Anuranan Das

EDUCATION

Indian Institute Of Technology Bombay — Mumbai, India
Electrical Engineering(Dual degree - B.Tech + Mtech) specializing in Microelectronics — 4^{th} *year UG(2018-2023)*
Minor in Management under *Shailesh J. Mehta School of Management, IIT Bombay*

Examination	University	Institute	Year	CPI(/10) / %
On-roll	IIT Bombay	IIT Bombay	2023 (Expected)	8.84
Intermediate/+2	WBCHSE	Ramakrishna Mission Vidyalaya,Narendrapur	2018	95.60
Matriculation	WBBSE	Ramakrishna Mission Vidyalaya, Narendrapur	2016	93.57

RESEARCH EXPERIENCE

Steady-State Tunable Entanglement Switch with Quantum Dots — Guide: Prof. Bhaskaran Muralidharan, EE(IITB)
UG researcher, Computational Nanoelectronics & Quantum Transport Group — *May'19 – Present*

- Developed and analyzed an entanglement generating nanotransistor model with the help of ancilla impurities and Transport Master equations. Visualized an amalgamation of quantum computing and quantum transport concepts.
- Audited and quantified the phenomenon of *spin resonance* without the application of magnetic field bias. Used the *gate pulsing scheme* to build a *Single-Qubit gate* based on *spin-polarised transistors*.
- Analyzed the development of current in Nanotransistors on *applying thermal bias*. Used *numerical kernel based methods* to find out the *energy compensation point* under such cases. Also, studied the behaviour under different *spin injection* configurations

Reliability of CMOS devices and circuits — Guide: Prof. Souvik Mahapatra, EE(IITB)
Summer Undergraduate Research Program — *May'21 - Jul'21*

- Investigated challenges in *CMOS technology scaling* in the semiconductor industry and the evolution of *FinFETs*.
- Simulated and examined the characteristics of *BSIM-CMG model* in *Hspice*, an analog circuit simulator.

Effect of mobility degradation in Cryo-CMOS — Guide: Prof. Suman Dutta, EE(Notre Dame)
IITB-ND Collaboration — *Aug'21 - Present*

- Familiarised with *Sentaurus Technology Computer-Aided Design (TCAD)* simulations of planar devices.
- Exploring possibilities of reducing power consumption in data centers by increase efficiency of transistors at *low temperatures*.

Interaction Coupling and Qubit from 2-D materials — Guide: Prof. Rajib Rahman, School Of Physics, UNSW
Remote Junior Researcher — *Aug'20 – Jan'21*

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

SCHOLASTIC ACHIEVEMENTS

- Earned 1^{st} position in *IBM Quantum Challenge 2021*, a Hackathon held for worldwide quantum computing community. (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)
- Awarded *Intermediate* and *Advanced* achievement badges respectively for completing IBMQ challenge. (2020, 2021)

TECHNICAL PROJECTS

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 Superconductiong qubit hardware to find a method to compute rigid body rotations.
- Aiming to highlight the results of the proposed model and simulation results in a scholarly journal.

Understanding and Implementing Machine Learning — Summer of Sciences
Reading and Coding Project, Maths and Physics Club, IITB — *May'19-July'19*

- Analyzed important principles of *unsupervised and supervised machine learning*, basics of neural networks, *k-means clustering*.
- Audited Machine learning course by Andrews NG from Coursera as a part of plan and implemented algorithms in *Octave*

Variational Quantum Eigensolver to Find the bond length of LiH molecule — IBM Quantum
Final project, Qiskit Global Summer School — *Aug'20*

- Successfully tested various combination of parameters like *Variational Ansatz*, *optimizers*, *initial state*, *noise simulators* to find out the best combination of result that matches with the classical prediction.
- Analyzed and documented the performance of various optimizers for *UCCSD variational form*.

Pauli Blockade in Graphene Double Quantum Dots — Guide: Prof. Bhaskaran Muralidharan
Supervised Research Exposition — *Jul'21-Present*
- Identified the regimes of valley blockade and spin blockade achieved experimentally in Bilayer Graphene Quantum dot.
- Striving towards developing a physical simulable model to explain the experimental findings.

COURSE PROJECTS

Liquid State Machine for Spoken Digits Classification — 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 the learning in the reservoir.

Clap detector for toy and appliance control — Electronic Design Lab, Spring'20
- Designed circuit with *envelope detector*, *Comparator* and *Current amplifiers* that will detect the occurrence of a clap .
- Devised *micro-controller control* codes to provide visual feedback to the user, depending on the interval of two successive claps.

Digital Filter Design under given specifications — Digital Signal Processing, Autumn'20
- Designed Infinite Impulse response *Bandpass(Butterworth)* and *Bandstop(Chebyshev)* filters under certain specifications.
- Used MATLAB to verify the stability and practicality of the filter and used *Kaiser filter approximations* to simulate finite responses.

Excitons in semiconductors — 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.

Consensus protocols in sensor networks — Network Theory, Autumn'19
- Identified and evaluated the importance of consensus in sensor networks to maintain stability using *stochastic* matrices
- Used MATLAB to plot and study the various cases of consensus for *Broadcast and Symmetric Gossip algorithm*

Alzheimer's Disease Detection by EEG Signal Processing — Digital Signal Processing, 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

Development and Practicality of Graphene transistor — Microelectronics, Autumn'19
- Extensively studied research papers on the development of graphene as *FET material* and manufacturing *nanoribbon MOSFETS*.
- Presented a *Poster* on the above topics at *GG Foyer, IITB* and participated in brain storming of current and future possibilities.

Strain Engineering for CMOS Scaling — Advanced 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.

Gate leakage in MOSFETs — Advanced CMOS Logic and Flash Memory Devices, Autumn'21
- Simulated gate tunneling leakage characteristics with Bilayer stack using WKB and Transfer matrix formalism.

Other Projects — Course
- Created circuitry to display any LED pattern on an 8x8 LED matrix using digital logic. — *Introduction to Electronics('19)*
- Audited *Amul Brand* and explored the *marketing strategies* for its products. — *Marketing Management('19)*
- Programmed 8051 micro-controller in *embedded C* to simulate the behavior of an ATM. — *Microprocessors Lab('20)*
- Reproduced Gate leakage Characteristics of a MOSCAP based on WKB tunneling approach. — *Physics Of Transistors('20)*
- Designed an Arithmetic Logic Unit(ALU) using VHDL(Altera Quartus). — *Digital Design Lab('20)*
- Reviewed financial crisis of 2008 from John Cassidy's 'How Markets Fail'. — *Capitalism:Theory,History and Varieties('20)*

INTERNSHIPS AND OTHER EXPERIENCES

Qiskit Global Summer School ('20, '21) — IBM Quantum
Virtual School Attendee — *July'20, July'21*
- Joined Global Summer school to get familiar with cutting edge Quantum hardwares('20) and Quantum Machine Learning('21).
- Successfully completed lab assignments and final project with the help of IBM mentors and peers.

FLY Scholar Programme — CMI, USA
Personality Development Program — *May'21-June'21*
- Successfully completed all the components of the program and revitalized personality growth of myself and my peers.
- Coordinated as the *team leader* for the final capstone project and oversaw the successful completion of the project.

Qiskit Advocate — Qiskit
Community member — *Aug'21 - present*
- Succeeded in *IBMQ Developer certification test (*) and contributing to Qiskit SDK as an active community member.

Educational Content Development — Embibe
Work From Home Internship — *April'20 - June'20*
- Worked on end to end creation, editing of solutions and correction of different questions of Intermediate level Physics for an online platform under *Reliance Industries Limited* which serves *7 million users across India*
- Collaborated with project coordinators to get the content developed as per company vision and daily targets

TECHNICAL SKILLS

Programming Languages	Python 3, Embedded C, C++, R, Scilab, MATLAB, VHDL, Octave, Assembly
Web	HTML, CSS, Javascript, Flask, Django, Jinja 2, Bootstrap 4, MySQL
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	AutoCAD, MS Office, Git, SolidWorks, InkScape, Anaconda, LaTeX

KEY COURSES

Core subjects and Interests:
- *On-campus:* Quantum Information and Computing, Physics of Nanoelectronic Devices, Physics Of MOS Transistors, Nanoelectronics, Quantum Transport in Nanoscale devices*, Digital Signal Processing, Advanced CMOS Logic and Flash Memory Devices, Microprocessors, VLSI Technology, Processor design*, VLSI Design , Testing and Verification Of VLSI Circuits*
- *Online:* Quantum Mechanics and Quantum Computation(), The Hardware of a Quantum Computer()

Computer Programming, Statistics and Mathematics:
- *Programming* : Computer Programming and Utilization(C++), Algorithms Specialization (), Deep Learning ()
- *Statistics* : Data Analysis and Interpretation, Probality and Random Processes, First Course in Optimization
- *Mathematics* : Calculus, Ordinary Differential Equations, Linear Algebra, Partial Differential Equations, Complex Analysis

Humanitites
- Economics, Operations Management, Marketing Management, Finance and Accounting, Human Resource Management, Sociology, Capitalism : Theories, History and Varieties, Project Management*, Industrial Economics*

**Audited, *Ongoing

POSITION OF RESPONSIBILITY

Hostel Sports Secretary — Hostel 2 council, IIT Bombay
Part of the sports council of the hostel catering to the residents of Hostel 2 in IIT Bombay — *Aug'19 – Jul'20*
- Acted as first point of contact in sports related queries and striving to make Hostel 2 pioneer in sports
- Managed and directed the teams representing Hostel 2 in General championships, won the *Runners up* position among 15 hostels

Summer Of Sciences, 2020 — Maths and Physics Club, IITB
Mentor — *Apr'20 - June'20*
- Mentored three freshmen on their endeavour to explore basics of nanotechnology and its applications for their project.
- Monitored their plan of action and resolved their doubts and verified their final study reports

Volunteer — Aavhan, IIT Bombay
IIT Bombay's premiere sports festival — *March'2019*
- Conducted the respective games in their respective slots, provided players with refreshments and controlled related matters

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 3^{rd} position in Table Tennis and Badminton in **Freshiesta**, alias for the Institute Freshman open (2018)
- Secured 1^{st} position in Table Tennis in **'Raftaar'**, a sports competition for all Freshmen. (2018)
- Took part in **Xlr8**, a remote-controlled bot making competition by **Electronics and Robotics club, IITB** (2018)
- Participated in **Qiskit India Hackathon** Organized by **IBM Quantum** as a part of their campaign (2020)

For verification of academic transcript, Please visit **Current Academic Transcript** (Please Use Token: B3 BB66 8284 0062 1711)
Transcript is attached hereby.

भारतीय प्रौद्योगिकी संस्थान मुंबई
INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
पवई / Powai, मुंबई / Mumbai 400 076

Official Transcript

Date of Issue : 17-January-2022 , liable to change since student has not yet graduated

Roll Number:	18D070037	Academic Unit:	Electrical Engineering
Name of the Student:	Anuranan Das	Discipline/Specialization:	Microelectronics
Programme:	Dual Degree (Dual Degree Programme)	Joining Month & Year:	July 2018

Code	Name	Credits	Tag	Grade/ Marks	Code	Name	Credits	Tag	Grade/ Marks
Academic Year: 2018 - 2019, Term: Semester Autumn									
CH 105	Organic & Inorganic Chemistry	4.0	MA	BC	ME 113	Workshop Practice	4.0	MA	AA
CH 107	Physical Chemistry	4.0	MA	AB	NOCS01	NCC/NSS/NSO	0.0	MA	PP
CS 101	Computer Programming and Utilization	6.0	MA	BB	PH 107	Quantum Physics and Application	6.0	MA	BB
EE 111	Introduction to Electrical Systems	6.0	MA	AA	PH 117	Physics Lab	3.0	MA	AA
MA 105	Calculus	8.0	MA	AB					
SPI= 8.83/10					CPI= 8.83/10				
Academic Year: 2018 - 2019, Term: Semester Spring									
BB 101	Biology	6.0	MA	AA	MA 108	Differential Equations	4.0	MA	AB
CH 117	Chemistry Lab	3.0	MA	AB	ME 119	Engineering Graphics & Drawing	5.0	MA	AA
EE 112	Introduction to Electronics	6.0	MA	AA	NOCS02	NCC/NSS/NSO	0.0	MA	PP
MA 106	Linear Algebra	4.0	MA	CC	PH 108	Basics of Electricity & Magnetism	6.0	MA	BC
SPI= 8.79/10					CPI= 8.81/10				
Academic Year: 2019 - 2020, Term: Semester Autumn									
EE 207	Electronic Devices & Circuits	6.0	MA	AA	HS 101	Economics	6.0	MA	AA
EE 223	Data Analysis and Interpretation	6.0	MA	BC	MA 205	Complex Analysis	4.0	MA	AB
EE 225	Network Theory	6.0	MA	AB	MA 207	Differential Equations II	4.0	MA	CC
EE 227	Microelectronics	6.0	MA	AA	MG 401	Marketing Management	6.0	MI	AA
EE 236	Electronic Devices Lab	3.0	MA	AA					
SPI= 8.93/10					CPI= 8.85/10				
Academic Year: 2019 - 2020, Term: Semester Spring									
EE 204	Analog Circuits	6.0	MA	BB	EE 230	Analog Lab	3.0	MA	PP
EE 210	Signals and Systems	6.0	MA	PP	EE 234	Machines Lab	4.0	MA	AB
EE 214	Digital Circuits Lab	3.0	MA	PP	MG 406	Operations Management	6.0	MI	AA
EE 222	Electrical Machines and Power Electronics	6.0	MA	AA	PH 534	Quantum Information and Computing	6.0	AL	BC
EE 224	Digital Systems	6.0	MA	AB					
SPI= 9.00/10					CPI= 8.88/10				
Academic Year: 2020 - 2021, Term: Semester Autumn									
EE 301	Electromagnetic Waves	6.0	MA	AB	EE 338	Digital Signal Processing	6.0	MA	BB
EE 308	Communication Systems	6.0	MA	BC	EE 723	Physics of Nanoelectronic Devices - I	8.0	MA	BB
EE 309	Microprocessors	6.0	MA	BB	HS 307	Sociology	6.0	MA	AB
EE 325	Probability and Random Processes	6.0	MA	BB					
SPI= 8.14/10					CPI= 8.70/10				
Academic Year: 2020 - 2021, Term: Semester Spring									
EE 302	Control Systems	6.0	MA	BC	EE 344	Electronic Design Lab	6.0	MA	AB
EE 324	Control Systems Lab	3.0	MA	AB	EE 620	Physics of Transistors	6.0	MA	AA
EE 328	Digital Communications	6.0	MA	BB	EE 724	Nanoelectronics	6.0	MA	AA
EE 337	Microprocessors Laboratory	3.0	MA	AB	HS 449	Capitalism : theories, histories, varieties	6.0	AL	AB
EE 340	Communications Lab	3.0	MA	AA					
					MG 402	Human Resource Management	6.0	MI	AB
SPI= 8.92/10					CPI= 8.74/10				

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Official Transcript

Name of the Student: Anuranan Das | Roll Number : 18D070037

Code	Name	Credits	Tag	Grade/ Marks	Code	Name	Credits	Tag	Grade/ Marks
Academic Year: 2021 - 2022, Term: Semester Autumn									
EE 451	Supervised Research Exposition	6.0	MA	AA	EE 735	Microelectronics Simulations Lab	6.0	MA	AB
EE 659	A First Course in Optimization	6.0	AL	BC	EE 746	Neuromorphic Engineering	6.0	MA	AB
EE 669	VLSI Technology	6.0	MA	AB	EE 788	Advanced CMOS Logic and Flash Memory Devices	6.0	MA	AA
EE 671	VLSI Design	6.0	MA	AA	MG 403	Accounting and Finance	6.0	MI	BB

SPI= 9.50/10 CPI= 8.84/10

Mandatory Course Credits (MA+HO)	**= 257.0**	**CPI (Courses)**	**= 8.84/10**
Project Credits (PR)	**= 0.0**		
Net Mandatory Credits (MA+PR)	**= 257.0**	**CPI (Overall)**	**= 8.84/10**
Overall Completed Credits	**= 257.0**		
Overall Grade Points	**= 2273.0**		

Current Status

The academic requirements for the degree are yet to be completed.

General Information

The medium of instruction at the Institute is English.

Course credits and grade: Each academic course is associated with a credit which is an indicator of its relative academic weight in calculating the academic performance. A two-letter grade is awarded to students on the basis of their performance in examinations and assignments of a specific course. The letter grades have numerical equivalents on a 0-10 scale as given below.

Letter Grade	AP	AA	AB	BB	BC	CC	CD	DD	FF	FR	W	DX	PP	NP	AU
Numerical Equivalent	10	10	9	8	7	6	5	4	0	0	–	–	–	–	–

FF: Fail, FR: Fail and repeat, W: Withdrawn, DX: Insufficient attendance, AU: Satisfactory performance in an audit course, PP: Pass, NP: Not Pass. The minimum passing grade in a course is DD. The grade AP is awarded to students with exceptional performance in core courses of a programme. Numerical equivalents of letter grades are referred to as grade points.

The numerical grade points are not convertible into marks or percentages.

Performance Indicators: The performance of a student in a semester is given by a number called the Semester Performance Index (SPI),which is the weighted average of the earned grade points in the courses during the semester.

If a student has courses with credits C_1, C_2,..., C_n, with grade points of G_1, G_2,..., G_n respectively, then

Semester Credits = $C_1 + C_2 + ... + C_n$.	Semester Grade Points = $C_1G_1 + C_2G_2 + ... + C_nG_n$.	SPI = Semester Grade Points ÷ Semester Credits.

Cumulative Performance Index (CPI) is the weighted average of the grade points in the courses in all semesters. The indices SPI and CPI are calculated upto two decimal places.

Courses are tagged as MA: Mandatory (Core/Elective), MI: Minor, HO: Honours, AL: Additional Learning, AU: Audit

- Each degree programme has mandatory credits consisting of core courses, elective courses, and non credit courses. These courses are tagged as MA.
- For calculation of SPI and CPI, grades obtained only in mandatory courses (MA) are considered.
- Students can supplement the learning experience by crediting additional courses. Credits earned in these courses, when appropriate, can earn additional credentials either in the form of "Honours" (HO) in the chosen discipline or "Minor" (MI) in another discipline or both.
- "Honours" is not indicative of proficiency, and can be earned by completing the additional prescribed set of advanced core and elective courses in the chosen discipline. "Minor" can be earned by completing the prescribed set of courses in a discipline other than the chosen discipline. Additional courses that are not used for earning "Honours" or "Minor" are tagged as "Additional Learning" (AL).
- The AU is awarded based on satisfactory attendance and fulfilling the minimum requirements as set by the course instructor.It carries no grade points and does not figure in SPI or CPI calculations.
- PP or NP is awarded in some credit courses that are not earmarked with a letter grade. Correspondingly, PP/NP does not carry a grade point.
- O-IITB is/are the Course(s) completed by a student outside IIT Bombay (NPTEL/ Swayam). These course(s) contribute towards the completion of credits for a degree requirement. However, grades/marks earned for such course(s) is/are not considered for SPI / CPI calculation.

The Institute does not award any class or division. Notionally, the CPI may be multiplied by a factor of 10 to obtain a numerical percentage.

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END OF TRANSCRIPT | Roll Number: 18D070037