1. Introduction to Data Architecture

A. What is Data Architecture?
B. Role of data architecture in analytics & AI
C. Data types and sources (structured, semi-structured, unstructured)
D. Relational vs non-relational systems
E. Data lifecycle in organizations

2. Data Modeling Fundamentals

A. Conceptual, logical, and physical data models
B. Entity-Relationship (ER) modeling
C. Dimensional modeling overview
D. Star schema, Snowflake schema, Fact and Dimension tables
E. Slowly Changing Dimensions (SCD)
F. Normalization vs Denormalization
G. Data dictionary and metadata concepts

3. Data Warehouse Architecture

A. What is a Data Warehouse?
B. Batch and real-time analytics systems
C. Data staging layer, integration layer, presentation layer
D. Three-tier DW architectures
E. Operational Data Store (ODS)
F. Data Marts
G. OLTP vs OLAP systems
H. Metadata repositories

4. Extract, Transform, Load (ETL/ELT) Concepts

A. Overview of ETL and ELT processes
B. Data extraction from heterogeneous sources
C. Data transformation: cleaning, integration, enrichment
D. Loading strategies: batch vs incremental
E. Change data capture
F. ETL tools overview (Talend, SSIS, Informatica, dbt)
G. Scheduling and workflow orchestration

5. Data Warehousing Design & Implementation

A. Warehouse building lifecycle
B. Kimball vs Inmon architectures
C. Schema design for performance

D. Data cube and multidimensional models
E. OLAP operations (slice, dice, drill-down/up)
F. Partitioning and indexing strategies
G. Data quality and governance

6. Data Pipelines & Modern Architectures

A. Fundamentals of data pipelines
B. Batch vs real-time pipelines
C. Tools and frameworks (Apache Kafka, NiFi, Airflow)
D. Medallion/Lakehouse architecture (bronze, silver, gold layers)
E. Cloud data pipelines (AWS/Azure/GCP)
F. Pipeline monitoring, error handling, retries

7. Big Data & Lakehouse Concepts

A. Data lakes vs data warehouses
B. Lakehouse fundamentals (Delta Lake, Iceberg, Hudi)
C. Integration with warehouse systems
D. Data cataloging and governance
E. Security and compliance considerations

8. Data Governance & Quality

A. Importance of data governance
B. Data quality frameworks
C. Master data management (MDM)
D. Lineage and metadata management
E. Compliance (e.g., GDPR)

9. Tools & Platforms

A. SQL & database systems
B. Data modeling tools (ERwin, PowerDesigner)
C. ETL tools (Talend, SSIS)
D. Orchestration (Airflow)
E. Cloud platforms (AWS Glue, Azure Data Factory)
F. Warehouse solutions (Redshift, Snowflake, BigQuery)

Mini Projects:

- Design a data warehouse for business requirements
- Build ETL/ELT pipelines ingesting data from real systems
- Implement staging and presentation layers
- Model and optimize analytics schemas
- Document architecture and governance plan