Traceability Matrix

Req ID	Requirement	Design Artifacts
FR1	Create Timetable	- Use Case: Create Timetable - Context Diagram (Level 0) - DFD Level 2: Timetable Management Module - Sequence Diagram: Timetable Creation with Conflict Detection - Activity Diagram: Timetable Creation and Publishing Workflow - Classes: Timetable, TimetableManagementService, TimetableEntry, Course, User, Venue, TimeSlot, Department - Components: Timetable Management
FR2	Edit Timetable	- Use Case: Edit Timetable - DFD Level 2: Timetable Management Module - Activity Diagram: Timetable Creation and Publishing Workflow - Classes: Timetable, TimetableManagementService, TimetableEntry, TimetableVersion - Components: Timetable Management
FR3	Delete Timetable	- Use Case: Delete Timetable - DFD Level 2: Timetable Management Module - Classes: Timetable, TimetableManagementService - Components: Timetable Management
FR4	Conflict Detection	- Use Case: Detect Conflicts - Context Diagram (Level 0) - DFD Level 2: Conflict Management Module - DFD Level 2: Timetable Management Module - Sequence Diagram: Timetable Creation with Conflict Detection - Activity Diagram: Conflict Detection and Resolution Workflow - Classes: Conflict, ConflictDetectionEngine, TimetableEntry, ConflictManagementService - Components: Conflict Detector

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FR5	Conflict Resolution Suggestions	- Use Case: Resolve Conflicts - DFD Level 2: Conflict Management Module - Sequence Diagram: Conflict Resolution with Suggestions - Activity Diagram: Conflict Detection and Resolution Workflow - Classes: ConflictResolution, ConflictResolver, ConflictManagementService - Components: Resolution, Conflict Detector
FR6	Publish Timetable	- Use Case: Publish Timetable - DFD Level 2: Timetable Management Module - Sequence Diagram: Timetable Publishing - Activity Diagram: Timetable Creation and Publishing Workflow - Classes: Timetable, TimetableManagementService, NotificationService - Components: Timetable Management
FR7	Archive Timetable	- Use Case: Archive Timetable - DFD Level 2: Timetable Management Module - Classes: Timetable, TimetableManagementService - Components: Timetable Management
FR8	Import and Export Timetable	- Use Case: Import/Export Timetable - DFD Level 2: Timetable Management Module - Classes: FileParser, ExportService, Report - Components: Timetable Management
FR9	Bulk Operations	- Use Case: Edit Timetable - DFD Level 2: Timetable Management Module - Activity Diagram: Timetable Creation and Publishing Workflow - Classes: TimetableEntry, TimetableManagementService - Components: Timetable Management
FR10	Timetable Versioning	- DFD Level 2: Timetable Management Module - Classes: TimetableVersion, TimetableManagementService - Components: Timetable Management
FR11	Conflict Report	- Use Case: View Conflict Report - DFD Level 2: Conflict Management Module - DFD Level 2: Timetable Management Module - Activity Diagram: Report Generation Workflow - Classes: ConflictReport, ReportingService, ConflictManagementService - Components: Reporting

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FR12	Track Resolution Status	- Use Case: View Conflict Report - DFD Level 2: Conflict Management Module - Activity Diagram: Conflict Detection and Resolution Workflow - Classes: Conflict, ConflictManagementService - Components: Conflict Detector
FR13	Automated Conflict Resolution	- Use Case: Resolve Conflicts - DFD Level 2: Conflict Management Module - Sequence Diagram: Conflict Resolution with Suggestions - Activity Diagram: Conflict Detection and Resolution Workflow - Classes: ConflictResolution, ConflictResolver, ConflictManagementService - Components: Resolution, Conflict Detector
FR14	User Registration	- Use Case: Manage Users - Context Diagram (Level 0) - Activity Diagram: User Registration Workflow - Classes: User, UserManagementService, AuthenticationService - Components: User Manager
FR15	User Login and Authentication	- Use Case: Login - Context Diagram (Level 0) - Sequence Diagram: User Login - Activity Diagram: User Login Workflow - Classes: User, AuthenticationService, Session - Components: Auth Service
FR16	Role-Based Access Control	- Use Case: Login - Context Diagram (Level 0) - Classes: User, AuthenticationService, SecurityService - Components: RBAC, Access Control
FR17	User Profile Management	- Use Case: Update Profile - Classes: User, UserManagementService - Components: User Manager
FR18	Password Reset	- Use Case: Login - Sequence Diagram: Password Reset - Activity Diagram: Password Reset Workflow - Classes: AuthenticationService, EmailService - Components: Auth Service, Email Server

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FR19	Bulk User Import	- Use Case: Manage Users - Sequence Diagram: Bulk User Import - Activity Diagram: Bulk User Import Workflow - Classes: UserManagementService, FileParser, User, EmailService - Components: User Manager
FR20	User Deactivation	- Use Case: Manage Users - Classes: User, UserManagementService - Components: User Manager
FR21	Multi-Factor Authentication	- Use Case: Login - Sequence Diagram: User Login - Activity Diagram: User Login Workflow - Classes: AuthenticationService, Session - Components: Auth Service
FR22	Email Notifications	- Use Case: Send Notifications - Context Diagram (Level 0) - DFD Level 2: Notification and Communication Process - Sequence Diagram: Notification and Communication - Activity Diagram: Notification Delivery Workflow - Classes: Notification, EmailService, NotificationService - Components: Notification Service, Email Server
FR23	In-App Notifications	- Use Case: View Notifications - DFD Level 2: Notification and Communication Process - Sequence Diagram: Notification and Communication - Activity Diagram: Notification Delivery Workflow - Classes: Notification, NotificationService - Components: Notification Service
FR24	Scheduled Notifications	- Use Case: Send Notifications - DFD Level 2: Notification and Communication Process - Activity Diagram: Notification Delivery Workflow - Classes: Notification, NotificationService - Components: Notification Service
FR25	Notification Preferences	- Use Case: Update Profile - DFD Level 2: Notification and Communication Process - Classes: NotificationPreference, NotificationService - Components: Notification Service

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FR27	Timetable Summary Report	- Use Case: Generate Reports - Context Diagram (Level 0) - Activity Diagram: Report Generation Workflow - Classes: TimetableSummaryReport, ReportingService, ReportGenerator, Report - Components: Reporting
FR28	Resource Utilization Report	- Use Case: Generate Reports - Activity Diagram: Report Generation Workflow - Classes: ResourceUtilizationReport, ReportingService, ReportGenerator, Report - Components: Reporting
FR29	Audit Log Report	- Use Case: Generate Reports - Context Diagram (Level 0) - Activity Diagram: Report Generation Workflow - Classes: AuditLogReport, AuditLog, AuditLogService, ReportingService - Components: Audit Service
FR30	Venue and Classroom Management	- Use Case: Configure System - Context Diagram (Level 0) - Classes: Venue, ResourceManagementService, Booking - Components: Resource Management
FR31	Lab Management	- Use Case: Configure System - Classes: Venue, ResourceManagementService, Booking - Components: Resource Management
FR32	Resource Constraints	- Use Case: Configure System - Classes: ConflictDetectionEngine, CourseConstraint, TimetableEntry - Components: Resource Management
FR33	Resource Conflict Detection	- Use Case: Detect Conflicts - DFD Level 2: Conflict Management Module - Activity Diagram: Conflict Detection and Resolution Workflow - Classes: ConflictDetectionEngine, ResourceManagementService, Booking - Components: Conflict Detector, Resource Management
FR34	Course Registry	- Use Case: Manage Courses - Context Diagram (Level 0) - Classes: Course, CourseManagementService, Department - Components: Course Management

Req ID	Requirement	Design Artifacts
FR35	Department Management	- Use Case: Manage Departments - Context Diagram (Level 0) - Classes: Department, CourseManagementService - Components: Course Management
FR36	Course Constraints	- Use Case: Configure System - Classes: CourseConstraint, Course - Components: Course Management
FR37	Admin Dashboard	- Use Case: Generate Reports, Manage Users, Manage Departments, Manage Courses, Configure System - Context Diagram (Level 0) - DFD Level 2: Dashboard - Classes: Dashboard, AdminDashboard, DashboardService - Components: Search, Search Engine
FR38	Faculty Dashboard	- Use Case: View Timetable, View Notifications, Update Profile - Context Diagram (Level 0) - DFD Level 2: Dashboard - Classes: Dashboard, FacultyDashboard, DashboardService - Components: Search, Search Engine
FR39	Student Dashboard	- Use Case: View Timetable, View Notifications, Update Profile - Context Diagram (Level 0) - DFD Level 2: Dashboard - Classes: Dashboard, StudentDashboard, DashboardService, ExportService - Components: Search, Search Engine
FR40	Filter and Sort	- Use Case: View Timetable - DFD Level 2: Dashboard - Classes: DashboardService - Components: Search, Search Engine
FR41	Academic Calendar Setup	- Use Case: Configure System - Context Diagram (Level 0) - DFD Level 2: System Configuration - Classes: TimeSlot - Components: Config Manager
FR42	Time Slot Configuration	- Use Case: Configure System - DFD Level 2: System Configuration - Classes: TimeSlot - Components: Config Manager

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FR43	System Settings	- Use Case: Configure System - DFD Level 2: System Configuration - Classes: NotificationService, EmailService - Components: Config Manager
FR44	Constraint Configuration	- Use Case: Configure System - DFD Level 2: System Configuration - Classes: CourseConstraint, ConflictDetectionEngine - Components: Config Manager
FR45	Data Validation	- Context Diagram (Level 0) - DFD Level 2: Timetable Management Module - DFD Level 2: Conflict Management Module - DFD Level 2: System Configuration - Classes: TimetableManagementService, UserManagementService, FileParser, SecurityService, TimetableEntry - Components: Validation
FR46	Data Consistency	- Context Diagram (Level 0) - Classes: Course, Timetable - Components: PostgreSQL/MySQL
FR47	Access Control	- Use Case: All system operations - Context Diagram (Level 0) - Sequence Diagram: User Login - Classes: User, AuthenticationService, SecurityService - Components: Access Control, RBAC
FR48	Data Backup	- Use Case: Backup Data - Context Diagram (Level 0) - Classes: SecurityService - Components: Data Security, Timetable Management
FR49	Automatic Timetable Generation	- Use Case: Generate Timetable (Create Timetable) - DFD Level 2: Timetable Management Module - Sequence Diagram: Automatic Timetable Generation - Activity Diagram: Auto Timetable Generation Workflow - Classes: Timetable, TimetableEntry, TimetableManagementService, Course, User, Venue, TimeSlot, CourseConstraint, ConflictDetectionEngine - Components: Generator

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FR50	Draft Review and Approval	- Use Case: Validate Timetable - DFD Level 2: Timetable Management Module - Sequence Diagram: Timetable Publishing - Activity Diagram: Timetable Creation and Publishing Workflow - Classes: Timetable, TimetableVersion, TimetableManagementService, ConflictDetectionEngine - Components: Timetable Management