

# Joel Sleeba

[✉ joelsleebea1@gmail.com](mailto:joelsleebea1@gmail.com) [🐦 JoelSleebea](https://twitter.com/JoelSleebea) [🌐 joelsleebea](https://github.com/joelsleebea) [🌐 joelsleebea.github.io](https://joelsleebea.github.io)

## Research Interests

I am broadly interested in **functional analysis** and **harmonic analysis**. I am currently working on **operator algebras**. As part of my master's thesis I have worked on **Fourier analysis**.

## Education

### Indian Institute of Science Education and Research

*Master of Science in Mathematics, GPA: 8.38*

**Oct. 2021 – May 2023**

*Thiruvananthapuram, Kerala*

### Madras Christian College

*Bachelor of Science in Mathematics, GPA: 8.03*

**June 2018 – May 2021**

*Chennai, Tamil Nadu*

## Relevant Coursework

- Functional Analysis
- Measure Theory
- Representation Theory
- Finite Frames
- Topology
- Real Analysis
- Analysis of Manifolds
- Machine Learning

## Experience

### Unitary Invariants for Representations of Operator Algebras

**Sept. 2023 – Present**

*Reading Project*

*Dr. Soumyashant Nayak, ISI Bangalore*

- Plans to read the article by Richard Kadison of the same name.
- Currently reviewing the representations of groups and  $C^*$  algebras as a first step to the reading project.

### Introduction to $C^*$ Algebras

**June 2023 – Sept. 2023**

*Summer Reading Project*

*Dr. P Shankar, Cochin University of Science and Technology*

- Understood the basics of Banach algebras including spectrum, Gelfand representations of abelian algebras, compact and Fredholm operators in Hilbert spaces.
- Learned  $C^*$  algebra theory including Gelfand transforms, functional calculus, sesquilinear forms, positive linear functionals, and GNS construction.
- Covered chapters 1-3 from  *$C^*$  Algebras and Operator Theory* by Gerald Murphy and parts of chapter 1 from *An Invitation to  $C^*$  Algebras* by William Arveson.
- This project significantly influenced me to explore further about  $C^*$  algebras and its representations.

### A Study in Fourier Analysis

**Jan. 2023 – May 2023**

*Masters Thesis*

*Dr. P Devaraj, IISER Thiruvananthapuram*

- Explored Fourier transforms in the circle and line,  $\ell^p$  convergence of Fourier series, Fourier Inversion, and classical Paley Wiener theorems
- Covered chapters 3, parts of chapter 4 and 10 from *Early Fourier Analysis* by Hugh L Montgomery and parts of chapter 19 from *Real and Complex Analysis* by Walter Rudin.

## Summer Schools

### Mathematics Training and Talent Search | Level 1 Camp

**April 2021 – May 2021**

- Participated in the online summer camp hosted by MTTS trust, funded by the National Board of Higher Mathematics.
- Helped revise concepts in group theory, real analysis and linear algebra.

### Mathematics Training and Talent Search | Level 0 Camp

**May 2020 – June 2020**

- Gained a deeper understanding of topics including logic, sequence and series, vector spaces.
- The programme promoted active discussions in mathematics and gave a platform to connect with people passionate about mathematics.

## Leadership / Extracurricular

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### Operator Algebra Reading Group

Sept. 2023 – Present

- Reading group of friends who are interested in discussions on the basics of  $C^*$  algebra and related topics.
- Hosts weekly meetups and presentations on selected topics.

### Introduction to $C^*$ algebras

Oct. 9, 2023

Student Seminar Presentation

IISER Thiruvananthapuram

- [Access the presentation slides](#)

### Computability

Jan. 2022 – March 2022

Student Reading Project

Ashish Kujur, IISER Thiruvananthapuram

- Understood the notion of computable functions in unlimited register machines(URM).
- Read upto Church-Turing thesis from *Computability: An Introduction to Recursive Function Theory* by Nigel Cutland.
- An article we authored as part of the project was published in the quarterly newsletter of Club of Mathematics. [\[Link\]](#)

### Pi Quiz 3.0

March 14, 2022

Host

Club of Mathematics, IISER Thiruvananthapuram

- Co-hosted the annual  $\pi$  day quiz organized by the maths club of IISER Thiruvananthapuram.

### Online Foundation Course in Mathematics

Sept. 2021 – Oct. 2021

Mentor

MTTS Trust

- Guided pre-final year undergraduate students in the post lecture discussion sessions of the course.
- The course aimed at helping the students develop mathematical thinking by focusing on logic, sequence and limits and linear algebra.

## Achievements

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### M.Sc Entrance Examination

2021

Rank 1, Mathematics

Pondicherry University

### M.Sc Entrance Examination

2021

Rank 3, Mathematics

Hyderabad Central University

## Additional Courses

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### CS101.2x: Object-Oriented Programming

July 2020 – Dec. 2020

Grade: A+ (Maximum possible grade)

MOOCs Course, IITBombayX

### CS101.1x: Programming Basics

July 2020 – Dec. 2020

Grade: A+ (Maximum possible grade)

MOOCs Course, IITBombayX

## Volunteering and Other Projects

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### Math Modelling

Sept. 2022 – Nov. 2022

Volunteer

The International Genetically Engineered Machine competition (iGEM), IISER Thiruvananthapuram

- Modelled the partial differential equations for the internalization of vesicles through cell membrane. [\[Link\]](#)

### Web Development

Sept. 2022 – Nov. 2022

Volunteer

The International Genetically Engineered Machine competition (iGEM), IISER Thiruvananthapuram

- [Access the webpage](#)

### XOR Encryptor

Jan. 2022

Developer

- Developed a simple programme to encrypt text and files using a symmetric key or password. [\[Link\]](#)

### CSSart

May. 2020

Developer

- Created a handful of webpages as a part of learning CSS. [\[Link\]](#)

## Technical Skills

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**Programming:** Python, C, C++, Java, Bash, SQL

**Markup:**  $\text{\LaTeX}$ , Markdown, HTML, CSS

**CAS:** MATLAB, GNU Octave, Maxima, SageMath