PHASE III: Materials Supply & Sales Management System Logical Model Design

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Course: Database Development with PL/SQL (INSY 8311)

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1. **Introduction**
2. This document presents the Logical Model Design for the **Materials Supply & Sales Management System**.
3. The design is based on the ER diagram provided and serves as the foundation for building an efficient database that supports:

- Supplier deliveries
- Stock management
- Material records
- Customer sales
- Transaction tracking

This logical model ensures data accuracy, integrity, and readiness for PL/SQL implementation.
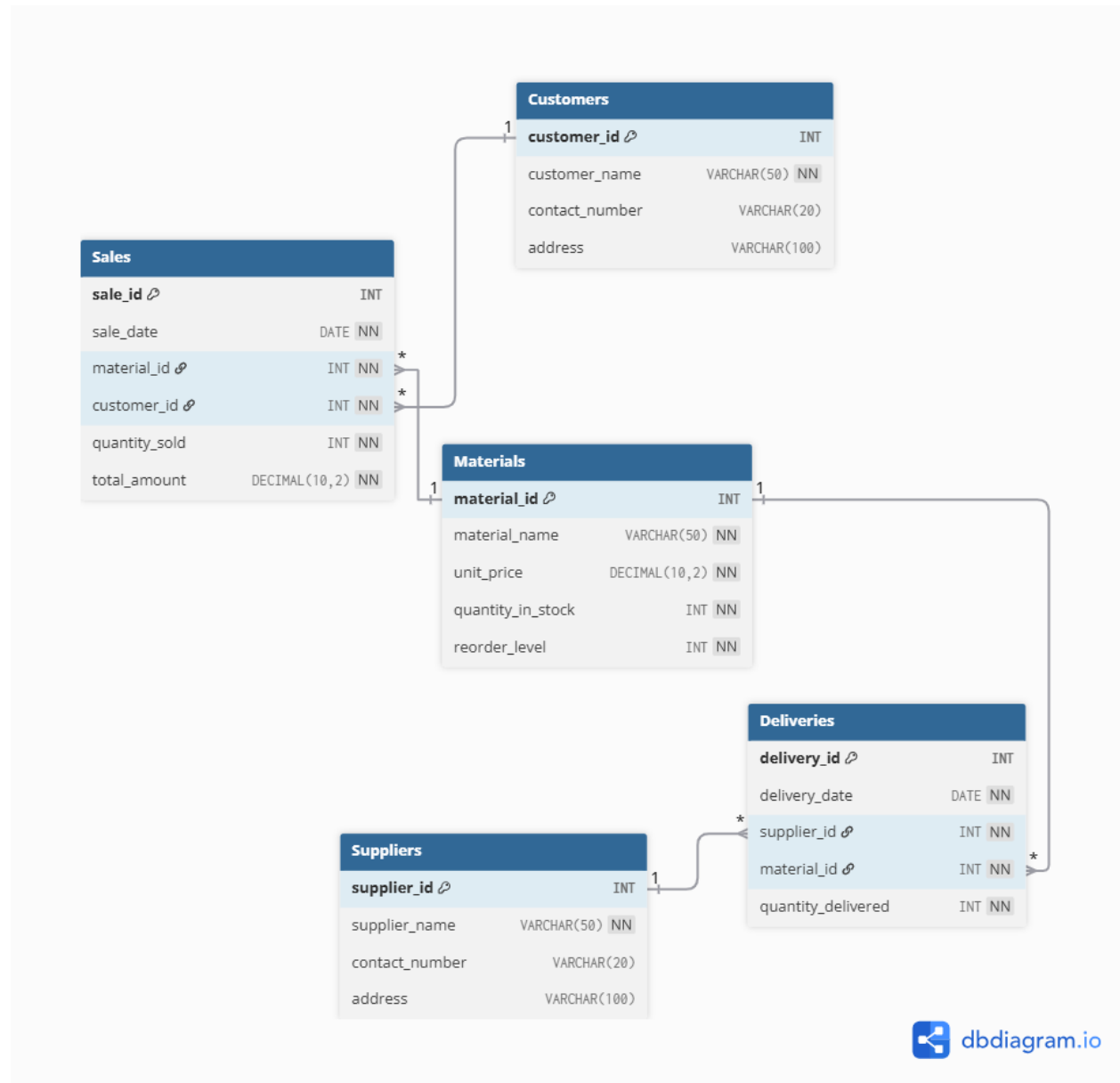
2. **Project Overview**

The Materials Supply & Sales Management System is designed to manage:

- Suppliers
- Materials
- Deliveries
- Inventory levels
- Customer sales

The system centralizes all essential business information, helping the organization maintain consistent stock levels, record supplier activities, and track customer purchases smoothly. This improves workflow efficiency and supports better decision-making.

3. **Entity Relationship Diagram**

Below is the ER diagram representing the logical model of the system you designed:

4. Entity Relationship Analysis

4.1 Core Entities

The logical model contains five main entities:

Customers – Stores customer information.

Materials – Stores product information and stock levels.

Suppliers – Stores supplier details.

Deliveries – Records supplier shipments.

Sales – Records customer transactions.

4.2 Relationships

Customer → Sales: One customer can make many sales.

Material → Sales: One material can appear in many customer transactions.

Supplier → Deliveries: One supplier can make multiple deliveries.

Material → Deliveries: One material can appear in many deliveries.

These relationships ensure that all real-world interactions are captured accurately.

5. **Detailed Entity Definitions**

5.1 Customers Entity
 Attributes

customer_id – PRIMARY KEY

customer_name – NOT NULL

contact_number – Customer phone

address – Customer location

Business Rules

Each customer must have a unique ID.

Contact information should be stored.

5.2 Materials Entity

Attributes

material_id – PRIMARY KEY

material_name – NOT NULL

unit_price – Price per unit

quantity_in_stock – Current quantity

reorder_level – Minimum level before reordering

Business Rules

Material names should be meaningful.

Stock levels must always be updated.

5.3 Suppliers Entity

Attributes

supplier_id – PRIMARY KEY

supplier_name – NOT NULL

contact_number – Supplier phone

address – Supplier address

Business Rules

Every supplier must have a unique name and ID.

5.4 Deliveries Entity

Attributes

delivery_id – PRIMARY KEY

delivery_date – Date of delivery

supplier_id – FOREIGN KEY referencing Suppliers

material_id – FOREIGN KEY referencing Materials

quantity_delivered – Number of units delivered

Business Rules

Quantity delivered must always be positive.

Delivery must be linked to a valid supplier and material.

5.5 Sales Entity

Attributes

sale_id – PRIMARY KEY

sale_date – Date of sale

material_id – FOREIGN KEY referencing Materials

customer_id – FOREIGN KEY referencing Customers

quantity_sold – Units sold

total_amount – Total sale value

Business Rules

total_amount must be greater than zero.

Sales must be recorded with valid material and customer references.

6. Normalization Analysis

The database is normalized up to **Third Normal Form (3NF):**

1NF

No repeating groups

All fields contain atomic values

2NF

All non-key attributes fully depend on the primary key

3NF

No transitive dependencies

Each attribute depends only on the primary key

This ensures the system avoids redundancy and update anomalies.

7. Additional Constraints and Indexes

Check Constraints

 quantity_delivered > 0

quantity_sold > 0

Indexes

- Automatically created for all primary keys
- Indexes recommended for:
- material_name
- supplier_name
- customer_name

These improve system performance and searching efficiency.

8. Data Integrity Rule

Entity Integrity

 Every table has a unique primary key

Referential Integrity

 All foreign keys reference valid parent records

Domain Integrity

Correct data types and CHECK constraints enforce valid data

9. PL/SQL Implementation Plan

You will implement the following using PL/SQL:

Stored Procedures

- Add/update materials
- Add/update suppliers
- Process deliveries
- Process sales

Functions

Calculate sale totals

Check stock level

Triggers

 Deduct stock after sale

Increase stock after delivery

Packages

Organize procedures and functions into modules

This ensures modular and maintainable database logic.

10. Conclusion

 This logical model fully describes the structure required for the Materials Supply & Sales Management System. It supports all business activities including supply tracking, inventory management, and customer sales.

The model is normalized, efficient, and ready for implementation in Oracle using PL/SQL. It provides a reliable blueprint for the physical database design and application development.