

## 3. REQUIREMENTS

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### 3.1 Functional Requirements

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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

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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

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### 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**

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### *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