

## University ERP System - Project Summary

**Student Name:** Mukul & Mayank rana **Course:** Advanced Programming (Java)

### 1. Project Scope

I developed a comprehensive desktop-based University ERP system using **Java Swing** and **JDBC**. The application streamlines academic management by providing distinct, secure interfaces for Students, Instructors, and Administrators. The system is designed to handle course registration, automated grading, and user management efficiently.

### 2. Architecture & Security

To strictly adhere to security best practices, the system uses a "**Shadow Database**"

**Architecture:**

- **Authentication DB (auth\_db):** Dedicated solely to security. It stores usernames, roles, and **BCrypt hashed passwords**. Real passwords are never stored.
- **ERP Database (erp\_db):** Stores operational data (courses, enrollments, grades).
- **Role Enforcement:** Users are authenticated via the Auth DB, which then grants access *only* to the specific Dashboard authorized for their role (Student, Instructor, or Admin).

### 3. Key Functionalities

- **Student Module:** Features a responsive Course Catalog. Students can view course details, check real-time seat availability, and enroll in classes. The system automatically prevents duplicate enrollments and blocks registration if a course is full.
- **Instructor Module (Automated Grading):** Instructors can view their assigned sections and enter marks. I implemented an automated logic where the system sums component scores (**Quiz: 20, Midterm: 30, EndSem: 50**) and immediately calculates the Final Letter Grade (A, B, C, etc.).
- **Admin Module & Maintenance Mode:** The Admin serves as the superuser. A critical feature is the "**Maintenance Mode**" toggle. When enabled, it sets a global flag that intercepts and blocks "write" operations (like enrolling or saving grades) from all other users to ensure data integrity during updates.

### 4. Bonus Features

To enhance the user experience, I integrated several advanced features:

- **Data Visualization:** The Admin Dashboard includes dynamic **Pie Charts** (User Distribution) and **Bar Charts** (Course Popularity).

- **Notifications System:** A dedicated panel for users to receive and view system alerts.
- **Reports & Backup:** A summary window providing a quick snapshot of system statistics.

## 5. Technical Stack

- **Language:** Java (JDK 21)
- **UI Framework:** Java Swing with FlatLaf for modern styling.
- **Database:** MySQL 8.0 (connected via JDBC).
- **Security:** JBCrypt for password hashing.