

# Manish Kumar

## Curriculum Vitae

Shivaji Nagar, Jakkampur, Patna, Bihar-800001

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### Education

- August 2019- **Integrated Ph.D.**, Indian Institute of Science Education and Research (IISER), Kolkata, West Bengal, India.  
Current
- August 2016- **B.Sc.(Hons.) in Mathematics**, CGPA: 9.54, Rajdhani College, University of Delhi, May 2019 Delhi, India.
- 2014-2016 **Higher Secondary in Science**, Percentage: 91.67%, D.A.V Public School, BSEB Colony Road, Patna, Bihar, India.
- 2014 **Matriculation**, CGPA: 10.0, R.P.S Public School, Pahari, Patna, Bihar, India.

### Research Interests

**Partial Differential Equations, Fluid Mechanics, Control Theory, Numerical Analysis:**

Linear and Nonlinear Partial Differential Equations, Fluid Mechanics, Compressible Navier-Stokes equations, Control of PDE (In particular Controllability, Stabilizability, Optimal control problem for coupled parabolic-parabolic and parabolic-hyperbolic mixed class of PDEs)

### Awards & Achievements

**PMRF Fellow**, Selected for Prime Minister Research Fellowship for May, 2021 cycle.

**Interviews**, Cracked IPhD interviews of IISER, TVM and IISER, Kolkata in 2019.

**JAM**, Got 491 rank in JAM exam in Mathematics in 2019.

**Topper**, In bachelors at college level.

### Projects

#### ◦ Summer Project

Project Title: *Semigroup Theory For Operators And Control Of PDEs*

I did this project in the last summer under the supervision of my PhD supervisor where I learned the controllability and stability concepts in case of PDEs, for which I needed the semigroup theory as a tool.

#### ◦ IPhd Project II

Project Title: *Controllability and Stability of ODEs*

I did this project in my 4th semester of MS under the supervision of my PhD supervisor where I got introduced to my research field, i.e., Control of PDEs. In this project because of ODE setup, everything was in finite dimension.

#### ◦ IPhd Project I

Project Title: *Distribution theory and Sobolev Space*

I did this project in my 3rd semester of MS under the supervision of my PhD supervisor where I get to know about the generalisation of classical theories and about new spaces, using which we work in research.

- **Summer Project**

Project Title: *Partial differential equations*

I did this project in 2020 under the supervision of my present PhD supervisor Dr. Rajib Dutta and it was a sort of introductory study in pde where I learned about Characteristic method of solving 1st order pde and also studied about the four important linear PDEs.

- **Summer Project**

Project Title: *Completion of incomplete metric space and basic topology*

I did this project in 2018 in IISER,TVM under the supervision of Dr. Srihari Sridharan and it was mainly about how the number system evolved from counting numbers to complex numbers and few approximation results of real analysis.

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## Master's Thesis

### **Controllability of a hyperbolic and a parabolic system in one dimensional periodic domain.**

In the thesis, I have studied controllability aspect of transport equation and Kuramoto-Sivashinsky-Korteweg-De-Vries equation using Carleman estimates and method of moments, respectively.

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## Publications

*Local null controllability of the stabilized Kuramoto-Sivashinsky system using moment method*, Joint work with Subrata Mazumdar.

Advances in Differential Equations, July 2023

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## Preprints

*Null Controllability of a System Coupling Kuramoto-Sivashinsky-Korteweg-De-Vries and Transport Equations.*, Joint work with Subrata Mazumdar.

HAL link: <https://hal.science/hal-03695906v1/document>

*Boundary controllability of 1-d coupled time discrete heat equation with Kirchhoff conditions*, Joint work with Kuntal Bhandari and Rajib Dutta.

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## Ongoing Works

*Null controllability of linearized compressible Navier-Stokes equation under nonnegative constraint*, Joint work with Shirshendu Chowdhury and Rajib Dutta.

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## Teaching Assistantships

Spring 2023 **Mathematics II**, 1st year undergraduate, IISER Kolkata.

- **Instructor:** Dr. Anirban Banerjee

NCMW 2022 **Control Theory for Differential equations**, IISER Kolkata.

- **Organizers:** Dr. Shirshendu Chowdhury, Dr. Rajib Dutta

AFS 2022 **AFS-II**, IISER Kolkata.

- **Organizers:** Dr. Shirshendu Chowdhury, Dr. Somnath Basu

Spring 2022 **Mathematical Methods I**, 1st year undergraduate, IISER Kolkata.

- **Instructor:** Dr. Anandamohan Ghosh

Spring 2022 **Analysis II**, 2nd year undergraduate, IISER Kolkata.

- **Instructor:** Dr. Rajib Dutta

Autumn 2021 **Linear Algebra I**, 2nd year undergraduate, IISER Kolkata.

- **Instructor:** Dr. Somnath Basu

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## NPTEL Live sessions

- Spring 2023 **Ordinary and Partial Differential Equations and Applications.**  
◦ **Instructors:** Prof. P.N. Agarwal, Prof. D.N. Pandey
- Autumn 2022 **Sobolev Space and Partial Differential Equations.**  
◦ **Instructor:** Prof. S. Kesavan

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## Workshops and webinars attended

- **Title:** Control Theory meets the Theory of Homogenization  
**Organizers:** Debanjana Mitra, Harsha Hutridurga  
**Date:** 28 Feb-04 March, 2023
- **Title:** NdAM Workshop - Analysis and Numerics of Design, Control and Inverse Problems  
**Organiser:** Giuseppe Floridia and Enrique Zuazua.  
**Date:** 1-7 July, 2021
- **Title:** Convex integration solutions for the transport equation  
**Speaker:** Dr. Ujjwal Koley, TIFR CAM  
**Date:** November, 2021
- **Title:** NdAM Workshop - Analysis and Numerics of Design, Control and Inverse Problems  
**Organiser:** Giuseppe Floridia and Enrique Zuazua.  
**Date:** 1-7 July, 2021
- **Title:** Webinar on PDE and related areas  
**Organiser:** IIT Kanpur in collaboration with TIFR-CAM, IISER-Pune and IISER-Kolkata  
**Date:** 3 September -15 December, 2020

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## Posters and Talks

- Poster presentation **Control Theory meets the Theory of Homogenization**, March, 2023.  
Indian Institute of Technology, Bombay
- Talk **Graduate Student Seminar**, August, 2022.  
Indian Institute of Science Education and Research, Kolkata

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## References

- **PhD Supervisor: Dr. Rajib Dutta**  
Department of Mathematics  
Faculty  
IISER Kolkata  
West Bengal, India  
rajob.dutta@iiserkol.ac.in
- **Dr. Shirshendu Chowdhury**  
Department of Mathematics  
Faculty  
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## Additional responsibilities

- As a current member of Library committee of my department.
- As a current member of Outreach committee in my institute.

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## Webpage Link

**`manishgnu.github.io`.**

**Declaration:** I hereby declare that all the statements made herein are true to my best of knowledge and belief.

Place: Kolkata

Manish Kumar