

HAPPY NEW YEAR 2021



07 Jan 2021

CS-226@IITB

1

CADSL

Welcome to the Virtual Institute and course CS-226



CS-226:

Digital Design

Course Introduction

Virendra Singh

Professor

Computer Architecture and Dependable Systems Lab

Department of Electrical Engineering

Indian Institute of Technology Bombay

<http://www.ee.iitb.ac.in/~viren/>

E-mail: viren@ee.iitb.ac.in



07 January 2021

CADSL

WHAT IS THE DIFFERENCE BETWEEN THE COMPUTING INDUSTRY AND THE PAPER TOWEL INDUSTRY?



Industry of Replacement



1971

2020



Industry of new possibilities



07 Jan 2021

CS-226@IITB

5

CADSL

CAN WE CONTINUE BEING AN INDUSTRY OF NEW POSSIBILITIES ???

Personalized
healthcare

Virtual
reality

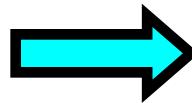
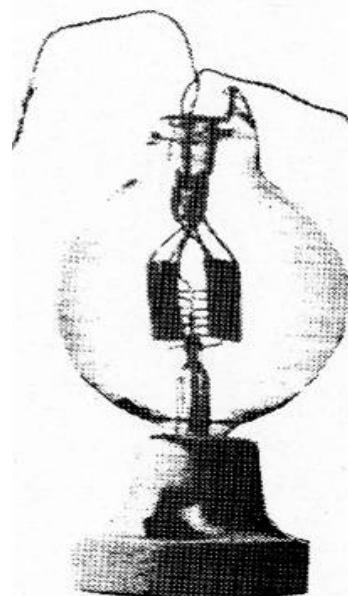
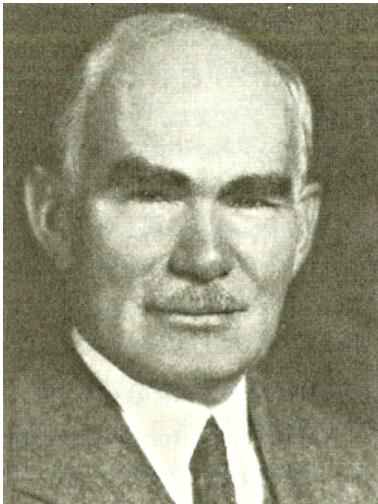
Real-time
translators



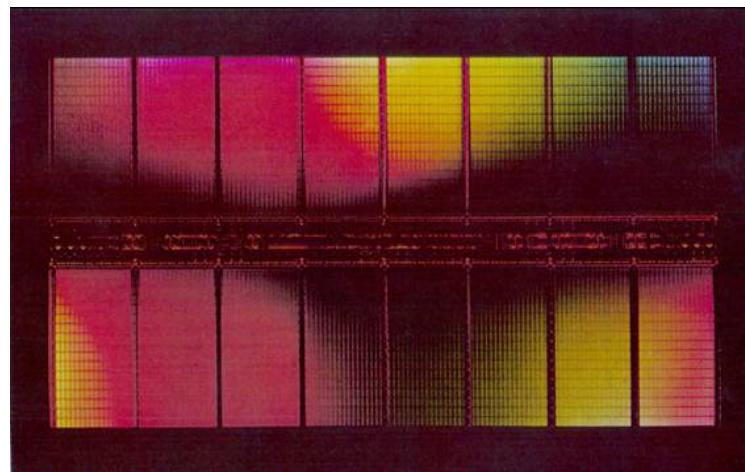
History of Electronics

- Electronics is the most important invention of the 20th century
- Electronic Circuits in 100 years
 Vacuum tube → VLSI (Very Large Scale Integrated circuits)

14 years ago, it was the 100 year anniversary



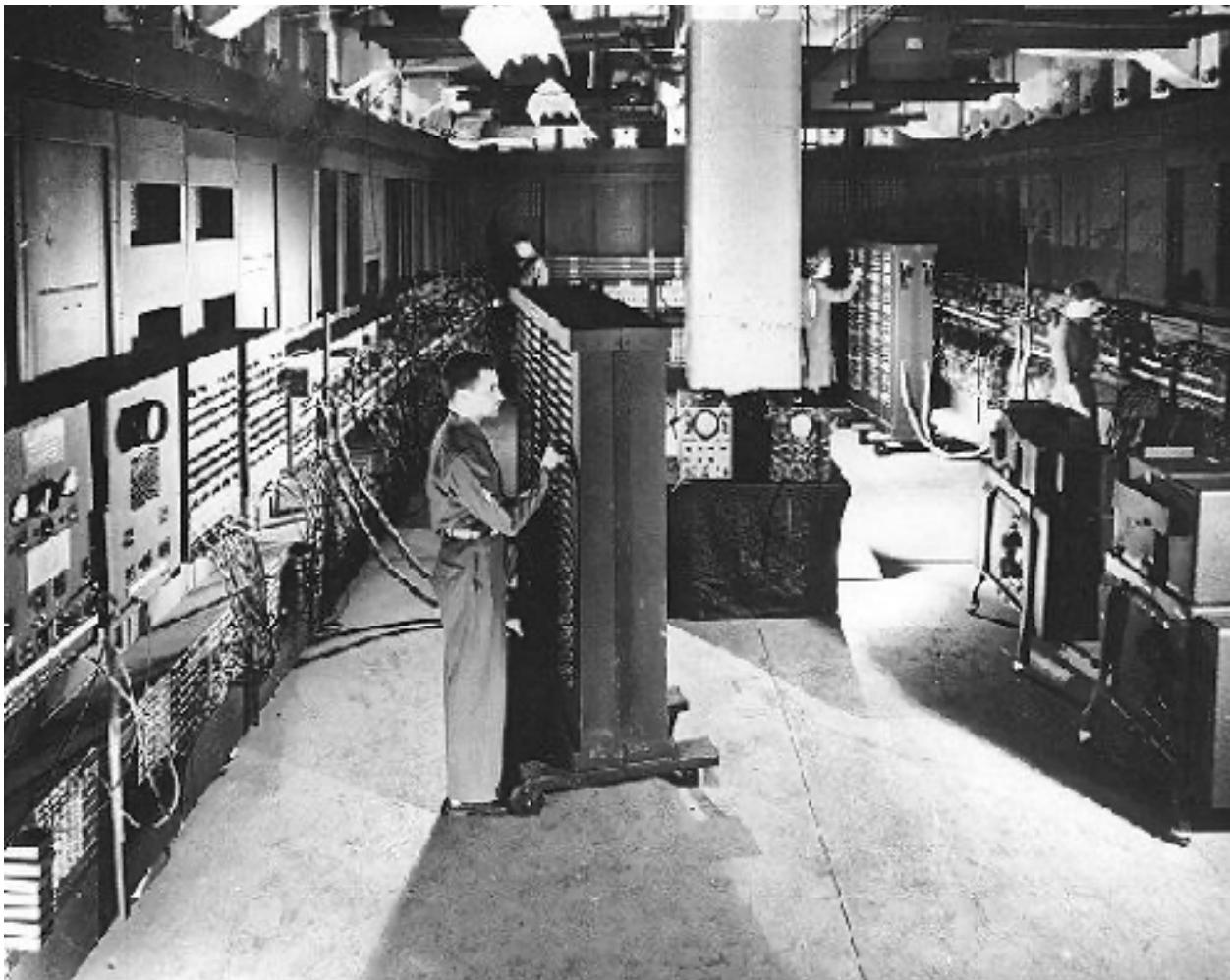
1906



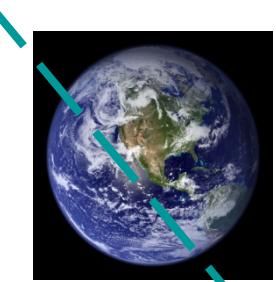
Electronic Computer

First Computer ENIAC: made of huge number of vacuum tubes 1946

Big size, huge power, short life time filament



Wanted: **CUSTOMERS**, who breathe, eat, and live in.....

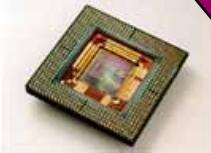


Global & Regional Political & Macro-Economic Environments



Customer Demand

Electronic End Equipment



Semiconductors

~\$ 50,000B

~\$ 1050B

~\$ 400B

~\$ 100B



Semiconductor Equipment & Materials



International Techno

07 Jan 2021



Sources: NASA Gov., SEMI

CS-226@MITB

Interesting Applications



Why Study Digital Design?

- **It's exciting!** It has never been more exciting!
- It impacts every other aspect of electrical engineering and computer science



Bionics:

Sensors in latex fingers instantly register hot and cold, and an electronic interface in his artificial limb stimulates the nerve endings in his upper arm, which then pass the information to his brain. The \$3,000 system allows his hand to feel pressure and weight, so for the first time since losing his arms in a 1986 accident, he can pick up a can of soda without crushing it or having it slip through his fingers. *One Digital Day*

Next Generation Vehicles



07 Jan 2021

CS-226@IITB

12

CADSL

System Realization Process

Customer's need

Determine requirements

Write specifications

Design synthesis and Verification

Test development

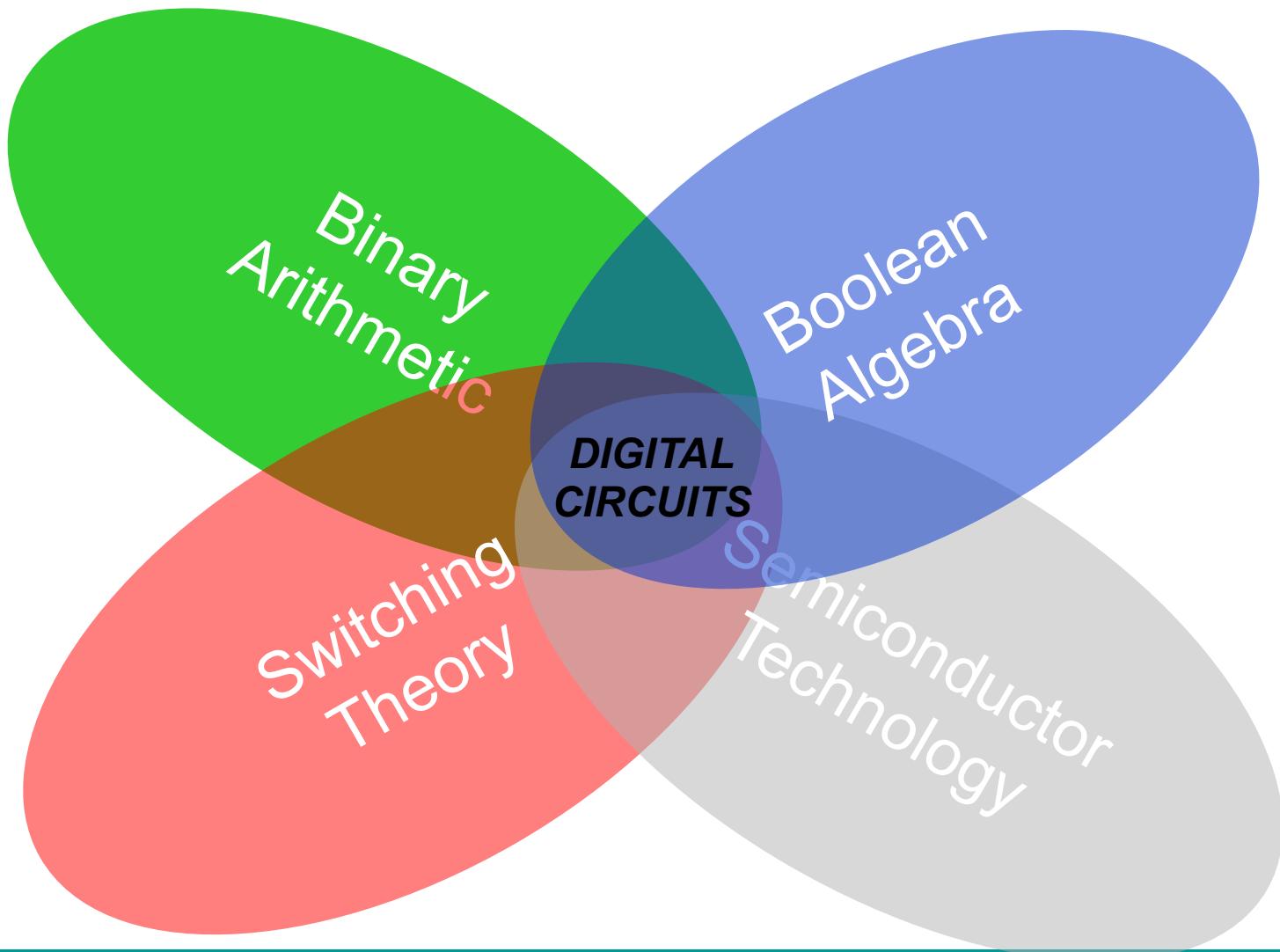
Fabrication

Manufacturing test

System to customer



Digital Systems



Course Schedule

Class Hours: Slot 2

- ❖ Monday: 9:30 am to 10:25 am
- ❖ Tuesday: 10:35 am to 11:30 am
- ❖ Thursday: 11:35 am to 12:30 pm

Additional Slot: TBD

Office Hours: TBD



Course Contents

- Logic design process
- Boolean Algebra
- Logic representation
- Combinational circuits
- Circuit optimization
- Arithmetic circuits
- Verification and testing
- Sequential synchronous circuits
- Finite state machine optimization and verification
- Computing system design
- Asynchronous circuits [if time permits]



Books

- Switching and Finite Automata Theory
 - Kohavi and Jha
- Digital Design: Principles and Practices
 - John F Wakerley
- Digital Logic and Computer Design
 - Morris Mano



Course Evaluation

- ❖ Mid Term Exam (15%)
- ❖ Final Exam (40%)
- ❖ Assignments (15%)
 - Set of assignments will be given periodically
- ❖ Course Project- I (15%)
 - ❖ Design of a CPU
 - ❖ Group of 2
- ❖ Continuous Evaluations (15%) – quizzes
- [BONUS] Project - II (10%)



Grades

Absolute Grade

- > 90: AA
- 81 – 90: AB
- 71 – 80: BB
- 61 – 70: BC
- 51 – 60: CC
- 45 – 50: CD
- 40 – 44: DD
- < 40 : FR



Thank You

