1. Introduction to databases
   Sub-topics:
   a. Database Management Systems benefits

2. The Relational Model
   Sub-topics:
   a. Relation/Table
      • Attributes
   b. Integrity Constraints
   c. Keys
   d. Primary key
   e. Candidate key
   f. Surrogate key
   g. Foreign key
      • Referential integrity constraint

3. SQL
   Sub-topics:
   a. SELECT…FROM… WHERE… framework
   b. DISTINCT keyword
   c. ORDER BY
   d. Aggregate operators: COUNT, MIN, MAX, AVG, SUM
   e. GROUP BY… HAVING
   f. Subqueries
   g. Joins (select from multiple tables), including outer joins (left, right)
   h. Set operations: UNION, UNION ALL
   i. CREATE /ALTER /DROP TABLE
   j. INSERT, DELETE, UPDATE

4. Data Modeling with the Entity-Relationship Model
   Sub-topics:
   a. Entities
      • Identifiers /Composite identifiers
      • Attributes
   b. Relationships
      • Has-A relationships
         Maximum and minimum cardinality
         Identifying/non-identifying relationships
      • Is-A relationships (supertype/subtype)
         Inclusive/Exclusive
5. Transforming ER diagrams to Relational Model

Sub-topics:
   a. Transform entities
      • Specify primary key
      • Specify candidate (alternate keys)
      • Specify properties for each column
         1. data type
         2. null/not null
         3. default values
         4. other constraints
   b. Transform relationships (foreign keys used here)
      • 1:1 relationships, 1:N relationships
         - identifying relationships
         - non-identifying relationships
      • N:M relationships
      • Supertype/subtype relationships
   c. Specify logic to enforce minimum cardinalities

6. Normalization

Sub-topics:
   a. Purpose
   b. Insert/delete/update anomalies
   c. Functional dependencies
      • Definition of key based on functional dependencies
   d. Normal forms
      • First normal form
      • Boyce-Codd Normal Form
      • Decomposition into relations that are in Boyce-Codd Normal Form

7. Triggers
   a. A trigger is a stored program that is attached to a table or view.
   b. Type of triggers
   c. Uses for triggers
   d. Writing a trigger
   e. Differences between triggers and stored procedures

8. Stored Procedures
   a. A stored procedure is a program that performs some common action on database data and is stored in the database.
   b. Advantages of stored procedures
   c. How to write a stored procedure

9. SQL VIEWS
a. SQL View is a virtual table that is constructed from other tables or views.
b. Syntax: CREATE VIEW viewname AS viewquery
c. Order By clause cannot be used in the Create View query.
d. A view can be queried as if it is a table.
e. Uses for views
f. Updating views

10. PHP - general
   a. variables, constants, arrays (numerically indexed arrays and associative arrays)
   b. control statements (if, for, foreach, while, …)
   c. files
   d. functions and variables scope
   e. objects/classes, inheritance

11. PHP - Work with MySQL
    - Connect to a database
    - Query
    - process results
    - close connection

12. Session variables
    a. Start/continue session
    b. Work with session variables
    c. Close session

13. Database security
    a. Create users
    b. Grant/revoke permissions
    c. Storing and checking passwords
    d. SQL-injections
    e. General security guidelines

14. Concurrent processing
    a. Transactions
    b. Concurrent transaction processing
       - Lost Updates
       - Inconsistent read
          1. Dirty read
          2. Unrepeatable read
          3. Phantom read
    c. ACID transactions
1. Atomic
2. Consistent
   a. statement level
   b. transaction level
3. Isolation
   a. read uncommitted
   b. read committed
   c. repeatable read
   d. serializable
4. Durable
15. Storage and indexing
   a. Hash index /B+Tree index
   b. Clustered / unclustered index
   c. How to choose indexes to improve performance

16. Ethics:
   a. The code of professional responsibility
   b. Data misuse – LEADS case