AP Project Report : University ERP System

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1 Introduction

1.1 Project Overview

The University ERP System is a robust desktop application developed using Java and Swing. It is designed to digitize and streamline academic operations at IIIT-Delhi. The system manages the core lifecycle of academic administration, including user management, course cataloging, section allotment, student enrollment, and grade computation.

The architecture enforces a strict separation of concerns by utilizing two distinct databases: one for Authentication (`auth_db`) and one for ERP Data (`erp_db`).

1.2 Key Features

- **Role-Based Access Control (RBAC):** Three distinct dashboards for Admins, Instructors, and Students with strictly enforced permissions.
- **Dual-Database Architecture:** Separation of sensitive login credentials from general academic records for enhanced security.
- **Secure Authentication:** Implementation of **BCrypt** password hashing. No passwords are stored in plain text.
- **Account Lockout Policy:** Automatic account locking after 3 consecutive failed login attempts.
- **Maintenance Mode:** A global system-wide lock that allows Admins to pause data modifications (registrations/grading) while keeping the system read-only for users.
- **Deadlines Enforcement:** Admins can set Registration and Drop deadlines; the system automatically blocks actions after these dates.
- **Dynamic Grading System:** Instructors can enter component scores (Quiz, Midsem, Endsem), and the system auto-calculates Letter Grades based on a defined scale.
- **CSV Reporting:** Functionality to export Student Transcripts and Instructor Gradebooks to CSV format.

1.3 Technology Stack

- **Language:** Java (JDK 24)
- **UI Framework:** Java Swing (Custom layouts using GridBagLayout and absolute positioning)
- **Database:** MySQL 8.0+
- **Connectivity:** JDBC (MySQL Connector/J)
- **Security:** jBCrypt for hashing
- **Utilities:** OpenCSV for report generation

2 Project Structure and Execution

2.1 Directory Structure

The submitted project folder `2024560_2024106_Project` is organized as follows:

```
2024560_2024106_Project/
|-- erpportal/          (Source Code & IntelliJ Project)
|-- database/           (SQL Scripts)
|   |-- db_schema.sql
|   |-- short_seed_data.sql
|   |-- long_seed_data.sql
|-- demo/               (Project Demo Video)
|-- documentation/      (Project Report & Diagrams)
```

2.2 Prerequisites

- Java Development Kit (JDK) 21 or higher.
- MySQL Server running on localhost:3306.
- Required Libraries: `mysql-connector-j`, `jbcrypt`, `opencsv`.

2.3 Database Configuration

The system requires the SQL scripts located in the `database/` folder to be executed in the specific order below. We have provided three files for flexibility:

1. `db_schema.sql`: This must be run **FIRST**. It creates the `auth_db` and `erp_db` schemas and defines all table structures (Users, Courses, Sections, Enrollments, Grades, Settings).
2. `short_seed_data.sql` (Recommended for quick testing): Contains a minimal dataset with 1 Admin, 1 Instructor, and 2 Students to verify core functionality quickly.
3. `long_seed_data.sql` (Optional for stress testing): Contains a comprehensive dataset with 100 users (5 Admins, 25 Instructors, 70 Students), 20 Courses, and 250+ Enrollments.

Note: Run only *one* seed file (Short OR Long) after running the schema file.

Configuration in `DatabaseConnector.java`:

```
private static final String DB_USER = "root";
private static final String DB_PASSWORD = "YOUR_PASSWORD";
```

2.4 Default Login Credentials

The system comes pre-seeded with the following accounts for testing (using `short_seed_data.sql`):

Role	Username	Password	Notes
Admin	`admin1`	`a1`	Main Administrator
Instructor	`inst1`	`i1`	Teaches CS101, CS305
Student	`stu1`	`s1`	B.Tech CS Student
Student	`stu2`	`pass123`	Secondary Student

Table 1: Default Login Credentials

3 System Architecture

3.1 Database Schema Design

The project implements a specialized security design by splitting data into two databases.

3.1.1 1. Authentication DB (`auth_db`)

Stores only login-critical information.

- **users_auth:** Stores `user_id`, `username`, `role` (VARCHAR), `password_hash`, `status` (active/locked), and `failed_attempts`.

3.1.2 2. ERP Data DB (`erp_db`)

Stores academic data linked to the Auth DB via `user_id`.

- **students / instructors:** Profile data.
- **courses:** Catalog of available subjects.
- **sections:** Specific instances of courses (Time, Room, Capacity).
- **enrollments:** Maps students to sections (Many-to-Many).
- **grades:** Stores scores for Quiz, Midsem, and Endsem.
- **settings:** Stores global flags like Maintenance Mode and Deadlines.

3.2 Grading Logic

The grading module allows instructors to input raw scores. The system automatically computes the total and assigns a letter grade based on the following logic:

3.2.1 Components

- **Quiz:** Max 20 marks.
- **Midsem:** Max 30 marks.
- **Endsem:** Max 50 marks.

3.2.2 Computation

The total score is a simple summation:

$$\text{Total} = \text{Quiz} + \text{Midsem} + \text{Endsem}$$

3.2.3 Grade Scale

Score Range	**Letter Grade**
≥ 90	A
$80 - 89$	B
$70 - 79$	C
$60 - 69$	D
< 60	F

4 Feature Implementation Details

4.1 Maintenance Mode

The Admin has a "Toggle Maintenance" switch.

- **When ON:** A flag is set in the `settings` table.
- **Impact:** Students cannot Register/Drop courses. Instructors cannot Save/Compute grades.
- **UI Feedback:** A red warning banner "SYSTEM UNDER MAINTENANCE" appears on all dashboards.

4.2 Registration System

The system handles complex registration constraints:

- **Capacity Check:** Students cannot register if `Enrolled` ≥ `Capacity`. UI shows "Enrolled / Cap" (e.g., 2 / 60).
- **Duplicate Check:** Prevents enrolling in the same section twice.
- **Deadline Check:** Checks against the Admin-configured deadline date stored in the DB.

4.3 Reporting (CSV Exports)

We utilized `OpenCSV` to generate professional reports.

- **Student Transcript:** Groups grades by course, filters out duplicate entries (e.g., prefers "Quiz (20)" over "Quiz"), and adds a summary row for the Final Grade.
- **Instructor Gradebook:** Exports the entire class list with individual component scores.

4.4 Security Implementation

- **BCrypt Hashing:** Passwords are salted and hashed before storage.
- **Account Lockout:** If a user enters the wrong password 3 times, the `status` in `users_auth` is updated to 'locked', preventing further access until an Admin intervenes.

5 Screenshots

5.1 Login Window

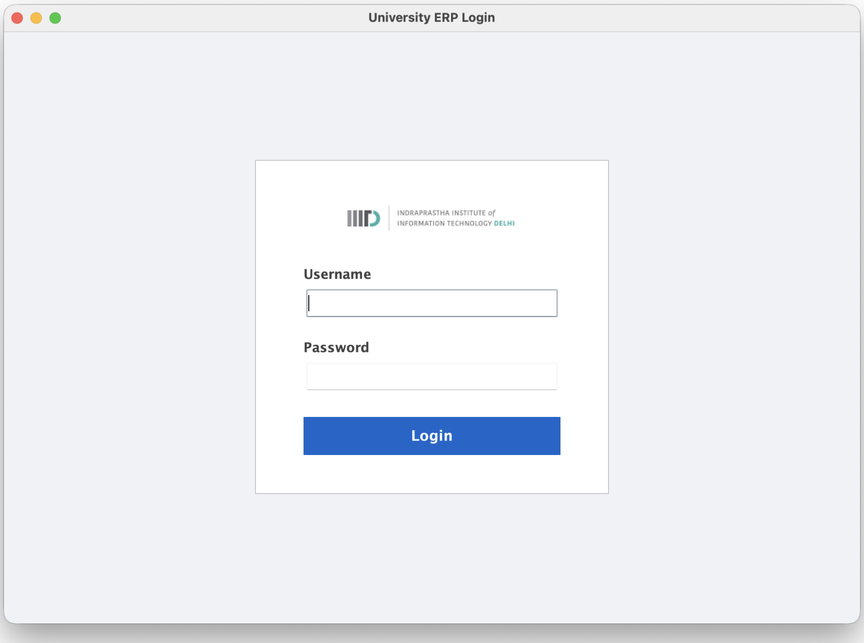
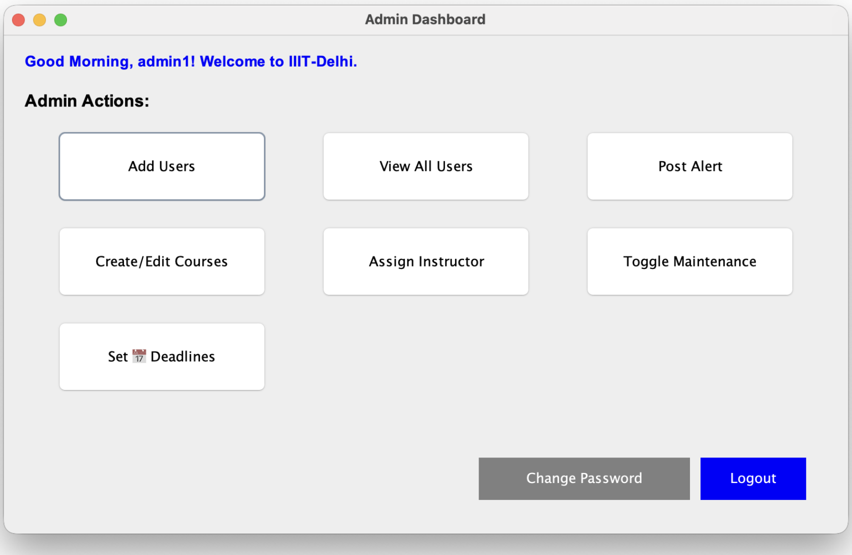


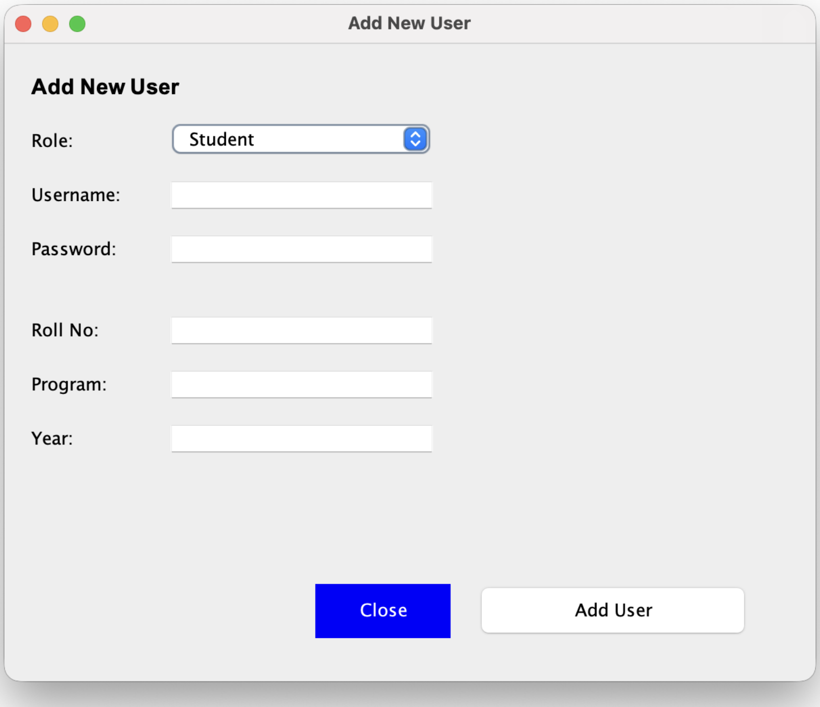
Figure 1: Login Screen with IIIT-D Branding

5.2 Admin Window



Good Morning, admin1! Welcome to IIIT-Delhi.

Figure 2: Admin Dashboard with Maintenance Controls



Add New User

Role: Student

Username:

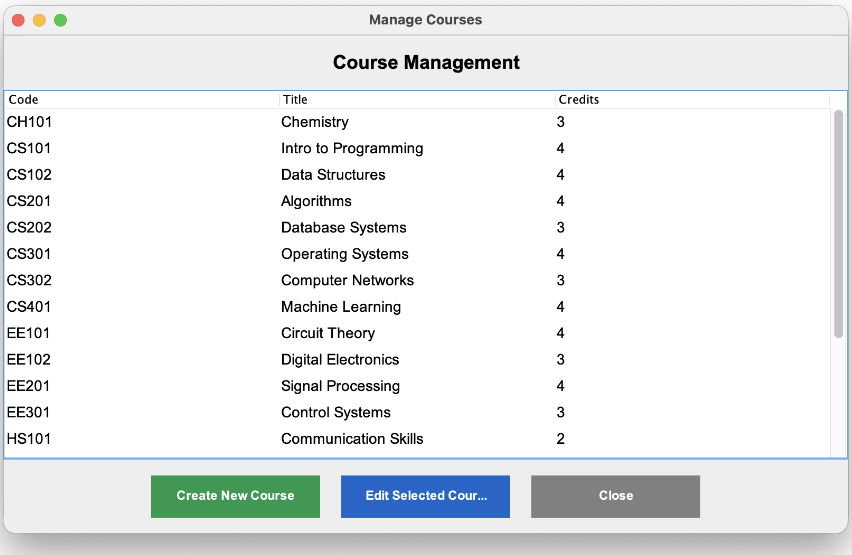
Password:

Roll No:

Program:

Year:

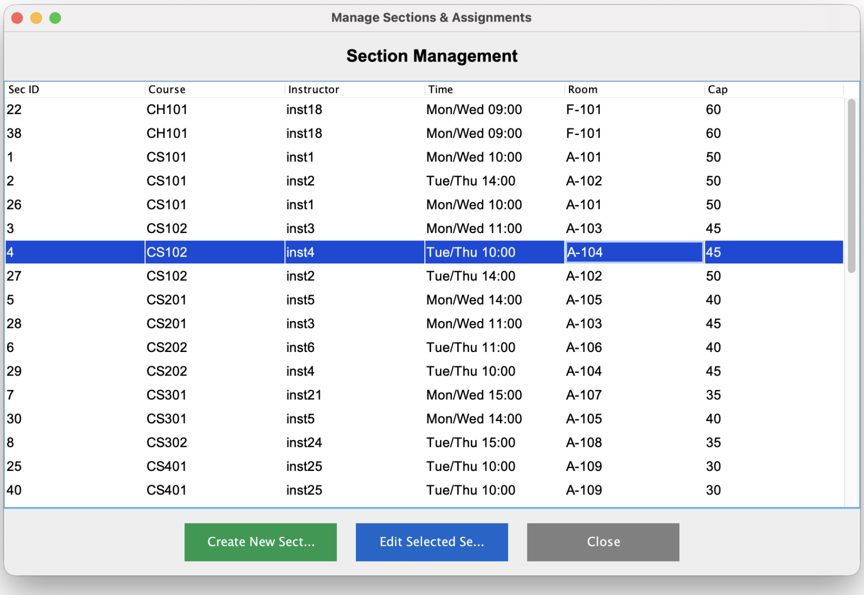
Figure 3: Add user by admin



Course Management

Code	Title	Credits
CH101	Chemistry	3
CS101	Intro to Programming	4
CS102	Data Structures	4
CS201	Algorithms	4
CS202	Database Systems	3
CS301	Operating Systems	4
CS302	Computer Networks	3
CS401	Machine Learning	4
EE101	Circuit Theory	4
EE102	Digital Electronics	3
EE201	Signal Processing	4
EE301	Control Systems	3
HS101	Communication Skills	2

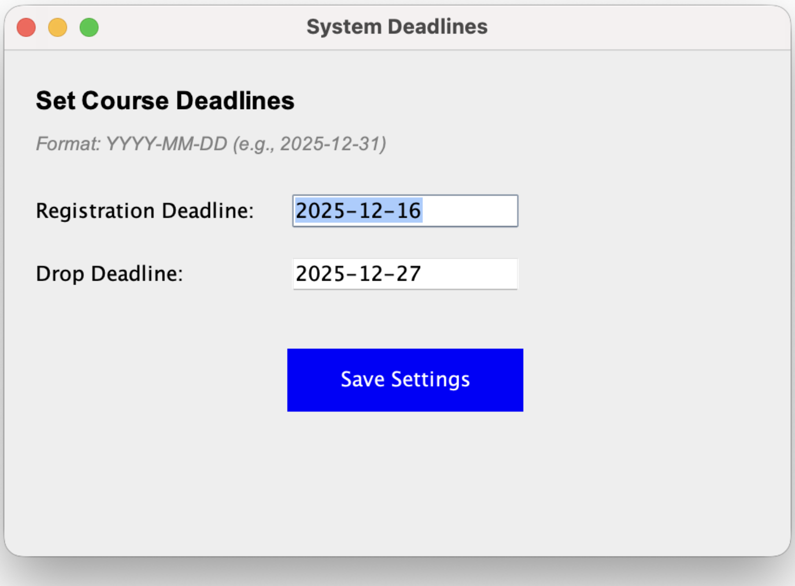
Figure 4: Course Management by admin



Section Management

Sec ID	Course	Instructor	Time	Room	Cap
22	CH101	inst18	Mon/Wed 09:00	F-101	60
38	CH101	inst18	Mon/Wed 09:00	F-101	60
1	CS101	inst1	Mon/Wed 10:00	A-101	50
2	CS101	inst2	Tue/Thu 14:00	A-102	50
26	CS101	inst1	Mon/Wed 10:00	A-101	50
3	CS102	inst3	Mon/Wed 11:00	A-103	45
4	CS102	inst4	Tue/Thu 10:00	A-104	45
27	CS102	inst2	Tue/Thu 14:00	A-102	50
5	CS201	inst5	Mon/Wed 14:00	A-105	40
28	CS201	inst3	Mon/Wed 11:00	A-103	45
6	CS202	inst6	Tue/Thu 11:00	A-106	40
29	CS202	inst4	Tue/Thu 10:00	A-104	45
7	CS301	inst21	Mon/Wed 15:00	A-107	35
30	CS301	inst5	Mon/Wed 14:00	A-105	40
8	CS302	inst24	Tue/Thu 15:00	A-108	35
25	CS401	inst25	Tue/Thu 10:00	A-109	30
40	CS401	inst25	Tue/Thu 10:00	A-109	30

Figure 5: Section Management by admin



Set Course Deadlines

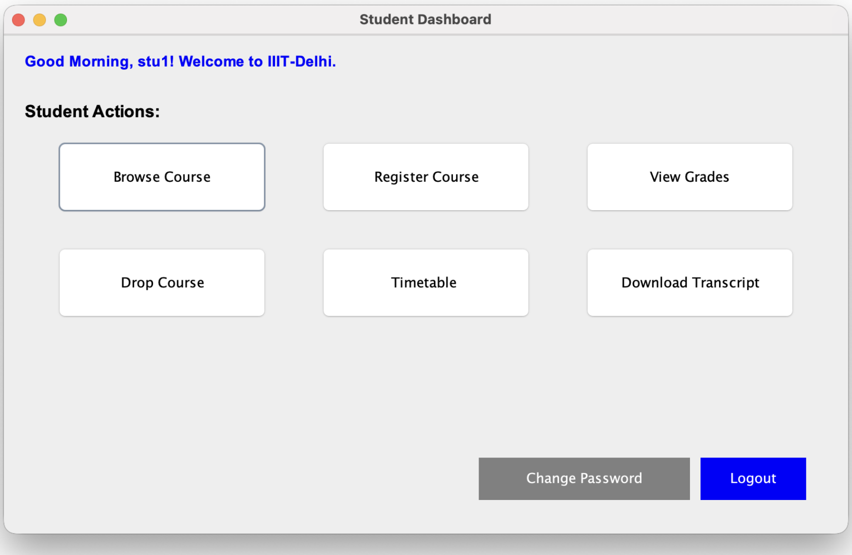
Format: YYYY-MM-DD (e.g., 2025-12-31)

Registration Deadline: 2025-12-16

Drop Deadline: 2025-12-27

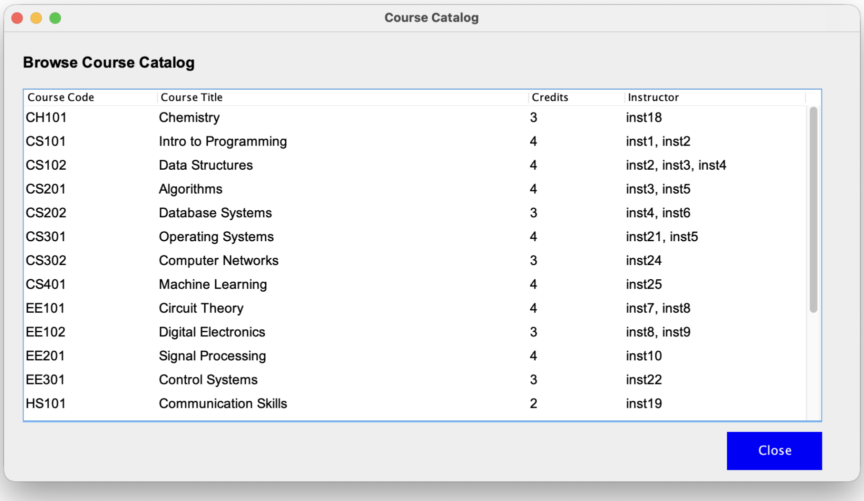
Figure 6: Edit/Add Deadline Window

5.3 Student Window



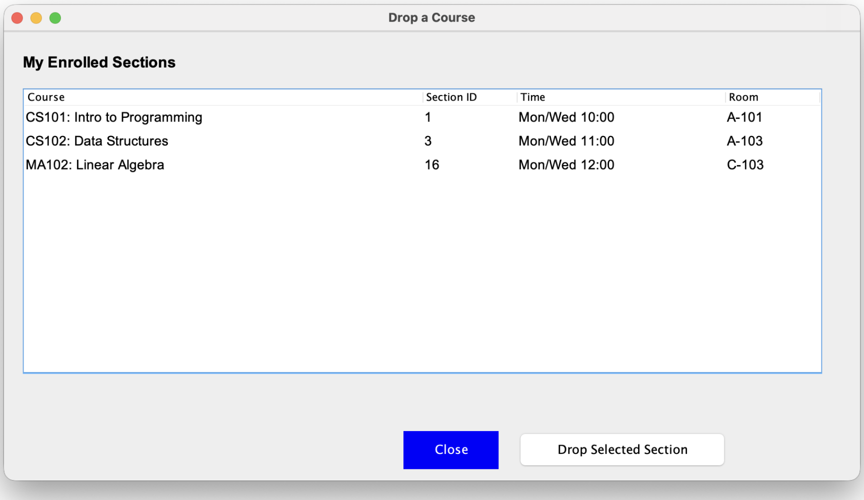
Good Morning, stu1! Welcome to IIIT-Delhi.

Figure 7: Student Dashboard



Course Code	Course Title	Credits	Instructor
CH101	Chemistry	3	inst18
CS101	Intro to Programming	4	inst1, inst2
CS102	Data Structures	4	inst2, inst3, inst4
CS201	Algorithms	4	inst3, inst5
CS202	Database Systems	3	inst4, inst6
CS301	Operating Systems	4	inst21, inst5
CS302	Computer Networks	3	inst24
CS401	Machine Learning	4	inst25
EE101	Circuit Theory	4	inst7, inst8
EE102	Digital Electronics	3	inst8, inst9
EE201	Signal Processing	4	inst10
EE301	Control Systems	3	inst22
HS101	Communication Skills	2	inst19

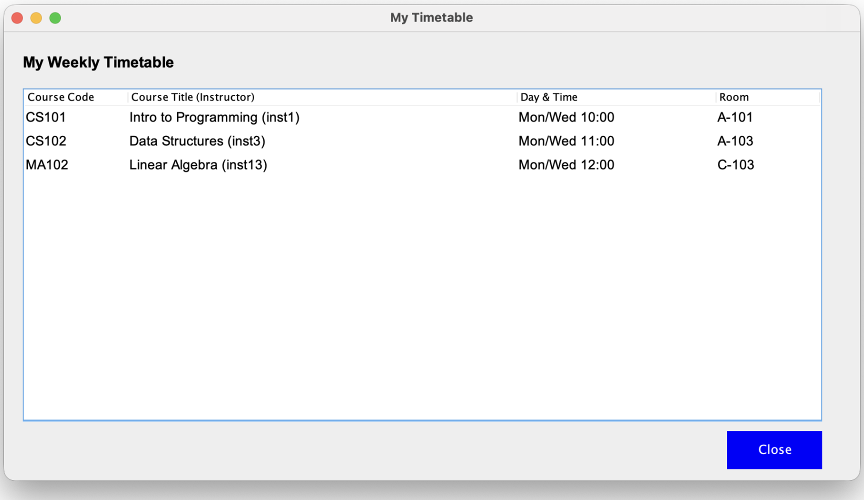
Figure 8: Course Catalog - Browse Available Courses



My Enrolled Sections

Course	Section ID	Time	Room
CS101: Intro to Programming	1	Mon/Wed 10:00	A-101
CS102: Data Structures	3	Mon/Wed 11:00	A-103
MA102: Linear Algebra	16	Mon/Wed 12:00	C-103

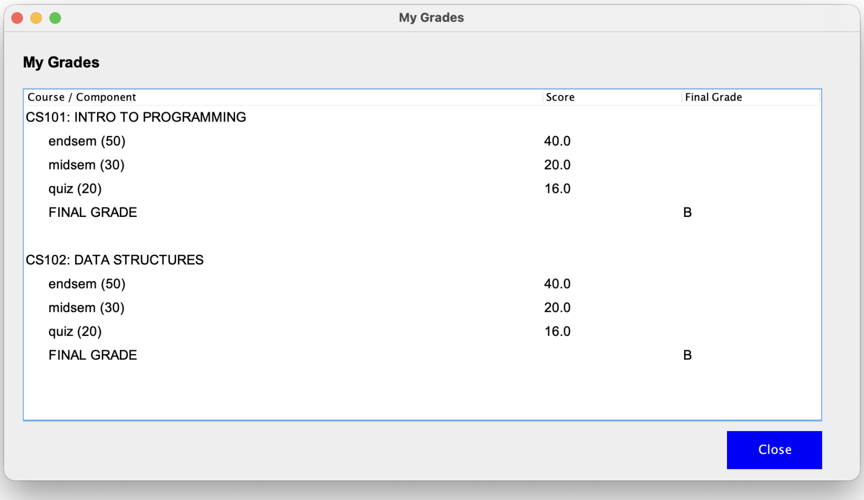
Figure 9: Drop Course - Student Course Withdrawal



My Weekly Timetable

Course Code	Course Title (Instructor)	Day & Time	Room
CS101	Intro to Programming (inst1)	Mon/Wed 10:00	A-101
CS102	Data Structures (inst3)	Mon/Wed 11:00	A-103
MA102	Linear Algebra (inst13)	Mon/Wed 12:00	C-103

Figure 10: Student Timetable View



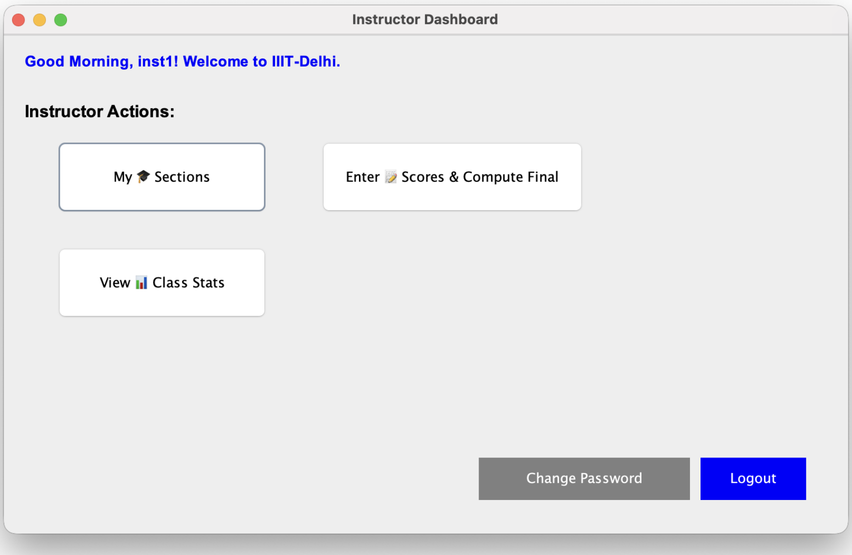
My Grades

My Grades

Course / Component	Score	Final Grade
CS101: INTRO TO PROGRAMMING		
endsem (50)	40.0	
midsem (30)	20.0	
quiz (20)	16.0	
FINAL GRADE		B
CS102: DATA STRUCTURES		
endsem (50)	40.0	
midsem (30)	20.0	
quiz (20)	16.0	
FINAL GRADE		B

Figure 11: Grades - Student Academic Performance

5.4 Instructor Window

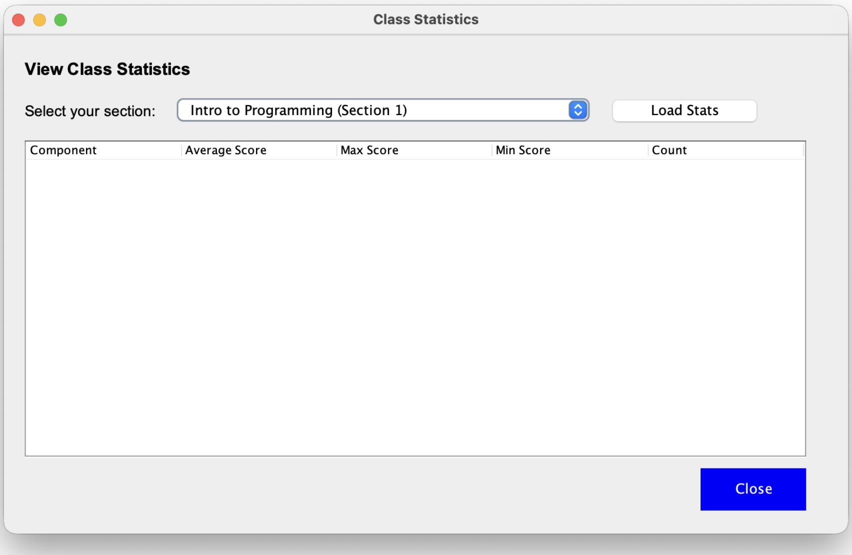


Instructor Dashboard

Good Morning, inst1! Welcome to IIIT-Delhi.

Instructor Actions:

Figure 12: Instructor Dashboard

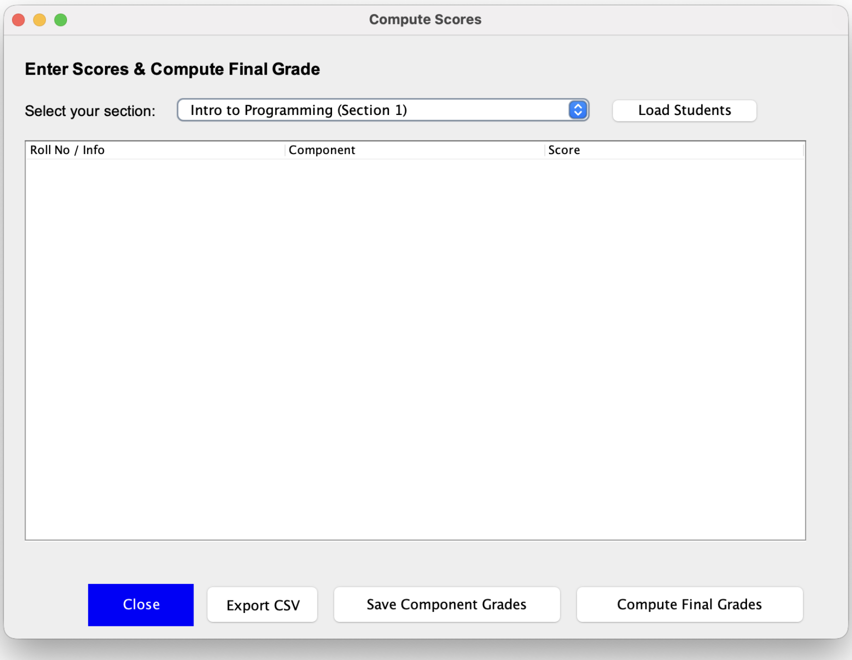


View Class Statistics

Select your section: Intro to Programming (Section 1)

Component	Average Score	Max Score	Min Score	Count

Figure 13: Class Statistics - Performance Analytics



Enter Scores & Compute Final Grade

Select your section: Intro to Programming (Section 1)

Roll No / Info	Component	Score

Figure 14: Compute Scores - Grade Calculation Interface

6 Conclusion

This project successfully implements a scalable, secure, and user-friendly ERP system. It addresses real-world requirements such as concurrency (via transaction management in registration), security (via hashing and architecture), and usability (via intuitive Swing UIs).