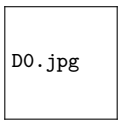
Z2004: Database Management Systems

Lecture 01: Course Introduction & Orientation

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IIT Madras Zanzibar

March 2, 2026

Today's Journey

From Data Chaos to Structured Knowledge

- **1. The Big Picture**
  - Welcome & The "Theory-First" Approach
  - Real-world context (M-Pesa, WhatsApp)
  - Why data powers the modern economy
- **2. Course Blueprint**
  - Syllabus & Modules
  - **85% Attendance Mandate** (Strict)
  - Grading: Exams (40%), Project (20%)
- **3. Tools & Resources**
  - Required: SQL Server 2022 + SSMS
  - Textbook: Silberschatz et al.
  - GitHub & LMS Access
- **4. Next: Lecture 02 Preview**
  - Life before DBMS (The "Flat File" Era)
  - The 5 Failures of early computing
  - Evolution of Data Systems

Question: How much data did you generate before breakfast today?

SECTION 1

The Big Picture

Welcome, Introductions & Real-World Context

You Already Know This

You used a database three times before you had breakfast.

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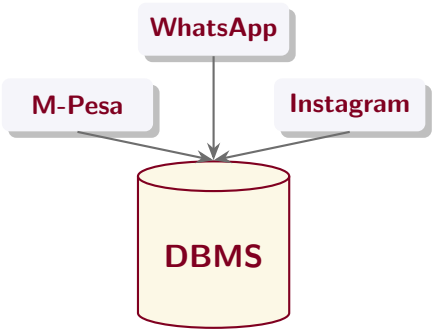
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Every single one runs on a DBMS.

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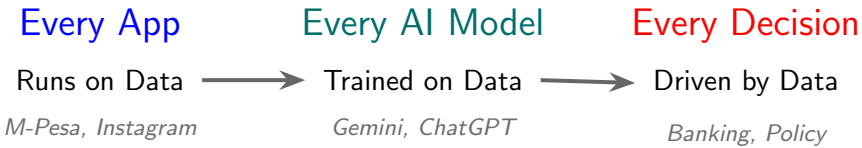
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The Invisible Engine

Every single one runs on a DBMS.

Why This Course Exists



You cannot build AI without **mastering data**.

Real Scale: Google serves **8.5 billion** searches/day. Latency? $<$**100 ms**.

Course Identity

Z2004 – Database Management Systems

BS Data Science & AI, Year 2

Logistics

Credits
10 Credits (3 Lec + 1 Tut)

Schedule
3 Lectures / week
1 Tutorial / week

Resources

Textbook
Database System Concepts
Silberschatz, Korth, Sudarshan (7th Ed.)

The Golden Rule
SQL by hand.
No GUI builders allowed.

The Roadmap

March

02 Mar Course Kickoff (Lecture 01)

April

Mid-Apr Quiz 1 (ER Diagrams & Relational Model)

May

Late May Quiz 2 (SQL & Normalization)

June – July

Week 17 Project Final Submission

29 Jun **End-Semester Exam**

17 Weeks at a Glance

Phase 1: Theory

THE BLUEPRINT

- **Wk 1–2**
  Foundations & File Systems
- **Wk 3–4**
  ER & Relational Modeling
- **Wk 5–6**
  Normalization
- **Wk 7**
  QUIZ 1

Phase 2: SQL

THE ENGINE

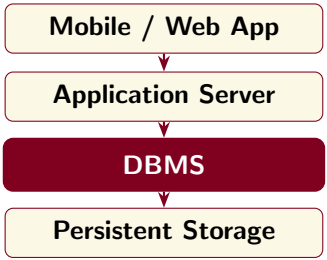
- **Wk 8–9**
  Relational Algebra & SQL
- **Wk 10–11**
  Indexing (B-Trees)
- **Wk 12**
  ACID Transactions
- **Wk 13**
  QUIZ 2

Phase 3: AI

THE FUTURE

- **Wk 14**
  NoSQL (Mongo)
- **Wk 15**
  Vector DBs
- **Wk 16**
  RAG Pipelines
- **Wk 17**
  End-Sem & Demo

What Sits Between Your App and Your Data?



← *this course*

The DBMS answers three questions:

1. What data is **stored**?
2. How is it **structured**?
3. Who can **access** it?

Every system you will ever build – from a hospital app to a chatbot – is ultimately this stack.

What are we actually managing?

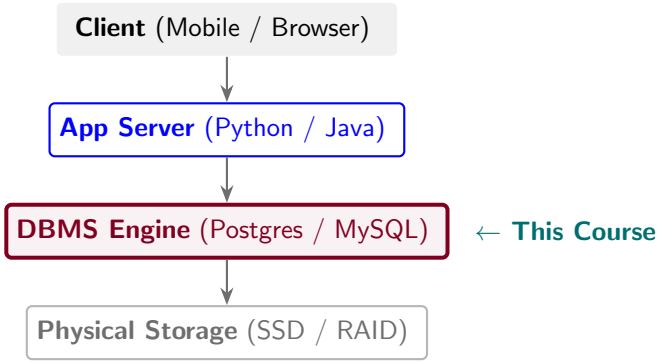


A **Database** is a collection of related data.

A **DBMS** is the software that manages it.

Without the DBMS, you don't have a database. You just have files.

Where It Fits



Why separate them?

The App Server
Handles *logic*.
"If user is logged in, show profile."

The DBMS
Handles *data*.
"SELECT * FROM users WHERE id=1."

The Benefit
You can change the code without breaking the data.

How the Engine Answers

We asked three questions. Here is how the DBMS solves them.

1. Structure
"How is data defined?"

→

The Schema (DDL)
We write `CREATE TABLE`.
Enforces types (Integer vs String) and constraints.

2. Storage
"Where does it live?"

→

The Storage Engine
Manages Blocks & Pages.
It maps logical data to physical bytes on the SSD.

3. Access
"Who touches it?"

→

The Query Processor
Authentication & Optimization.
Checks permissions before executing SQL.

Scenario: The Cross-Border Transfer

Alice sends $100 USD to Bob in Tanzania.

Current Rate: 1 USD = 2,600 TZS

Target: 260,000 TZS

In a DBMS, this is ONE transaction:

1. **Read** Alice's Balance ($500).
2. **Read** Exchange Rate (2,600).
3. **Debit** Alice (-$100).
4. **Credit** Bob (+260,000 TZS).
5. **Log** the transfer.

CRITICAL FAILURE:

Power fails after Step 3.

Alice lost money. Bob got nothing.

Option A: Flat Files



RESULT: DATA CORRUPTION

Option B: DBMS



RESULT: ROLLBACK (SAFE)

Before DBMS: Five Failures That Changed Computing

1960s: Data lived in flat files.

Each program owned its own file.
No sharing. No coordination.

1. **Redundancy** – data repeated everywhere
2. **Inconsistency** – copies get out of sync
3. **No sharing** – one program per file
4. **No security** – anyone reads anything
5. **No atomicity** – crash = corrupted data

Each failure drove exactly one DBMS innovation.
Lecture 02 walks through all five in detail.

Lectures/filedbms.png

What You Will Build – Phase by Phase

Phase	Topics	You Build	Real System
Phase 1	ER diagrams, schema design, normalization 1NF–BCNF	Normalised schema	Hospital patient system
Phase 2	SQL, joins, indexing, B-trees, transactions, ACID	SQL scripts + indexes	E-commerce orders
Phase 3	NoSQL, vector search, pgvector, RAG pipelines	AI-powered search layer	Chatbot memory store
Project	End-to-end: schema to AI feature	Live demo + report	Your domain, your data

Grading & Policies

Component	Weight
End-Semester Exam	40%
Semester Project	20%
Quiz 2	15%
Quiz 1	15%
In-Class Assignments	10%
Total	**100%**



Non-negotiable:

- No make-up quizzes without prior written approval
- SQL by hand – no GUI builders, ever
- In-class tasks: graded live, no late submission
- Project milestones: **–10% per day** late
- AI tools: declare in writing or it is plagiarism

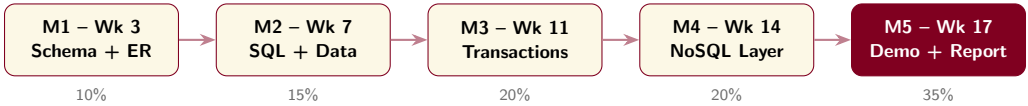
Attendance:

- Minimum **85%** to sit the End-Sem Exam

The Semester Project

Theme 2026:

Design, build and deploy a data-driven application
with a relational core and an AI-powered feature.



- Teams of **3–4 students**
- Topic proposal: **end of Week 2**
- Peer review at M3 and M5
- Each milestone has a published rubric
- Deliverable: code + report + live demo
- Top projects: department showcase

This Course IS – and IS NOT

✔ IS:

- Theory-first: understand before you build
- Classical RDBMS through to AI vector stores
- Every SQL line written by hand
- The foundation of your entire career
- Every concept anchored to a real system

✖ IS NOT:

- A GUI click-through tutorial
- A course where AI writes your queries
- Easy if you skip the tutorials
- About memorising SQL syntax
- Optional

"Understand the engine, not just the steering wheel."

In-Class Activity

Think – Pair – Share — 5 Minutes

Pick any app you used today.

1. What data does it **store**?
2. What happens when you **request** data?
3. What **breaks** if the database goes down?

3 minutes with your neighbour. Two pairs share with the class.

Examples: M-Pesa, Jumia, Google Maps, WhatsApp, Student Portal

Exit Quiz – 3 Questions, 3 Minutes

Q1. Minimum attendance to sit the End-Semester Exam?

(a) 60% (b) 65% (c) 70% (d) 85%

Q2. Which component carries the highest weight?

(a) Quiz 1 (b) Project (c) End-Semester Exam (40%) (d) Tutorials

Q3. The M-Pesa scenario illustrated which concept?

(a) Network latency (b) A transaction (c) UI design (d) Encryption

Exit Quiz – 3 Questions, 3 Minutes

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Answers: Q1-(d) Q2-(c) Q3-(b)

Missed one? Re-read the slides before Lecture 02.

Before You Leave

Quick checklist + what's next

Before Lecture 02

1. Join **Google Classroom** (code on the board)
2. Visit `inyalala.github.io/courses`
3. Install **MS SQL Server Express + SSMS**
4. Read Silberschatz Ch. 1 (pp. 1–25)
5. Pick a **project domain**

Lecture 02 Preview

- Data management before databases
- The five failures of flat files
- Birth of the DBMS (1960s IBM)
- Each failure drove one innovation
- Three-level DBMS architecture

Welcome to Z2004 