Development Plan – Library Management System

Phase 1: Project Setup & Environment

- Create Spring Boot project using Maven
- Set up Docker and WSL environment
- Run PostgreSQL container using Docker
- Configure PostgreSQL connection in application.properties
- Verify application startup and database connectivity

Phase 2: Project Structure & Core Entities

- Set up layered architecture
- Create User entity with roles
- Create Item parent class and child entities
- Create Category entity
- Configure JPA mappings

Phase 3: Authentication & Role-Based Access

- Implement signup and login functionality
- Assign default STUDENT role
- Implement role-based authorization
- Redirect users to Admin or Student dashboards

Phase 4: Admin Module Development

- Design Admin dashboard UI
- Implement Book and Category CRUD operations
- View all users
- Promote Student to Admin
- Delete user accounts
- Display dashboard statistics

Phase 5: Student Module Development

- Design Student dashboard UI
- Implement book search and filtering
- Implement issue and return book functionality
- Display issued books and due dates

Phase 6: Multithreading & Synchronization

- Implement background overdue checker thread
- Use Thread.start(), Thread.sleep(), and interrupt
- Apply ReentrantLock for issue and return operations

Phase 7: AI Features Implementation

- Implement rule-based recommendation system
- Implement smart search auto-suggestions
- Implement overdue prediction logic
- Implement rule-based chatbot

Phase 8: Notifications & Alerts

- Implement overdue notifications
- Display alerts on dashboards

Phase 9: Generics & Exception Handling

- Implement generic Library<T> class
- Create custom exceptions
- Implement global exception handling

Phase 10: Unit Testing

- Write unit tests using JUnit
- Use Mockito for mocking
- Test authentication and role-based access

Phase 11: UI Finalization & Documentation

- Enhance UI using HTML, CSS, and JavaScript
- Add form validations

- Perform integration testing
- Prepare final documentation and screenshots