Design Document

University Portal (LUMS-like) — SDLC Step (b) Design

Document ID: DES-UP-001
Version: 1.0
Date: 2026-02-05
Related SRS: docs/SRS_University_Portal_IEEE830.md

1. Design Goals

- Deliver a secure, responsive university portal that runs well on desktop and mobile browsers (Android/iOS).
- Support all roles defined in the SRS (Student, Faculty, Staff, Registrar Staff, Finance Staff, IT/Admin, Alumni).
- Integrate with SIS (mandatory) and also Finance + LMS where available.
- Provide official transcript request/approval workflow with strong auditability.
- Meet usability/accessibility targets (WCAG 2.1 AA) and standarYou are an autonomous software engineering agent who is building a website using complete Software Development Life Cycle. We will go step by step: a. Requirements b. Design c. Code d. Test e. Improve f. Deploy

TASK:

Act as an autonomous agent and prompt the LLM yourself for first step i.e. Requirements. You need to generate a IEEE format SRS document. Reference website is: http://portal.lums.edu.pk

The delivered application shall be mobile enabled as well, that is it shall be able to run on Android and/or iOS.

INSTRUCTIONS

Save whole conversation, thoughts and the actions you took in a separate file. All the history should be available at the end with a SRS document. Keep the conversation going until a IEEE format SRS document is finalized for requirements.

OUTPUT

Three files in total. One text and one json file for conversation history One file for IEEE format SRS documentds-based security targets (OWASP ASVS L2).

2. Scope and Assumptions

2.1 In Scope (Design)

- Application architecture and module boundaries
- UI information architecture, navigation, and wireframes
- Data model (portal-owned vs external/system-of-record)
- Key workflows and state machines (registration, grading, transcript request)
- Integration approach (SSO, SIS, Finance, LMS)
- Security architecture and controls
- Observability, audit logging, and operational concerns

2.2 Key Assumptions

- Identity Provider exists for SSO using OIDC or SAML.
- SIS exposes APIs (preferred) or batch exports.
- Finance and LMS integrations may be partial at MVP; design supports progressive integration.

---

3. Architecture Overview

3.1 Context Diagram

```
flowchart LR
  U[Users\nStudents/Faculty/Staff/Admin/Alumni] -->|Browser HTTPS|
FE[Portal Web UI]
  FE -->|HTTPS| BE[Portal Backend API]
  BE -->|OIDC/SAML| IDP[University IdP / SSO]
  BE -->|API/Batch| SIS[SIS\n(Enrollments, Grades, Holds)]
  BE -->|API/Batch| FIN[Finance System\n(Fee status)]
  FE -->|SSO Deep Links| LMS[LMS\n(Course content)]
  BE -->|Email| EMAIL[SMTP/Email Provider]
  BE --> DB[(Portal DB\nRBAC, prefs, audit, requests)]
```

3.2 Logical Component Architecture

- **Front-End (FE):** responsive SPA/MPA hybrid (implementation choice later), role-based navigation, accessibility-first components.
- **Backend API (BE):** domain services for registration, grades submission, transcript workflow, announcements, support tickets.
- **Integration Layer:** adapters per upstream system (SIS/Finance/LMS) with retry, backoff, and idempotency.
- **Data Layer:** portal-owned relational DB for RBAC, preferences, workflow states, audit logs.
- **Observability:** structured logs, metrics, tracing, alerting, and audit log pipeline.

3.3 Deployment Topology (Target)

```
flowchart TB
  CDN[CDN + WAF] --> FE[Static Web Assets]
  CDN --> API[API Gateway / Load Balancer]
  API --> SVC[Backend Service\n(Containers)]
```

```
  SVC --> DB[(PostgreSQL)]
  SVC --> CACHE[(Redis optional)]
  SVC --> IDP[IdP/SSO]
  SVC --> SIS[SIS]
  SVC --> FIN[Finance]
  SVC --> EMAIL[Email Provider]
```

---

4. Information Architecture (IA)

4.1 Primary Navigation

Role-based navigation: items appear only if role/permission allows.

- Dashboard
- Registration (Student)
- Timetable (Student)
- Grades (Student/Faculty)
- Transcripts (Student/Alumni/Registrar)
- Announcements (All + Admin management)
- Finance (Student/Finance)
- Support (All)
- Admin (IT/Admin)

4.2 Sitemap (High Level)

```
flowchart TD
  Home[Landing/Login] --> Dash[Dashboard]
  Dash --> Ann[Announcements]
  Dash --> Prof[Profile/Preferences]
  Dash --> Support[Support]

  Dash --> Reg[Registration]
  Dash --> Time[Timetable]
  Dash --> Grades[Grades]
  Dash --> Tr[Transcripts]
  Dash --> Fin[Finance]

  Dash --> Fac[Faculty Tools]
  Fac --> Roster[Rosters]
  Fac --> GradeSub[Grade Submission]

  Dash --> Adm[Admin]
  Adm --> Roles[RBAC Management]
  Adm --> Term[Term Calendar]
  Adm --> AnnMgmt[Announcements Mgmt]
  Adm --> Queues[Work Queues]
  Queues --> TrQueue[Transcript Requests]
```

---

5. UI/UX Design

5.1 Visual Design System (Proposed)

- Typography: system UI / Inter-like, 14–16px base
- Layout: 12-column grid desktop; single column mobile
- Components: cards, tables, filters, status chips, dialogs
- Color: high contrast; support optional dark mode

5.2 Responsive Breakpoints

- Mobile: 320–480px
- Tablet: 481–1024px
- Desktop: 1025px+

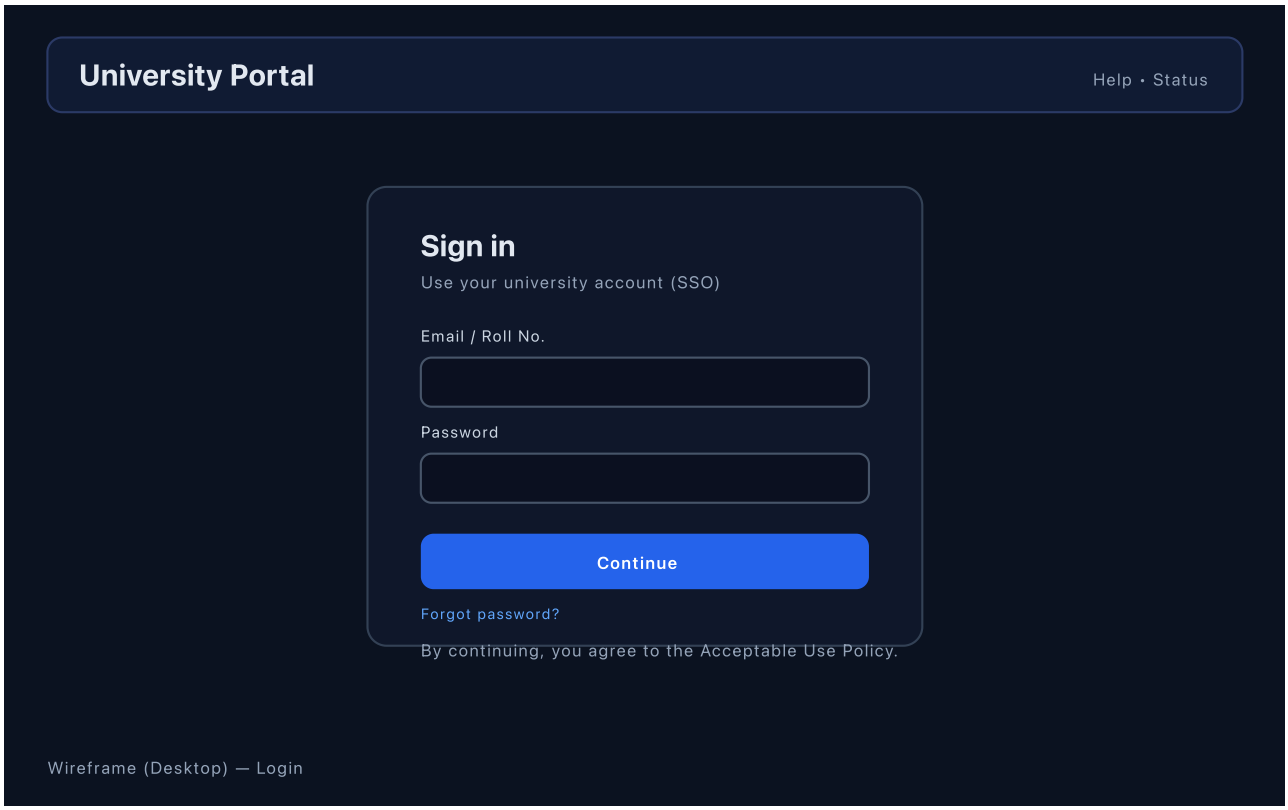
5.3 Accessibility Requirements (Design)

- Semantic HTML landmarks, correct heading structure
- Focus states for all interactive controls
- Keyboard operability for all core flows
- Color contrast meeting WCAG AA
- Screen-reader friendly form fields and errors

5.4 Wireframe Images

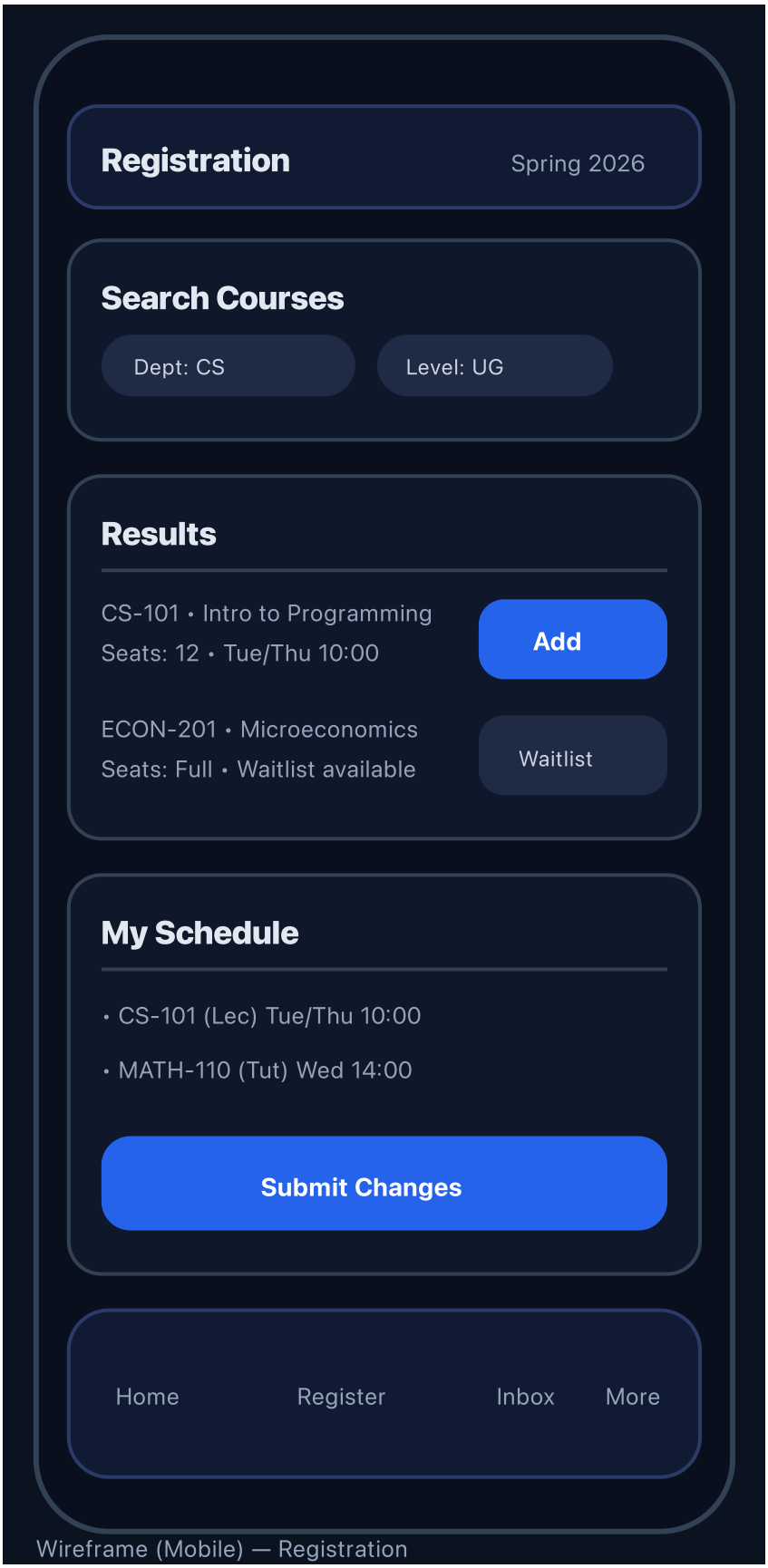
These are SVG wireframes stored in `docs/design/images/`.

- Login (Desktop):



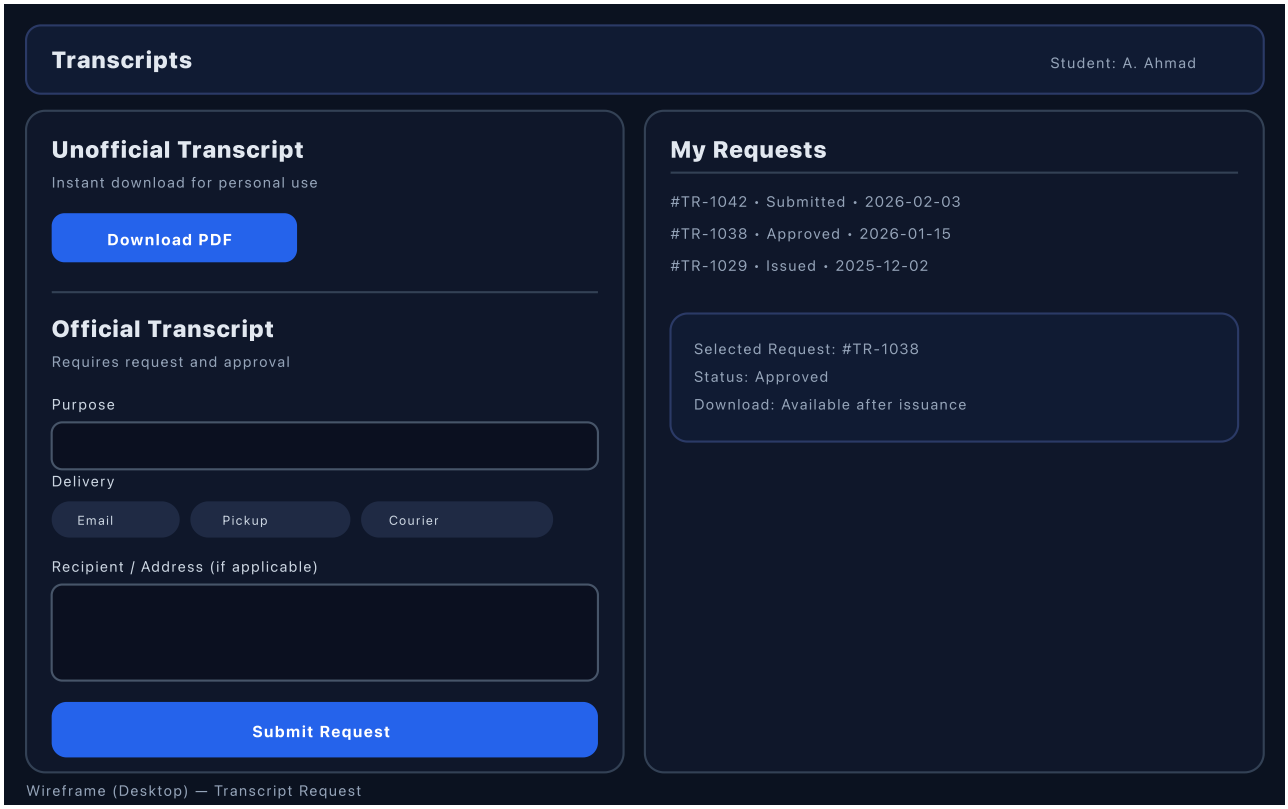
- Dashboard (Desktop): Dashboard Desktop

- Registration (Mobile):

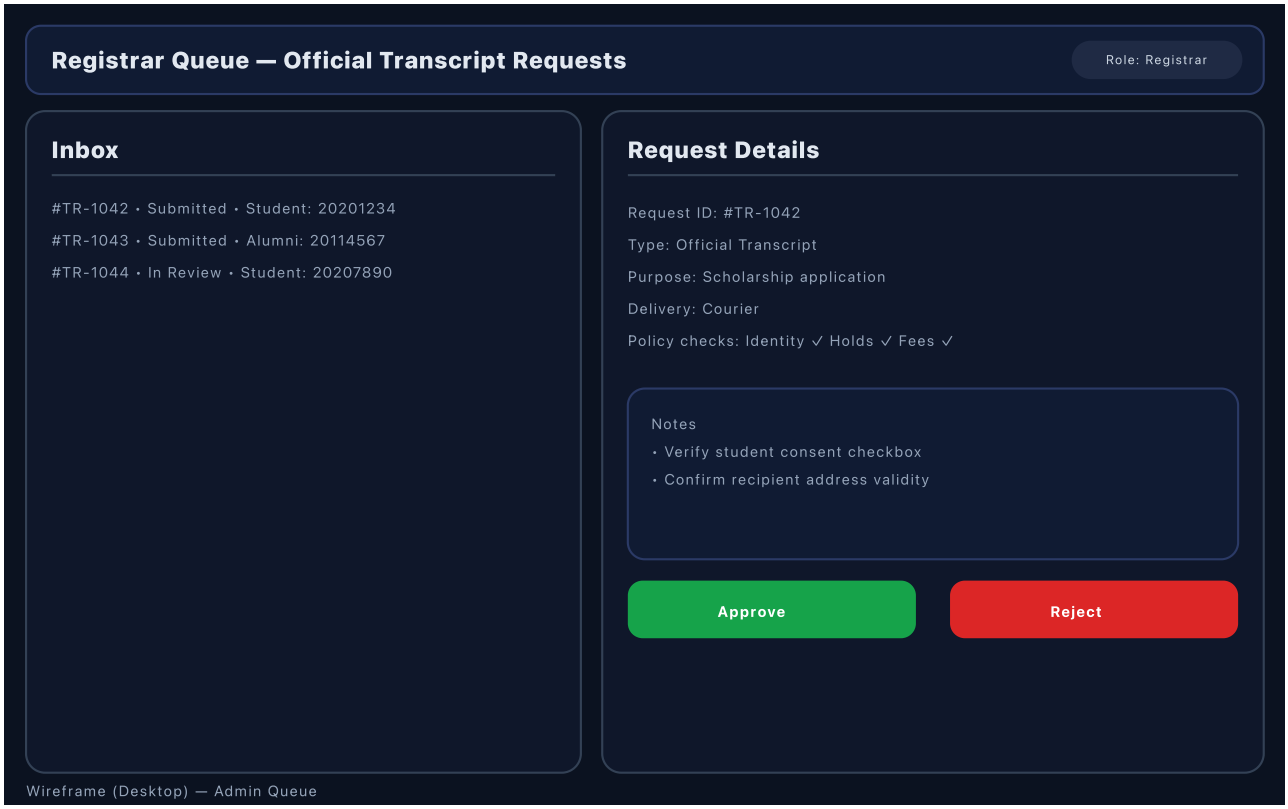


Wireframe (Mobile) — Registration

- Transcript Request (Desktop):



- Registrar Queue (Desktop):



---

6. Core Workflows

6.1 Authentication (SSO)

- FE redirects to IdP (OIDC/SAML).
- BE validates identity token / assertion.

- BE maps identity to portal user record and roles.
- Session established with secure cookies.

6.2 Course Registration (Student)

Design considerations:

- Registration windows enforced using term calendar.
- Rule checks delegated to SIS where possible; portal performs pre-checks where safe.
- Conflicts displayed clearly; submission is transactional.

State (simplified):

```
stateDiagram-v2
  [*] --> Draft
  Draft --> Submitted: Submit Changes
  Submitted --> Applied: SIS confirms
  Submitted --> Rejected: SIS rejects
  Rejected --> Draft: Edit selections
  Applied --> [*]
```

6.3 Grade Submission (Faculty)

- Faculty can save draft grades.
- Final submit triggers locking and audit.
- Optional: upload CSV with validations.

6.4 Official Transcript Request & Approval

- Student/Alumni submits request with metadata and consent.
- Registrar reviews, checks holds/fees/identity.
- Approve or reject with reason.
- Issuance produces tamper-evident PDF and audit trail.

State machine:

```
stateDiagram-v2
  [*] --> Submitted
  Submitted --> InReview
  InReview --> Approved
  InReview --> Rejected
  Approved --> Issued
  Rejected --> [*]
  Issued --> [*]
```

---

7. Data Design

7.1 Data Ownership

- **System of record:** SIS (enrollments, grades), Finance (fees), LMS (course content)
- **Portal-owned:** roles/permissions, preferences, announcements metadata (if not in SIS), support tickets, transcript request workflow, audit logs

7.2 Core Entities (Portal DB)

Proposed entities:

- `User` (id, externalId, name, email, status)
- `Role` / `Permission` / `UserRole`
- `Announcement` (target roles, publish window)
- `Notification` (inbox items)
- `TranscriptRequest` (requester, type, purpose, delivery, status)
- `TranscriptRequestEvent` (status transitions, actor, timestamp, reason)
- `AuditLog` (actor, action, entity, metadata, ip, userAgent)
- `SupportTicket` (category, status, messages)

ERD (logical):

```
erDiagram
  USER ||--o{ USER_ROLE : has
  ROLE ||--o{ USER_ROLE : assigned
  ROLE ||--o{ ROLE_PERMISSION : grants
  PERMISSION ||--o{ ROLE_PERMISSION : included

  USER ||--o{ TRANSCRIPT_REQUEST : submits
  TRANSCRIPT_REQUEST ||--o{ TRANSCRIPT_REQUEST_EVENT : has

  USER ||--o{ AUDIT_LOG : generates
  USER ||--o{ SUPPORT_TICKET : opens
  ANNOUNCEMENT }o--o{ ROLE : targets
```

7.3 Audit Log Design

- Append-only, immutable records.
- Separate retention and access controls.
- Sensitive document access logged (who/when/what).

---

8. Integration Design

8.1 Identity Provider (SSO)

- Preferred: OIDC (Auth Code + PKCE on FE; token exchange/validation on BE).
- Alternate: SAML 2.0.
- Roles can be mapped via claims/groups or maintained in portal.

8.2 SIS Adapter

- Read: term catalog, offerings, timetable, grades release, holds.
- Write: registration submissions (add/drop), grade submission (if SIS is SoR).
- Resilience: retries, idempotency keys for write operations.

8.3 Finance Adapter

- Read-only: fee invoice status, due dates, holds/blocks.

8.4 LMS Integration

- SSO deep links into course pages.
- Optional sync: course roster/enrollment alignment.

---

9. Security Design

9.1 Threat Model (High Level)

- Account takeover / session hijacking
- Unauthorized access to academic records and documents
- Injection and XSS
- CSRF
- Privilege escalation (RBAC bypass)
- Sensitive PDF link leakage

9.2 Controls

- HTTPS everywhere, HSTS, secure cookies
- RBAC in BE with centralized authorization checks
- CSRF protections, input validation, output encoding
- Rate limiting and abuse detection
- Separation of duties (e.g., transcript issuance) and mandatory audit
- Document access via short-lived signed URLs or authenticated download endpoint

---

10. Observability and Operations

- Structured application logs (PII minimized)
- Metrics: latency, error rates, upstream dependency health
- Tracing for critical workflows (registration, transcript issuance)
- Alerting: outage detection, dependency degradation, suspicious activity

---

11. Design Risks and Mitigations

- Upstream API instability → adapter layer + caching + fallbacks
- Peak load during registration → load testing + auto-scaling + queueing
- Privacy risk → strict RBAC + auditing + least privilege

12. Next SDLC Steps

- (c) Code: scaffold FE/BE project, implement RBAC, auth, and transcript workflow first.
- (d) Test: unit + integration tests; security testing (OWASP-focused).
- (e) Improve: performance, accessibility, UX polish.
- (f) Deploy: CI/CD and environment promotion.