# Joel Sleeba

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## 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 Eductaion and Research** **Oct. 2021 – May 2023**
*Master of Science in Mathematics, GPA: 8.38* *Thiruvananthapuram, Kerala*

**Madras Christian College** **June 2018 – May 2021**
*Bachelor of Science in Mathematics, GPA: 8.03* *Chennai, Tamil Nadu*

## Relevant Coursework

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

## Research Experience

**Counterexamples to the Extendibility of Positive Unital Norm-One Maps** **Oct. 2023 – Present**
*Reading Project* *Dr. P Shankar, CUSAT*

- Plans to read the article by *Chiribella et.al* of the same name
- Currently reading *Completely Bounded Maps and Operator Algebras* by *Vern Paulsen* as a first step.

**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.
- Reviewed 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, CUSAT*

- 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 *Willian 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

**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 Presenatation* *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 unlimitied 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]

**Peer Discussion: Real Analysis** **March 31, 2022**

*Host* *Club of Mathematics, IISER Thiruvananthapuram*

- Co-hosted the peer discussion session for BS-MS batch 21 organized by maths club of IISER Thiruvananthapuram.

**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

**M.Sc Entrance Examination** **2021**

*Rank 1, Mathematics* *Pondicherry University*

**M.Sc Entrance Examination** **2021**

*Rank 3, Mathematics* *Hyderabad Central University*

## Additional Courses

**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

**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* *Repository*

**CSSart** **May. 2020**

*Developer* *Website*

## Technical Skills

**Programming**: Python, C, C++, Java, Bash, SQL
**Markup**: LaTeX, MarkDown, HTML, CSS
**CAS**: MATLAB, GNU Octave, Maxima, SageMath