#### **Database Design and Applications (S2-23\_SSZG518)**

### ### Module 1: Introduction to Database Management Systems (DBMS) Concepts and Architecture

**Recorded Lecture 1.1:** What is DBMS

Contents

* Database Systems
* DBMS
* Database System Environment
* Traditional File Systems
* Advantages of DBMS over File Systems
* Disadvantages of DBMS

<https://www.youtube.com/watch?v=uHFoxX0-8k4&t=1s>

**Recorded Lecture 1.2:** DBMS concepts

Contents

* Describing and Storing data in DBMS
* Three Schema Architecture
* Data Independence
* Queries
* Transactions
* Structure of DBMS
* Users of DBMS

<https://www.youtube.com/watch?v=hr85TAWSbRg&t=1s>

### ### Module 2: Conceptual Database Design (ER Modelling)

**Recorded Lecture 2.1:** Conceptual Database Design

Contents

* Steps in database Design Process
* ER Concepts and Notations
* Class Hierarchies

<https://www.youtube.com/watch?v=AKLuBSBdigw&t=2s>

[**Recorded Lecture 2.**](https://taxila-aws.bits-pilani.ac.in/mod/page/view.php?id=54294)**2:**Relational Data Model and Relational Constraints

Contents

* Relational data model fundamentals
* Constraints in Relational data model
* Representation of schemas

<https://www.youtube.com/watch?v=6r5SSL01Qr8>

[**Recorded Lecture 2.**](https://taxila-aws.bits-pilani.ac.in/mod/page/view.php?id=54294)**3:**ER to Relational Mapping

Contents

* Mapping rules/guidelines for mapping ER constructs
* Mapping rules/guidelines for mapping hierarchies
* Examples

<https://www.youtube.com/watch?v=wVkQclixnME&t=1s>

### ### Module 3: Relational Data Model Languages

### Recorded Lecture 3.1: Relational Algebra

Contents

* Relational Query Languages
* Formal Query Languages
* Introduction to relational algebra
* Relational operators
* Set Operators
* Join operator
* Aggregate functions
* Grouping
* Relational Calculus concepts

### <https://www.youtube.com/watch?v=ZHZCAaDE_QA&t=1s>

### Recorded Lecture 3.2: Structured Query Language (SQL)

Contents

* Introduction to Structured Query Language (SQL)
* Features of SQL
* DDL Statements

### <https://www.youtube.com/watch?v=rS0yVyG9LWc>

### Recorded Lecture 3.3: Structured Query Language (SQL) 2

Contents

* Nested queries and correlated nested queries
* Use of EXISTS and NOT EXISTS
* Explicit join operations
* Aggregate functions
* Group by and Having clauses
* Insert / Update / Delete operations
* Views

### <https://www.youtube.com/watch?v=ukyCD1hOsEY&t=1s>

### ### Module 4: Schema Refinement and Normal Forms

### Recorded Lecture 4.1: Schema Refinement – 1

Contents

* Introduction to Schema Refinement
* Functional Dependencies
* Inference Rules
* Normalization
* Normal Forms (1NF and 2NF)

### <https://www.youtube.com/watch?v=ybWHPrGYAlk&t=1s>

### Recorded Lecture 4.2: Schema Refinement - 2

Contents

* 3NF and BCNF
* Decomposition requirements
* Lossless join decomposition
* Dependency preserving decomposition
* Examples

### <https://www.youtube.com/watch?v=C81dvhbq8MA>

### ### Module 5: Disk Storage, Hashing and Indexing

### Recorded Lecture 5.1: Data Storage

Contents

* Disk pack features
* Records and Files
* File operations
* Ordered and Unordered features

### <https://www.youtube.com/watch?v=GvJjQhp0ECc>

### Recorded Lecture 5.2: Hashing Techniques

Contents

* Introduction to Hashing
* Internal hashing
* Collision
* External hashing
* Static hashing
* Dynamic hashing

### <https://www.youtube.com/watch?v=f5HbEuya1Gg>

### Recorded Lecture 5.3: Indexing - 1

Contents

* Introduction to Indexing
* Primary and Secondary indexes
* Dense and Sparse indexing
* Multilevel indexing
* Designing Primary and Multilevel indexes

### <https://www.youtube.com/watch?v=r8lovwIXceU&t=1s>

### Recorded Lecture 5.4: B+ Tree Indexing

Contents

* Introduction to Tree indexing
* B+ Tree
* Inserting and Deleting keys into B+ trees
* Constructing a B+ tree
* Designing a B+ tree node structure

### <https://www.youtube.com/watch?v=Q3F_wJKiGXY&t=1s>

### ### Module 6: Transaction Management and Concurrency Control

### Recorded Lecture 6.1: Transaction Processing

Contents

* Introduction to Transaction Model
* Significance of Transaction Model
* States of a transaction
* ACID properties

### <https://www.youtube.com/watch?v=qBLAe-Hf-eM>

### Recorded Lecture 6.2: Concurrent Transactions and Schedules

Contents

* Concurrent Transactions
* Transaction Schedule
* Serial and Concurrent Schedules
* Need for Concurrency Control
* Conflicting Operations
* Conflict Equivalent Schedule
* Test for Conflict Serializability
* View Equivalent Schedule
* View Serializability

### <https://www.youtube.com/watch?v=GspaLqbj9jI&t=1s>

### Recorded Lecture 6.3: Concurrency Control

Contents

* Introduction to Concurrency Control
* Implementing Serializability
* Lock-based protocols
* Deadlock condition
* Two-phase locking protocol
* Time stamp based protocols

### <https://www.youtube.com/watch?v=NKsBwABSfwY>

### Recorded Lecture 6.4: Database Recovery

Contents

* Introduction to Recovery
* Recovery strategies
* Log-based recovery
* Check-pointing
* Shadow paging

### <https://www.youtube.com/watch?v=zlI43kov6SQ&t=1s>

### ### Module 7: Database Security

### Recorded Lecture 7.1: Database Security

Contents

* Introduction to Database Security
* Access Control
* Statistical Database Security
* Flow Control
* Other Challenges

### <https://www.youtube.com/watch?v=oKPugAySd5E&t=1s>

### ### Module 8: Additional Topics

#### **8.1: Query Processing, Query Optimization and Database Tuning**

### Recorded Lecture 8.1.1: Query Processing

Contents

* Steps in query processing
* SQL to relational expressions
* Algorithms for various operations

### <https://www.youtube.com/watch?v=7wREp73A1pw&t=1s>

### Recorded Lecture 8.1.2: Query Optimization

Contents

* Query Optimization using Heuristics
* Cost Estimation

### <https://www.youtube.com/watch?v=dBhPZ3jmDVA&t=1s>

### Recorded Lecture 8.1.3: Database Tuning

Contents

* Database Tuning Concepts
* Approaches

### <https://www.youtube.com/watch?v=Gm_Ryd7RiEo&t=2s>

#### **8.2: Database Design and Usage of UML**

**Recorded Lecture 8.2:** Database Design and Usage of UML

Contents

* Role of Information Systems
* Database Design and Implementation Process
* UML Diagrams for Database Design
* Tools

#### <https://www.youtube.com/watch?v=5N75WtG6DLM&t=1s>

#### **8.3: XML Databases**

**Recorded Lecture 8.3.1:** XML - 1 (Extended Markup Language)

Contents

* XML Data Model
* Significance, Structure and Features
* XML DTD and XML Schema

### <https://www.youtube.com/watch?v=2E1PgSzoBQw&t=1s>

**Recorded Lecture 8.3.2:** XML - 2 (Extended Markup Language)

Contents

* XML Documents and Databases
* Storing XML Data
* XML Querying
* Sample XML Applications

### <https://www.youtube.com/watch?v=7xeqXOevtzM&t=2>s