Database Schema Documentation: Banking Core System

1. Introduction

The Banking Core system is designed as a robust, secure, and scalable financial platform. The database serves as the authoritative source for all financial records, user identities, and system configurations. Key design goals include ensuring transaction integrity via double-entry bookkeeping principles, maintaining detailed audit trails for regulatory compliance, and implementing a granular Role-Based Access Control (RBAC) system.

2. Database Overview

The system utilizes a relational model (MySQL) organized into several functional modules:

- **Identity & Access Management (IAM)**: Manages users, roles, and permissions.
- **Customer Relationship Management (CRM)**: Tracks customer profiles and KYC status.
- **Core Banking Operations**: Handles accounts, balances, and account types.
- **Transaction Engine**: Implements the double-entry ledger system.
- **System Integrity & Security**: Includes audit logs, idempotency management, and fraud detection.

2.1 Key Design Principles

- **Double-Entry Bookkeeping**: Every transaction is reflected in at least two ledger entries (Debit and Credit) to ensure balanced records.
- **Idempotency**: Prevents duplicate processing of the same transaction request using a unique key system.
- **Auditability**: Extensive logging of both financial transactions and administrative actions.

3. Table-wise Attribute Listing

3.1 Module: Identity & Access Management

Table: `roles`

Description: Defines system roles and their associated permission sets.

Attribute	Data Type	Nullable	Default	Meaning
`id` (PK)	BIGINT	No	Auto-inc	Unique identifier for the role
`code`	VARCHAR(50)	No	-	Short string code (e.g., ADMIN, BANKER)
`name`	VARCHAR(100)	No	-	Human-readable name
`description`	TEXT	Yes	NULL	Detailed role description
`permissions`	JSON	Yes	NULL	List of functional permissions
`is_system`	BOOLEAN	No	FALSE	Indicates if it's a protected system role
`created_at`	TIMESTAMP	Yes	CURRENT_TIMESTAMP	Record creation timestamp

Table: `users`

Description: Stores administrative and staff user accounts.

Attribute	Data Type	Nullable	Default	Meaning
`id` (PK)	BIGINT	No	Auto-inc	Unique identifier for the user
`email`	VARCHAR(255)	No	-	Unique email address (login credential)

Attribute	Data Type	Nullable	Default	Meaning
`password_hash`	VARCHAR(255)	No	-	Securely hashed password
`first_name`	VARCHAR(100)	No	-	User's first name
`last_name`	VARCHAR(100)	No	-	User's last name
`role_id` (FK)	BIGINT	No	-	Link to `roles.id`
`status`	VARCHAR(20)	Yes	'ACTIVE'	Current account status (ACTIVE, INACTIVE)
`last_login_at`	TIMESTAMP	Yes	NULL	Timestamp of last successful login

3.2 Module: Customer Relationship Management (CRM)

Table: `customers`

Description: Stores retail customer information and KYC (Know Your Customer) details.

Attribute	Data Type	Nullable	Default	Meaning
`id` (PK)	BIGINT	No	Auto-inc	Unique identifier for the customer
`customer_number`	VARCHAR(20)	No	-	Unique business ID for the customer
`email`	VARCHAR(255)	No	-	Customer's email address
`password_hash`	VARCHAR(255)	No	-	Hashed portal password
`first_name`	VARCHAR(100)	No	-	Customer's first name
`last_name`	VARCHAR(100)	No	-	Customer's last name
`phone`	VARCHAR(20)	Yes	NULL	Primary contact phone number
`national_id`	VARCHAR(50)	Yes	NULL	Government-issued ID number

Attribute	Data Type	Nullable	Default	Meaning
date_of_birth	DATE	Yes	NULL	Date of birth for KYC
status	VARCHAR(20)	Yes	'PENDING'	Account status (ACTIVE, PENDING, FROZEN)
kyc_status	VARCHAR(20)	Yes	'PENDING'	KYC validation level

3.3 Module: Core Banking Operations

Table: `account_types`

Description: Defines product specifications (e.g., Savings, Checking).

Attribute	Data Type	Nullable	Default	Meaning
id (PK)	BIGINT	No	Auto-inc	Unique identifier
code	VARCHAR(50)	No	-	Internal code (e.g., SAVINGS)
name	VARCHAR(100)	No	-	Display name
min_balance	DECIMAL(18,4)	Yes	0	Minimum balance requirement
is_active	BOOLEAN	No	TRUE	If this product is currently offered

Table: `accounts`

Description: Individual customer financial accounts.

Attribute	Data Type	Nullable	Default	Meaning
id (PK)	BIGINT	No	Auto-inc	Unique internal ID
account_number	VARCHAR(20)	No	-	IBAN-style unique account number
customer_id (FK)	BIGINT	No	-	Link to `customers.id`
account_type_id (FK)	BIGINT	No	-	Link to `account_types.id`

Attribute	Data Type	Nullable	Default	Meaning
status	VARCHAR(20)	Yes	'PENDING'	Status (ACTIVE, CLOSED, etc.)
opened_at	TIMESTAMP	Yes	NULL	Date and time account was opened
currency	VARCHAR(3)	Yes	'BDT'	ISO currency code

Table: `account_balances`

Description: Real-time balance tracker for quick lookups.

Attribute	Data Type	Nullable	Default	Meaning
account_id (PK, FK)	BIGINT	No	-	Link to `accounts.id`
available_balance	DECIMAL(18,4)	No	0	Funds available for withdrawal
version	INT	Yes	1	Optimistic locking version
updated_at	TIMESTAMP	Yes	CURRENT_TIMESTAMP	Last update timestamp

3.4 Module: Transaction Engine

Table: `transaction_types`

Description: Categories of financial movements.

Attribute	Data Type	Nullable	Default	Meaning
id (PK)	BIGINT	No	Auto-inc	Unique identifier

Attribute	Data Type	Nullable	Default	Meaning
code	VARCHAR(50)	No	-	e.g., TRANSFER, DEPOSIT, WITHDRAWAL

Table: `transactions`

Description: High-level record of a financial transaction event.

Attribute	Data Type	Nullable	Default	Meaning
id (PK)	BIGINT	No	Auto-inc	Internal transaction ID
transaction_reference	VARCHAR(50)	No	-	Unique business reference (UUID)
transaction_type_id	BIGINT	No	-	Link to `transaction_types.id`
amount	DECIMAL(18,4)	No	-	Magnitude of the transaction
source_account_id	BIGINT	Yes	NULL	Sender's account (if applicable)
destination_account_id	BIGINT	Yes	NULL	Receiver's account (if applicable)
status	VARCHAR(20)	Yes	'PENDING'	Finality (COMPLETED, FAILED)

Table: `ledger_entries`

Description: The granular double-entry records. Each transaction has multiple entries.

Attribute	Data Type	Nullable	Default	Meaning
id (PK)	BIGINT	No	Auto-inc	Entry ID
transaction_id (FK)	BIGINT	No	-	Link to parent `transactions.id`

Attribute	Data Type	Nullable	Default	Meaning
account_id (FK)	BIGINT	No	-	Account affected by this entry
entry_type	VARCHAR(10)	No	-	DEBIT or CREDIT
amount	DECIMAL(18,4)	No	-	Amount of this specific entry
balance_after	DECIMAL(18,4)	No	-	Account balance after this entry

3.5 Module: System Integrity & Security

Table: `audit_logs`

Description: Captures administrative and security events.

Attribute	Data Type	Nullable	Default	Meaning
id (PK)	BIGINT	No	Auto-inc	Log ID
actor_id	BIGINT	Yes	NULL	ID of the entity performing action
actor_type	VARCHAR(20)	No	-	Type (user, customer, system)
action_type	VARCHAR(50)	No	-	Event type (e.g., LOGIN, FROZEN)
before_state	JSON	Yes	NULL	Snapshot before change
after_state	JSON	Yes	NULL	Snapshot after change

Table: `idempotency_keys`

Description: Ensures API requests are not processed more than once.

Attribute	Data Type	Nullable	Default	Meaning
idempotency_key (PK)	VARCHAR(64)	No	-	Unique request identifier
response_status	INT	Yes	NULL	Cached HTTP status code
response_body	JSON	Yes	NULL	Cached response JSON

Attribute	Data Type	Nullable	Default	Meaning
expires_at	TIMESTAMP	Yes	NULL	When this key will be purged

Table: `fraud_queue`

Description: Transactions flagged for manual review by auditors.

Attribute	Data Type	Nullable	Default	Meaning
id (PK)	BIGINT	No	Auto-inc	Queue entry ID
transaction_id (FK)	BIGINT	No	-	Flagged transaction
severity	ENUM	No	-	LOW, MEDIUM, HIGH, CRITICAL
status	ENUM	No	'PENDING'	REVIEWING, APPROVED, REJECTED
fraud_score	INT	No	0	Risk assessment score