Analog Verse
The Circuit Design Challenge
Ingenium — IIT Indore

Overview

Theme: Analog Signal Processing, Simulation, and PCB Design

Analog Verse challenges participants to design sophisticated analog signal processing circuits using a rigorous engineering workflow. This Competition goes beyond basic breadboarding and emphasizes literature review, professional-grade simulation, and industry-standard PCB design practices.

The objective is to simulate real-world research and development environments where noise performance, signal integrity, and PCB layout decisions critically impact system behavior.

Competition Structure

This is a **single-round, long-duration** design challenge, which may be conducted entirely online or split over two days.

Problem Statement Release: T−7 Days before the submission deadline

Task:
Participants must design a signal processing circuit for a specified application.

Example Problem Statements:

- Design a high-precision ECG Analog Front-End (AFE) capable of filtering 50 Hz power-line noise and baseline wander, with an overall gain of 1000

- Design an active crossover network for a 3-way audio system with specified cutoff frequencies

Phase 1: Design & Simulation

Activities:

- Perform a literature review to select suitable op-amp topologies such as Sallen–Key, Multiple Feedback (MFB), or Instrumentation Amplifiers

- Simulate the circuit using professional SPICE-based tools such as:

  - LTspice
  - Multisim

  – Cadence PSpice

  Deliverables:

- Simulation logs demonstrating:

  – Transient Response

  – AC Analysis (Bode Plot)

  – Noise Analysis

Phase 2: PCB Layout

Activities:

- Convert the validated schematic into a manufacture-ready PCB layout using industry-standard PCB design tools such as:

  – KiCad

  – Eagle

  – Altium Designer

  Design Constraints:

- Maximum board dimensions: $100\,\text{mm} \times 100\,\text{mm}$

- Use of standard component footprints (SMD 0805 or Through-Hole)

- Proper grounding techniques such as ground planes or star grounding must be clearly implemented

  The Competition may be conducted fully online with both phases combined, or may include a presentation with a live demonstration of a soldered PCB.

Judging Criteria

Criterion	Weightage	Description
Simulation Accuracy	30%	Compliance of Bode plot and transient response with problem specifications
Circuit Justification	20%	Quality of literature review and reasoning behind component selection
PCB Layout Quality	30%	Trace width calculations, EMI/EMC considerations, ground usage, and compactness
Manufacturability	20%	Correct footprint usage, BOM generation, and DRC clearance

Further instructions will be communicated to registered participants.