Industrial Diploma in Integrated Circuits (IC) and Systems Design

Dept. of Electrical Engineering, FAST NUCES ISLAMABAD

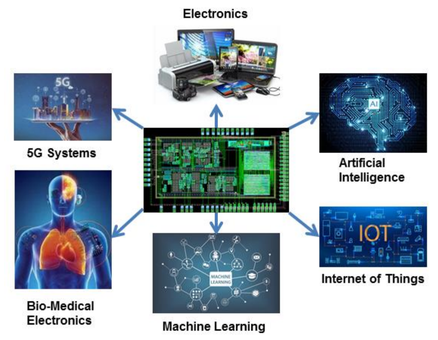
Duration : 1 Year

Schedule: Diploma Will be Offered on Demand

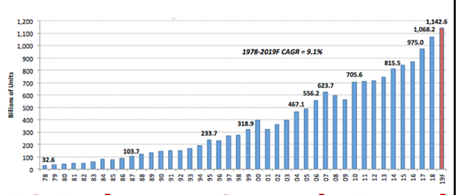
Integrated Circuit Design Lab

WHY INTEGRATED CIRCUITS (ICs) DESIGN ?

- Integrated circuits (ICs) is one of the most impactful inventions of the 20th century
- IC Design is pivotal in 21st century technology trends; e.g. 5G systems, Artificial Intelligence (AI), and smart systems, which are supposed to be leading towards 5th industrial revolution
- Resulting a high demand of IC design engineers globally
- IC growth trend of last four decades also shows promising IC engineers future
- Lack of skilled IC designers in Pakistan is a major bottleneck in international investments in circuit design sector
- A pool of skilled IC designers can attract international companies in Pakistan



IC Design Trending Areas



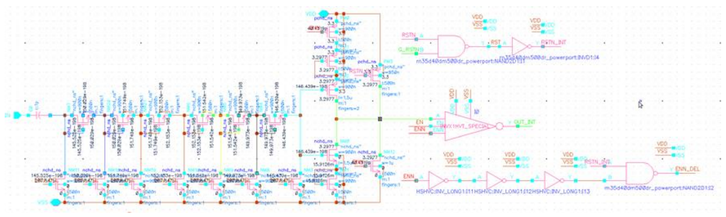
IC Industry Growth Trend (1978 – 2019)

WHY from FAST NUCES ?

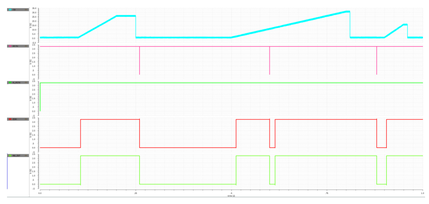
- Pioneer of IC design program in Pakistan.
- International Standard IC design training program Capability.
- 25 fully industrial funded MS students already enrolled in Spring-2020 will tape-out 8 group projects on two ICs in Spring-2021.
- An established theoretical and experimental program with a hands on experience of conceptualization to end product IC design process.
- Fully developed ICD lab with four full time faculty members with degrees in IC design and cumulative experience of over a dozen IC tapeouts.
- An opportunity to learn modern IC design technique from experts.
- Introduction and experience design experience on licensed Cadence tools suite (Worth: US$ 35000/-) and advanced 65nm, 130nm, and 180nm process development kits (PDKs).

PROGRAM GOALS

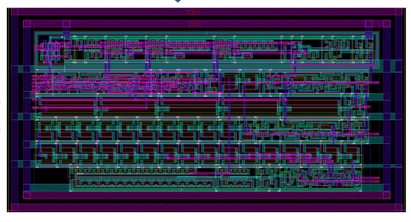
- Introduction to CMOS integrated circuits basics and fabrication process
- Detailed illustration and hands on experience of complete integrated circuit system design



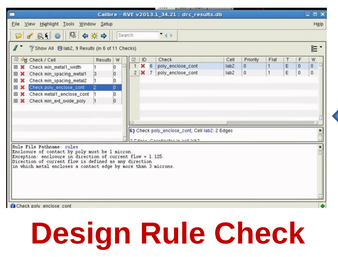
IC Schematic Design



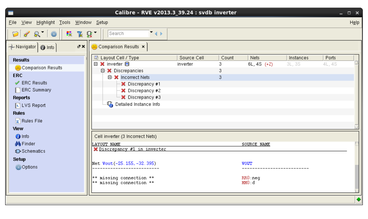
Simulation and Analysis



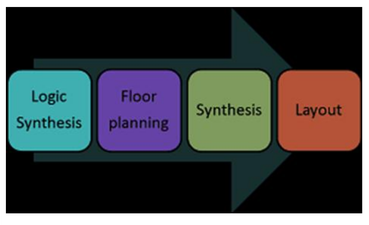
Custom Layout Design



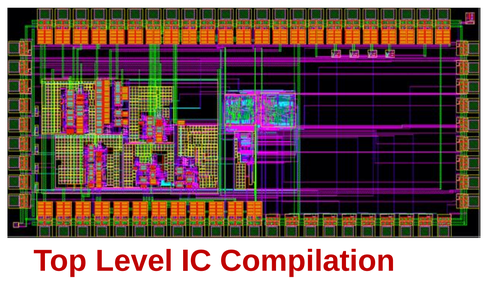
Design Rule Check



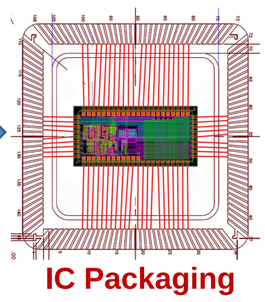
Layout vs Schematic check



Verilog Design Synthesis



Top Level IC Compilation



IC Packaging

COURSE OUTLINE (Pre-Semester & Semester 1)

Pre-Semester

- 2 week crash course
- Course Contents
  - CMOS Device characteristics
  - CMOS Inverters
  - Transmission gates
  - Multiplexer
  - Combinational logic
  - Sequential logic
  - Verilog Digital Logic Synthesis and CAD Tools

Semester 1

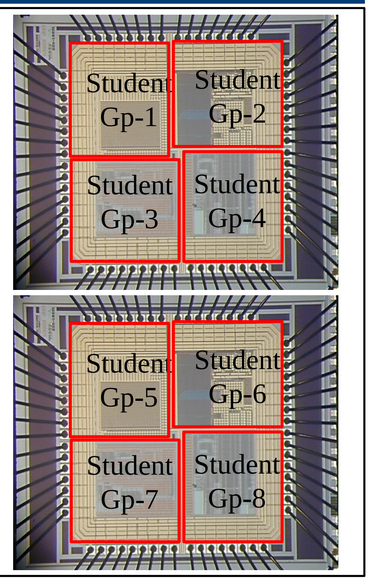
- Mixed Signal ICs:
  - Non-linearity & Mismatch
  - IC fabrication process
  - Layout Fundamentals
  - Sample and hold circuits
  - Performance metrics
  - Digital to analog converters
  - Analog to Digital Converters
  - Z – Transform
  - Oscillators
  - Reference generators
  - Phase Lock Loop (PLL)
- Signal Integrity & SoC Design:
  - Signal integrity principals
  - Chip interconnect
  - Transmission lines and power planes
  - Clock distribution network
  - Pad types
  - Pad driver circuits and
  - High speed characteristic
  - IBIS modeling
  - IC Packaging types

DESIGN PROJECT (Semester 2)

- A custom IC design group project in collaboration with M.S .students
- IC packaging design
- Printed circuit board (PCB) designing for IC testing
- IC testing tools/instruments training
- Fabricated IC testing and analysis
- Technical report/paper writing

Tapeout Projects (Session-2020)

- **Gp-1:** Logic Family for Self-Powered ASICs
- **Gp-2:** Fault Tolerant CLB Design
- **Gp-3:** 28-32 GHz LNA for 5G NR applications
- **Gp-4:** mm Wave Phase Shifter for massive MIMO application
- **Gp-5:** MMIMO Channel Estimation with ΣΔ ADC
- **Gp-6:** Capacitor Less High Efficiency Triboelectric Energy Harvester
- **Gp-7:** ASIC Implementation of ALU based Approximate Computing
- **Gp-8:** True Random Number Generator for 5G NR



Teaching and Technical Staff

Prof. Dr. Rashad Ramzan
Professor & Director RFCS² Lab
FAST, NUCES, ISB.
http://isb.nu.edu.pk/rfcs2/team_files/CV_Rashad_06_Dec_2020.pdf

Dr. Hassan Saif
Asst. Professor at
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http://isb.nu.edu.pk/rfcs2/team_files/Hassan%20Saif%20FAST%20Lab%20CV.pdf

Engr.Sidra Saeed
Design Engineer
MS EE (IC Design)
FAST, NUCES, ISB.

Engr.Hamza Atiq
Design Engineer
MS EE (IC Design)
FAST, NUCES, ISB.

ELIGIBILTY

- Bachelor in
  - Elect./ Electronics Engineering
  - Computer Engineering
  - Telecommunication Engineering
  - Mechatronics Engineering

Who Should Enroll ?

- Industrial Engineers looking for IC design skills
- Engineers from Organization intend to develop IC design expertise
- Engineer aiming for stepping in semiconductor industry

PROGRAM DETAILS

- For more details about MS IC design and our research group please visit our research group website http://isb.nu.edu.pk/rfcs2/
- Contact: rashad.ramzan@nu.edu.pk , hassan.saif@nu.edu.pk ,