Pushkar Mohile
Engineering Physics
Indian Institute of Technology Bombay

180260027
UG Third Year (B.Tech.)
Male
DOB: 25/03/2000

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2021	9.82
Intermediate/+2	Maharashtra Higher Secondary Certificate Examination	Abasaheb Chinchwade Junior College of Arts, Science, Commerce	2018	92.92
Matriculation	Central Board of Seconday Education	Global Indian International School, Chinchwad	2016	98.20

Academic Achievements

2019-2020 Department Rank 1 in batch of 2022 Engineering Physics

2018-19 and 2019-20 **Institute Academic Award**
Awarded to the **Top 20 out of 1000**+ Freshmen on the basis of academic performance and the top academic performers in the department in the sophomore year

2018 Secured a percentile of 99.62 in JEE Advanced out of 220,000 candidates

2018 Secured a percentile of 99.95 in JEE Mains out of 1,000,000 Candidates

2017 Achieved a rank of 124 among 1000 selected candidates for Kishore Vaigyanik Prothsahan Yogna (KVPY) Scholarship for basic sciences

2018 Top 1 Percent in Maharashtra in Class 12 HSC Exam and eligible for INSPIRE Scholarship

2017 **Indian National Chemistry Olympiad**
Ranked in the top 1% out of 55,000 + students of the National Standard Examination in Chemistry and participated in InCHO exam used for selection for international Olympiads

Fall 2019 **AP Grade in Differential Equations 2**
Awarded to top 1% of the course for exceptional performance

Research Experience

Comparing Extinction in Deterministic and Stochastic Population Models

May-July 2019 *Prof Chetan Gadgil, CEPD National Chemical Laboratory*

- Performed a literature survey of mathematical models used to represent interacting populations showing inter-species and intra-species competition, cyclic dominance and harvesting
- Studied analytical and numerical techniques for analyzing extinction conditions in population models
- Built and simulated these deterministic models and their stochastic analogues in MATLAB using SimBiology to show that extinction is favoured more in stochastic models

Key Projects

Solitons, Integrable Systems , Infinite Dimensional Algebras

July 2020-December 2020 *PH303 Supervised Learning Project. Guide: Prof UA Yajnik, Dept. of Physics, IITB*

- Studied the kink and soliton solutions in the ϕ^4 model, sine-Gordan system in 1+1 dimensions and $O(3)$ Ferromagnet in 2+1 dimensions, and the topological charges present in this system.
- Reviewed the inverse scattering method and the lax pair formalism as a method for finding the time evolution of classical integrable systems in 1+1 dimensions such as the K-dV equation and the conservation laws arising from the monodromy matrix in these cases.
- Explored the connection between the K-dV equation and Conformal Field Theory through the infinite dimensional affine lie algebras generating symmetries in the K-dV equation and the Virasoro algebra using the Sugawara construction.

Solitons as energy carriers in 1-D FPUT Lattices

Spring 2020 *Course Project, Waves, optics and Oscillations Prof Anshuman Kumar, Dept. of Physics, IITB*

- Worked in a team of 4 to reproduce the calculations in the 2018 paper "Solitons as candidates for energy carriers in Fermi-Pasta-Ulam lattices" that shows *sech* and $sech^2$ type solitons are viable energy carriers in $\alpha\beta$ type FPUT lattices where phonon normalization isn't accurate
- Used Mathematica for performing analytical calculations and Matlab for simulating FPUT lattices in order to extract predictions for sound velocity based on multiple parameters like Temperature and α or β
- Explored the notion of Spectral entropy as an indicator for super recurrences in FPUT lattices instead of directly directly examining the phase space plots while looking for recurrences.

Simulating Tetris using Verilog and SDL2

Spring 2020 *Course Project, Digital Circuits Lab, Prof Pradeep Sarin, Dept. of Physics*

- Worked in a team of 2 to design and simulate the game of Tetris. Used Verilog to make a state machine and SDL2 with OpenGL and a C++ wrapper to handle Input/Output
- Created a 10×20 board with transitions based on the inputs which would move the active tetrimino and delete rows and update the score when the tetrimino could no longer move
- Rendered the board state frame by frame based on a clock from the C++ wrapper which would then display the game

Key Courses

Physics: Quantum Mechanics, Advanced Quantum mechanics and Relativistic quantum mechanics, Photonics, Waves and optics, Electromagnetism, Special Theory of Relativity, Classical Mechanics, Thermal Physics

Maths: Finite Semigroup Theory:Bimonoids and bialgebras in species, Topics in algebra 2:Introduction to Category Theory and Representation Theory of Hyperplane arrangements, Calculus, Linear Algebra, Ordinary Differential Equations 1 and 2, Complex Analysis, Numerical Analysis

Labs: General Physics, Chemistry, Introduction to Electronics, Op-Amp Circuits, Digital Circuits.

Other: Organic and Inorganic Chemistry, Physical Chemistry, Introduction to Electronics, Biology, Data Analysis and Interpretation, Introduction to Programming

*: To be completed Fall 2020

Positions of Responsibility

August-November 2019 **Teaching Assistant, Quantum Physics and its Application**

- Conducted weekly tutorial classes for a batch of 46 1st Year Students for introductory quantum physics course
- Solved problems and held doubt clearing sessions while being regularly available to help students outside class hours.

Extracurricular Activities

December 2020 Open Quarterfinalist, United Asians Debating Championship,reaching the top 8 out of 100+ teams across Asia

October 2020 Open Semifinalist, Asian British Parliamentary Debate, reaching the top 8 out of 160+ teams across Asia

July 2020 Open Octofinalist, Australasian Intervarsity Debate Championship, reaching the top 16 out of 130+ teams from all over Asia and Australia.

Sept 2020 Winner, CDPT Pre-ABP Tournament

2018-2020 Open Breaks at over 15 national and international tournaments