**Formal Technical Documentation**

**of**

**Custom EEG Biosensing & Signal Acquisition Device**

**1. Cover Page**

* Project Title: **Custom EEG Biosensing Device Documentation**
* Author(s): **Sarah Bulatao (primary), Edwin Ruiz (secondary)**
* Date:
* Version: **1.0 (draft version)**

**2. Introduction**

* Briefly describe the purpose of the custom EEG device
* Outline the key specifications (number of channels, ADC bit depth, amplification stages)
* Mention why this design was chosen over commercial options

**3. System Architecture & Components**

* Block diagram of the system showing:
  + Electrodes → Amplifiers → Filters → ADC → Microcontroller → PC
* List of all major components (with datasheets linked):
  + ESP32 (Microcontroller)
  + ADS1299 (24-bit ADC) / ADS1120 (16-bit ADC)
  + INA128 / AD620 (Instrumentation Amplifiers)
  + Passive components (Resistors, Capacitors, etc.)

**4. Circuit Design & Calculations**

Each section must include:

1. **Amplifier Calculations** – Show gain equations for INA128/AD620
2. **Filter Design Calculations** – Derive equations for low-pass, high-pass, and notch filters, including component values for R and C
3. **ADC Specifications** – Explain the bit depth, sampling rate, and expected EEG signal resolution
4. **Power Consumption & Requirements** – Ensure ESP32 and ADS1299 receive proper voltage levels
5. **PCB Design Considerations** – Explain grounding, noise reduction, and shielding techniques for low-noise EEG acquisition

**5. PCB Layout & Design**

* Include screenshots of PCB layout, layer design, and 3D renderings
* Describe trace routing, ground planes, and interference minimization techniques

**6. Testing & Validation Plan**

* How will the EEG signals be tested?
* What signal validation techniques (e.g., FFT, SNR analysis) will be used?

**7. Future Improvements & Issues Identified**

* Identify potential design flaws and improvements for future iterations