**Ayush Prasad** | **22B0674**
**Mechanical Engineering** | **B.Tech.**
**Indian Institute of Technology Bombay** | **Gender: Male**
**DOB: 05/11/2004**

| Examination | University | Institute | Year | CPI / % |
|---|---|---|---|---|
| Graduation | IIT Bombay | IIT Bombay | 2026 | |
| Intermediate | CBSE | VIBGYOR High International School | 2022 | 97.40% |
| Matriculation | CBSE | VIBGYOR High International School | 2020 | 96.40% |

## Scholastic Achievements

- Awarded a **Branch change** to **Mechanical Engineering, B.Tech** for remarkable performance (33 out of 1400+) *(2023)*
- Ranked **6th** amongst **225+** undergraduates in the Department | Achieved SPI of **9.83** in the fourth academic semester *(2024)*
- Awarded an **AP** grade for exceptional academic performance in a course on Engineering Mechanics (**2** in **200**) *(2023)*
- Achieved **98.3** percentile in the JEE Advanced examination among **0.15 million+** candidates across India *(2022)*
- Secured **99.77** percentile in JEE Main examination among **1.2 million+** candidates across India *(2022)*
- Scored **100%** in **Mathematics** and **Chemistry**, in CBSE Class XII among **1.4 million+** candidates *(2022)*
- Secured a rank **45** in Admission Committee for Professional Courses, Gujarat out of **0.12 million+** candidates *(2022)*

## Professional Experience

**Product Development Intern** | Codemischief Software Solutions Pvt. Ltd. *(Mar'24 - Apr'24)*

*Worked in a **2-member team** on Industrial automation project "Dosa.Kitchen"*

- Performed comprehensive prototyping, involving **CAD modeling**, simulation and **3D printing** with PLA, ABS & Nylon
- Evaluated prototypes for **temperature** and **wear** resistance, identifying improvements across materials and designs
- Conducted **research** on existing products, materials, and technologies relevant to smart kitchen appliances

## Research Experience

**Intelligent Dynamical Ubiquitous Systems Lab** | Guide: Prof. Vivek Sangwan *(May'24 - Present)*

- Derived dynamic equations for 2R mechanism using **Euler-Lagrangian method** & simulated in **MATLAB** using ode45
- Implemented a **PID** controller in MATLAB to achieve precise **set point** and **trajectory tracking** of 2R manipulator
- Designed a physical setup with **Encoder** & **Brushed DC motor** to implement PID control for set point & trajectory tracking
- Conducted literature review on **Force Field Controllers** and currently implementing it for the 2R link in **MATLAB**

**Autonomous Underwater Vehicle** | Guide: Prof. Leena Vachhani, Prof. Shashi R *(Jan'23 - Present)*

AUV-IITB is an **all-student team** working on the design and development of a state-of-the-art AUV, Matsya, capable of **self-localisation**, **way-point navigation** & **pneumatic actuation** to perform **realistic naval tasks**

***Accolades***

- Pre-qualified and selected as **semifinalists** at **RoboSub 2024**, outshining over **50+** teams from around the world
- Among the **Top 6** finalists out of **35+** teams and **40+** vehicles from all over the world in **RoboSub, 2023**

***Mechatronics Head*** *(May'24 - Present)*

- Leading a **sub-division** with 10+ members, responsible for **ceaseless improvement** in sub-division
- Overseeing the ongoing **research projects**, like soft-robotics gripper and image processing acceleration

***Electrical Design Engineer*** *(Sep'23 - May'24)*

- Conceptualized and fabricated a comprehensive **Electrical stack**, encompassing all **onboard electronics** for Matsya 7
- Established dual-core communication on **Raspberry Pi Pico** to receive data via serial USB & send **PWM** values via UART
- Designed a **PCB** enabling PWM transmission to different thrusters and the ability to **toggle sensors** on & off
- Researched to Optimize electrical stack, achieving **50% space reduction** & **20% computing power boost**
- Performed testing and maintenance of the **electrical stack** on Matsya 6, including **hydrophones, kill switches** & **thrusters**
- Developed a code that effectively operates the **vehicle's actuators**, including a **torpedo shooter** & **marker dropper**

**Towfish for Pipeline and Seabed Surveying** | Guide: Prof. Leena Vachhani *(May'24 - Present)*

*AUV-IITB, Centre of Excellence in Oil, Gas & Energy*

- Integrated **Doppler Velocity Log, Inertial Measurement Unit**, and **Pressure Sensor** for enhanced data accuracy
- Utilized **ROS** & **Python scripts** on **Raspberry Pi 4B** to efficiently manage data collection from the sensors
- Employed **I2C**, **UART**, and **serial port protocols** to ensure reliable data acquisition from **3** sensors
- Established **secure SSH** connection between a laptop & Raspberry Pi 4B running **Debian-based OS** for data transfer

## Key Projects

**Humanoid Bot** | Electronics and Robotics Club | IIT Bombay *(May'24 - Present)*

- Designed a CAD model of humanoid with **16 DoFs** in **SolidWorks** using servo motors and fabricated it with 3D printing
- Converted the CAD model to a **URDF** file and visualised it in **rviz2** using **ROS2** for accurate representation
- Simulating the humanoid in **Gazebo** with **ros2_control** for precise movement and developing a stable walking path

**SCARA** | Electronics and Robotics Club | IIT Bombay *(Nov'23 - Jan'23)*

- Designed and Manufactured a **SCARA** using **SolidWorks** and **3D printing** refining through iterations
- Implemented **forward** and **inverse kinematics** algorithms to enable precise control of the robot's arm movements
- Utilizing **RRT* path planning** algorithm with **Simscape** add-on in **MATLAB** for efficient trajectory optimization

**IMU-controlled Rocker Bot** | Electronics and Robotics Club | IIT Bombay *(Aug'23 - Sep'23)*

- Revamped the mechanical design with **split axles**, enhancing stability for navigation across **challenging terrains**
- Established wireless communication by **ESP01** & **ESP32** using Wi-Fi protocol to relay controller **IMU** data to vehicle
- Designed a **joystick** equipped with **ESP01, IMU** and other components for **remote control** of the bot's movements

**Bauschinger Effect Experiment** | Guide: Prof. V. Karthik | Course Project *(Oct'23 - Nov'23)*

- Devised an experiment to analyze the **Bauschinger effect** in a specimen through cyclic loading using **Hydraulic UTM**
- Compared **yield stress** variations across multiple loading cycles, illustrating findings through **stress-strain** curve plotting
- Studied the material's stress/strain characteristics change as a result of the **microscopic stress distribution**

**Early Detection of Failures in Gears** | Guide: Prof. Alankar Alankar | Course Project *(Mar'24 - April'24)*

- Analyzed gear failure data, using advanced **visualization** techniques to derive actionable insights and key features
- Trained machine learning models like **Random Forest Classifier**, **Neural Network** & **Gradient Boosting Classifier**
- **Evaluated** and compared the **accuracy** of these models with different feature sets to improve the detection of failures

**Analysis of Jansen Linkages** | Guide: Prof. V. Kartik | Course Project *(Mar'24 - April'24)*

- Designed and simulated Jansen's linkage, a planar leg mechanism, using **SolidWorks** with Motion Analysis
- **3D-printed a prototype** driven by DC geared motor to achieve an accuracy of **50%** with respect to simulated motion
- Analyzed and compared results between the physical model and SolidWorks **simulation** to **validate accuracy**

## Technical Skills

| | |
|---|---|
| **Programming** | C, C++, Python, Java, MySQL, HTML, LaTeX |
| **Libraries** | Numpy, Pandas, Scikit-learn, Matplotlib |
| **Softwares** | Arduino IDE, Git & Github, EAGLE, Jupyter, Fusion360, SolidWorks, MATLAB, ROS & ROS2, Gazebo, Abaqus |

## Positions of Responsibility

**Manager** | Electronics and Robotics Club | IIT Bombay *(April'24 - Present)*

*Leading a **12-member team** organising **20+** events, hackathons & discussions for a community of **8000+** enthusiasts*

- Leading **XLR8**, a bot racing competition and the **institute's largest** tech event, with **800+** freshman participants.
- Achieve **2x** YoY growth in course engagement by utilizing data-driven insights to introduce engaging content
- Facilitating **national robotics events** and hackathons and **fostering collaboration** with other IITs
- Empowering all student technical activities & engrossment as a part of **25-membered tech-managers council**

## Key Courses Undertaken

| | |
|---|---|
| **CS and DS** | Computer Programming (C++) \| Applied Data Science and Machine Learning |
| **Makerspace** | AutoDesk Fusion 360 \| Electrical and Electronic Circuits |
| **Mechanical** | Engineering Mechanics \| Structural Materials \| Thermodynamics \| Solid Mechanics \| Kinematics and Dynamics of Machines \| Advanced Engineering Dynamics \| Fluid Mechanics \| Mechanical Processing of Materials |
| **Math** | Calculus \| Differential Equations \| Linear Algebra |
| **Miscellaneous** | Design \| Philosophy \| Economics \| Design Thinking and Innovation |

## Extracurricular Activities

- Awarded a **Senior Diploma** in Keyboard with a **First Division** from the Bangiya Sangeet Parishad *(2016)*
- Enhanced **keyboard-playing skills** through a year-long program with **NSO**, achieving advanced proficiency *(2023)*
- Developed a main PCB for a RC Bot, benefiting **160+ underprivileged girls** through **WiSE-IITB** *(2023)*
- Worked as a campus ambassador for **Axiom Futures** to spread awareness about **AI safety** *(2024)*
- Participated in **Zephyr**, Aerospace Department's annual fest, giving a presentation on **ROVs and AUVs** *(2023)*
- Participated in the **Rural IT Quiz**, organised by **Gujarat Council on Science and Technology** *(2019)*