Software Requirements Specification (SRS)

AI-Based Timetable Generation System aligned with NEP 2020

Version: 1.0
Date: September 2025

1. Introduction

1.1 Purpose: The purpose of this document is to define the requirements for an AI/ML-assisted Timetable Generation System designed for higher education institutions implementing the National Education Policy (NEP) 2020.

1.2 Scope: The system will generate conflict-free, optimized academic timetables across FYUP, B.Ed., M.Ed., and ITEP programs. It integrates student electives, faculty workload, and room availability while supporting exports and AMS/LMS integration.

1.3 Definitions: NEP 2020 (National Education Policy), FYUP (Four-Year Undergraduate Programme), ITEP (Integrated Teacher Education Programme), AI/ML (Artificial Intelligence / Machine Learning).

1.4 References: Government of India NEP 2020, Google OR-Tools documentation, IEEE 830-1998.

2. Overall Description

2.1 Product Perspective: Web-based platform with admin dashboard, faculty and student portals, and backend optimization engine.

2.2 Product Functions: Data import/export, timetable generation, optimization, visualization, and integration with AMS/LMS.

2.3 User Characteristics: Admins (moderate IT), Faculty (basic IT), Students (simple UI), Developers (advanced IT).

2.4 Constraints: Must satisfy hard constraints, solve time < 30 min, comply with NEP 2020, secure data handling.

2.5 Assumptions and Dependencies: Institutions provide datasets, stable internet, SSO authentication, dependencies include OR-Tools, PostgreSQL, FastAPI/React.

3. System Features

3.1 Timetable Generation: Generates automated timetables ensuring conflict-free scheduling.

3.2 Optimization Engine: Balances workloads, minimizes gaps, respects preferences.

3.3 Scenario Simulation: Allows admins to test what-if changes.

3.4 Export & Integration: Provides PDF, Excel, ICS outputs; integrates with AMS.

3.5 User Interfaces: Admin dashboard, faculty view, student view.

4. External Interface Requirements

4.1 User Interfaces: Web-based dashboard, drag-and-drop editor, conflict heatmap.

4.2 Hardware Interfaces: Standard PCs, tablets, mobiles.

4.3 Software Interfaces: PostgreSQL DB, REST APIs, Pandas/ReportLab exports.

4.4 Communication Interfaces: Secure HTTPS, OAuth/SSO authentication.

5. Non-Functional Requirements

Performance: Generate timetables within 30 minutes.

Scalability: Support 10,000+ students, 500+ faculty.

Security: Role-based access, encryption.

Reliability: 99.5% uptime.

Usability: Intuitive UI, minimal training.

Maintainability: Modular design for upgrades.

6. Other Requirements

Audit logs of timetable changes.

Versioning of generated timetables.

Mobile-friendly student/faculty access.

7. Appendices

Future Enhancements: AI-powered elective recommendations, predictive analytics for conflicts, voice assistant for timetable queries.