BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
WORK INTEGRATED LEARNING PROGRAMMES
COURSE HANDOUT
M.Tech

Course Title	Database Systems and Applications
Course No(s)	SESAP ZC337
Credit Units	4 Credits, 24 Hours optimized delivery
Lab Session 27 September 25	Demonstration of the solution to given problem statement

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Problem Statement: Design and Implementation of an Employee Management Database with Multimodal Extensions.

The organization requires a centralized database system to manage information about employees, departments, projects, dependents, and reporting structures. The system must support efficient data management, enforce integrity constraints, and allow future extension for multimodal data such as spatial and image attributes.

1. **Employee Management**:
   o Store personal details of employees: Name, SSN (unique identifier), Birth Date, Address, Sex, and Salary.
   o Each employee works in exactly one department.
   o Employees may supervise other employees; each employee has at most one direct supervisor.
2. **Department Management**:
   o Each department has a unique department number, a department name, and can operate across multiple locations.
   o Each department is headed by one manager (an employee), and the system must record the start date of their managerial assignment.
3. **Project Management**:
   o Each project has a unique project number, project name, and location.
   o Every project is controlled by exactly one department.
   o Employees can work on multiple projects, and each project can have multiple employees assigned.
   o For each assignment, the system must record the number of hours worked by an employee.
4. **Dependent Management**:
   o Employees may have dependents (e.g., family members).
   o For each dependent, store: Name, Sex, Birth Date, and Relationship to the employee.
5. **Reporting Structure**:
   o Capture supervisor–subordinate relationships

o An employee may supervise several employees, but each employee has exactly one supervisor.
6. **System Requirements**:
    o Provide CRUD (Create, Read, Update, Delete) operations through a front-end interface.
    o Backend database should be relational, normalized, and enforce entity, referential, and key integrity constraints.
    o Design must consider scalability, with provisions for handling multimodal data (e.g., storing spatial data for project locations, image data for employee profiles).

Deliverables:

1. **ER Modelling**
    o Draw the initial ER diagram based on customer requirements.
    o Refine and optimize the ER model by resolving constraints, applying normalization, and ensuring lossless decomposition.
2. **Relational Schema**
    o Translate the ER diagram into relational schema with primary keys, foreign keys, and constraints.
    o Show how the schema can scale to include multimodal attributes (e.g., `Project. Location` as spatial datatype, `Employee. Photo` as image blob).
3. **Optimization and Constraints Documentation**
    o Describe steps taken to optimize the ER diagram: removal of redundancy, handling of multivalued attributes (e.g., department locations), and enforcement of integrity constraints.
    o Show how normalization up to 3NF/BCNF is achieved.
4. **Database Implementation**
    o Create a relational database in SQLite.
    o Populate with sample data representing employees, departments, projects, dependents, and reporting structure.
5. **Front-End Application**
    o Develop a simple front-end interface (e.g., in Flask/Django, Node.js/React, or Java/Spring) to perform CRUD operations.
    o Example operations: add a new employee, update salary, assign employee to project, view dependents, etc.
6. **Scalability Discussion**
    o Document how the system can be extended to multimodal applications (supporting GIS/spatial data types, storing employee photos/documents as multimedia).