



GALGOTIAS
UNIVERSITY

**School of Computing
Science and Engineering**

Program: B.Sc.

Course Code: BSCS2312

Course Name: Database Management
System

Vision

To be known globally as a premier department of Computer Science and Engineering for value-based education, multidisciplinary research and innovation.

Mission

- ❑ **M1:** Developing a strong foundation in fundamentals of computing science with responsiveness towards emerging technologies.
- ❑ **M2:** Establishing state-of-the-art facilities and adopt education 4.0 practices to analyze, develop, test and deploy sustainable ethical IT solutions by involving multiple stakeholders.
- ❑ **M3:** Establishing Centers of Excellence for multidisciplinary collaborative research in association with industry and academia.

Course Outcomes (COs)

CO Number	Title
CO1	Understand the basic concepts, modeling techniques and architecture of DBMS (K2).
CO2	Apply the concept of ER Model and SQL programming using DDL and DML commands (K3).
CO3	Able to store and analyze data into normalized format. (K4).
CO4	Analyze the transaction processing concept and recovery methods in database (K4)
CO5	Examine the concept of concurrency control techniques in database (K4).
CO6	List out the various contemporary research areas and database tools (K2).

Program Outcomes (POs)

PO Number	Title
PO1	Computing Science Knowledge: Apply the knowledge of mathematics, statistics, computing science and information science fundamentals to the solution of complex computer application problems.
PO2	Problem Analysis: Identify, formulate, review research literature, and analyze complex computing science problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and computer sciences.
PO3	Design/development of Solutions: Design solutions for complex computing problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Program Outcomes (POs)

PO Number	Title
PO4	Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern computing science and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	IT specialist and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional computing science and information science practice environmental considerations.

Program Outcomes (POs)

PO Number	Title
PO7	Environment and Sustainability: Understand the impact of the professional computing science solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the computing science practice
PO9	Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Program Outcomes (POs)

PO Number	Title
P10	Communication: Communicate effectively on complex engineering activities with the IT analyst community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project Management and Finance: Demonstrate knowledge and understanding of the computing science and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO12	Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent

Program Specific Outcomes (PSO)

PSO Number	Title
PSO1	Ability to work with emerging technologies in computing requisite to Industry 4.0
PSO2	Demonstrate Computing science Practice learned through industry internship to solve live problems in various domains.

Program Educational Objectives (PEOs)

PEO Number	Title
PEO1	Be engaged with leading Global Software Services and Product development companies handling projects in cutting edge technologies.
PEO2	Engaged in technical or managerial roles at Government firms, Corporates, Start-ups or contribute to the society as successful entrepreneurs.
PEO3	Undertake higher education, research or academia at institutions of transnational reputation.

Course Prerequisites

- Knowledge of Mathematics**
- Query Languages**

Syllabus

Unit 1 - Introduction

(6 hours)

- An Overview of Database Management System
- Database System vs File System
- Database System Concept and Architecture
- Data Model Schema and Instances
- Overall Database Structure

Unit 2 – ER Modeling & SQL

(10 hours)

- ER Model Concepts, Notation for ER diagram
- Mapping Constraints
- Keys, Concepts of Super Key, Candidate Key, Primary Key
- Generalization- Aggregation
- Reduction of an ER Diagrams to Tables, Extended ER Model
- Relational Algebra
- Introduction to SQL, DDL, DML, Basic Queries, Complex SQL Queries, Views
- Keys, Concepts of Super Key, Candidate Key, Primary Key

Syllabus

Unit 3 - Database Normalization

(8 hours)

- Functional Dependencies
- Normal Forms- Firsts, Second
- Third Normal Forms, BCNF
- Inclusion Dependence
- Loss Less Join Decomposition

Unit 4 - Transaction Processing Concept

(8 hours)

- Transaction System
- Testing of Serializability
- Serializability of Schedules
- Conflict & View Serializable Schedule
- Recoverability, Recovery from Transaction Failures
- Log based Recovery
- Checkpoints, Deadlock Handling

Syllabus

Unit 5 - Concurrency Control Techniques

(7 hours)

- Concurrency Control
- Locking Techniques for Concurrency Control
- Time Stamping Protocols for Concurrency Control
- Validation based Protocol
- Multiple Granularity
- Validation based Protocol

Unit 6 - Advancement & Research

(4 hours)

- Meaning and Objectives of Research
- Basic idea of Publication
- Databases in the Cloud/Platform as a Service
- Contemporary research applications in database domains

Recommended Books

Text books

- ❑ Abraham Silberschatz, Henry F. Korth and S. Sudarshan- “Database System Concepts”, Fourth Edition, McGraw-Hill, 2002.

Reference Book

- ❑ Ramez Elmasri and Shamkant B. Navathe, “Fundamental Database Systems”, Third Edition, Pearson Education, 2003.
- ❑ Raghu Ramakrishnan, “Database Management System”, Tata McGraw- Hill Publishing Company, 2003.
- ❑ Hector Garcia–Molina, Jeffrey D.Ullman and Jennifer Widom- “Database System Implementation”- Pearson Education- 2000
- ❑ Peter Rob and Corlos Coronel- “Database System, Design, Implementation and Management”, Thompson Learning Course Technology- Fifth edition, 2003

Additional online materials

- ❑ Coursera - <https://www.coursera.org/learn/database-management>
- ❑ NPTEL- <https://nptel.ac.in/courses/106/105/106105175/>
- ❑ <https://www.coursera.org/learn/research-methods>
- ❑ <https://www.coursera.org/browse/physical-science-and-engineering/research-methods>

Data

- ❑ Data is collection of unstructured facts and figures about the object of interest.
- ❑ For e.g. data about an employee would include information like name, address, age, educational qualifications etc.
- ❑ For example, take yourself. You may be 5ft tall, have brown hair and blue eyes. All of this is “data”. You have brown hair whether this is written down somewhere or not.



Figure 1: Example of Data

Requirement Meet by Data

Requirement

Description

Integrity

Data should be accurate e.g. my LinkedIn profile should contain valid country name.

Availability

I should be able to access LinkedIn and see my data at all times.

Security

Only my friends should be able to see my posts and no one else.

Independent of
Application

I should be able to access the same data from my Android app as well as from web browser on my laptop.

Concurrency

All my friends should be able to see my posts at the same time.

Information

- Systematic and meaningful form of data.
- Information allows us to expand our knowledge beyond the range of our senses. We can capture data in information, then move it about so that other people can access it at different times.
- If I take a picture of you, the photograph is information. But what you look like is data.
- Information helps human beings in their decision making.



Figure 2: Example of Information

Knowledge

- ❑ Knowledge is information processed in the mind of individual.
- ❑ It gives answers to “Why and how”, “Know how”, “Truth and beliefs” and “judgments”
- ❑ Think of this as the map of the World we build inside our brains. Like a physical map, it helps us know where things are – but it contains more than that. It also contains our beliefs and expectations.



Figure 3: Example of Knowledge

Data, Information and Knowledge

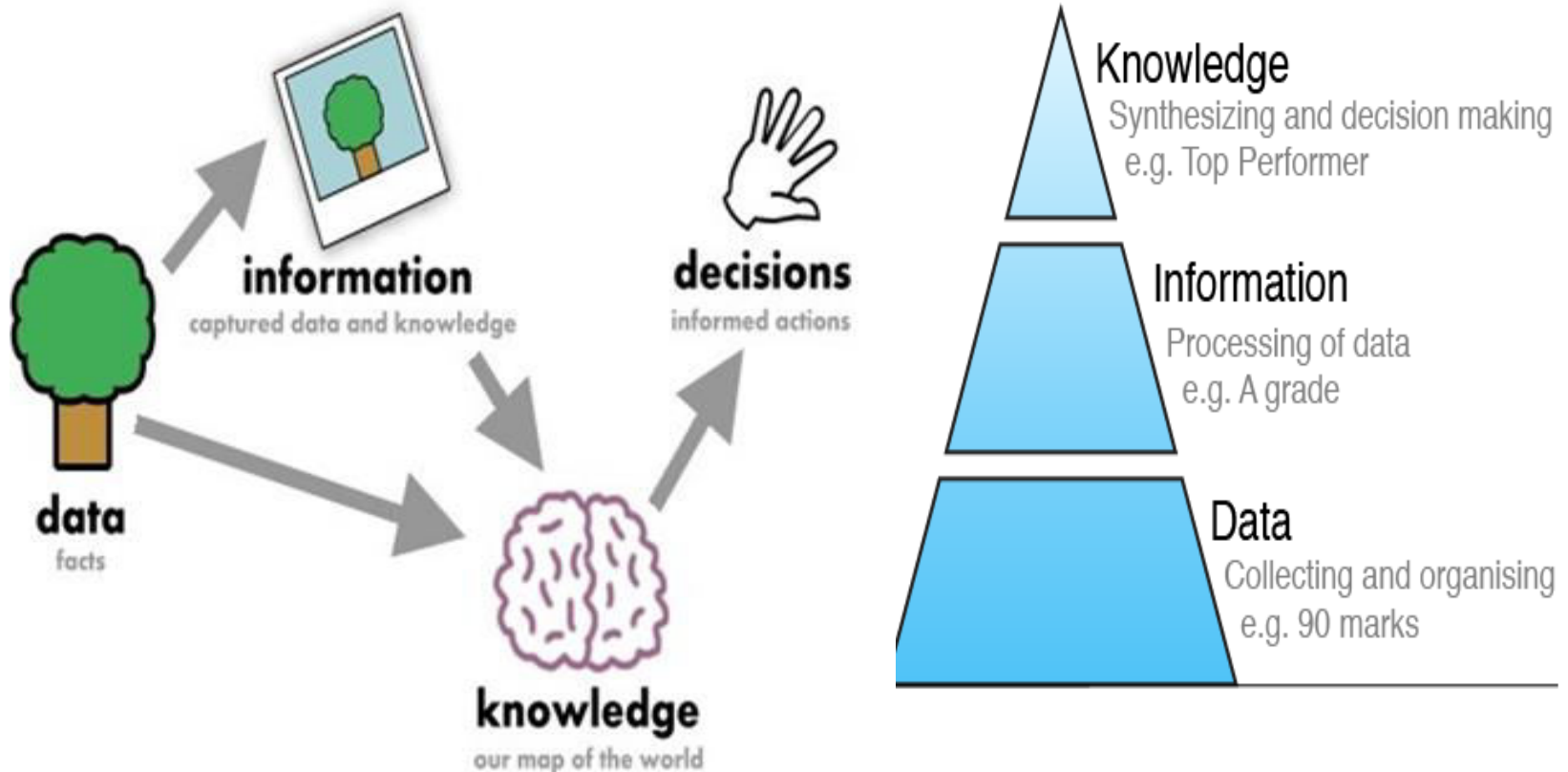


Figure 4: Example of Data, Information and Knowledge

Database

- ❑ A repository of logically related and similar data.
- ❑ An organized collection of related information so that it can easily be accessed, managed and updated.
- ❑ It is supposed to meet the requirements of different users of an organization.
- ❑ A self describing collection of integrated records.
- ❑ Example includes Dictionary, Airline Database, Student Database, Library, Railways Timetable, YouTube (All songs of Mohd. Rafi, Jagjeet Singh)



Figure 5: Example of Database

Database Management System (DBMS)

- ❑ A set of programs to access the interrelated data.
- ❑ DBMS provides an interface to perform various operations like database creation, storing data in it, updating data, creating a table in the database.
- ❑ It provides protection and security to the database. In the case of multiple users, it also maintains data consistency.
- ❑ Example includes MySQL, Oracle, IBM's DB2, Microsoft's SQL Server, MS-Access etc are a very popular commercial database which is used in different applications.



Figure 6: Example of DBMS

Characteristics of DBMS

- Provides security and removes redundancy
- Self-describing nature of a database system
- Insulation between programs and data abstraction
- Support of multiple views of the data
- Sharing of data and multiuser transaction processing
- DBMS allows entities and relations among them to form tables.
- It follows the ACID concept (Atomicity, Consistency, Isolation, and Durability).
- DBMS supports multi-user environment that allows users to access and manipulate data in parallel.

Advantages of DBMS

- ❑ **Controlling Data Redundancy:** Data is recorded in only one place in the database and it is not duplicated.
- ❑ **Data Consistency:** Data item appears only once, and the updated value is immediately available to all users.
- ❑ **Control Over Concurrency:** In a computer file-based system in updating, one may overwrite the values recorded by the other.
- ❑ **Backup and Recovery Procedures:** automatically create the backup of data and restore data if required.
- ❑ **Data Independence:** Separation of data structure of database from application program that uses the data is called data independence.

Disadvantages of DBMS

- ❑ **Cost of Hardware and Software:** Processor with high speed of data processing and memory of large size is required.
- ❑ **Cost of Data Conversion:** Very difficult and costly method to convert data of data file into database.
- ❑ **Cost of Staff Training:** A lot of amount for the training of staff to run the DBMS.
- ❑ **Appointing Technical Staff:** Trained technical persons such as database administrator, application programmers, data entry operators etc. are required to handle the DBMS.
- ❑ **Database Damage:** All data is integrated into a single database. If database is damaged due to electric failure or database is corrupted on the storage media, then your valuable data may be lost forever.

Questions

- Illustrate data, information and knowledge with example.
- Explain the advantage of DBMS.
- Explain the disadvantage of DBMS.
- List four significant characteristics if a DBMS?



Thank You