Curriculum Vitae
Tenzing Jampa Bhutia

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Research Interests

My research interests include **Condensed Matter Physics**, **Astronomy**, and the Mathematical Modeling of **Non-linear Systems**.

Education

Indian Institute of Technology Bombay, India *('22-'26)*

Major: Bachelor of Technology in Engineering Physics with Honors, **GPA: 6/10**
Minor: Entrepreneurship

Scholastic Achievements

- Secured a position in the top **1.10%** in the JEE Main examination among 0.9 million+ candidates *('22)*
- Secured a position in the top **2.57%** in the JEE Advanced examination among 0.15 million+ candidates *('22)*

Research Experience

Mechanical Impacting System *(Aug'24 - Dec'24)*
Non Linear Dynamics | Prof. Puneet Parmananda

I along with two of my colleagues implemented a paper on Electrical equivalent of a mechanical impacting system. This paper was published by ***Soumyajit Seth*** *on 20th of Jan 2020.*

- The mechanical to electrical equivalent was based on $M = L$, $R1 = R$, $k1 = 1/C1$, $k2 = 1/C2$, $x = q$, $d = q_{ref}$. Where the system is originally a **1-DOF** mechanical system.
- Translated a forced damped oscillator with a massless compliant wall that the mass M can impact with into an electrical system. By increasing the stiffness ratio $k1/k2$ ($C2/C1$ where $C1$ & $C2$ are the capacitance's), one can bring the behavior close to that of a system with instantaneous or hard impacts.
- The system, initially exhibiting period-1 oscillatory motion, transitioned to chaotic behavior when the stiffness ratio was modified such that the block of mass grazed the massless plate. Subsequently, the system stabilized into a period-2 oscillatory state.
- The correct conditions for chaotic behavior were identified, and a significant flaw in the analysis was resolved using Python-generated plots and differential calculus. These findings are detailed in the accompanying presentation:link to presentation

Key Projects

LIGO on a breadboard *(Aug '23 - Dec ' 23)*
Course Project| Guide: Prof. Pradeep Sarin

- Engineered a closed-loop system using **Op-amps** and LED with a **phototransistor** to provide real-time feedback
- Designed a **Proportional Controller** with a **differential amplifier** for calculating and responding to error signals
- Tuned the proportionality parameter (**Kp**) to maintain **robust system** performance and **stability** across different light frequencies **(5 Hz, 20 Hz, and 80 Hz)**, optimizing response to various external lighting conditions

Smart Appliance Infrared Controller *(Mar '24 - Apr ' 24)*
Course Project | Prof: Maniraj Mahalingam

- Developed the **Smart Appliance Infrared Controller**, Utilizing **Arduino** and Arduino based components
- Integrated **2 Arduinos** via Serial Communication protocol, with the ability to store signals for **5+** different devices
- Utilized **HC-05** Bluetooth module, increasing its functionality by enabling remote control via a Bluetooth device

Line Following Bot *(Jan '23 - Feb '23)*
Course Project| Guide: Prof. Joseph John

- Utilized **IR** sensors to detect a thick, dark line and successfully maneuvered a line-following robot
- **Bluetooth** technology was employed to facilitate the control of the device via handheld devices, thereby ensuring accuracy in executing turns.
- The application of the rocker-bogie concept in the **Mars Rover** facilitates enhanced traversal across challenging terrains
- Finally, the bot was meticulously crafted, drawing inspiration from the beloved Disney character **Wall-E**, in order to infuse our robot with a distinct and captivating personality
- Selected as one of the best teams out of **120+ teams** and Invited to present the bot in an institute-wide exhibition

RC Plane Design and Development *(Sep '23 - Oct ' 23)*
RC Plane Competition | Aeromodelling Club, IIT Bombay

- Designed and built a remote-controlled trainer plane, carefully dimensioning the control surfaces namely **rudder, ailerons, and elevators**, to achieve effective manoeuvrability, flight stability and aerodynamic performance
- Developed and configured the electrical system, including the integration of a **LiPo battery**, a transmitter for remote control, **servo motors** for actuating control surfaces, a **BLDC motor** for propulsion, and **ESCs** for throttle response
- Completed training in flight dynamics, through simulation software and hands-on real-world sessions, learning the control of **pitch, yaw, and roll** to enhance practical understanding of flight mechanics and control systems

Cosmology and Dark Matter Report *(Jun '24 - Aug ' 24)*
Self Project | Research in Astrophysics | Summer of Science organized by IITB

- Authored a comprehensive project report on **cosmology and dark matter** over an 8-week period, delving into foundational and advanced concepts in the field. The report was created using **LaTeX**, featuring explanatory figures and mathematical formulations
- Investigated the origins of the universe, focusing on the **Big Bang theory** and the subsequent expansion. Along with it, explored the significance of the **CMB (Cosmic Microwave Background)** as the remnant radiation from the early universe, providing critical evidence for the Big Bang theory.
- Studied **Einstein's theory of general relativity**, which describes the gravitational interaction and its role in cosmological models and analyzed the evidence for **Dark Matter**
- Reviewed theoretical models and experimental searches for **WIMPs** as potential dark matter candidates.Explored the concept of **axions**, another candidate for dark matter, and their theoretical and observational implications
- Engaged with **cutting-edge research papers and reports** in **cosmology and astrophysics** to ensure the report reflected the most current scientific understanding and discoveries.

Other Projects

Learning In A Library *(Jun '24 - Aug '24)*
Self Project | Data Structure and Machine Learning | Summer of Coding organised by IITB

- Acquired foundational **Python** skills and gained proficiency in **Object-Oriented Programming (OOP)** concepts
- Learned essential mathematical tools required for **Machine Learning** and mastered **vectorization** techniques using the **NumPy** library and implementing **Scikit** and **Pytorch**
- Developed a **personalized Python library**. Applying the homemade library effectively to complete a Machine Learning project of choice within an 8-week timeframe.

"Flavour Craft"Nutrition Tracker App *(Jan '24 - Mar '24)*
Team Project | An App Design with Prototype | DE101 course by IITB

- **Project Overview :** Spearheaded the design and development of a comprehensive health management food app over a period of three months, involving meticulous planning, user research, and iterative design processes
- **User Research :** Conducted in-depth interviews and surveys to gather user insights, identify pain points, and understand dietary preferences and needs across different ethnicities
- **Design and Prototyping :** Utilized **Figma** to create intuitive and user-friendly prototypes. The design underwent rigorous evaluation by professors, ensuring functionality and user experience excellence
- **Impact :** Enabled users to conveniently access information about meal options available in hostel messes and canteens, ensuring they make informed dietary choices aligned with their nutritional requirements

Simple Calculator *('20)*
Self Project

- Developed an **app** in **Python** Programming language for a basic calculator that is capable of performing calculation on two variables
- Used the library **Tkinter** to give the calculator a good GUI along with icons and button designs

Simple Product Design *('25)*
Course Project | DE344 Course by IITB

- Conceptualized, prototyped, and developed four distinct products using diverse materials:
    - Bamboo laptop stand
    - Galvanized steel mobile stand
    - Polystyrene bedside lamp
    - Pine wood desk organizer
- Applied comprehensive design methodologies, including brainstorming, mock-ups, iterative feedback loops, and refinement to achieve final products.
- Successfully completed each project within a two-week timeframe, over a total duration of two months.
- Designs were evaluated and graded by PhD-level design professionals, receiving a perfect score (10/10) for all projects.

Key Courses Undertaken

Mathematics	Calculus, Linear Algebra, Differential Equations, Real Analysis, Complex Analysis
Systems & Control	Non-linear Dynamics, Digital Photogrammetry and Cartography
Physics	Classical Mechanics, Quantum Mechanics, Statistical Physics, Numerical Methods in Physics, Mathematical Physics, Waves and Oscillations, Quantum Information and Computing, Semiconductors Physics, Condensed Matter Physics, Electromagnetic Theory Light Matter Interaction, Molecular Spectroscopy, Optical Physics
Electrical	Analog Electronics, Digital Electronics, Microprocessors, Nano Devices and Applications
CS and ML	Computer Programming and Utilisation, Programming for Data Science, Makers Space Introduction to Machine Learning
Miscellaneous	Physics lab, Economics, Introduction to Management, Design Thinking, Organic, Inorganic and Quantum Chemistry, Biology, Psychology, Chemistry Lab, Capitalism, Simple Product Design, Bamboo Construction for Rural Infrastructure

Technical Skills

Development & Simulations	Python, C++, Git, Autodesk Fusion 360, Blender, Canva, Figma, LTspice, LaTeX, Origin
Libraries & Frameworks	SciPy, Numpy, Tensorflow, Scikit-learn, Matplotlib, Pandas, Tkinter, Pytorch

Extra-Curricular Activities

- Completed a yearlong training programme at National Sports organisation, IIT Bombay in **Basketball** *('22-'23)*
- Awarded an **A+** in a 100 hours Japanese Communication course offered by Office of IR, IIT Bombay *('23-'24)*
- Analyzed and pitched the Dream 11, a as a prominent fantasy sports platform and its revenue generation strategies, achieving a **8/10** grade in coursework *(Jun '23)*
- Performed with Hostel 5 in the **General Championships IITB Basketball** and acquired the **3rd position** *('25)*
- Fluent in **five** languages including **English, Hindi, Nepali, Tibetan, Japanese** *('24)*