



PARSHVANATH CHARITABLE TRUST'S

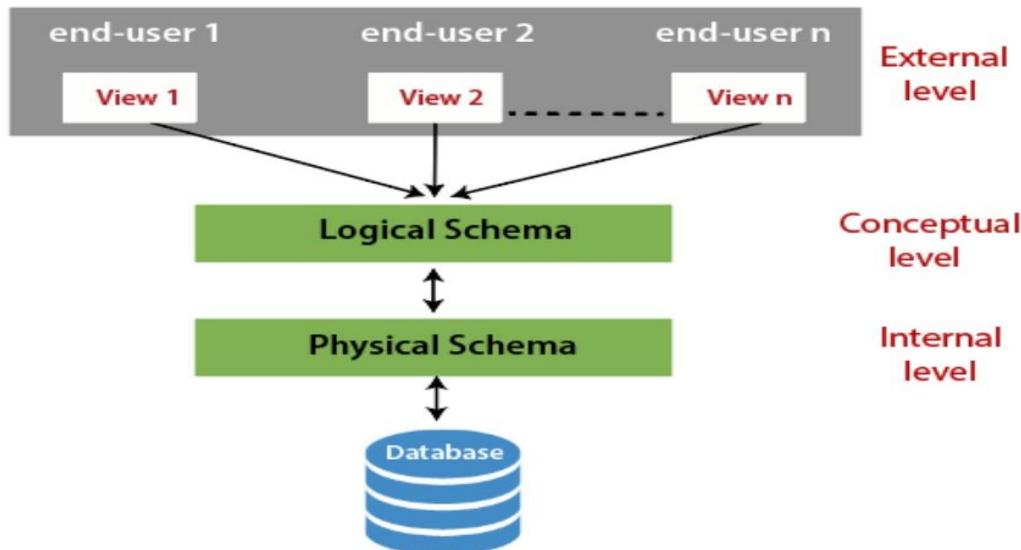
A. P. SHAH INSTITUTE OF TECHNOLOGY

Department of Information Technology

(NBA Accredited)



Q.1) Explain the 3-Level Architecture Schema?



1.External or View level:

This is the highest level of database abstraction. External or view level describes the actual view of data that is relevant to the particular user. This level also provides different views of the same database for a specific user or a group of users. An external view provides a powerful and flexible security mechanism by hiding the parts of the database from a particular user.

2. Conceptual or Logical level:

The conceptual level describes the structure of the whole database. This level acts as a middle layer between the physical storage and user view. It explains what data to be stored in the database, what relationship exists among those data, and what the datatypes are. There is only one conceptual schema per database. This level does not provide any access or storage details but concentrates on the relational model of the database.

3. Internal or Physical level:

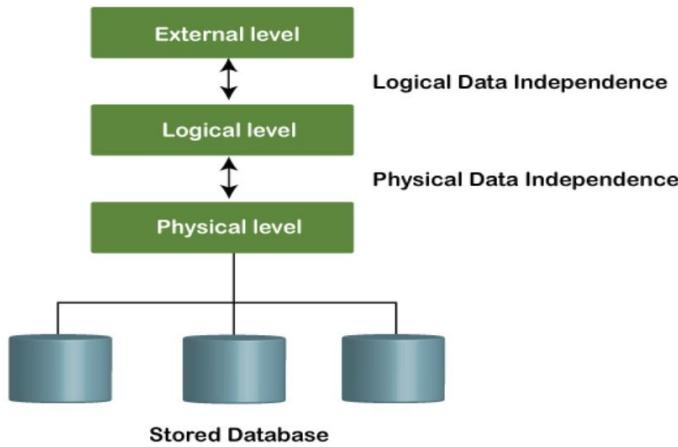
This is the lowest level of database abstraction. It describes how the data is actually stored in the database and provides methods to access data from the database. It allows viewing the physical representation of the database on the computer system. **Advantages of Three-schema Architecture**

- This architecture makes the database abstract. It is used to hide the details of how data is physically stored in a computer system, which makes it easier to use for a user.
- This architecture allows each user to access the same database with a different customized view of data.



- This architecture enables a database admin to change the storage structure of the database without affecting the user currently on the system.

Q.2) Explain the term Data Independence?



Definition: Capacity to change the schema at one level of a database system without having to change the schema at the next higher level.

Logical Data Independence

Logical Data Independence is a term that changes the schema at the conceptual level without having to modify the external level or application program. The external or user view would not be affected when there is any change in conceptual view data.

This data independence is mainly used for separating the external schema from the schema at the conceptual level. Modifications at the logical level are compulsory when there is any modification in the logical structure of the database.

Following are the examples of logical data independence, which will not affect the external or user view:

1. We can easily break the existing record into more than two records.
2. We can also combine the two records into one.
3. We can easily modify, delete or insert the attribute.

Physical Data Independence

Physical Data Independence is another type of data independence that alters the schema at the internal/ physical level without having to alter the schema at the conceptual level. The conceptual



PARSHVANATH CHARITABLE TRUST'S

A. P. SHAH INSTITUTE OF TECHNOLOGY

Department of Information Technology

(NBA Accredited)



structure of the database systems will not be affected if there is any modification in the storage size of the database .This data independence is mainly used for separating the internal schema from the schema at the conceptual level. As compared to the above **data independence**, this data independence can be achieved easily.

Following are the examples of physical data independence, which will not affect the conceptual view:

1. We can modify the indexes in the database system.
2. We can easily modify the data structure, which is used for storage.

Presented by Prof. Charul Singh



PARSHVANATH CHARITABLE TRUST'S
A. P. SHAH INSTITUTE OF TECHNOLOGY

Department of Information Technology

(NBA Accredited)



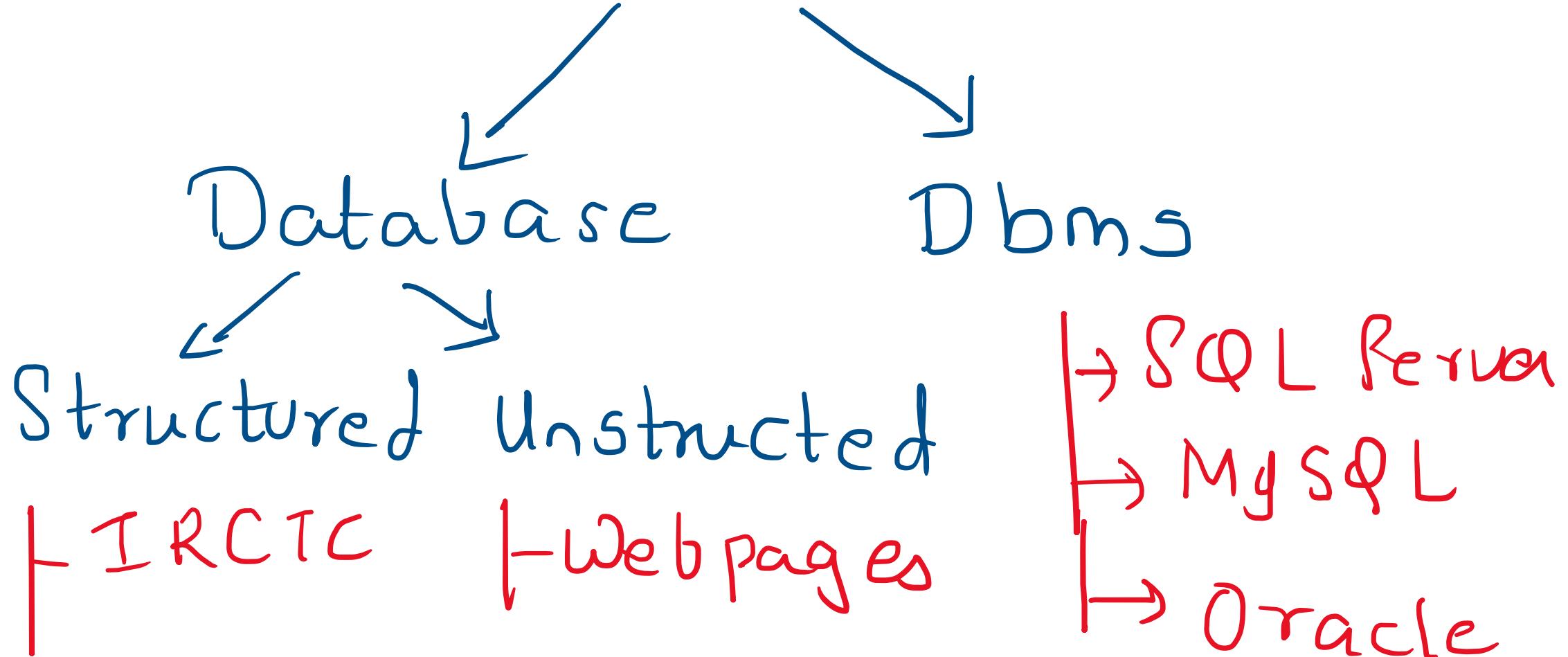
Chapter 1: Introduction

----Presented by: Prof. Charul Singh

Outline

- Database System
- Database System Examples
- File System v/s Database system
- Three-level schema architecture/ Data Abstraction
- Data Independence
- Data Models
- Users
- DBA
- DBMS Architecture

Database System



Database Systems

- DBMS contains information about a particular enterprise
 - Collection of interrelated data
 - Set of programs to access the data
 - An environment that is both *convenient* and *efficient* to use
- Database systems are used to manage collections of data that are:
 - Highly valuable
 - Relatively large
 - Accessed by multiple users and applications, often at the same time.
- A modern database system is a complex software system whose task is to manage a large, complex collection of data.
- Databases touch all aspects of our lives

Database Example

Applications are
University

- Add new students, instructors, and courses
- Register students for courses, and generate class rosters
- Assign grades to students, compute grade point averages (GPA) and generate transcripts
- Enterprise Information
 - Sales: customers, products, purchases
 - Accounting: payments, receipts, assets
 - Human Resources: Information about employees, salaries, payroll taxes.

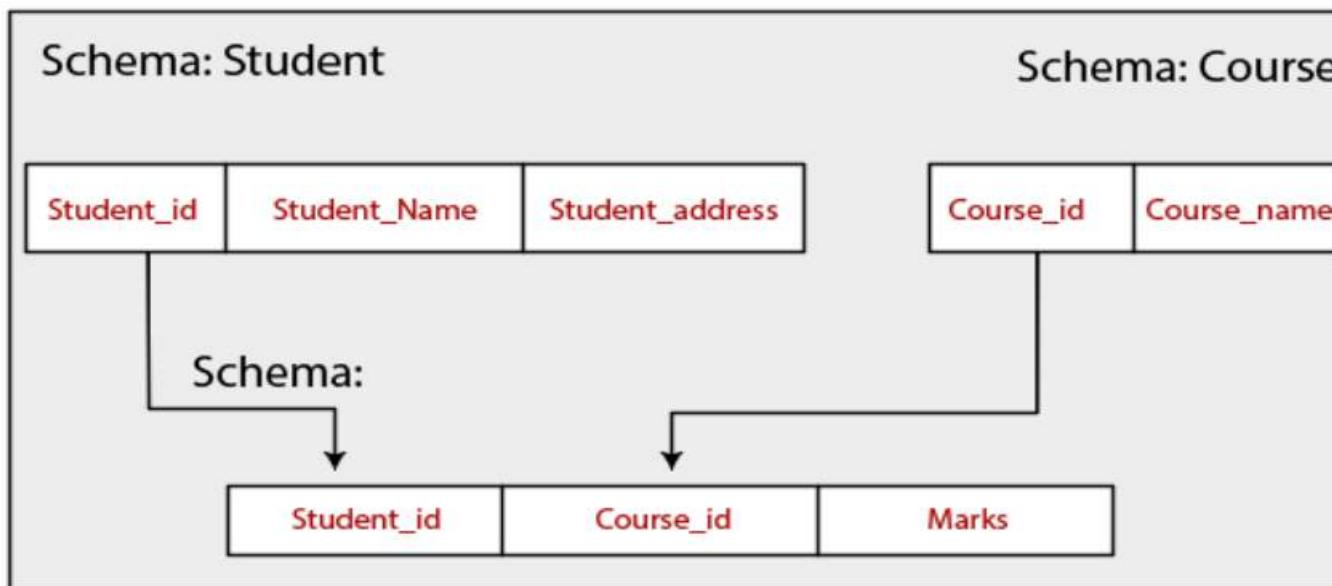
File System v/s Database system

- Data redundancy and inconsistency
 - Multiple file formats, duplication of information in different files
- Difficulty in accessing data
 - Need to write a new program to carry out each new task
- Data isolation — multiple files and formats
- Integrity problems
 - Integrity constraints (e.g., account balance > 0) become “buried” in program code rather than being stated explicitly
 - Hard to add new constraints or change existing ones

- Atomicity of updates
 - Failures may leave database in an inconsistent state with partial updates carried out
 - Example: Transfer of funds from one account to another should either complete or not happen at all
 - Concurrent access by multiple users
 - Concurrent access needed for performance
 - Uncontrolled concurrent accesses can lead to inconsistencies
 - Example: Two people reading a balance (say 100) and updating it by withdrawing money (say 50 each) at the same time
 - Security problems
 - Hard to provide user access to some, but not all, data
-
- **Database systems offer solutions to all the above problems**

Schema

- It is a logical representation of data that appears in the database management system.
- In simple words, a schema is the structure of any database.
- It defines how the data is stored in a database and relationship among those data, but it does not show the data available in those tables.
- it can only be modified or changed by modifying the DDL statements.



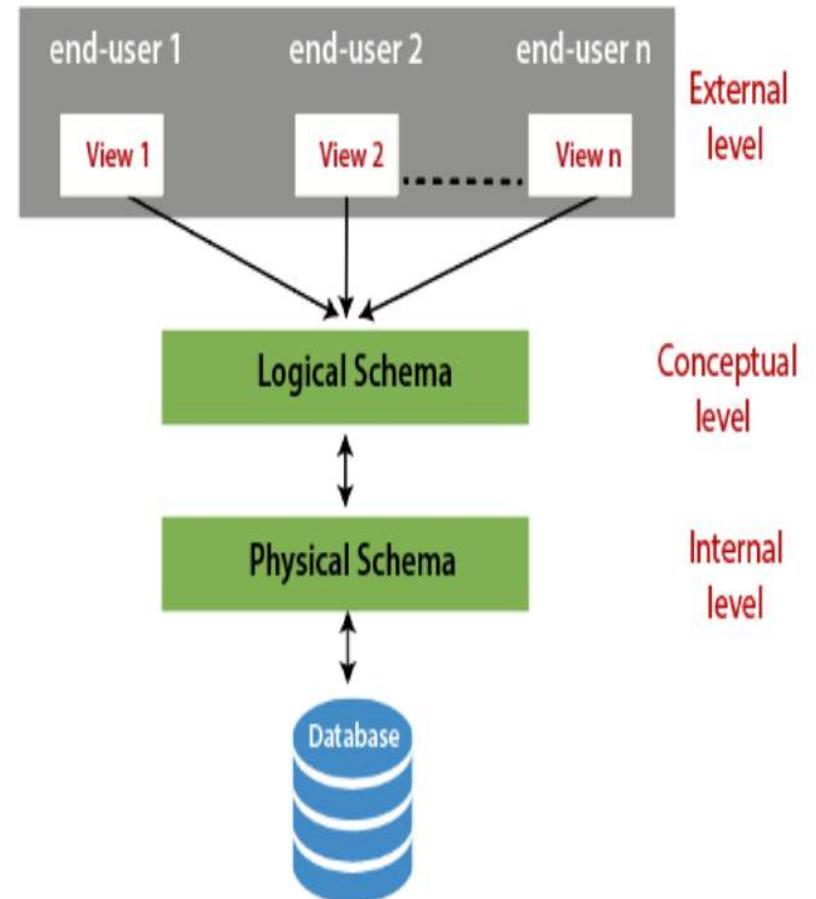
Three-Levels Schema Architecture/ Data Abstraction

Goal: To separate the user applications and the physical database.

3 Levels:

Internal Level:

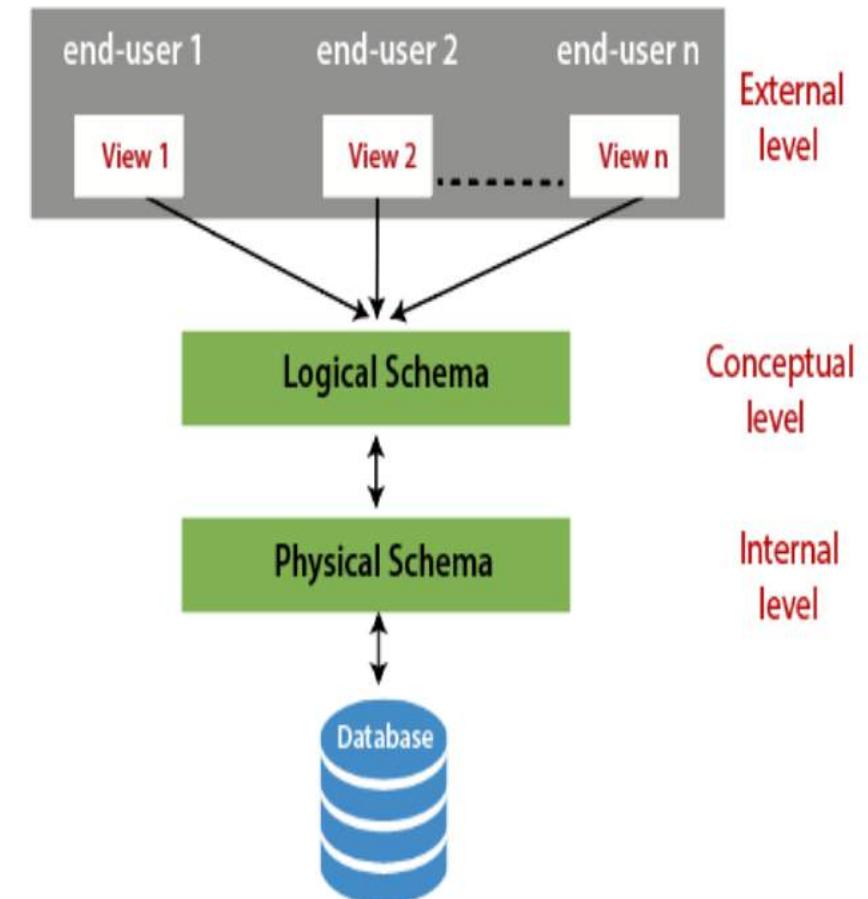
- Describes the physical storage structure Of the database.
- Describes complete details of data storage and access paths



Three-Levels Schema Architecture/ Data Abstraction

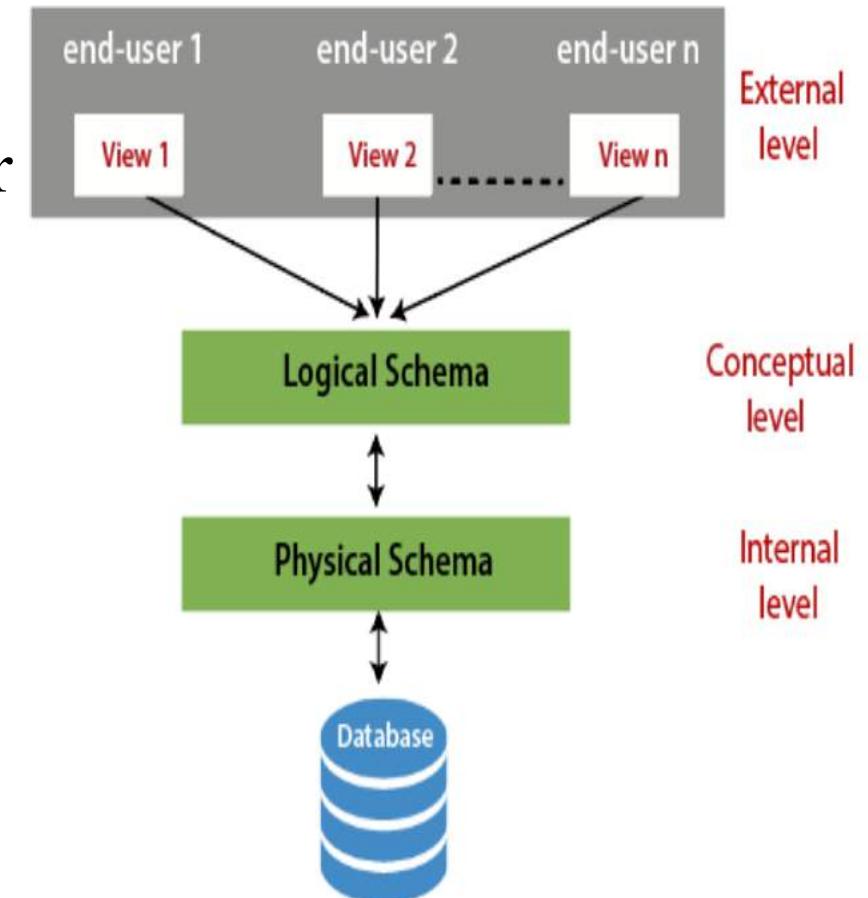
Conceptual Level:

- Hides the details of the physical storage Structure and concentrate on describing Entities, data types, relationships, constraints, etc



Three-Levels Schema Architecture/ Data Abstraction

- External Level:
 - Describes the part of the database that a user is interested in and hides the rest of the Database from the user group.



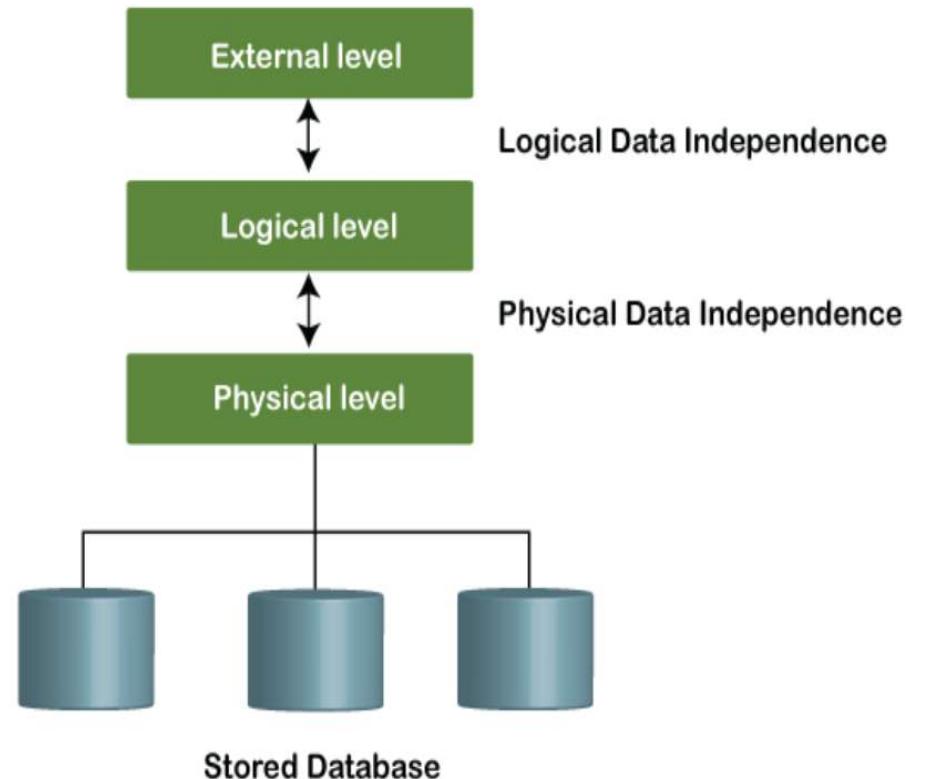
Advantages of Three-schema Architecture

- This architecture makes the database abstract. It is used to hide the details of how data is physically stored in a computer system, which makes it easier to use for a user.
- This architecture allows each user to access the same database with a different customized view of data.
- This architecture enables a database admin to change the storage structure of the database without affecting the user currently on the system.

Data Independence

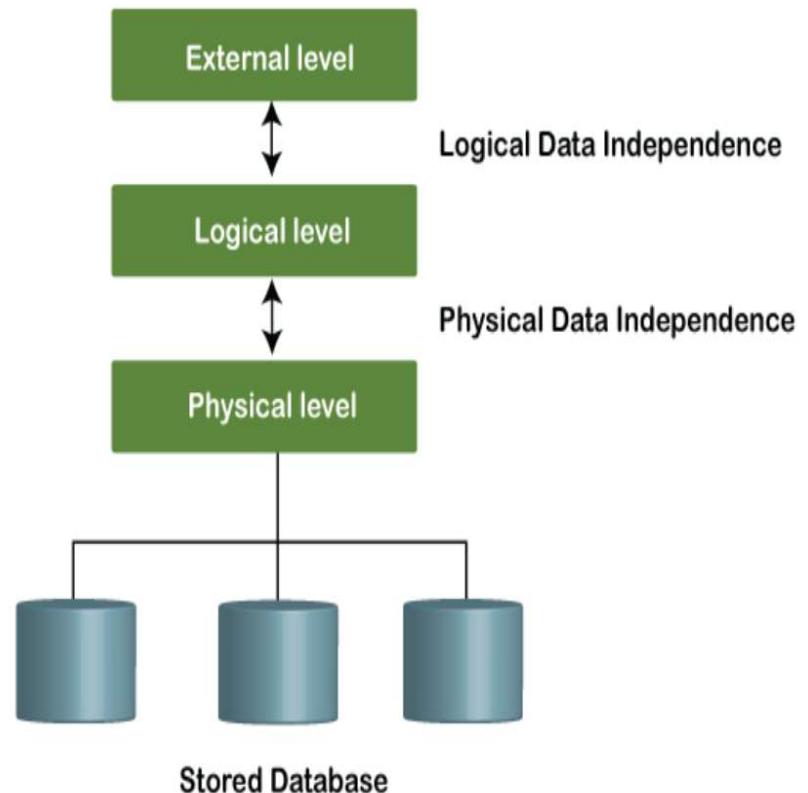
Defn:

- Capacity to change the schema at one level of a database system without having to change the schema at the next higher level.



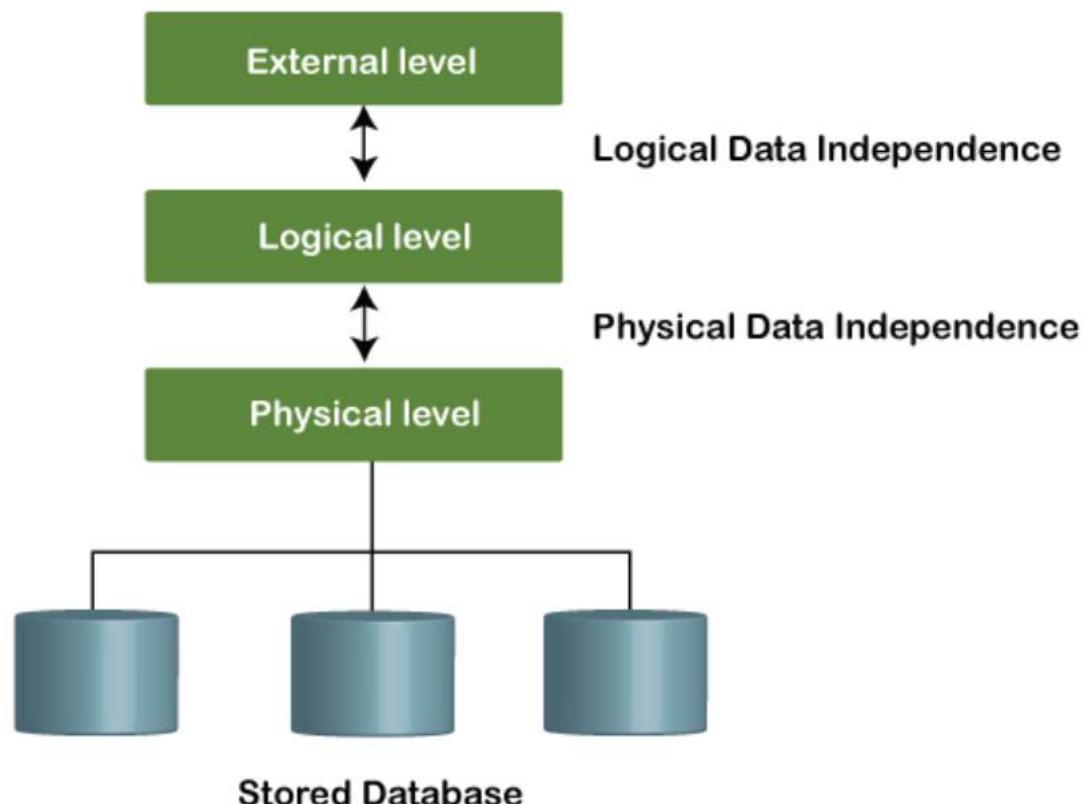
Data Independence

- ❖ Logical Data Independence:
 - Ability to modify the conceptual schema without changing the external schemas or application programs.



Data Independence

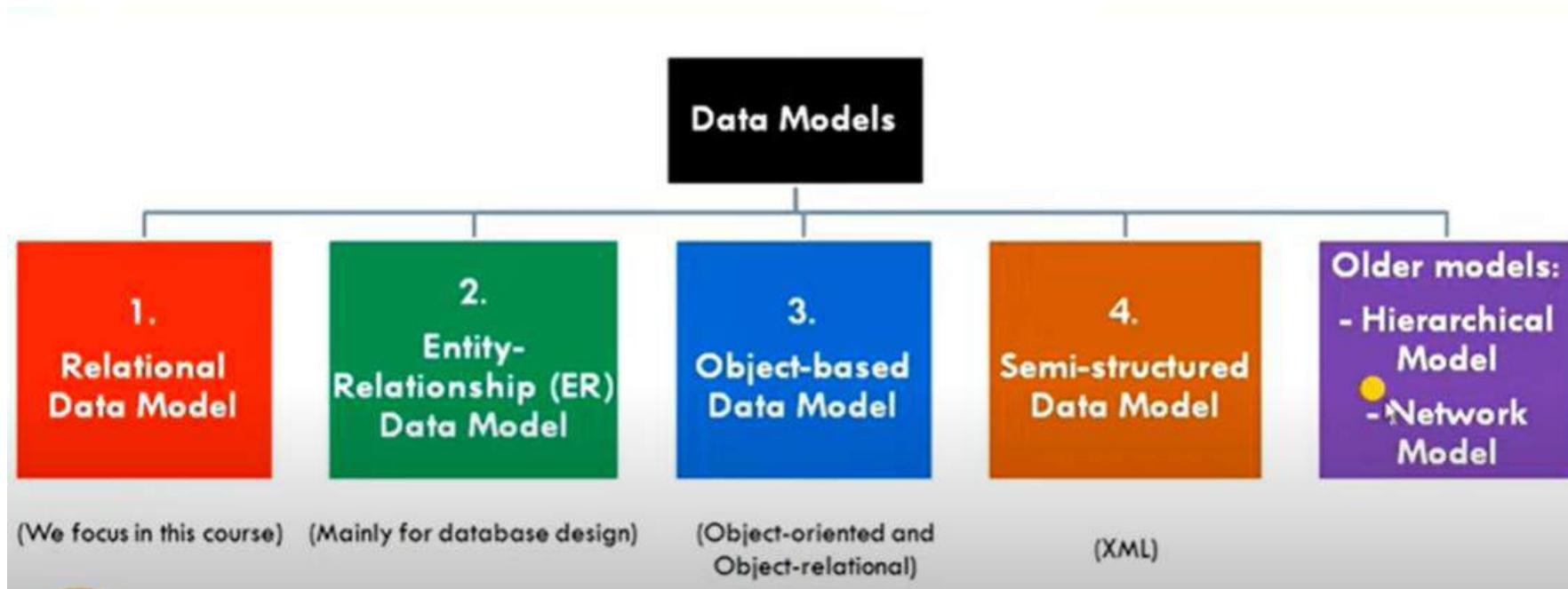
- ❖ Physical Data Independence:
 - Ability to modify the internal schema without changing the Conceptual schema.
 - Changes may be needed to improve the performance.



Data Models in DBMS

- Data Model gives us an idea how the final system will look after its implementation.
- A Data Model in DBMS, is the concept of tools that are developed to summarize the description of the database.
- It defines how the logical structure of a database is modeled,.
- A Data Model is collection of conceptual tools for describing:
 - Data
 - Data Relationships
 - Data semantics
 - Consistency Constraints
- It describes the design of a database at each level of data abstraction.
- It defines how data is connected to each other and how they are processed & stored inside the system

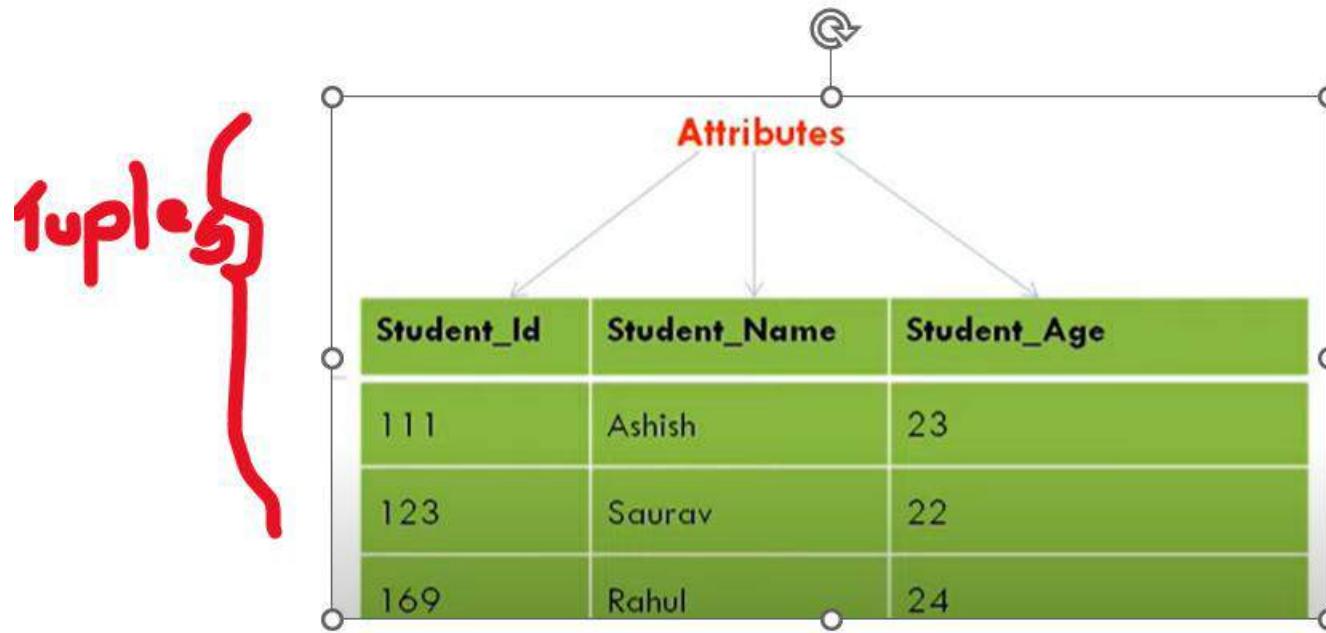
Types of Data Models.



1.Relational Model

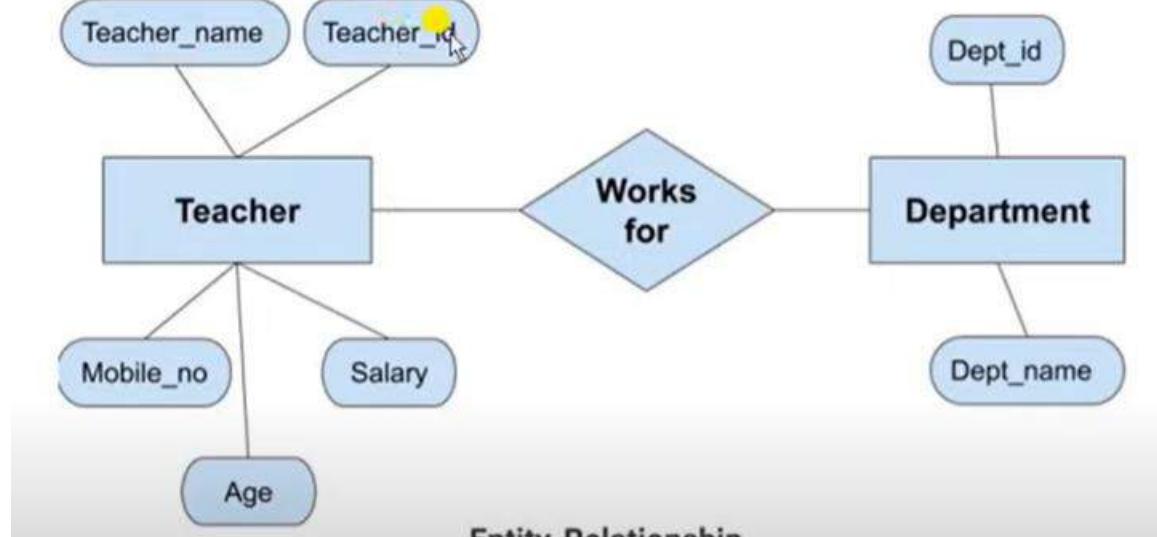
- Most widely used model by commercial data processing applications
- It uses collection of tables for representing data and the relationships among those data.
- Data is stored in tables called Relations
- Each table is a group of column and rows where column represents attribute of an entity and rows represents records(or tuples)

Student Table



2. Entity-Relationships Model (E-R)

- ER model is a high-level data model diagram
- ER model describes the structure of a database with the help of diagram, which is known as Entity-Relationship Diagram(ER Diagram)
- An ER model is a design or blue print of a database that can later be implemented as a database
- It is based on the notion of real –world entities and relationships among them
- ER diagram has the following 3 components:
 - ❖ Entities, Attributes, Relationships

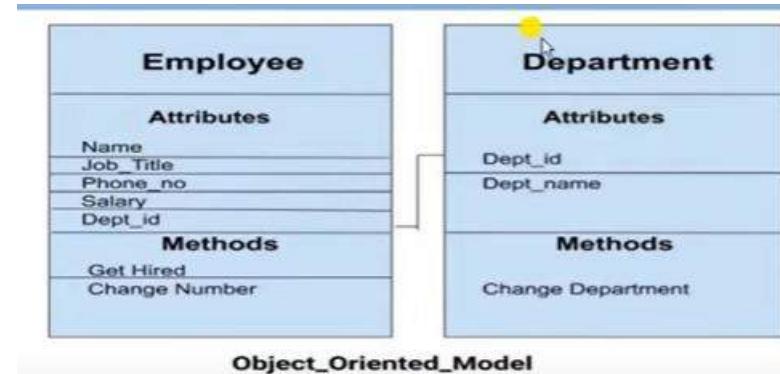


Object –based Data Model

- Two Types:
 1. Object-oriented data model
 2. Object-relational data model

1.Object-oriented data model

- An extension of the Er model with notions of functions, encapsulation, and object identity as well.
- In this model, both the data and relationships are represent are present in a single structure known as an object.
- Two or more objects are connected through links. We use this link to related one object to other objects.



Object-relational data model

- It is a combination of the object-oriented data model and relational data model
- This model was built to fill the gap between object-oriented model and the relational model
- It has many advanced features like complex data types that can be formed using the existing data types.
- The problem with this model is that this can get complex and difficult to handle. So, proper understanding of this model is required.

4.Semi-structued Data model

- Semi-structured model is an evolved form of the relational model.
- The semi-structured data model allows the data specifications at places where the individual data items of the same type may have different sets of attributes.
- In this model, some entities may have missing attributes while others may have an extra attribute.
- This model gives flexibility in storing the data. It also gives flexibility to the attributes.
- Eg: If we are storing any value in any attribute then that vale can be either atomic values or a collection of values.

- The Extensible Markup Language (XML) is widely used for representing the semi-structured data
- In XML we can create use tags and use different makr ups to describe the data

Example: XML or JSON

```
<student 1>
    <Roll. No.>.....</Roll. No.>
    <Name>.....</Name>
    <Class>.....</Class>
    <Age>.....</Age>
</student 1>
```

```
<student 2>
    <Name>.....</Name>
    <Class>.....</Class>
    <Age>.....</Age>
</student 2>
```

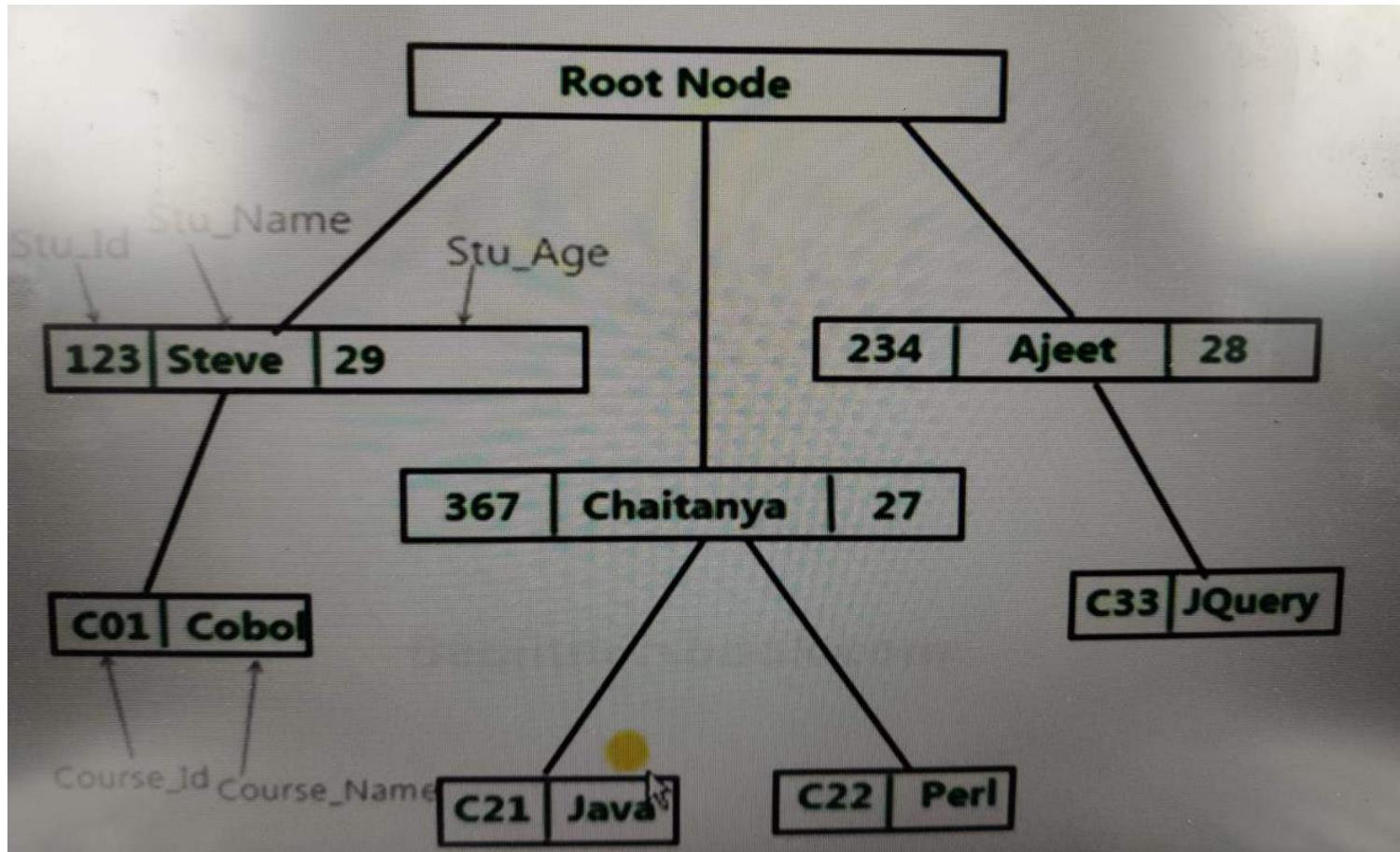
Older Data Models

- Hierarchical Data Model
- Network Data Model
- Hierarchical Data Model & Network Data Model preceded the Relational data model
- But today they are accepted by Relational data model

Hierarchical Data Model

- It was the first DBMS model
- In Hierarchical Data Model , data is organized into a tree like structure with each record having one parent record and many children.
- The main drawback of this model is that, it can have only one to many relationships between nodes.
- Hierarchical Data Model are rarely used now.

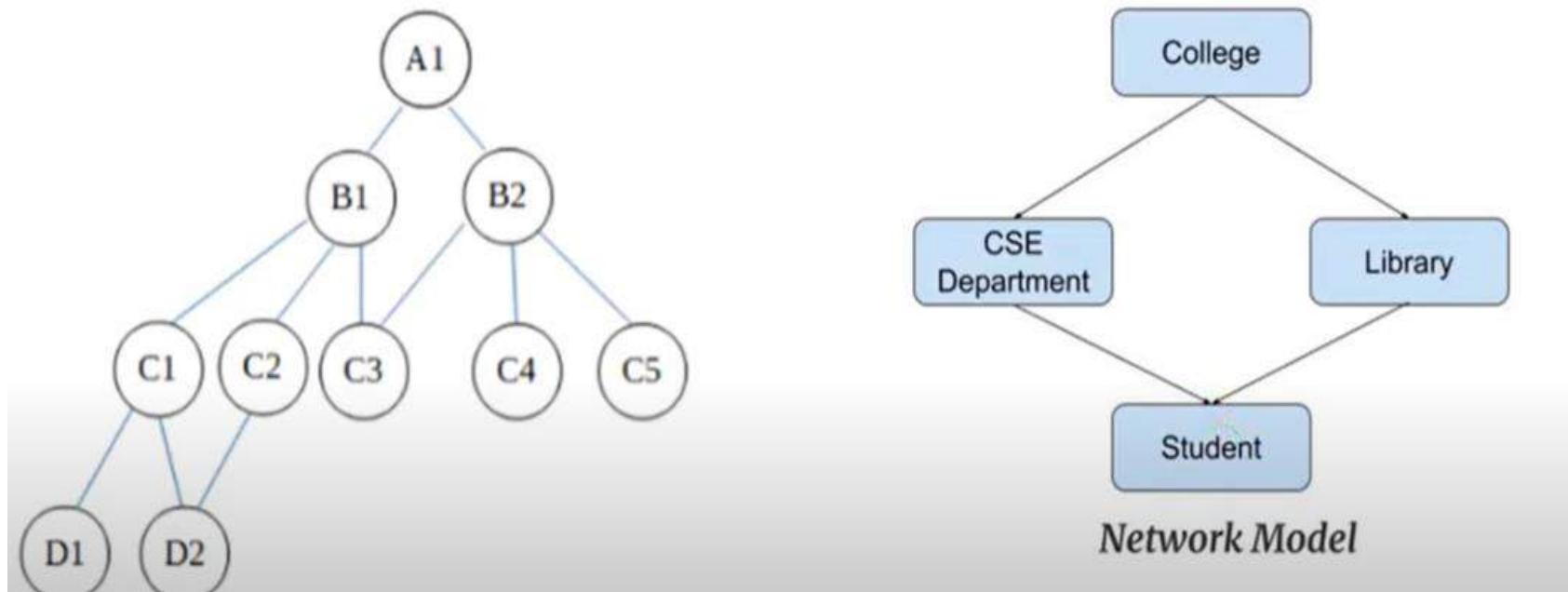
Eg : Hierarchical Data Model



Network Model

- This model is an extension of the Hierarchical Data Model .It was the most popular model before the relational model
- Network Model is a same as Hierarchical Data Model except that it has graph-like structure rather than a tree-based structure and are allowed to have more than one parent node.
- It supports many-to-many data relationships
- This was the most widely used database model,before Relational Model was introduced.

Eg of Network Model



Database users

- Persons who interact with the database and take the benefits of the database
- Users are differentiated by the way expect to interact with the system.
- Four types of users:
- 1. Naive users/ End users
- 2. Application programmers
- 3. Sophisticated users
- 4. Specialized users

1. Naïve users/End users

- They are the unsophisticated users who use the existing application to interact with the database
- Eg: People accessing database over the web, clerical staffs etc

2. Application Programmers:

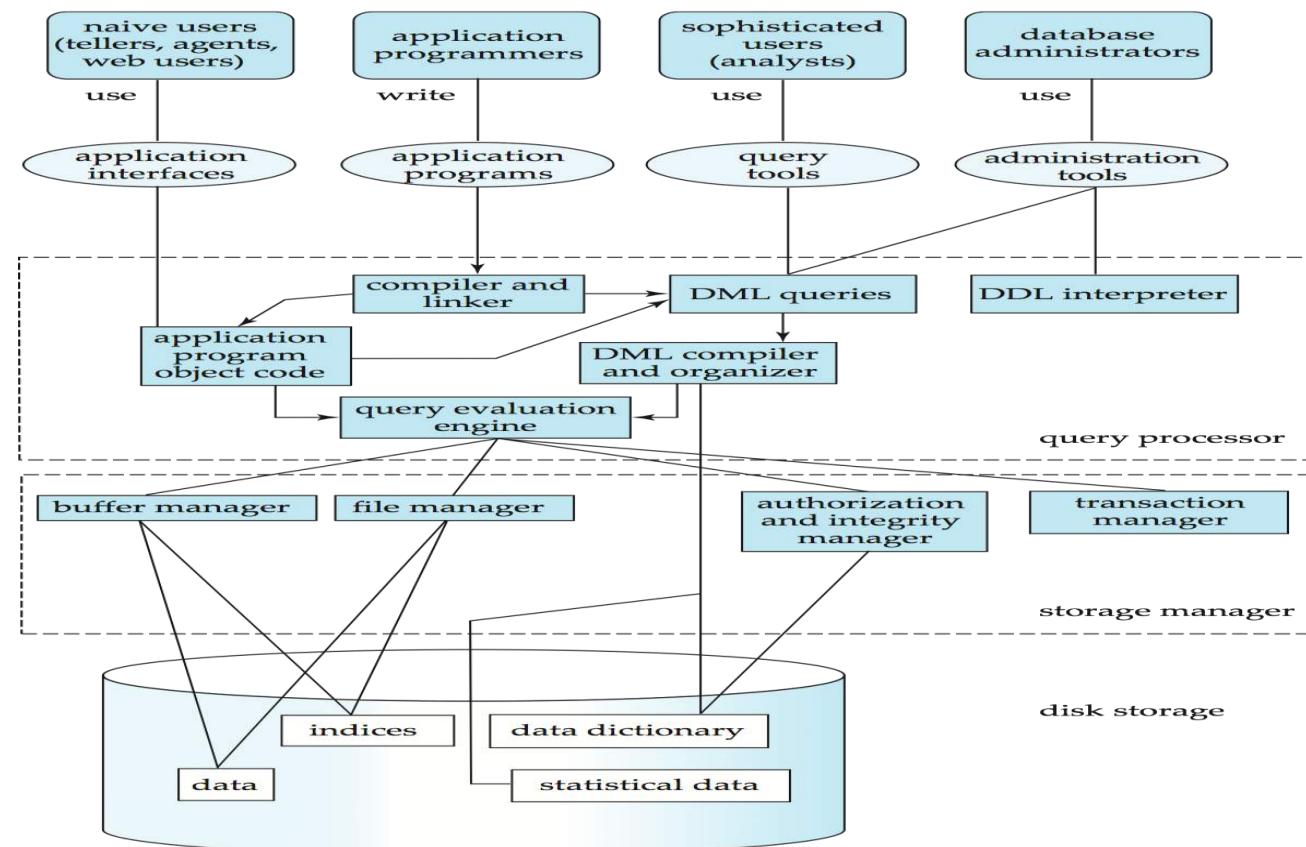
- They are the computer professionals who write the application programs. They interact with system through DML queries
- Eg: Writing C prog to generate the report of emp who are working in particular dept, will require a query to fetch data from the database.

- 3. Sophisticated Users:
 - They interact with the system by writing the SQL queries directly through the query processor (like SQL) without writing Application prog.
 - Eg: Analyst who submits SQL queries to explore data in the DBMS
- 4. Specialized Users:
 - They are also sophisticated users who write specialized database applications that do not fit into the traditional data processing framework. They are the developers who develop the complex programs to the requirement
 - Eg: Expert System

Architecture of DBMS

- The Database System is divided into 3 components:

1. Query Processor
2. Storage Manager
3. Disk Storage



About Users & Programmers

1. Native Users: Unsophisticated Users,Interact with the system through application programs.

Eg: Online Banking screen

2. Application Programmers: Users who write & develop application programs by using different tools
3. Sophisticated Users: Interact with the system by making request in the form of query of query language.These queries submitted to query processor.
4. Database Administrator: Handle Physical & Logical level of database.Gives privileges to users.

About Query Processor

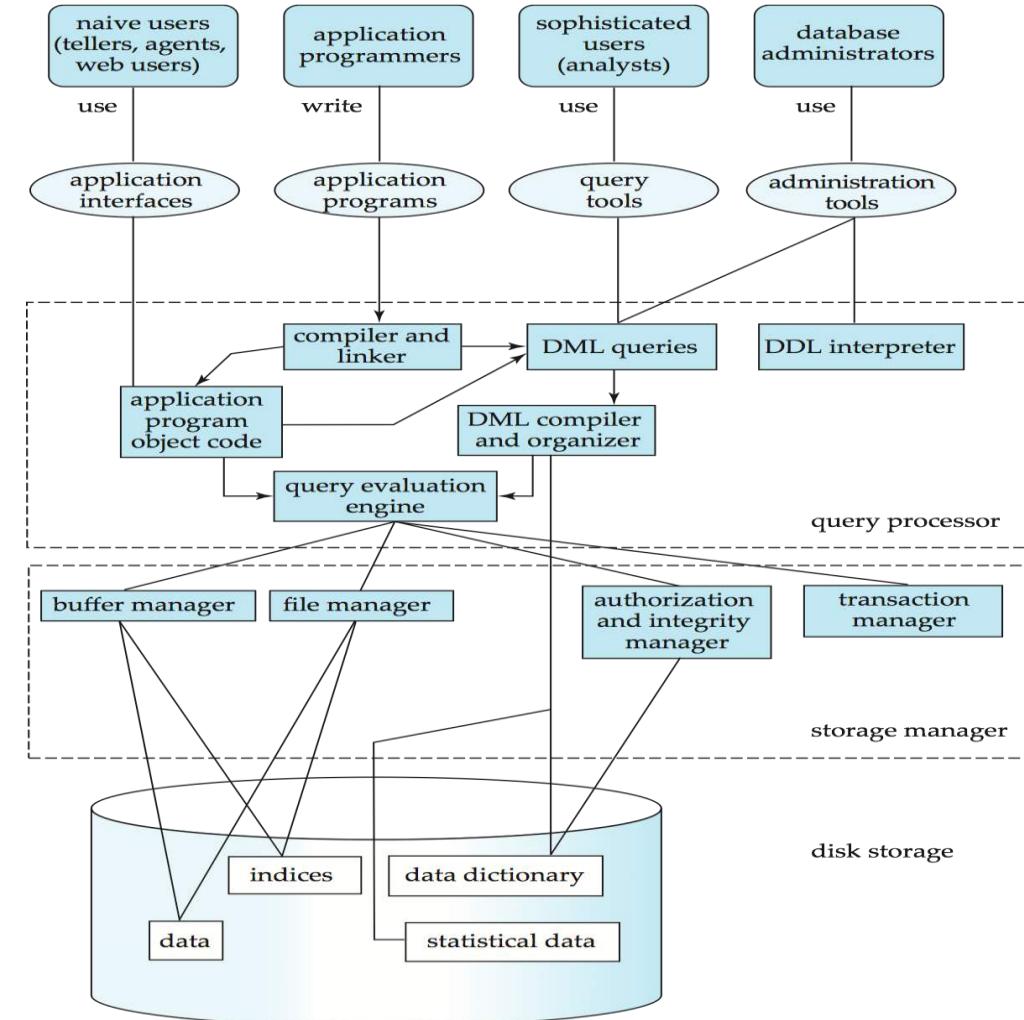
→ It Interprets the requests (queries) received from end user via an application programs into instructions

1. DML Compiler: It processes the DML statements into low level instruction (machine language)

2. DDL Interpreter: It processes the DDL statements into a set of table containing meta data (data about data)

3. Compiler &Linker: It processes & link DML statements embedded in an application program into procedural calls.

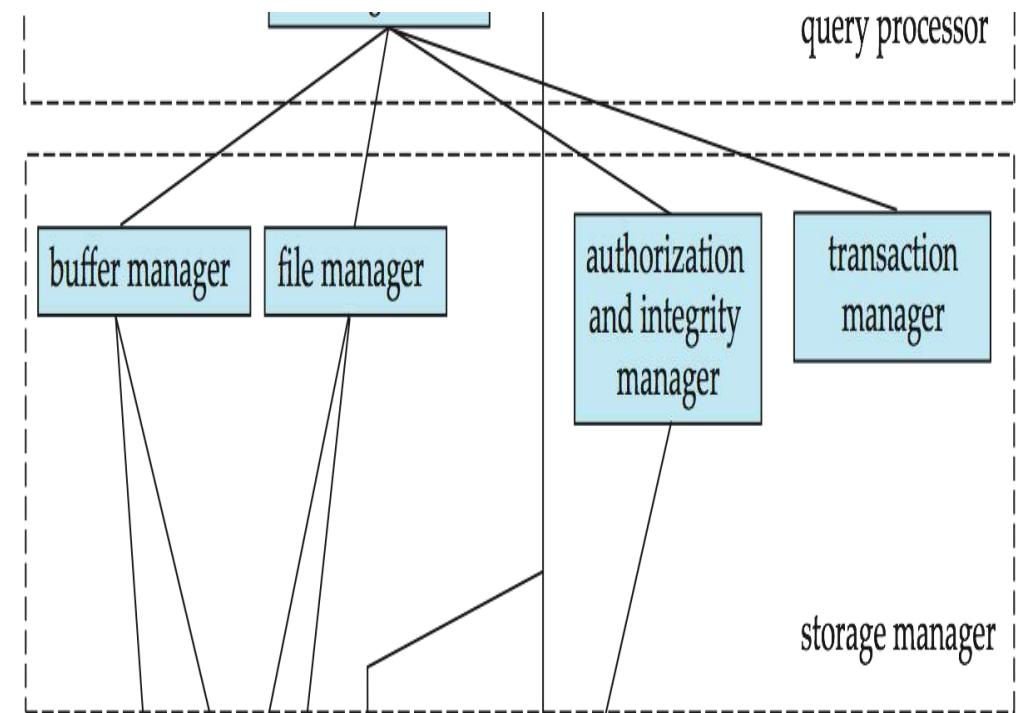
4. Query Evaluation Engine: It executes the instruction generated by DML Compiler



About Storage Manager

- It provides an interface between the data stored in the database & the queries received. It is also known as Database Control System
- 1. Authorization Manager:** It ensures role-based access control, i.e checks whether the particular person is privileged to perform the requested operation or not.
 - 2. Integrity Manager:** It checks the integrity constraints when the database is modified.
 - 3. Transaction Manager:** It controls concurrent access by performing the operations in a scheduled way that it receives the transaction.
 - 4. File Manager:** Manages the file space and the data structure used to represent information in DB.

5. Buffer Manager: It is responsible for cache memory and the transfer of data between secondary storage and main memory



About Disk Storage

- It contains the following components:

1. Data Files:

It stores the data.

2. Data Dictionary:

It contains the information about the structure of any database object. Is is the **repository of information** that governs the metadata

3. Indices:

It provides **faster retrieval** of data item

DBA (Database Administrator)

- Can be a single person or group of users.
- Central control over both data and application programs.
- Responsible for everything that is related to database.
- Make policies ,strategies & provides technical support.

Roles / Responsibilities of DBA

- Schema definition & modification
- Granting of Authorization of data access
- Routine maintenance
- New software installation
- Monitoring performance
- Security enforcement & administration
- Deciding the storage structure & access strategy
- Database availability
- Training & supporting users



Subject:DBMS
Academic Year: 2018-19
File system v/s Database system:

- * characteristics of databases :-
(File system v/s Database system).
- 1) Self-describing nature of a database system.
 - Database system contains not only the database itself but also a complete definition or description of the database structure and constraints.
 - This definition is stored in the DBMS catalog (meta-data).
 - DBMS catalog (meta-data) contains information such as the structure of each file, the type and storage format of each data item, and various constraints on the data.
 - The database catalog is used by DBMS software and also by database users who need information about the database structure.
 - The DBMS software must work equally well with any number of databases applications - for e.g. - a university database, a banking database, or a company database - as long as the database definition is stored in the catalog.
 - In traditional file processing, data definition is typically part of the application programs themselves. Hence, these programs are constrained to work with only one specific database, whose structure is declared in the application programs.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19

- This disadvantage of file processing system is called as Data Isolation.
Because data are scattered in various files, and files may be in different formats, writing new application programs to retrieve the appropriate data is difficult.
- Whereas file processing software can access only specific databases, DBMS software can access diverse databases by extracting the database definitions from the catalog and using these definitions.



Subject:DBMS
Academic Year: 2018-19

2) Data Independence :-

(Insulation between programs and data and data abstraction).

- In traditional file processing, the structure of data files is embedded in the application programs, so any changes to the structure of a file may require changing all programs that access that file.
- By contrast, DBMS access programs do not require such changes in most cases. The structure of data files is stored in the DBMS catalog separately from the access programs. We call this property as program-data independence.

* Data Abstraction :-

- A major purpose of a database system is to provide users with an abstract view of the data. That is, the system hides certain details of how the data are stored and maintained.

- To retrieve data efficiently designers use complex data structures to represent data in the database. Since many database-system users are not computer trained, developers hide the complexity from users through several levels of abstraction, to simplify users interactions with the system:-

- Physical level
- Logical level
- View level.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19

- Physical level / Internal level :-

Describes how the data are actually stored physically. Describes the complete details of data storage and access paths for the database.

- Logical level / conceptual level :-

Describes what data are stored in database & what relationships exists among the data.

Hides the details of physical storage structures & concentrates on describing entities, data types, relationships, user operations and constraints.

The logical level thus describes the entire database in terms of a small number of relatively simple structures. User of logical level need not to be aware of complex physical-level structures.
(Physical data independence)

- View level / External level :-

Variety of information stored in a large database. Users do not need all this information; instead they need to access only a part of the database.

Describes the part of the database that a particular user group is interested in & hides the rest of the database from that user group.

The view level of abstraction exists to simplify their interaction with the system.



Subject:DBMS
Academic Year: 2018-19

3) Integrity Constraints :-

- most database applications have certain integrity constraints . A DBMS should provide capabilities for enforcing & defining these constraints.
- Integrity constraints provide a way of ensuring that changes made to the database by authorized users do not result in a loss of data consistency and correctness.
- The simplest type of integrity constraint involves specifying a data type for each data item . for e.g. Name must be a string of no more than 30 alphabetic characters.
- A more complex type of constraint that frequently occurs involves specifying that a record in one file must be related to record in other files. This is known as referential integrity constraint.
- Another type of constraint specifies uniqueness on data item values . Such as every student record should have unique value for Roll No . This is known as key or uniqueness constraint.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject: DBMS
Academic Year: 2018-19

4) controlling redundancy & inconsistency :-

- Since different programmers create the files and application programs, various files are likely to have different structures & the programs may be written in several languages.
i.e., the same information may be duplicated in several places.
for e.g. if a student has double major (music & mathematics) then the address, telephone number of that student may appear in a file that consists of student records of students in music department and in a file that consists of student records of students in mathematics department.

music

Rohan Thane 22222

mathematics

Rohan Thane 22222

- This redundancy leads to higher storage and access cost.
- In addition, it may lead to inconsistency; for e.g. - Rohan's address has changed in music department but not in mathematics department.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19

5) Restricting unauthorized access :-

- when multiple users share a large database, it is likely that most users will not be authorized to access all information in the database for e.g. financial data is often considered confidential, and only authorized persons are allowed to access such data.

6) Ease of accessing data :-
(Efficient query processing)

- conventional file processing environments do not allow needed data to be retrieved in a convenient & efficient manner
- Database system provide capabilities for efficiently access the data using queries .

7) Backup and Recovery :-

- DBMS must provide facilities for recovering from hardware & software failures.
for e.g.- if the computer system fails in the middle of a complex update transaction, then the recovery system should make sure that the database is restored to the state it was in before the system failure happened.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19

8) Sharing of data :-

- DBMS must allow multiple users to access the database at the same time.
- DBMS must include concurrency control s/w to ensure that several users trying to update the same data do so in a controlled manner so that the result of the updates is correct.
for e.g.- When several reservation agents try to assign a seat on an airline flight, the DBMS should ensure that each seat can be accessed by only one agent at a time for assignment to a passenger. These type of applications are called as online transaction processing (OLTP) applications.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19
DBMS Architecture:

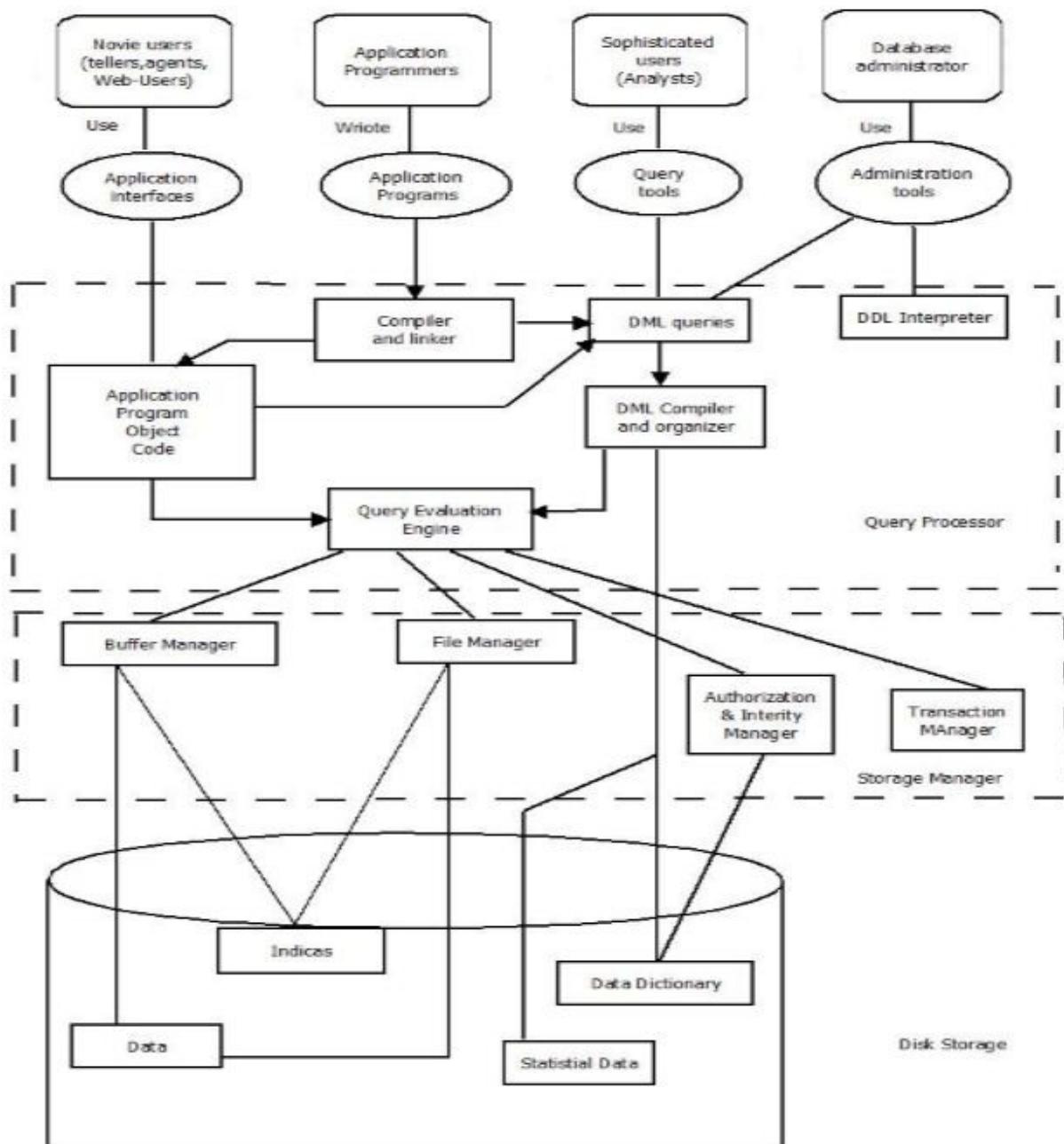
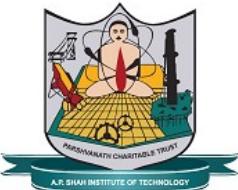


Fig1. Database System Architecture.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19

1) Storage manager :-

- The storage manager is the component of a database system that provides the interface between the low level data stored in database and the application programs and queries submitted to the system.
- The storage manager is responsible for the interaction with the file manager. The raw data are stored on the disk using the file system provided by the operating system.
- The storage manager translates the various DML statements into low-level file system commands.
- Thus, the storage manager is responsible for storing, retrieving, and updating data in the database.

The storage manager components include :-

a) Authorization and Integrity manager .

It checks the authority of user to access data and integrity constraints .

b) Transaction manager .

It ensures that the database remains in a consistent (correct) state despite system failures, and the concurrent transaction executes without any conflict .



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19

c) File manager.

It manages the allocation of space on disk storage and the data structures used to represent information stored on disk.

d) Buffer manager.

It is responsible for fetching data from disk storage into main memory, and deciding what data to cache in main memory.

The buffer manager is critical part of the database system, since it enables the database to handle data sizes that are much larger than the size of main memory.

The storage manager implements several data structures as part of the physical system implementation :-

a) Data files.

Data files store the database itself.

b) Data dictionary :-

It stores metadata about the structure of the database (in particular schema of database).

c) Indices.

It provides the fast access to data items. Like the index in the textbook.



Subject:DBMS
Academic Year: 2018-19

2) Query Processor :-

The query processor components include :-

a) DDL interpreter.

It interprets DDL statements and records the definitions in the data dictionary.

b) DML compiler.

It translates DML statements in a query language into an evaluation plan consisting of low-level instructions that the query evaluation engine understands.

A query can usually be translated into any of a number of alternative evaluation plans that all give the same result.

The DML compiler also performs query optimization ; that is , it picks the lowest cost evaluation plan from among the alternatives.

c) Query evaluation engine.

It executes low-level instructions generated by the DML compiler.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS

Academic Year: 2018-19

| Sr. No. | File Management System | Database Management System |
|----------------|--|---|
| 1. | Security is low in File Management System. | Security is high in Database Management System. |
| 2. | Data Redundancy is more in file management system. | Data Redundancy is less in database management system. |
| 3. | When data is redundant, it is difficult to update | In DBMS, as there is no or less data redundancy, data remains consistent. |
| 4. | Centralisation of data is hard to get when it comes to File Management System. | Centralisation of data is achieved in Database Management System. |
| 5. | As data is not centralized, it is very difficult to access the data | As data is centralized, it is easy to access the data |
| 6. | File system doesn't provide multiple user interfaces as data is not centralized(data is scattered) | DBMS provide multiple user interfaces due to centralized data |
| 7. | File system doesn't allow sharing of data or data sharing is very complex | In DBMS data can be shared very easily due to centralized system. |
| 8. | In file system, data search/retrieve/access is difficult | In DBMS it is easy |
| 9. | Unauthorized access is not restricted in file system | Unauthorized access is restricted in DBMS |
| 10. | Concurrent access and recovery is not possible | Concurrent access and recovery is possible in database |



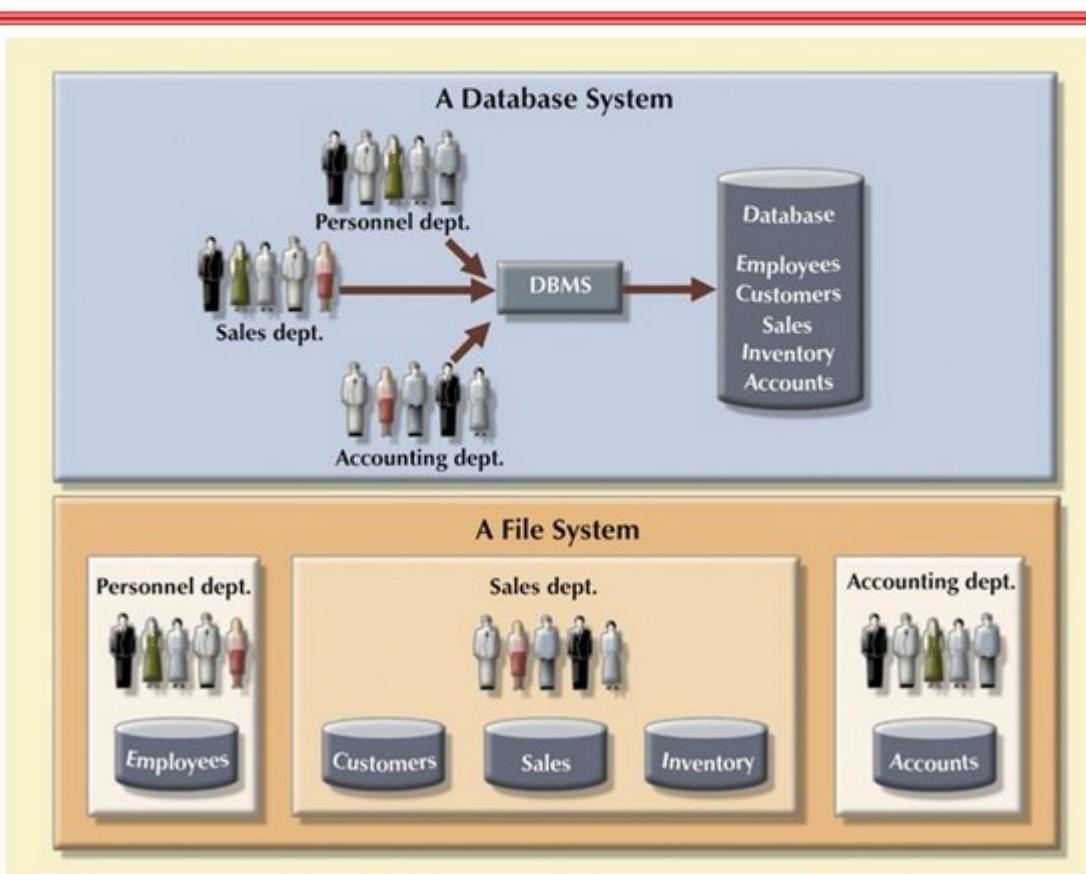
Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS

Academic Year: 2018-19

| | | |
|-----|--|---|
| 11. | A file manager is used to store data in directories in file systems. | A database manager (administrator) stores the data in form of structural tables |
|-----|--|---|

Database vs. File Systems





Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19

Introduction to database concepts:-

* What is database :-

- Database is a collection of related data.
By data we mean name of a person, price of book, no. of students in a college, pin code of a city etc. are some examples of data.
- Database can be of any size & complexity.
e.g.- list of names and phone numbers in mobile phones is a database.
e.g.- Amazon.com
- Database can be maintained manually or computerized.
we will explore & study computerized database .



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19



Subject:DBMS
Academic Year: 2018-19

* What is DBMS :-

- Database management system (DBMS) is a collection of interrelated data (database) and a set of programs to access those data.
- DBMS is a general purpose software system that facilitates the processes of defining, constructing, manipulating and sharing databases among various users and applications.

* Functions provided by DBMS:-

- Defining :- specifying data types, structures and constraints of data to be stored.
[constraints → limitations or rules while entering the data in the database]
- Constructing :- It is the process of storing the data on some storage medium that is controlled by the DBMS.
- Manipulating :- It means querying the database, retrieving specific data from database, updating the database etc.
- Sharing :- A database allows multiple users and programs to access the database simultaneously.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19

- The other important functions provided by DBMS are :-
 - protecting the database - Protection includes system protection against hardware and software malfunction (or crashes) and security protection against unauthorized or malicious access.
 - Maintaining a database over a long period of time - A typical database may have a life cycle of many years, so the DBMS must be able to maintain the database system by allowing the system to evolve as requirements changes over time.
- The database definition /descriptive information also stored by DBMS in the form of Database catalog [Dictionary] also called as meta-data.

—



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19

* Database System Applications :-

Databases are widely used.

Some representative applications are :-

a) Banking :-

For customer information, accounts, loan and banking transactions.

b) Railways :-

For reservations & schedule information.

c) Universities & colleges :-

For student information, course registration and grades.

d) credit card transaction :-

For purchases on credit cards and generating monthly statements.

e) Telecommunication :-

For keeping records of call made, generating monthly bills etc.

f) Sales :-

For customer, product and purchase information.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject:DBMS
Academic Year: 2018-19

g) Manufacturing :-

Tracking production of items in factories,
warehouses & ~~with~~ orders for items,

h) Human resources :-

For information about employees, salaries
etc.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY

(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject: Database Management Systems

SEM:III

3) Relational model :-

- Relational model was first described in 1969 by Edgar F. Codd.
- A relational database is a collection of rows and columns.

Relational model

Customer table

| cust_id | cust_name | phone |
|---------|-----------|-------|
| 101 | Neha | 1111 |
| 102 | Sneha | 22222 |
| 103 | Swati | 33333 |
| 104 | Mudra | 44444 |

* Advantages :-

- changes in tables do not affect data access or application programs. (structural independence)
- Tabular view substantially improves conceptual simplicity, which makes the database easier to access. (structural independence).
- RDBMS isolates the end user from physical level details & improves implementation and management simplicity.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY

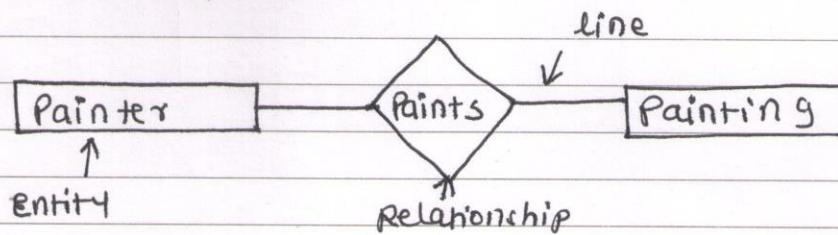
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject: Database Management Systems

SEM:III

4) Entity - relationship data mode (E-R) :-

- The E-R model is a way of graphically representing the logical relationships of entities (or objects) to create a database.
- It works around real-world entities and their associations among them.
- Graphical representation of entities and their relationships in a database structure.
- Entity instance is present in rows in table
- Diamond represents relationship among the entities which can be connected through relationship line.



- Relationships can be of three types :-
① one-to-one (1:1)



one employee manages only one store.



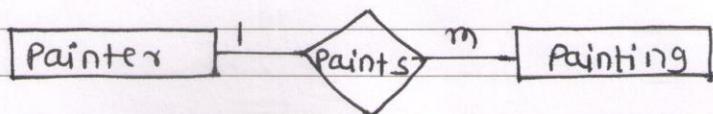
Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY

(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject: Database Management Systems

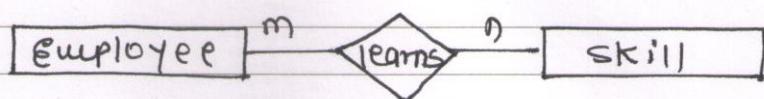
SEM:III

⑤ one - to - many (1 : m) :-



one painter can paints many painting .

⑥ Many - to - many (m : n) :-



many employees can learn many skills .

* Advantages :-

- E-R model has an exceptional conceptual simplicity .
- Visual representation makes it an effective communication tool .
- It is integrated with the relational model



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY

(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject: Database Management Systems

SEM:III

* Disadvantages :-

- There is a limited constraints representation.
- There is limited relationship representation.
- There is no DML
- Loss of information content occurs when attributes are removed from entities to avoid crowded displays.



Subject:DBMS
Academic Year: 2017-18

Database Users:

Users are differentiated by the way they expect to interact with the system:

- **Application programmers:**

- Application programmers are computer professionals who write application programs. Application programmers can choose from many tools to develop user interfaces.
- Rapid application development (RAD) tools are tools that enable an application programmer to construct forms and reports without writing a program.

- **Sophisticated users:**

- Sophisticated users interact with the system without writing programs. Instead, they form their requests in a database query language.
- They submit each such query to a query processor, whose function is to break down DML statements into instructions that the storage manager understands.

- **Specialized users :**

- Specialized users are sophisticated users who write specialized database applications that do not fit into the traditional data-processing framework.
- Among these applications are computer-aided design systems, knowledge base and expert systems, systems that store data with complex data types (for example, graphics data and audio data), and environment-modeling systems.

- **Naïve users :**

- Naïve users are unsophisticated users who interact with the system by invoking one of the application programs that have been written previously.
- For example, a bank teller who needs to transfer \$50 from account A to account B invokes a program called transfer. This program asks the teller for the amount of money to be transferred, the account from which the money is to be transferred, and the account to which the money is to be transferred.



Subject:DBMS
Academic Year: 2017-18

Database Administrator:

- Coordinates all the activities of the database system. The database administrator has a good understanding of the enterprise's information resources and needs.
- Database administrator's duties include:
 - **Schema definition:** The DBA creates the original database schema by executing a set of data definition statements in the DDL.
 - **Storage structure and access method definition.**
 - **Schema and physical organization modification:** The DBA carries out changes to the schema and physical organization to reflect the changing needs of the organization, or to alter the physical organization to improve performance.
 - **Granting user authority to access the database:** By granting different types of authorization, the database administrator can regulate which parts of the database various users can access.
 - **Specifying integrity constraints.**
 - **Monitoring performance and responding to changes in requirements.**

Query Processor:

The query processor will accept query from user and solves it by accessing the database.

Parts of Query processor:

- **DDL interpreter**

This will interprets DDL statements and fetch the definitions in the data dictionary.

- **DML compiler**

- a. This will translates DML statements in a query language into low level instructions that the query evaluation engine understands.
- b. A query can usually be translated into any of a number of alternative evaluation plans for same query result DML compiler will select best plan for query optimization.



Subject:DBMS
Academic Year: 2017-18

- **Query evaluation engine**

This engine will execute low-level instructions generated by the DML compiler on DBMS.

Storage Manager/Storage Management:

- A storage manager is a program module which acts like interface between the data stored in a database and the application programs and queries submitted to the system.
- Thus, the storage manager is responsible for storing, retrieving and updating data in the database.
- The storage manager components include:
 - **Authorization and integrity manager:** Checks for integrity constraints and authority of users to access data.
 - **Transaction manager:** Ensures that the database remains in a consistent state although there are system failures.
 - **File manager:** Manages the allocation of space on disk storage and the data structures used to represent information stored on disk.
 - **Buffer manager:** It is responsible for retrieving data from disk storage into main memory. It enables the database to handle data sizes that are much larger than the size of main memory.
 - **Data structures implemented by storage manager.**
 - **Data files:** Stored in the database itself.
 - **Data dictionary:** Stores metadata about the structure of the database.
 - **Indices:** Provide fast access to data items.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY

(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject: Database Management Systems

SEM:III

• 14

* Users of Database system :-

- People who work with a database can be categorized as database users / database administrator.
- Database users are of following types :-

a) Naïve users :-

Naïve users are unsophisticated users who interact with the system by using the available application programs.

for e.g. a office person in the college who needs to add a new professor to the department

b) Application programmers :-

Computer professionals who write application programs ;

c) Sophisticated users :-

Interact with the system without writing programs . Uses database query language for the interaction .

d) Specialized users :-

Sophisticated users who write specialized database applications such as computer - aided design systems, etc .



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY

(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject: Database Management Systems

SEM:III

15

- one of the main reasons for using DBMS is to have central control of both the data and the programs that access those data. A person who has such control over the system is called a database administrator (DBA).

* Functions of DBA :-

→ Schema definition -

The DBA creates the original database schema by executing a set of data definition statements in the DDL.

→ Storage structure & access-method definition.

→ Schema & physical-organization modification -

The DBA carries out changes to the schema & physical organisation to reflect the changing needs of the organisation, or to alter the physical organization to improve performance.

→ Creating authorization for data access -

→ Routine maintenance -

Periodically backing up the database.
Ensuring that enough free space is available for normal operations.



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY

(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject: Database Management Systems

SEM:III



Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY

(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Subject: Database Management Systems

SEM:III