



Anuranan Das
Electrical Engineering
Indian Institute of Technology Bombay
Specialization: Microelectronics and VLSI

18D070037
Dual Degree (B.Tech. + M.Tech.)
Gender: Male
DOB: 27/03/2001

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2023	8.85
Intermediate	WBCHSE	RKM Vidyalaya, Narendrapur	2018	95.60%
Matriculation	WBBSE	RKM Vidyalaya, Narendrapur	2016	93.57%

Completed **Minor** in Management under **Shailesh J. Mehta School of Management, IIT Bombay** (CPI: 8.8)

INTERNSHIPS AND RESEARCH EXPERIENCE

Few layer MoS_2 based NEMS for sensor applications

Prof. M. Adachi, ENSC (SFU, BC)

Mitacs Globalink Research Intern(Canada)

May'22 - Jul'22

- Performed electrical characterization of suspended MoS_2 NEMS to find resonant frequency and current voltage characteristics using a combined setup of **Lock-in amplifier, vacuum chamber, optical microscope and Keithley 2400 sourcemeter**.
- Formulated a **COMSOL Multiphysics model** to simulate the eigenfrequency of the device and thereby match with experiments.
- Visualized possible extensions of the device as a photocurrent-based pressure sensor dependent on the tensile stress subjected.

Steady-State Tunable Entanglement Switch with Quantum Dots

Guide: Prof. B. Muralidharan, EE (IITB)

UG researcher, Computational Nanoelectronics & Quantum Transport Group

Dec'20 - Dec'21

- Developed and analyzed an entanglement generating thermal machine model with the help of ancilla impurities and Transport Master equations. Envisaged an amalgamation of quantum computing and quantum transport concepts.
- Analyzed the variation of quantum entanglement measure in the model with **thermal bias**. Documented results were submitted for publication in the form of a research article. Currently being reviewed at **Quantum Science and Technology, IOPScience**.

Reliability of CMOS devices and circuits

Guide: Prof. Souvik Mahapatra, EE (IITB)

Undergraduate Researcher(SURP)

May'21 - Dec'21

- Investigated challenges in **CMOS technology scaling** in the semiconductor industry and the evolution of **FinFETs**.
- Explored possibilities of reducing power consumption in data centers by increasing efficiency of transistors at **low** temperatures.

Interaction Coupling and Qubit from 2-D materials

Guide: Prof. R. Rahman, Physics (UNSW, Australia)

Remote Junior Researcher

Aug'20 - Jan'21

- Conducted extensive literature review on **coherent spin exchange via a quantum mediator** and effect of nuclear spins.
- Analysed the possibilities of creating qubits from 2-D materials on the basis of various intrinsic properties of the materials.

SCHOLASTIC ACHIEVEMENTS

- Selected alongwith **34** students all over India for the **Chanakya UG/PG Fellowship** for research in Quantum Technologies (2022)
- Earned **1st** position in **IBM Quantum Challenge 2021**, a worldwide Hackathon held for quantum computing community (2021)
- Awarded **Intermediate and Advanced** achievement badges respectively for completing IBMQ challenge. (2020, 2021)
- Achieved **99.83** percentile among **10,74,319** candidates in **JEE MAIN 2018** (2018)
- Secured a rank in the top **3.06** percent among **231024** candidates in **JEE ADVANCED 2018** (2018)

KEY PROJECTS

Clap detector for toy and appliance control (Course Project)

Electronic Design Lab, Spring'20

- Designed a circuit with **envelope detector, Comparator** and **Current amplifiers** that can detect the occurrence of a clap .
- Devised **control** codes to provide visual feedback to the user, depending on the interval of two successive claps.

FPGA based Traffic Light Controller System (Course Project)

VLSI Design Lab, Spring'21

- Designed a Traffic Light Control System to manage the road traffic in **Verilog** and operated on **Intel DE2-115** board.
- Supplanted the design with **Intelligent peak timing** method based on sensors, more efficient than **fixed time method**.

Pipelined RISC Microprocessor (Course Project)

Processor Design, Spring'21

- Devised IITB-RISC, an **8-register, 16-bit** system with standard **6 stage** pipelines capable of executing **15** instructions.
- Programmed the design in **Verilog** and equipped the design with control flow, data forwarding & hazard mitigation.

32-bit Brent Kung Adder (Course Project)

VLSI Design, Autumn'21

- Described a **32-bit Brent Kung** adder using **carry-generate** and **carry-propagate** logic in **VHDL** with delay timing of 100ps.
- Tested the final model by generating testcases through **Python** and feeding them through **VHDL** model to check validity.

Strain Engineering for CMOS Scaling (Course Project)

CMOS Logic and Flash Memory Devices, Autumn'21

- Reviewed the Industry grade procedures used for strain engineering and participated in an in-class seminar to deliver a presentation on the same. Simulated tunneling leakage characteristics of gate stack using **Wentzel-Kramers-Brillouin (WKB)** method.

Alzheimer's Disease Detection by EEG Signal Processing (Course Project)

DSP, Autumn'20

- Implemented feature extraction process using **Fast Fourier Transforms** from Alzheimer's patients' database availed online
- Initiated and trained **classifiers** based on logistic regression, SVMs, Decision Trees(Binary), Random Forest and Adaboost

Liquid State Machine for Digits Classification (Course Project)

Neuromorphic Engineering, Autumn'21

- Created a speech classification model using **reservoir computing** and **bio-inspired neuron** learning.
- Proposed a graph visualization based method to analyze the extent of **delayed coincidence** affecting learning in the reservoir.

Computing Rigid Body Rotations with Qiskit

Daniel Sierra-Sosa, QAMP'21

Qiskit Advocate Mentorship Program, IBMQ

Aug'21 - Dec'21

- Developed an algorithm to use Superconducting qubit hardware to find a method to compute rigid body rotations.
- Wrote a programming blog on **Implementing A Hybrid Quantum Classical Neural Network With Qiskit** on blogging site **Medium**.

Quantum Key Distribution Protocol

QuTech Challenges @ MIT iQuHACK 2022

Two Day long Hackathon

Jan'22

- Constructed a QKD system exploiting the **MQTT protocol** for remote devices with low code footprint & Network Bandwidth.
- Visualized the possibilities of transforming the two-user system into a multi-user one using multiple Quantum keys.

Pauli Blockade in Graphene Double Quantum Dots

Guide: Prof. Bhaskaran Muralidharan

Supervised Research Exposition and Master's Thesis

Jul'21 - Dec'21, Jul'22 - Present

- Identified the regimes of **valley blockade** and **spin blockade** achieved experimentally in Bilayer Graphene Quantum dots.
- Aiming towards developing a **physics-based simulable** model to explain recent experimental findings in **Bilayer Graphene**.

Excitons in semiconductors (Course Project)

Physics Of Nanoelectronic Devices, Autumn'20

- Studied and analysed methodology to determine the exciton binding energy and wave functions for two dimensional systems.
- Simulated the dependence of binding energy as per various parameters using the **Potential Morphing Method** in Python.

Digital Filter Design under given specifications (Course Project)

Digital Signal Processing, Autumn'20

- Designed Infinite Impulse response **Bandpass(Butterworth)** and **Bandstop(Chebyshev)** filters under certain specifications.
- Used MATLAB to verify the stability of the filter and applied **Kaiser filter approximations** to simulate finite responses.

Analysis of Josephson Effects (Course Project)

Quantum Transport In Nanoscale Devices, Spring'21

- Reviewed the interpretation of **Bogoliubov-deGennes formalism** using both NEGF and Scattering Matrix Based approaches.
- Reproduced sinusoidal **DC current-phase ($I - \phi$)** relationship for Josephson Junction in s-wave superconductors using MATLAB.

TECHNICAL SKILLS

Programming Languages	Python 3, Embedded C, C++, R, Scilab, MATLAB, VHDL, Octave, Assembly
Electronics	EAGLE, Altera Quartus Prime, Keil uVision, Proteus, NgSpice, GNU Radio, Sentaurus TCAD
Frameworks and libraries	Qiskit, QuTip, Tkinter, Numpy, Pandas, Tensorflow, Keras, Scipy, Mpmath, Sympy, Dplyr(R)
Softwares	COMSOL Multiphysics, AutoCAD, MS Office, Git, SolidWorks, InkScape, Anaconda, LaTeX
Web(Basics)	HTML, CSS, Javascript, Flask, Django, Jinja 2, Bootstrap 4, MySQL

KEY COURSES

- Electronics**: Physics of MOS Transistors, Nanoelectronics, Advanced CMOS Logic and Flash Memory Devices, Microprocessors, VLSI Technology, Processor Design, VLSI Design, Testing and Verification of VLSI Circuits, Quantum Information and Computing.
- Programming**: Computer Programming and Utilization, Algorithms Specialization (Coursera), Deep Learning (Coursera)
- Statistics**: First Course in Optimization, Data Analysis and Interpretation, Probability and Random Processes
- Mathematics**: Calculus, Ordinary Differential Equations, Linear Algebra, Partial Differential Equations, Complex Analysis

POSITION OF RESPONSIBILITY

Hostel Sports Secretary

Hostel 2 council, IIT Bombay

Sports council of Hostel 2 in IIT Bombay

Aug'19 - Jul'20

- Acted as first point of contact in sports related queries and strived to make Hostel 2 pioneer in sports
- Managed the teams representing Hostel 2 in General championships, won the **Runners up** position among 15 hostels

Qiskit Advocate

Qiskit

Quantum Computing Advocate

Aug'21 - present

- Succeeded in **IBMQ Developer certification test** and contributing to Qiskit SDK as an active community member.
- Acting as volunteer for various programs organized by the Qiskit community for inculcating Quantum education.

Teaching Assistant | VLSI Design(EE671)

Jul'22 - Present

- Upskilled the performance of enrolled students by collaborating with the instructor and helping conduct weekly lectures

EXTRACURRICULAR ACTIVITIES AND AWARDS

- Received **Hostel Sports Color** award in **2019-20** for invaluable contribution to the Hostel sports culture (2020)
- Part of the 5-player Hostel Table Tennis team to win the Institute-wide **Table Tennis General Championships** (2020)
- Led the team to **Runners up** position in **Institute Table Tennis League** (2019)
- Finished **3rd** position in Table Tennis and Badminton in **Freshiesta**, alias for the Institute Freshman open (2018)
- Secured **1st** position in Table Tennis in '**Raftaar**', a sports competition for all Freshmen. (2018)