

CE4031 and CZ4031 - Database System Principles

Course Code	CE/CZ4031							
Course Title	Database System Principles							
Pre-requisites	CE/CZ2001 Algorithms; CZ2007 Introduction to Databases							
Pre-requisite for	CZ4033 Advanced Data Management (not offered currently)							
No of AUs	3							
Contact Hours	Lectures	26	TEL	0	Tutorials	13	Student presentations	0

Course Aims

Database management systems (DBMS) are designed to manage large and complex data sets. The fundamentals of the implementation of database management systems must be understood by all Computer Science students. This will help students to develop and design software systems utilizing databases, and equip students with the knowledge of managing data of large scale. Moreover, this should be understood by current and future business leaders so that they can offer strategic guidance based on an informed understanding of database business capabilities. This course provides the basis for achieving this goal.

Intended Learning Outcomes (ILO)

This course introduces the basic concepts and methods of implementing a data management system. Upon the successful completion of this course, you shall be able to:

1. Discuss the importance of, and uses for, databases within organizations.
2. Explain how a relational database is implemented.
3. Describe the principles behind commercial databases and how to manage a relational database system.
4. Communicate knowledgeably about data management using professional language

CE4032 and CZ4032 – Data Analytics and Mining

Course Code	CE/CZ4032							
Course Title	Data Analytics and Mining							
Pre-requisites	CE/CZ2001 Algorithms							
Pre-requisite for	NIL							
No of AUs	3							
Contact Hours	Lectures	24	TEL	0	Tutorials	13	Student presentations	4

Course Aims

In the era of big data, large quantities of data are being accumulated. The amount of data collected is said to double every nine months. Seeking knowledge from massive data is one of the most desired attributes of Data Mining. In general, there is a huge gap from the stored data to the knowledge that could be construed from the data. This transition will not occur automatically, that is where Data Mining comes into picture. In Exploratory Data Analysis, some initial knowledge is known about the data, but Data Mining could help in a more in-depth knowledge about the data. Courses on Database systems give methods to extract information, but they fail to extract knowledge that is actionable.

Manual data analysis has been around for some time now, but it creates a bottleneck for large data analysis. Fast developing computer science and engineering techniques and methodology generates new demands. Data mining techniques are now being applied to all kinds of domains, which are rich in data. Although data mining is partly based on statistical methods, data mining methods give a lot more than the statistical methods. Data mining methods are to a large extent based on machine learning methods. The difference is data mining is meant for huge data whereas machine learning is usually done over relatively small-sized data. Huge data brings completely a new set of problems to be solved.

This course aims to introduce you to the exciting and ever-evolving world of data analytics and mining.

Intended Learning Outcomes (ILO)

This course introduces data mining at an elementary level. Upon the successful completion of this course, you shall be able to:

1. Discuss basic concepts and general knowledge of data analytics, data mining and the KDD process, using professional language associated with data analytics and data mining
2. Pre-process the data so that it can be analyzed further using sophisticated data analytics and mining algorithms
3. Discuss several major data mining tasks (including classification, clustering, and association rule mining, etc) and related algorithms to solve them
4. Apply data mining techniques to tackle real-world big data applications, to perform core data analytics & mining tasks with large amount of data.

CE4034 and CZ4034 – Information Retrieval

Course Code	CE/CZ4034							
Course Title	Information Retrieval							
Pre-requisites	CE/CZ2001 Algorithms							
Pre-requisite for	NIL							
No of AUs	3							
Contact Hours	Lectures	23	TEL	0	Tutorials	8	Student presentations	0

Course Aims

This course aims to involve students in a technical way to understand and build information retrieval systems. They were expected to master the basic concepts and building blocks for information retrieval systems. In addition, applications in artificial intelligence were also introduced to get students acquainted with state of the arts.

Intended Learning Outcomes (ILO)

This course introduces information retrieval at an elementary level. Upon the successful completion of this course, you shall be able to:

1. List and explain each of the modules information retrieval system;
2. Code with necessary packages to build a preliminary search engine;
3. Describe and distinguish various retrieval systems;
4. Apply fundamental clustering, classification and web search techniques to solve problems, such as computations and designs.

CE4041 and CZ4041 – Machine Learning

Course Code	CE/CZ 4041							
Course Title	Machine Learning							
Pre-requisites	CE/CZ1011: Engineering Mathematics I CE/CZ1007: Data Structures							
No of AUs	3							
Contact Hours	Lectures	22	TEL	0	Tutorials	10	Student presentations	6

Course Aims

This course provides an introductory but broad perspective of machine learning fundamental algorithms, and is relevant for anyone pursuing a career in AI or Data Science. It aims to provide you with the essential concepts and principles of algorithms in machine learning so that you can use various machine learning techniques to solve real-world application problems.

Intended Learning Outcomes (ILO)

This course introduces machine learning at an elementary level. Upon the successful completion of this course, you shall be able to:

1. Explain the motivations and principles behind various machine learning algorithms;
2. Apply or even design specific machine learning algorithms to solve real-world application problems;
3. Identify some state-of-the-art machine learning techniques.
4. Conduct research on machine learning.

CE4062 and CZ4062 – Computer Security (System Security)

Course Code	CE/CZ4062							
Course Title	Computer Security (System Security)							
Pre-requisites	CE/CZ2005 Operating Systems							
Pre-requisite for	NIL							
No of AUs	3							
Contact Hours	Lectures	26	TEL	0	Tutorials	13	Student presentations	0

Course Aims

This course aims to equip you with foundational knowledge on issues and techniques required for the cyber security.

You will have the knowledge of different security policies and security models, and have the ability to recognise security features and discover pitfalls in computing systems, including the operating system and softwares.

Intended Learning Outcomes (ILO)

Upon successful completion of this course, you should be able to:

1. Explain the principles of access control and security models in computer systems.
2. Interpret different security mechanisms in modern operating systems.
3. Distinguish different vulnerabilities associated with computer systems.
4. Reproduce and detect vulnerable scenarios in existing software.

CE4071 and CZ4071 – Network Science

Course Code	CE/CZ4071							
Course Title	Network Science							
Pre-requisites	CE/CZ2001 Algorithms							
Pre-requisite for	-							
No of AUs	3							
Contact Hours	Lectures	26	TEL	0	Tutorials	13	Student presentations	0

Course Aims

We live in a world where we are surrounded by systems that are incredibly complex, from the society, a collection of billions individuals, to communications systems, integrating billions of devices, from computers to cell phones. In fact, the existence of living beings in this planet depends on the ability of thousands of proteins to work together in a seamless fashion. Furthermore, our ability to comprehend our surroundings is heavily influenced by the activity of billions of neurons in our brain. Such *complex systems* can be represented as static or dynamic *networks* of many interacting components. These components are typically much simpler in terms of behavior or function than the overall system, implying that the additional complexity of the latter is an *emergent network property*.

Network science is a new discipline that investigates the topology and dynamics of such complex networks, aiming to better understand the behavior, function and properties of the underlying systems. In this course, we will study algorithmic, computational, and statistical methods of network science, as well as its applications in solving real-world problems in communications, biology, sociology, and cyber security. The specific topics include network metrics, properties, and models, network querying and analytics, network dynamics, and distributed graph engines. Another pervasive goal of this course is to guide students into the future by presenting research that reveals the “next big thing” in network science.

Intended Learning Outcomes (ILO)

This course introduces network science at a foundation level. Upon the successful completion of this course, you shall be able to:

1. Explain the importance of, and uses for, network science in human society;
2. Describe various network analysis metrics;
3. Describe various static and dynamic properties and models of real-world networks;
4. Formulate basic network search queries and evaluate these in order to search and analyse underlying network data;
5. Describe the working and usage of various network analytics algorithms;
6. Describe the architecture and characteristics of distributed graph engines;
7. Explain the significance of network science models, properties, and algorithms in today's world;

CE4073 and CZ4073 – Data Science for Business

Course Code	CE/CZ4073							
Course Title	Data Science for Business							
Pre-requisites	CE/CZ1007 Data Structures; CE/CZ1011 Engineering Mathematics I							
Pre-requisite for	NIL							
No of AUs	3							
Contact Hours	Lectures	20	TEL	0	Tutorials	9	Presentations	0

Course Aims

Summary: “Data is the new Oil” in the modern era of Information. It is of paramount importance in each sector of Business to collect, maintain, visualize, explore, analyse, and model data, in every form and shape, to garner crucial inferential information about the scope and target audience, performance and potential optimizations, predictions and forecasting, as well as practical data-driven business decisions.

The Aim: This elective course in Computer Science and Engineering aims to introduce you, hands-on, to the core techniques of data manipulation, visualization, statistical modelling, inference, and digital data presentation, which constitute the business analytics toolbox for any practicing Data Scientist in the industry in order to make fundamental data-driven decisions in diverse Business scenarios.

Intended Learning Outcomes (ILO)

By the end of the semester, the students should be able to

1. Recognize and identify data-oriented problems in practical Business scenarios,
2. Discuss and explain the type of data required to solve the aforesaid problems,
3. Illustrate and articulate aforesaid problems in terms of relevant data exploration,
4. Devise machine learning models for prediction, classification, clustering, forecasting,
5. Assess and justify the inferential information extracted from data using the models,
6. Compose an engaging “data-story” to communicate the problem and the inference.