SENG 11232 · Engineering Foundation

ASSIGNMENT 02

Systems Design, Quality Engineering & Professional Practice

Group Assignment (2–3 students) — Modules 3 & 4 · Lectures 7–12

Course	SENG 11232 Engineering Foundation
Assignment	02 of 02
Weighting	25% of final grade
Submission	Week 12 — submitted by 23:59 on the Friday of Week 12 (exact date to be confirmed)
Format	Single PDF document per group, plus individual contribution statements as separate PDF per membe
Word Limit	5000 words (group report, excluding diagrams and tables)

Overview

This assignment covers Modules 3 and 4: Engineering Process & Design (Lectures 7–9) and Networks, Security & Professional Practice (Lectures 10–12). Working in groups of 2–3, you will apply the engineering knowledge and skills developed throughout the course to design, analyse and evaluate a real-world software system.

This is a GROUP assignment. All group members are equally responsible for the full submission. Each member must complete an individual contribution statement (Task 5) declaring their specific contributions.

You will design an engineering solution for the following system scenario:

Scenario — SmartCampus Student Services Platform: Your university wishes to commission a new integrated student services platform replacing 6 legacy systems. The platform must handle: student course registration and scheduling; assignment submission and grade management; campus facilities booking (rooms, equipment, sports facilities); a student wellbeing check-in service; real-time campus event notifications; and an administrative reporting dashboard. The system will serve 15,000 students, 800 academic staff and 200 administrative staff, with peak load during registration periods.

Tasks

Task 1: Requirements Engineering [25 marks]

Conduct a thorough requirements analysis for the SmartCampus platform.

Your submission must include:

- Part A — Stakeholder Analysis (8 marks): Identify at least 6 distinct stakeholders for the SmartCampus platform. For each stakeholder, state: their role, their top 3 requirements, and any potential conflicts with other stakeholders' requirements. Present as a structured table.

- Part B — Requirements Specification (12 marks): Write a minimum of 8 functional requirements and 8 non-functional requirements for the platform. All requirements must be SMART (Specific, Measurable, Achievable, Relevant, Testable). For non-functional requirements, specify measurable thresholds. Organise using the ISO 25010 quality characteristics (performance, reliability, security, usability, maintainability).
- Part C — User Stories (5 marks): Write 3 user stories for different user types, each with a minimum of 3 acceptance criteria in Given/When/Then format. At least one user story must address a non-trivial workflow (not just login or view).

GUIDANCE	Non-functional requirements without measurable thresholds (e.g. 'the system shall be fast') will receive zero marks for that requirement. Be specific: response time, uptime %, error rates, access time, etc.

Task 2: Systems Architecture & Design [30 marks]

Produce a high-level architectural design for the SmartCampus platform.

Your submission must include:

- Part A — System Architecture (15 marks): Produce a high-level architecture diagram for the SmartCampus platform. Your diagram must show: major system components/services; their interfaces and data flows; external systems the platform integrates with; deployment view (client, server, database tiers). Justify at least 3 significant architectural decisions using Architecture Decision Records (ADRs). Each ADR must document: the decision, the alternatives considered, and the rationale for the choice.
- Part B — Design Principles Application (8 marks): Identify and explain how you have applied at least 4 of the following in your architecture: abstraction, modularity, separation of concerns, SOLID principles, DRY, defence in depth, principle of least privilege. For each, give a specific example from your SmartCampus design.
- Part C — API Design (7 marks): Design the REST API for one subsystem of your choice (e.g. course registration or facilities booking). Specify at least 6 endpoints with: URL, HTTP method, request body/parameters, response format and relevant HTTP status codes. Justify your design against REST principles.

Task 3: Security & Networking Analysis [20 marks]

Analyse the security requirements and network architecture for the SmartCampus platform.

Your submission must include:

- Part A — Threat Analysis (10 marks): Conduct a threat analysis for the SmartCampus platform using the CIA triad as a framework. For each property (Confidentiality, Integrity, Availability), identify at least 2 specific threats relevant to this system, explain the potential impact, and specify technical and procedural controls. Identify which OWASP Top 10 vulnerabilities are most relevant to this platform and explain how your architecture mitigates each.
- Part B — Network & Data Communication Design (10 marks): Describe the network architecture required for the SmartCampus platform. Include: network protocols at each relevant OSI layer; data encryption in transit (TLS configuration) and at rest; authentication and session management mechanism (justify your choice of JWT vs session cookies vs OAuth); how you would design for 99.9% availability, including what happens during planned maintenance.

Task 4: Quality Engineering & Project Plan [20 marks]

Define the quality engineering approach and high-level project plan for developing the SmartCampus platform.

Your submission must include:

- Part A — Quality & Testing Strategy (12 marks): Define the testing strategy for the SmartCampus platform. Your strategy must include: testing pyramid showing the proportion of unit, integration and E2E tests with justification; 3 specific SLOs for the production system with the corresponding error budgets; a defect classification scheme with severity levels and response targets; how you would measure and report on quality to stakeholders (metrics, dashboards, review cadence).
- Part B — Project Plan (8 marks): Produce a high-level project plan for an 18-month development timeline. Include: choice of SDLC model with justification; a work breakdown at the milestone level; a risk register with at least 5 risks (probability, impact, mitigation strategy); team structure and key roles. Apply the triple constraint explicitly: what would you cut from scope if the deadline were moved forward 3 months?

Task 5: Individual Contribution Statement [5 marks]

Each group member must individually (not jointly) submit a one-page contribution statement.

Your submission must include:

- State each group member's name and student ID
- Describe YOUR specific contributions to each task (what did you personally research, write and produce?)
- Estimate the percentage of the total work contributed by each member
- Declare: 'I confirm that the described contributions are accurate and that all work submitted is the group's own original work.'

GUIDANCE	Contribution statements that are vague ('I helped with Task 2') will result in follow-up interviews. Be specific about what you personally produced.

Submission Instructions

- Submit group report via LMS: SENG11232_A2_Group[GroupNumber].pdf
- Each member submits their own contribution statement: SENG11232_A2_[StudentID]_contribution.pdf
- All architecture diagrams must be original (not copied from textbooks or AI-generated images)
- Requirements must be numbered consistently (e.g. FR-01, NFR-01) and cross-referenced where applicable
- ADRs must be in the standard format: Context | Decision | Alternatives | Rationale | Consequences
- Group peer review: your group will be asked to briefly present (5 minutes) your architecture decisions in class during Week 13
- Late submission: 10% per 24-hour period applied to the group mark

NOTE	Academic integrity: all submitted work must be your own. Use of AI tools to generate your submitted answers without acknowledgement constitutes academic misconduct. You may use AI as a thinking tool (to get feedback, generate counter-arguments), but the analysis, reasoning and writing must be yours.

Marking Scheme

Task	Description	Marks
Task 1A	Stakeholder analysis table	8
Task 1B	Functional and non-functional requirements (SMART)	12
Task 1C	User stories with acceptance criteria	5
Task 2A	Architecture diagram + ADRs	15
Task 2B	Design principles application with examples	8
Task 2C	REST API design	7
Task 3A	CIA threat analysis + OWASP mitigations	10
Task 3B	Network and availability design	10
Task 4A	Testing strategy and SLOs	12
Task 4B	Project plan, risk register, triple constraint	8
Task 5	Individual contribution statement	5
	TOTAL	**100**