Soumik Sahoo
B. Tech in Engineering Physics
Indian Institute of Technology, Bombay

Email: soumiksahoo000@gmail.com
Academic: 23b1825@iitb.ac.in
GitHub: https://github.com/Soumik969

Degree/Examination	University	Institute	Year	CPI/%
B. Tech in **Engineering Physics**	IIT Bombay	IIT Bombay	2023-2027	8.72
Higher Secondary **+2**	CHSE, Odisha	Saraswati Vidya Mandir,Neelakanthanagar	2022	89.66%
Secondary **10th**	BSE, Odisha	Saraswati Vidya Mandir,Singhpur	2020	93.5%

- Pursuing an **Honors** degree in the **Department of Physics, IIT Bombay**
- Pursuing a **Minor** degree in **Centre for Machine Intelligence and Data Science, IIT Bombay**

Scholastic Achievements

- Achieved 96.8 percentile in National Entrance Screening Test out of 25k candidates. *(2022)*
- Secured a place in the top 1% out of 0.18 million candidates in Joint Entrance Examination Advanced. *(2023)*
- Achieved 99.87 percentile out of 1.2 million candidates in Joint Entrance Examination Mains. *(2023)*

Key Projects

- **Non-Equilibrium Green's Function Formalism** | *Computational Physics Project* | *Krittika IITB* *(Dec '24 - Jan '25)*
  - Implemented NEGF formalism to model coherent electron transport in nanoscale systems, achieving accurate I-V predictions, capturing conductance quantization effects, and enhancing quantum device simulations.
  - Developed framework integrating multiple quantum transport methodologies including Self-Consistent Field (SCF) calculations, bandstructure analysis, and subband modeling, visualizing key quantum phenomena such as density of states, local density of states, potential profiles, and transmission functions.
  - Formulated matrix-based quantum transport equations for Hamiltonian, solving complex eigenvalue problems using basis function expansions, and iteratively computing electron density and electrostatic potentials.
- **Cosmology and Darkmatter** | *Summer of Science* | *Krittika IITB* *(April '24 - August '24)*
  - Studied the Special Theory of Relativity, covered basics of General Relativity which has essential concepts such as metric tensors, Christoffel symbols, the Riemann curvature tensor, and Einstein's field equations.
  - Analyzed the transition from early cosmic epochs through inflation, the matter-dominated phase, and dark energy-driven expansion, along with the critical factors and key processes influencing this evolutionary timeline.
  - Reviewed various theoretical models and experimental searches, culminating in a comprehensive 26-page report and presentation thoroughly detailing our significant findings and future research recommendations for the field.
- **Eclipsing Binaries** | *Krittika Summer Project* | *Krittika IITB* *(April '24 - August '24)*
  - Used the PHOEBE package extensively to determine the DI-Her eclipsing binary system's stellar masses, radii, orbital parameters, and overall system dynamics, while also analyzing light curves and improving data accuracy.
  - Focused intently on stellar temperatures, orbital inclination, eccentricity, and other parameters through iterative fitting and advanced optimization techniques for highly accurate system modeling, predictions, and analysis.
  - Simulated light curve variations and processed extensive data, providing valuable insights into the unique orbital dynamics, physical interactions, and overall stellar evolution of the components in the DI-Her binary system.
  - **C**reated a comprehensive and detailed 90-page report with my 5 team members, organized our research and analysis, and delivered a presentation of our significant findings and key conclusions to the attendees.
- **Group Theory** | *Learner Space* | *Maths & Physics Club IITB* *(April '24 - August '24)*
  - Studied discrete group theory, including subgroups, cosets, group actions, direct products, and equivalence relations; examined their definitions, and essential properties to gain an understanding of group structures.
  - Using concepts like group maps, homomorphisms, and equivalence classes, I successfully solved three rigorous and challenging assignment problems related to group theory and gained valuable insights in the process.
  - Studied advanced topics such as Polya's counting theory, chemical enumeration, and cyclic groups and tones to further enhance my understanding of group theory applications and their relevance in mathematical contexts.
- **Web Development** | *Learner Space* | *Web & Coding Club IITB* *(April '24 - August '24)*
  - Gained proficiency in HTML, CSS, JavaScript, Django, Bootstrap, and React.js for building component-based architecture, implementing responsive design, and optimizing performance across different devices.
  - Developed a secured note-taking platform with controlled login/logout, enhancing user experience, data protection, and security through encryption and authentication methods to ensure privacy and reliability.

COURSE PROJECTS

- **Quantum System Analysis:** *(PH 227)* *(Aug'24-Dec'24)*
  Prof. Alok Shukla and Prof. Sadhana Dash | Department of Physics, IIT Bombay
  - Implemented ML models to predict quantum mechanical properties implementing real physics laws as parameters, achieving MSE of 0.00077 with PINNs compared to RF (0.01295) and XGB (0.03213).
  - Designed Physics-Induced Neural Networks incorporating Schrödinger equation constraints in the loss function, enabling accurate wavefunction predictions that closely matched analytical solutions for quantum SHO.
  - Generated synthetic datasets by numerical solution of Schrödinger equation, developed comparative analysis across multiple models, and demonstrated superior performance of PINN for quantum property prediction.
- **Universal Tensile Machine:** *(MS 101)* *(Aug'23-Nov'23)*
  Prof. Joseph John | Electrical Engineering Department, IIT Bombay
  - Created the design of a Universal Tensile Machine (UTM) to measure stress and strain accurately and efficiently.
  - Built the machine with durable acrylic sheets, aluminum rods, precision motors, Arduino control components, and custom fixtures for enhanced stability, reliability, and performance testing under various conditions.
  - Used different fabrication techniques like laser cutters, lathes, and advanced 3D printers for precise assembly.
  - Conducted experiment and presented to professors for reliability and accuracy in measurements of data.
- **Analysis of IBM:** *(SOM 101)* *(Jan'24-April'24)*
  Prof. Ashish Pandey | Shailesh J. Mehta School of Management, IIT Bombay
  - Analyzed IBM's strategies, market position, and technological innovations from the very beginning till now.
  - Worked collaboratively with two peers to gather insights for the studies related to IBM's evolution over the years.
  - Developed a comprehensive Presentation summarizing the findings for submission to the project committee.
- **Nonlinear Dynamics: Chaotic duffing oscillator:** *(PH 567)* *(Aug'24-Present)*
  Prof. Punit Paramananda | Department of Physics, IIT Bombay
  - Studied papers about Duffing Oscillator and used numerical methods and simulations to explore its behavior from simple harmonic motion to complex chaotic states, which is done just by triggering the initial conditions.
  - Done stability analysis of the Duffing Oscillator's fixed points by linearizing equations and examining eigenvalues.
  - Explored the transition to chaos by varying parameters such as the amplitude of the periodic driving force, and damping coefficient. Visualized chaotic behavior using time series, phase diagrams, and Poincaré sections and analyzed similar analogous potential by creating an electrical analog circuit using basic electronics devices.

Key Courses Undertaken

- **Physics**: Waves and Oscillation, Thermal Physics, Classical Mechanics, Analog and Digital Electronics, Physics Lab, Non-Linear Dynamics, General Relativity, Quantum Mechanics, Statistical Mechanics, Electromagnetic Theory .
- **Mathematics**: Calculus, Linear Algebra, Differential Equation, Complex Analysis, and Integral transforms.
- **Miscellaneous**: Introduction to Psychology, Introduction to Management, Economics, Computer Utilization and Programming, AI and Data Science, Makerspace, Design thinking and Innovation.

**Courses ongoing till April 2025*

Technical skills

- **Programming % Scripting Languages:** C++, Java, Javascript, Python, HTML, CSS, Blender, Photoshop
- **Libraries:** Scikit-Learn, Matplotlib, Pandas, Numpy, Scipy, Seaborn, Plotly, Tensorflow, Keras, XGBoost, Altair, Pytorch, MATLAB, LaTeX, ReactJS, Phoebe, Bootstrap, Django, LTSpice, Figma
- **Tools:** Arduino, 3-D printing, Lathe, Digital Storage Oscilloscope, Arbitrary Function Generator, DC Power Supply.

Extracurricular activities

Science Exhibition	– Secured top honors in district-level Vedic math competitions twice, demonstrating exceptional numerical skills and showcasing my profound understanding of mathematical concepts. **(2017-18)**
Social	– Devoted 80+ hours to NSS Green Campus by lots of planting activity also designed intuitive UI/UX for NSS website's Flare event, enhancing engagement for 10k+ users, while creating Instagram posters to boost social media presence and audience interaction. **(2023-25)**
Miscellaneous	– Participated in the XLR8 program with a group of four by Tinkerer's Lab at IITB, designing and building a small vehicle that was operated by a gyroscopic control mechanisms-based controller.**(2023)**