

# 3. REQUIREMENTS

## 3.1 Functional Requirements

ID	Requirement	Description
FR-1	User Registration	Email/password signup with validation and duplicate prevention
FR-2	JWT Authentication	Secure token-based login with Redis session management
FR-3	Role-Based Access	Student and Admin roles with differentiated permissions
FR-4	Academic Hierarchy	University > Course > Semester > Subject management
FR-5	Document Upload	PDF upload (10MB max) to DigitalOcean Spaces storage
FR-6	AI Syllabus Extraction	Auto-extract units, topics from syllabus PDFs (85% accuracy)
FR-7	Document Indexing	Auto-index documents into subject-specific AI knowledge bases
FR-8	AI Chat Interface	Llama 3.3 70B powered conversational assistant with context
FR-9	PYQ Management	Extract and categorize past year questions by topic/difficulty
FR-10	API Key Management	Encrypted API keys with scopes, rate limiting, and expiration

### 3.2 Non-Functional Requirements

ID	Category	Requirement
NFR-1	Performance	95% requests under 2s; AI responses stream within 5s
NFR-2	Scalability	1000+ concurrent users; 10,000 requests/minute capacity
NFR-3	Security	JWT RS256, bcrypt hashing, AES-256 encryption, HTTPS enforced
NFR-4	Availability	99.5% uptime with graceful failure handling
NFR-5	Usability	Responsive design (desktop/tablet/mobile), WCAG 2.1 AA compliant
NFR-6	Reliability	ACID compliance, daily backups, 30-day point-in-time recovery
NFR-7	Maintainability	Clean architecture, 70% test coverage, comprehensive logging
NFR-8	Protection	Rate limiting, CORS, input validation against SQL injection/XSS

### 3.3 Hardware Requirements

#### 3.3.1 Client-Side

Component	Minimum	Recommended
Processor	Dual-core 1.6 GHz	Quad-core 2.4 GHz
RAM	2 GB	4 GB
Network	1 Mbps	5 Mbps broadband
Browser	Chrome 90+, Firefox 88+, Safari 14+, Edge 90+	

3.3.2 Server-Side

Component	App Server	Database	Cache
CPU	4 vCPU	4 vCPU	2 vCPU
RAM	8 GB	8 GB	4 GB
Storage	80 GB SSD	200 GB SSD	40 GB SSD
OS	Ubuntu 22.04 LTS		

3.4 Software Requirements

3.4.1 Frontend Stack

Technology	Version
Next.js	15.5.6
React	19.1.0
TypeScript	5.x
Tailwind CSS	4.0
TanStack Query	5.90.9

### 3.4.2 Backend Stack

Technology	Version
Go (Golang)	1.24.1
Fiber	2.52.5
GORM	1.31.0
PostgreSQL	15.x
Redis	7.x

### 3.4.3 Cloud Services

Service	Provider
Compute (Droplets)	DigitalOcean
Object Storage (Spaces)	DigitalOcean
AI Platform (Llama 3.3 70B)	DigitalOcean GradientAI
Knowledge Bases	DigitalOcean AI

## 3.5 External Interface Requirements

- **User Interface:** Responsive web UI with dashboard, document upload, AI chat, and admin panels
- **API Interface:** RESTful JSON API with JWT authentication, rate limiting, and OpenAPI documentation
- **AI Platform:** DigitalOcean GradientAI API for chat completions and knowledge base management