arrays, linked lists, stacks, queues, trees, graphs, and hash tables, delving into their implementations, operations, and algorithms. Through practical exercises and projects, students learn to analyze problems, select appropriate data structures, and design algorithms for optimal performance. Emphasis is placed on understanding time and space complexities, enabling students to make informed choices when solving real-world problems. Additionally, the course often includes discussions on abstract data types, recursion, sorting, searching, and dynamic programming, preparing students for advanced data manipulation and algorithm design challenges.

### Web Systems Engineering

This course delves into the design, development, and maintenance of robust web-based systems. It covers fundamental concepts of web architecture, including client-server communication, database integration, and scalability. Students explore technologies such as HTML, CSS, JavaScript, and frameworks like React or Angular. They learn to build dynamic web applications using server-side scripting languages such as PHP, Python, or Node.js. Emphasis is placed on security practices, performance optimization, and usability principles. Through hands-on projects, students gain practical experience in deploying, monitoring, and troubleshooting web systems, preparing them for roles in web development and IT infrastructure management.

### Design and Analysis of Algorithms

This course delves into foundational principles and techniques for creating and evaluating efficient algorithms. Covering topics like algorithm design paradigms (such as greedy, divide and conquer, dynamic programming), complexity analysis (big O notation, worst-case analysis), and data structures, it equips students with the tools to solve computational problems effectively. Through theoretical study and practical implementation exercises, learners develop skills in algorithmic problem-solving, optimization, and understanding computational complexity. Emphasis is placed on algorithmic correctness, efficiency, and scalability, preparing students for real-world applications in fields like computer science, engineering, and data analysis.

### Applied Artificial Intelligence

This course delves into fundamental concepts and practical applications within AI. Topics include search techniques such as breadth-first and depth-first search, reasoning systems including propositional and first-order logic, game playing strategies like minimax and alpha-beta pruning, and various AI applications such as natural language processing and computer vision. Additionally, students explore the principles of intelligent agents, covering topics like Robot Hardware, Robotic Perception, Planning to Move, Planning Uncertain Movements, Moving Software Architectures, navigation and motion planning in application domains. Through this subject student gain a comprehensive understanding of how AI techniques are implemented and utilized across different domains.

### Data Handling and Visualizations

This course equips students with essential skills for managing and analyzing data effectively. Topics include data cleaning, manipulation, and visualization techniques using popular tools like Python, and R. Students learn to extract valuable insights from datasets, employing descriptive statistics and exploratory data analysis. They delve into various visualization methods to present findings compellingly, including charts, graphs, and interactive dashboards. Practical exercises and projects reinforce comprehension, fostering proficiency in handling real-world data scenarios. By course end, participants emerge equipped to tackle data-driven challenges, adept at transforming raw information into meaningful narratives through visualization and analysis.

## Database Management Systems

This course provides a comprehensive overview of key concepts and practices. Beginning with conceptual modeling, students delve into the relational approach, understanding the fundamentals of database design. They learn SQL-query basics, enabling them to interact with databases efficiently. RDBMS normalization principles are explored to ensure data integrity and efficiency. Transaction management techniques are studied to maintain database consistency and reliability. Finally, students examine data storage strategies and query processing methods to optimize database performance. Through theoretical learning and practical exercises, students gain a strong foundation in database management essential for modern information systems.

## Software Engineering

This course offers a structured approach to developing high-quality software systems. The course covers various stages of the software development lifecycle, including requirements analysis, design, implementation, testing, and maintenance. Students learn software development methodologies such as Agile, Waterfall, and DevOps, emphasizing the importance of teamwork, communication, and project management. Topics include software architecture, coding standards, version control, and quality assurance techniques. Through case studies and hands-on projects, students gain practical experience in designing scalable, maintainable, and reliable software solutions. The course equips them with the skills and knowledge needed to thrive in the dynamic field of software engineering.

## Theory of Computation

This course delves into the fundamental principles governing computation. Beginning with automata theory, students explore abstract machines such as finite automata and pushdown automata, analyzing their capabilities and limitations in solving computational problems. Formal language theory examines the properties of languages and grammars, establishing connections between automata and languages through the Chomsky hierarchy. Complexity theory delves into the classification of computational problems based on their inherent difficulty, introducing concepts like time and space complexity. Through rigorous mathematical analysis and problem-solving exercises, students develop a deep understanding of computation's theoretical underpinnings, essential for designing efficient algorithms and solving complex computational problems.

## Optimization Techniques

This course explores strategies to enhance efficiency and effectiveness across various domains. Students delve into mathematical models and algorithms aimed at maximizing or minimizing objective functions while adhering to constraints. Techniques include linear programming, dynamic programming, and metaheuristic algorithms like genetic algorithms and simulated annealing. Through case studies and practical applications, students learn to analyze complex problems, formulate optimization models, and implement algorithms to find optimal solutions. The course equips students with invaluable skills to tackle real-world challenges in diverse fields such as engineering, operations research, finance, and logistics, fostering a deeper understanding of optimization principles and their practical implications.

## Machine Learning

This course offers a comprehensive exploration of algorithms and techniques that enable computers to learn from data and make predictions or decisions. Students delve into supervised learning methods such as regression and classification, unsupervised learning techniques like clustering and dimensionality reduction, and reinforcement learning principles for sequential decision-making. Emphasis is placed on understanding model evaluation, feature engineering, and hyperparameter tuning to ensure effective model performance. Practical implementation using popular libraries like scikit-learn and TensorFlow is integrated with theoretical concepts. By the course's conclusion, students acquire a solid understanding of machine learning fundamentals and the ability to apply them to real-world problems.

## Computer Networks

This course offers a thorough exploration of networking principles and technologies. Beginning with foundational concepts, students learn about network architectures, protocols, and communication models. They delve into the intricacies of data transmission, including packet-switching and routing algorithms. The course covers various network types, such as LANs, WANs, and wireless networks, along with their respective technologies and topologies. Students also examine network security, addressing issues like encryption, authentication, and intrusion detection. Through theoretical study and practical exercises, students develop a comprehensive understanding of computer networks, preparing them to design, manage, and troubleshoot modern network infrastructures.

## Distributed Systems and Security

This course explores the intricacies of networked computing environments. Students delve into the design and implementation of distributed systems, studying concepts such as distributed algorithms, communication protocols, and fault tolerance mechanisms. Security aspects are emphasized throughout the course, covering authentication, encryption, access control, and threat mitigation strategies specific to distributed systems. Topics also include distributed storage systems, consensus algorithms, and scalability challenges. Through theoretical discussions and hands-on exercises, students develop a deep understanding of both the theoretical principles and practical considerations essential for building secure and robust distributed systems in today's interconnected world.

## Big Data Management

This course offers an in-depth exploration of handling large volumes of diverse data. It covers foundational concepts such as the 3Vs (Volume, Variety, Velocity) and scalability challenges. Students learn various big data processing frameworks like Hadoop and Spark, mastering techniques for distributed computing and parallel processing. The course addresses data ingestion, storage, and processing techniques tailored for big data environments. Advanced topics include data governance, security, and real-time analytics. Through hands-on projects and case studies, students develop skills in managing, analyzing, and deriving insights from massive datasets, preparing them for roles in industries reliant on big data technologies.

## PROFESSIONAL **ELECTIVES**

### Image Processing

This course offers a thorough exploration of techniques and principles fundamental to manipulating digital images. Beginning with an introduction to image representation, students delve into essential topics such as image enhancement, restoration, and segmentation. Advanced topics include image filtering, edge detection, and feature extraction, providing students with a comprehensive understanding of image analysis. Through hands-on projects and theoretical study, students gain proficiency in using tools like MATLAB or Python libraries for image processing tasks. By the end of the course, students are equipped with the skills necessary to address real-world challenges in fields such as medical imaging, remote sensing, and computer vision.

### Mobile Computing

This course delves into the intricate realm of mobile computing, offering a comprehensive overview of its principles, applications, and evolving trends. Students explore the fusion of data science methodologies with mobile technology, unraveling the potential of smartphones, wearables, and IoT devices. From understanding mobile platforms and architectures to harnessing data-driven insights for app development and optimization, this course equips learners with the skills to navigate the dynamic landscape of mobile computing. Through hands-on projects and real-world case studies, students embark on a transformative journey, mastering the fusion of data science and mobile innovation to shape the future of technology.

### Parallel and Distributed Algorithms

This course delves into the intricate realm of Parallel and Distributed Algorithms, a cornerstone of B.Tech Data Science curriculum. Through this course students unravel the complexities of designing algorithms capable of executing tasks concurrently across multiple computing nodes. From understanding fundamental parallel computing concepts to exploring cutting-edge distributed systems, learners embark on a journey of innovation and efficiency. They acquire proficiency in optimizing algorithm performance for large-scale data processing, essential in today's data-driven world. By mastering this course, students unlock the power to engineer scalable solutions that propel industries forward, shaping tomorrow's technological landscape.

### Cloud Computing

This course on Cloud Computing offers a comprehensive overview of the intersection between cloud technology and data science. Students delve into the fundamentals of cloud infrastructure, exploring concepts such as virtualization, scalability, and elasticity. Through projects and case studies, they master the deployment and management of data-intensive applications in cloud environments. Moreover, this course equips students with the skills to leverage cloud-based tools and platforms for data storage, processing, and analysis, enabling them to tackle real-world challenges with agility and efficiency. Join us on a journey where innovation meets scalability, shaping the future of data science in the cloud.

### Advanced Social, Text, and Media Analytics

This course offers a comprehensive exploration into Advanced Social, Text, and Media Analytics within the Data Science program. Through a blend of theory and practical application, students delve into cutting-edge methodologies for extracting valuable insights from diverse data sources. From sentiment analysis to natural language processing and multimedia data mining, learners uncover the intricacies of understanding human behavior and interactions in the digital sphere. With hands-on projects and real-world case studies, this course equips students with the skills to tackle complex societal challenges, drive innovation, and revolutionize industries through the power of data-driven decision-making.

### Augmented Reality and Virtual Reality

This course delves into the captivating realms of Augmented Reality (AR) and Virtual Reality (VR), pioneering the fusion of data science principles with immersive technologies. Through a dynamic blend of theory and hands-on practice, students harness the power of data analytics to revolutionize AR/VR experiences. From creating lifelike simulations to enhancing user interactions, this course equips future engineers with the skills to innovate across industries. Dive into cutting-edge coursework that explores data-driven design, spatial computing, and interactive storytelling, unlocking a world where imagination meets data science to redefine the boundaries of reality. Embark on an exhilarating journey where innovation knows no bounds.

### NOSQL Databases

The NoSQL Databases course provides an in-depth understanding of non-relational database systems, covering key concepts such as document, key-value, column-family, and graph databases. Students learn to design, implement, and manage NoSQL databases to handle large volumes of unstructured or semi-structured data effectively. Topics include data modeling, querying, scalability, fault tolerance, and consistency models. Through hands-on projects and case studies, students gain practical skills to address modern data storage and retrieval challenges in diverse application domains.

### Natural Language Processing

Natural Language Processing equips students with skills in computational linguistics, machine learning, and data science to analyze and understand human language. Core subjects include linguistics, algorithms, statistics, and programming languages. Students learn to develop applications like chatbots, sentiment analysis tools, and machine translation systems. Practical training in NLP techniques and projects often form a significant part of the curriculum, preparing graduates for careers in AI, data science, and software engineering.

### Parallel Computing

Parallel Computing explores foundational concepts, algorithms, and architectures for concurrent computation. Students delve into parallel programming paradigms, such as shared memory and distributed systems, and gain expertise in designing efficient parallel algorithms. Topics cover parallel hardware architectures, synchronization, and scalability. Practical applications include high-performance computing, data analytics, and machine learning. Hands-on projects and labs foster skills in parallel programming and system optimization.

## Software Project Management

Software Project Management covers fundamental principles of project planning, execution, and monitoring within software development contexts. Topics include project lifecycle, scheduling, budgeting, risk management, and team coordination. Students learn tools and methodologies like Agile and Waterfall, as well as software engineering practices to ensure successful project delivery. Emphasis is placed on practical application through case studies and hands-on projects to prepare graduates for real-world project management roles.

## Principles of IoT

Internet of Things (IoT) is the networking of physical objects that contain electronics embedded

within their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment. In the upcoming years, IoT-based technology will other advanced levels of services and practically change the way people lead their daily lives. Advancements in medicine, power, gene therapies, agriculture, smart cities, and smart homes are just a few of the categorical examples where IoT is strongly established.

## Information Security

Information Security typically covers topics such as cryptography, network security, ethical hacking, and secure software development. Students learn to analyze and mitigate security risks, protect information systems from cyber threats, and develop secure computing solutions. The curriculum combines theoretical knowledge with hands-on experience in areas like threat detection, intrusion prevention, and incident response. Graduates are equipped for roles in cybersecurity consulting, digital forensics, and security analysis across various industries.

## Information Retrieval Systems

Information Retrieval Systems typically covers fundamental concepts of data retrieval, indexing techniques, search algorithms, and information organization. Students learn about database systems, natural language processing, and machine learning algorithms for efficient data retrieval. Practical aspects involve designing and implementing search engines, query optimization, and evaluating retrieval effectiveness. The curriculum emphasizes both theoretical understanding and practical skills necessary for developing effective information retrieval systems.

## Predictive Data Analytics

Predictive Data Analytics equips students with skills in statistical analysis, machine learning, and data mining techniques to extract insights from large datasets. Courses cover programming languages like Python and R, database management, predictive modeling, and data visualization. Students learn to apply these techniques in various domains such as finance, healthcare, and marketing to make data-driven decisions. Emphasis is placed on practical applications through projects and internships.

## Fuzzy Logic Systems

Fuzzy Logic Systems, students learn the fundamentals of fuzzy set theory and its applications in decision-making and control systems. Topics include fuzzy set operations, fuzzy inference systems, fuzzy clustering, and fuzzy control algorithms. Students gain practical experience through projects involving fuzzy logic-based modeling and control in various engineering domains. Emphasis is placed on understanding uncertainty and imprecision in real-world data and developing solutions using fuzzy logic principles.

## Machine Learning for Engineering Applications

Machine Learning for Engineering Applications provides students with a comprehensive understanding of machine learning techniques and their applications in engineering domains such as robotics, automation, and optimization. Core subjects include linear algebra, statistics, programming languages, and algorithm design. Specialized topics cover neural networks, deep learning, reinforcement learning, and their implementation in engineering solutions. Practical projects and internships ensure hands-on experience in real-world applications.

## Reinforcement Learning

Reinforcement Learning is about learning the optimal behavior in an environment to obtain maximum reward. This optimal behavior is learned through interactions with the environment and observations of how it responds, similar to children exploring the world around them and learning the actions that help them achieve a goal. Reinforcement learning is an area of Machine Learning. It is about taking suitable action to maximize reward in a particular situation. It is employed by various software and machines to find the best possible behavior or path it should take in a specific situation. Reinforcement learning differs from supervised learning in a way that in supervised learning the training data has the answer key with it so the model is trained with the correct answer itself whereas in reinforcement learning, there is no answer but the reinforcement agent decides what to do to perform the given task. In the absence of a training dataset, it is bound to learn from its experience.

## Applied Natural Language Processing

Natural Language Processing (NLP) is an important area of Artificial Intelligence concerned with the processing and understanding (NLU) of a human language. The goal of NLP and NLU is to process and harness information from a large corpus of text with very little manual intervention. Natural language processing is a field of computer science and linguistics that deals with the interaction between computers and human languages. NLP enables computers to understand human language and respond in a way that is natural for humans. The ultimate goal of NLP is to help computers understand language as well as we do. It is the driving force behind things like virtual assistants, speech recognition, sentiment analysis, automatic text summarization, machine translation and much more.

## Computer Vision

Computer vision means the extraction of information from images, text, videos, etc. Sometimes computer vision tries to mimic human vision. It's a subset of computer-based intelligence or Artificial intelligence which collects information from digital images or videos and analyze them to define the attributes. Computer vision is closely related to artificial intelligence (AI) and often uses AI techniques such as machine learning to analyze and understand visual data. Machine learning algorithms are used to "train" a computer to recognize patterns and features in visual data, such as edges, shapes and colors.

## Agile Development and Scrum Practices

Agile Development and Scrum Practices offers a comprehensive understanding of iterative software development methodologies. It covers the principles of Agile and Scrum frameworks, emphasizing teamwork, adaptability, and continuous improvement. Students learn to manage projects efficiently through sprints, backlog grooming, and daily stand-up meetings. Hands-on exercises and case studies provide practical insights into implementing Agile practices in real-world scenarios, preparing students for dynamic industry demands.

## Deep Learning Techniques

deep learning typically covers fundamentals of neural networks, convolutional neural networks (CNNs), recurrent neural networks (RNNs), and advanced topics like generative adversarial networks (GANs) and reinforcement learning. Students learn programming languages like Python, TensorFlow, and PyTorch, alongside mathematical foundations such as linear algebra and calculus. Practical applications in computer vision, natural language processing, and autonomous systems are emphasized for real-world implementation.

## Advanced Data Mining

The Advanced Data Mining course delves into complex data analysis techniques, including machine learning algorithms, neural networks, and deep learning models. Students learn to extract valuable insights from vast datasets, mastering advanced statistical methods and data visualization tools. The curriculum covers topics such as pattern recognition, clustering, and predictive modeling. Practical applications in various fields, like finance, healthcare, and marketing, are emphasized to prepare students for real-world challenges in data-driven decision-making.

## Cryptography and Network Security

Cryptography and Network Security covers fundamental principles of secure communication, cryptographic algorithms, network security protocols, and threat analysis. Students delve into topics such as encryption, digital signatures, secure key exchange, and network defense strategies. Practical aspects include hands-on experience with security tools, simulation of attacks, and designing secure systems. The curriculum emphasizes understanding threats, implementing countermeasures, and ensuring the integrity and confidentiality of digital information.

## Human Computer Interaction (UI & UX)

Human-Computer Interaction (HCI) focuses on designing intuitive user interfaces (UI) and optimizing user experiences (UX) in digital systems. It covers principles of interaction design, usability testing, user research, and interface prototyping. Students learn to blend technology with psychology and design to create user-friendly products. Practical projects and internships enhance skills in UI/UX development for web, mobile, and other digital platforms.

## GPU Computing

GPU Computing offers comprehensive training in parallel processing using Graphics Processing Units (GPUs). Students delve into GPU architecture, parallel programming models like CUDA and OpenCL, and applications in fields like deep learning, scientific simulations, and computer graphics. The curriculum integrates theory with hands-on projects to equip graduates with skills in harnessing GPU power for accelerating computations across various domains.

## Blockchain Technologies

Blockchain Technologies provides a comprehensive understanding of blockchain fundamentals, decentralized systems, smart contracts, and cryptographic techniques. Students learn to develop blockchain-based applications, explore consensus mechanisms, and address security challenges. The curriculum includes courses on distributed ledger technologies, cryptography, and decentralized finance (DeFi). Practical projects and internships offer hands-on experience, preparing graduates for careers in blockchain development, cybersecurity, fintech, and more.

## Digital Visualizations

Digital Visualizations blends art and technology, focusing on creating compelling visual experiences across digital platforms. Students learn design principles, digital imaging, animation, and interactive media development. Core courses cover graphics programming, user interface design, and visual storytelling techniques. Advanced topics include virtual reality, augmented reality, and game design. Graduates are equipped for careers in animation studios, game development companies, advertising agencies, and digital media production houses.

## Edge Computing

Edge Computing typically covers fundamentals of cloud computing, networking, and IoT systems, emphasizing on processing data closer to its source for reduced latency and enhanced efficiency. Topics include edge device architecture, distributed systems, security, and real-time analytics. Hands-on experience with edge computing platforms and projects are integral, preparing students for careers in industries requiring agile, low-latency data processing solutions.

## Foundations of Cyber Physical Systems

Foundations of Cyber Physical Systems provides a comprehensive understanding of the integration between computer systems and physical processes. Students delve into areas like embedded systems, control theory, networking, and cybersecurity. The curriculum emphasizes hands-on experience through practical projects and explores topics such as real-time computing, sensor networks, and system optimization. Graduates are equipped to design and manage complex interconnected systems across various industries, from healthcare to transportation.

**Find out more:**
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