Below is **Part II – System Architecture and Mathematical Framework** for your project  
**“RBP-DSP: High-Precision Speech Signal Processing Pipeline for Linguistically and Phonetically Informed Dataset Construction.”**

This section is written in the **scientific + engineering style** expected in professional DSP or acoustic-AI system documentation, using both conceptual and mathematical precision.

**PART II — SYSTEM ARCHITECTURE & MATHEMATICAL FRAMEWORK**

**1. System Overview (Conceptual Block Diagram)**

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**2. Mathematical DSP Foundations**

Each stage of the system is formulated below for algorithmic implementation and later reproducibility by DSP engineers.

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A screenshot of a computer program

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A screenshot of a math book

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A screenshot of a math formula

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A screenshot of a math test

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A screenshot of a computer program

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**Output:**  
A structured JSON and plots stored in verification/, automatically appended to a cumulative report for each processed file.

**6. Computational Notes for Engineers**

* **Precision:** 32-bit float throughout pipeline; double precision in LPC and IAIF stages.
* **Latency:** Non-causal algorithms acceptable (offline batch mode).
* **Parallelism:** Segment-wise multiprocessing; GPU for separation (Demucs).
* **Repeatability:** Deterministic seeds, config logging via YAML; pipeline orchestrated by Snakemake or DVC.

**7. Deliverables Recap**

✅ processed\_data/ — denoised, dereverbed, leveled WAVs  
✅ features/ — MFCC, LogMel, PNCC, formants, glottal, prosody  
✅ annotations/ — TextGrids with phones, words, ToBI-LR tiers  
✅ metadata/ — JSON/CSV linking files and processing parameters  
✅ verification/ — metrics, heatmaps, statistical summary  
✅ scripts/compare\_signals.py — scientific comparator

**8. Expected Scientific Impact**

This corpus will be the **first DSP-engineered, phonetics-aware dataset** of Sindhi (Laari-accent) speech constructed at scientific precision.  
It bridges **communication science ↔ digital signal processing ↔ AI voice synthesis**, establishing a replicable pipeline for cultural-linguistic voice preservation and speech-identity modeling.