Arnav Jayswal | **23B0319**
Chemical Engineering | **B.Tech.**
Indian Institute of Technology Bombay | **Gender: Male**
DOB: 21/12/2005

Examination	University	Institute	Year	CPI / % Credits
Graduation	IIT Bombay	IIT Bombay	2027	7.98 **Core:** 177 **| Total:** 201
Intermediate	CBSE	Suryadatta Junior College	2023	91.20%
Matriculation	CBSE	Millennium National School	2021	97.20%

Scholastic Achievements

- Achieved **AA/AB grades** in **10+** diverse courses spanning ML, mathematics and core chemical engineering *('26)*
- Secured an **AA grade** in **AI-DS**, awarded to only **6 of 110+** students enrolled in the course that semester *('24)*
- Secured a Certificate of Merit, **top 3%** out of **10k+** in the Indian Olympiad Qualifier in Maths (**IOQM**) *('20, '21)*
- Secured an All India rank within **top 4** percent of **50,000+ candidates** appearing in the **KVPY SA** exam *('21)*
- Advanced to the **INOI** via Zonal Informatics Olympiad (ZIO-2021), ranking in **top 229 of 1340+** candidates*('21)*
- Secured a **top-100 rank** nationally in the **SPOT 100** examination, administered across India by the **VSSF** *('21)*

Professional and Research Experience

Summer Associate Intern | FinMechanics *(May '26 – Jul '26)*
Provides consulting and technology solutions to financial institutions' Financial Markets and Risk Departments

- Root-caused **4 crashes** blocking the **end-of-day mark-to-market** batch, restoring a **90,861**-trade run in **108 s**
- Cut processing cost by **60%** on a core pricing routine via **JFR profiling**, with an untouched control held flat
- Shipped default accounting configs for **EQ** and **FX** asset classes, mapping **20+ rules** to dynamic **IFRS 9** ledgers
- Engineered an **84,843-trade** volume test bed, batching past SQL Server's **2,100**-parameter cap to unblock runs
- Diagnosed a **4x slowdown** in options-risk Greeks runtime, isolating a **76%** compute bottleneck with a roadmap
- Authored **8** critical change sets across **3 live production repos**, root-causing **4 crashes** blocking the pipeline

Machine Learning Engineer | Myelin *(May '25 – Jun '25)*
*Received a **Letter of Recommendation** from the **Founder and CEO** | AI-powered EdTech serving **700+** schools*

- Designed **ML-based diagnostics** for an EdTech learning platform in **700+** schools, serving **3** distinct user roles
- Ranked future academic risk at **0.91 F1** using a **Random Forest** over a **13-parameter** longitudinal profile
- Modeled **280+ curriculum competencies** across grades using longitudinal student records to map learning gaps
- Generated synthetic datasets via probabilistic simulations on **15+** pedagogical features to diversify contexts
- Developed a **Whisper-based tool** to analyze pronunciation and fluency of teachers in Marathi-medium schools

Microheater-Embedded Nanowire Dehumidifier | Research Intern *(Dec '25 – Jan '26)*
*Supervisor: Prof. Kazuki Nagashima | Hokkaido University, Japan | Received a **Letter of Recommendation***

- Built **ZnO**/**TiO_2**/**$CaCl_2$** nanowire dehumidifiers via **photolithography, sputtering**, and **ALD** for ML gas sensing
- Reduced humidity from **∼88% to ∼50% RH** within **300 s** testing dehumidification on sensorized **PCB** board
- Fabricated **microheater-embedded** dehumidifier prototypes enabling **rapid active drying** for gas sensing

Key Projects

Physics-Informed Deep Adaptive Diffusion *(Aug '25 –Nov '25)*
Course Project | Advanced Machine Learning | Prof. Amit Sethi

- Adapted PINN-DADif for CT on **250** COVID-19 slices, replacing Fourier with differentiable **Radon Transform**
- Engineered a **4-stage** physics-informed architecture enforcing **Poisson** consistency via weighted least-squares fits
- Validated differentiable CT operators, achieving **4.3%** adjoint error and **28.5 dB** round-trip reconstruction PSNR
- Improved sparse CT reconstruction by **0.6 dB PSNR**, **2.1% SSIM**, and reduced **RMSE** over the FBP baseline

LLM Post-Training using GRPO and LoRA *(Jul '26 – Aug '26)*
Self Project: Reinforcement Learning, LLMs

- Built a **GRPO** pipeline in PyTorch+TRL for Qwen2.5 0.5B/1.5B in BF16 on an **AWS EC2 L4 GPU** node
- Designed **3 verifier reward functions** (2.0/0.5/0.5 weighting) for correctness, XML format and numerics
- Ran **500** GRPO steps over 2,000 GSM8K prompts at 4 generations/prompt, rank-8 LoRA on **0.27%** of params
- Lifted GSM8K accuracy **44.5%→47.0%** on 0.5B and **60.5%→63.8%** on 1.5B, checkpointing via S3 and W&B

Real-Time Multimodal AI Security Agent *(Aug '25 – Nov '25)*
Course Project | Advanced Machine Learning | Prof. Amit Sethi

- Orchestrated speech, vision & LLM into a real-time multimodal agent sustaining **10 FPS** via non-blocking threading
- Achieved **95 %** wake-command activations at **1.3 s** median latency using Faster-Whisper running on-device
- Grounded a **4-level escalation** state machine in **FAISS** RAG over **15** policies, **200** sentence-transformer chunks
- Reached **94% Recall@3** and **91%** policy-action accuracy over **100** test incidents at a **10 ms** retrieval latency

Sparse Autoencoders for LLM Interpretability *(Aug '24 – Nov '24)*
Course Project | Mathematical Structures for Control | Prof. Ravi Banavar

- Trained a **16× overcomplete SAE** (**12,288** features) on **50M GPT-2** activations, **∼95%** variance at **L0 ≈ 32**
- Derived **ReLU** as the proximal operator of ℓ_1 + **non-negativity**, unrolling one **ISTA** step into the encoder
- Engineered a **Triton** fused gather-matmul decoder over **∼32** active atoms/token, cutting decode latency **∼15×**
- Shipped a **Dockerized** dashboard on **HF Spaces** tracking **L0**, dead features and error over an **8-point** λ **sweep**

Quantitative Option Pricing & Volatility Surface Modeling *(Jul '26 – Aug '26)*
Self Project: Quantitative Finance & Derivatives Analytics

- Matched **100K-path Monte Carlo** prices to closed-form **Black-Scholes** within **0.02%**, validating **5** Greeks
- Cleaned and processed **295** SPY option contracts across **5** expiries, extracting IVs via **Brent**'s root-finding method
- Calibrated **5-parameter SVI** slices per expiry under **L-BFGS-B**, beating a **2-layer MLP** by **0.0028** IV RMSE
- Simulated **Heston** stochastic vol via **50K Euler-Maruyama** MC; surface hedges cut delta error to **0.0275**

Clinically-Tuned Multimodal Model for Chest X-ray Report Generation *(Jun '25 – Jul '25)*
Self Project: Applied Multimodal LLMs

- Fine-tuned **LLaVA-1.5-7B** on paired chest X-rays and reports, generating findings-style text conditioned on images
- Curated a **3k+-sample** multimodal dataset with clinical prompts, pathology labels, and demographic embeddings
- Scored **0.30 ROUGE-L** and **0.45 CheXbert F1**, measuring clinical finding accuracy over n-gram overlap
- Attained **0.92 F1** on the pneumonia finding via **QLoRA 4-bit** tuning of adapters in **7 transformer layers**

Quantum Machine Learning *(Dec '24 – Jan '25)*
Computational Physics Projects | Mathematics and Physics Club, IIT Bombay

- Designed quantum teleportation circuit using **Qiskit**, tested on both **Aer simulator** and **IBMQ hardware**
- Verified hardware performance with **∼95% fidelity** vs simulator, analyzing key deviations and noise impacts
- Reached **97% energy match** with exact value via **VQE** on a 2-qubit Hamiltonian using iterative optimization
- Extended a **1D** differentiable quantum circuit **ODE** solver to a **PDE** by vectorizing the input encoding **(Pasqal)**

Positions of Responsibility

Editorial Board Member | ***Insight***, *IIT Bombay's Student Media Body* *(Apr '25 – Apr '26)*
*Creating content reaching **12k+** students with an online readership of **0.4M+**, in a **3-tier** team of **35+** students*

- Authored a long-form investigation on **faith, identity and freshman influence**, examining institutional duty
- Published an investigative analysis of **campus security**, evaluating policy gaps and proposing future reforms
- Led **6** junior editors on the **first-ever semester exchange newsletter**, in collaboration with the **Dean IR**
- Conducted the senior survey, gathering **50+ data points** from **280+ graduating students** on campus life

Institute Student Mentor & Department Academic Mentor | ***SMP***, *IIT Bombay* *(Jun '25 – Present)*

- Selected among **158** ISMPs (of **330+**) and **45** DAMPs (of **120+**) mentors via interviews & structured peer reviews
- Mentoring **12** freshmen through academic and personal transition across their entire first year at the institute
- Advising **2 ARP** (Academic Rehabilitation Program) students on semester planning to clear standing backlogs
- Heading the **resources subgroup**, curating course reviews and notes which are widely used by **400+** juniors

Technical Skills

Languages	Python, C++, Java, SQL, Bash, JavaScript, HTML/CSS, LaTeX
Software & Tools	AWS (EC2, S3), Git, GitHub, Docker, Hugging Face Hub & Spaces, Weights & Biases, CUDA, Kafka, SQL Server, Jupyter, VS Code, MATLAB, JFR Profiler
Libraries & Frameworks	PyTorch, TensorFlow, Transformers, TRL, PEFT, FAISS, Sentence-Transformers, LangChain, Triton, BitsAndBytes, MLX, OpenCV, Scikit-Learn, SciPy, Librosa, Pandas, NumPy, Matplotlib

Key Courses Undertaken

AI-ML & CS	Computer Programming, AI & Data Science, Statistical Machine Learning & Data Mining, Advanced Machine Learning, Probability & Stochastic Processes *(ongoing)*
Mathematics	Linear Algebra, Differential Equations, Calculus, Introduction to Numerical Analysis, Mathematical Structures for Control, Introduction to Network Analysis *(ongoing)*

Extracurricular Activities

- Served as **Teaching Assistant** for **English** (HS113), mentoring **30+** students via tutorials and feedback *(Nov '25)*
- Mentored juniors on career direction, target roles and internship applications via **Career Catalysis** program *('26)*
- Taught **astrophysics and astrophotography** to **400+** students through learner-led **Krittika** courses *(Jun '24)*
- Led **astronomy trips** to **Bhandardara** and **Udaipur** for **100+** participants across night-sky sessions *('24–'25)*
- Organized **National Space Day**, engaging **10k+ residents**, **100+** students, and a team-led exhibition *(Aug '24)*
- Earned certificate twice from **Harvard University** for perfect scores in global **CS50 Puzzle Day** event *('20–'22)*
- Earned **Distinction** in Piano (Initial Grade examination) conducted by the **Trinity College London** *(Jan '20)*