Practical Assignment: Requirements to Architecture (1hour)

Scenario:

You are developing a **Smart Home Energy Monitor (SHEM)** that measures total household power consumption and reports the data to a local server.

Part 1: Requirement Specification and Traceability (30 min)

Objective:

Define clear Functional Requirements (FRs) and Non-Functional Requirements (NFRs) and create a traceability sheet.

Task 1: Defining Functional Requirements (FRs)

Scenario Detail:

The SHEM must read consumption data from a high-accuracy current sensor (via SPI), process it, and transmit summarized data.

Your Tasks:

1. **Identify 5 core user functions** of the SHEM.
2. **Write each function as a formal requirement** using the "shall" format.
3. **Record the FRs** in the Functional Requirements tab of your sheet.

Template — Functional Requirement (FR):

- **Req ID:** FUN-___
- **Requirement Statement:** The system shall …
- **Reason / Description:**
- **Priority (P1/P2/P3):**
- **Verification Method:** (for example, Software Test / Hardware Test / Inspection)

Task 2: Defining Non-Functional Requirements (NFRs)

Scenario Detail:

The SHEM is battery-backed, must operate in low-power mode, and must fit into a wall junction box.

Your Tasks:

1. Identify **5 critical NFRs** across the categories below.

2. Write **specific, measurable** statements.
3. Document each requirement in the appropriate NFR tab.

NFR Categories (Sheet Tabs):

- Performance
- Reliability & Safety
- Constraints
- Hardware Interface

Template — Non-Functional Requirement (NFR):

- **Req ID:** NFR-__-_
- **Category:** (Performance / Reliability / Constraints / Hardware Interface)
- **Requirement Statement:** The system shall …
- **Measurement Criteria:**
- **Priority (P1/P2/P3):**
- **Verification Method:**

(Ensure all requirement examples in the original text are replaced by your own.)

Task 3: Establishing Traceability

For **all 10 requirements (5 FRs + 5 NFRs):**

Complete the following columns in your sheet:

- **Req ID**
- **Requirement Statement**
- **Category** (for NFRs)
- **Priority**
- **Verification Method**
- **Traced Architectural Component**

Traceability Template:

Req ID	Requirement Statement	Category	Priority	Verification Method	Architecture Link

Part 2: Architecture Design and Refinement (30 min)

Objective:

Design and refine a block diagram based on your requirements.

Task 4: Initial Block Diagram Design (use your preferrable diagramming tool)

Your Tasks:

1. Identify **core components** of the SHEM:
    - Microcontroller Unit (MCU)
    - Current Sensor
    - Power Management subsystem
    - Communication Module
    - Status Indicator (LED)
2. Use **your preferrable diagramming tool** to draw the block diagram.
3. **Label interface connections**, such as:
    - Sensor → SPI
    - LED → GPIO
    - Power → Converter

Block Diagram Template (Elements to include):

- MCU
- Current Sensor (SPI)
- Communication Module
- Power Management
- Status LED
- Data/Power/Control connections labeled

Task 5: Architectural Evaluation and Refinement

Your Tasks:

1. Evaluate your chosen communication module against your NFRs.

2. Identify any violations (e.g., power consumption).
3. Refine the design by replacing or adjusting components.
4. Update your draw.io diagram accordingly.
5. Add an **annotation** explaining what was changed and why.

Refinement Annotation Template:

"Component ___ replaced with ___ to satisfy NFR-__-_."

Submission Instructions

You must submit **TWO FILES** in the Moodle assignment link:

1. Requirements & Traceability Sheet (Excel or Google Sheet PDF)

Must include:

- All FRs and NFRs
- Proper IDs
- Priorities
- Verification methods
- Completed traceability table

2. Architecture Diagram

Must include:

- Initial architecture
- Refined architecture
- Annotations explaining changes

Submission Format:

Upload the files in Moodle using:

- **File 1:** SHEM_Requirements_Groupno.xlsx
- **File 2:** SHEM_Architecture_ Groupno.pdf

Note: Prepare a short presentation