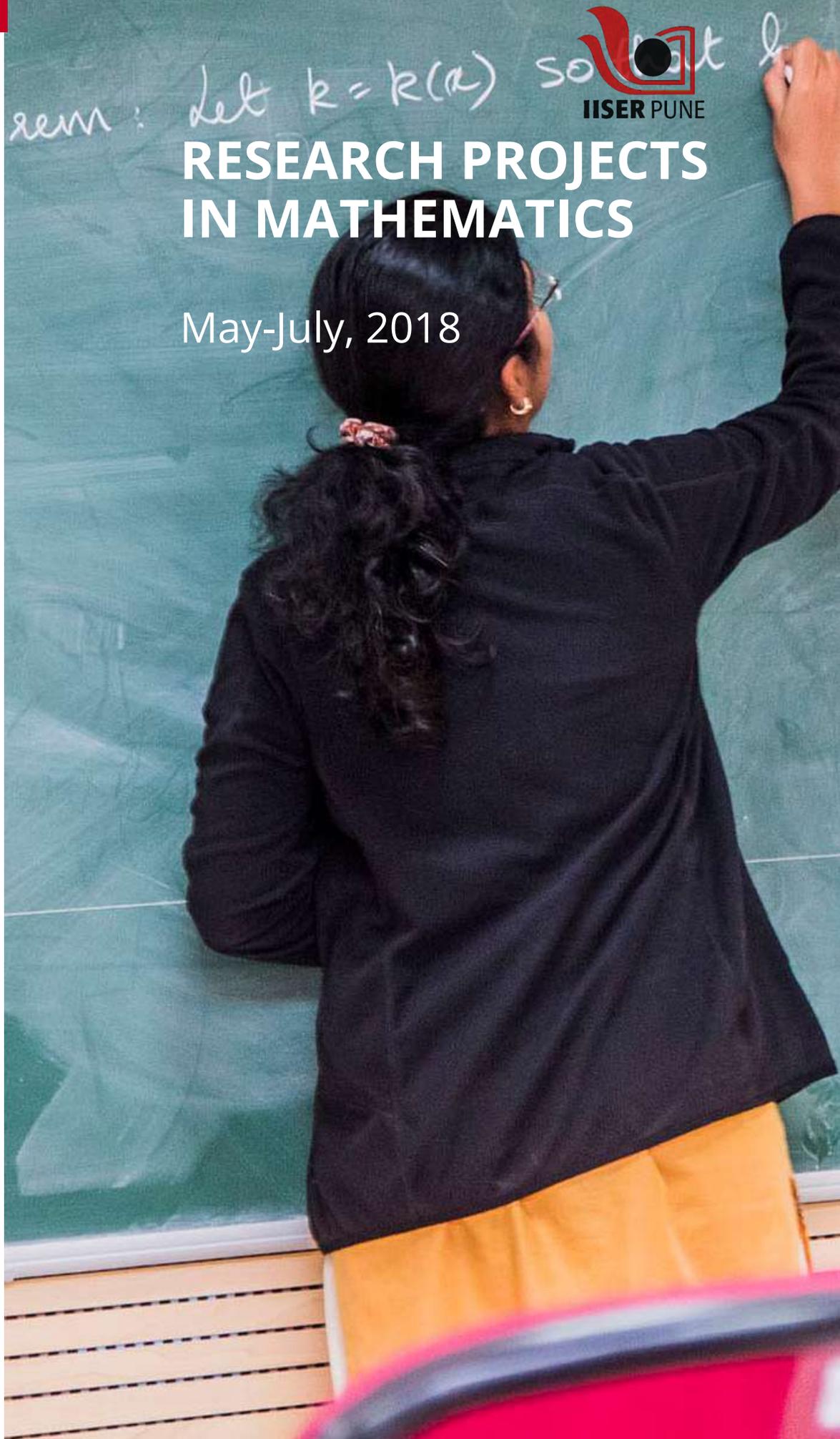


IISER PUNE - TEMPLE UNIVERSITY SUMMER PROGRAM 2018



RESEARCH PROJECTS IN MATHEMATICS

May-July, 2018

ABOUT THE PROGRAM

Temple University and IISER Pune have signed a Memorandum of Understanding focusing on student and faculty exchange with emphasis on joint research programs. To strengthen this initiative, internships have been initiated for students from Temple University to work in research groups at IISER Pune.

This brochure includes information on the faculty and research projects that are open to accept students for Summer 2018 as part of this Program.

Applications: Interested students should directly contact the Project Investigator of interest. The initial inquiry should include a resume/CV, a transcript and a statement describing prior research experience, career goals and why the particular project is of interest.

Visa and Travel: Students will be responsible for obtaining **research visa** for participation in the summer research program. Students are responsible for travel arrangements. The most convenient would be to fly to Pune International Airport (PNQ) which has some international connections or fly to Mumbai (BOM) airport. IISER Pune is 3 hour drive from Mumbai airport .

Housing and Food: On-campus housing will be provided with access to several cafeteria. The estimated cost of housing and food: USD 300 per month.

For any questions related to visa, travel, housing and food, please contact Dr. Naresh Sharma (International Relations). Email: naresh.sharma@iiserpune.ac.in

General information: Inquiries about the program should be directed to arun@iiserpune.ac.in





AN INTRODUCTION TO THE ISOPERIMETRIC PROBLEM

Project Investigator: Dr. Anisa Chorwadwala

Preferred scientific requirements: Real Analysis, Linear Algebra

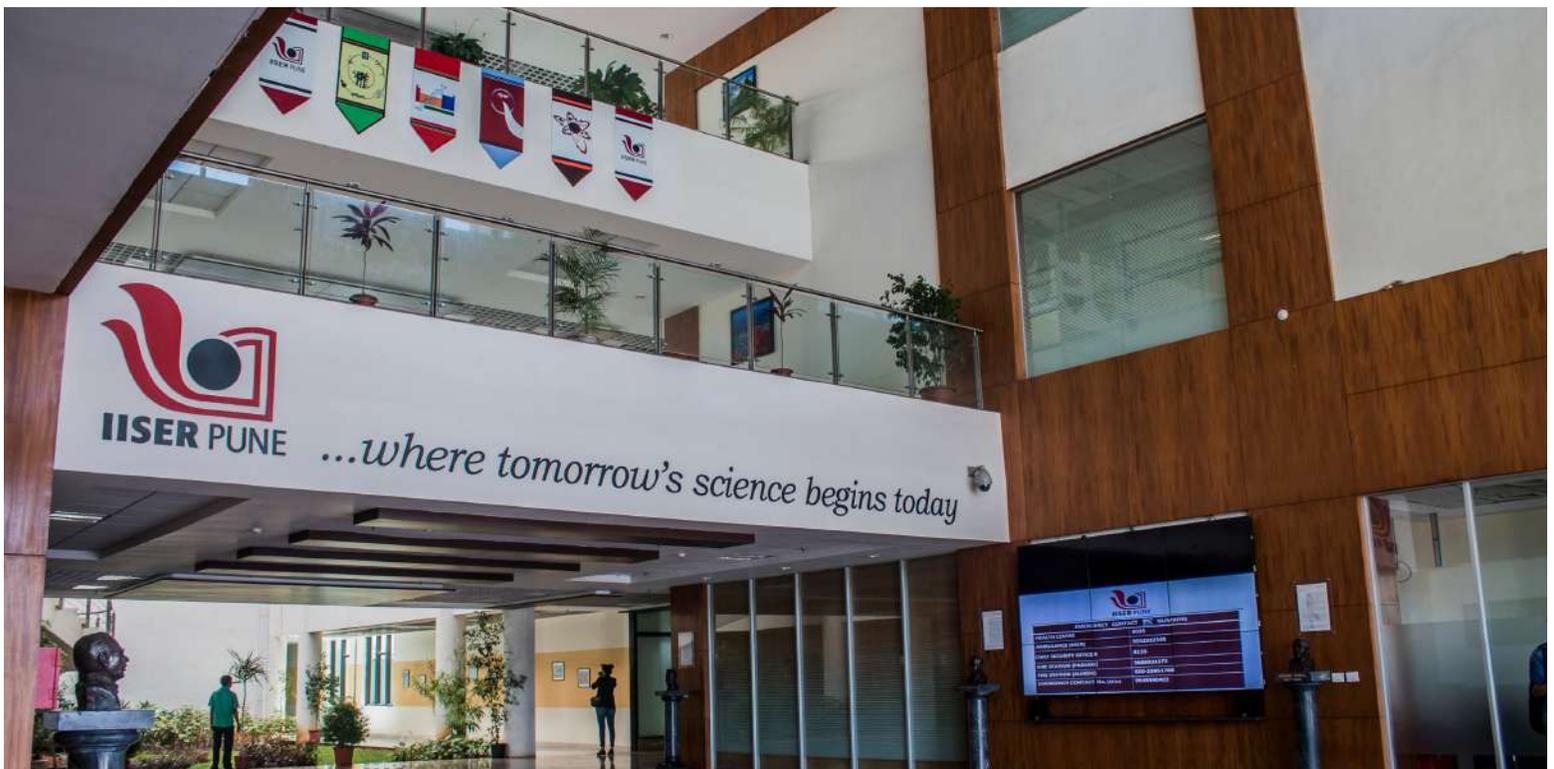
Research summary: Problems involving maxima/minima arise quite naturally. For example, why are small water droplets and bubbles that float in air approximately spherical? Why does a herd of Reindeer form a circle if attacked by wolves? These problems are capable of stimulating mathematical thought. Of all geometric figures having certain property, which has the area or volume; and of all figures having certain property, which has least perimeter or surface area? These problems are called Isoperimetric Problems; Isoperimetric means "with the same perimeter". The answer to the question like "What is the shape with area one which has the least perimeter? It is easy to state and equally easy to intuitively see the answer: a circle. But to justify this mathematically required hundreds of years of work by generations of mathematicians (including Euclid, Euler, the Bernoulli brothers, Gauss, Steiner, Weierstrass, Schwarz, Levy and Schmidt and many more). Variants of the problem appear in the epic called Aeneid (in the story of Queen Dido), in the fables of early England and in Islamic and Buddhist texts. In this course, we will examine this problem from its foundations, tracing ancient solutions to the problem and some underlying mathematical challenges. Students in this course would get a chance to know the fascinating history and evolution of the Isoperimetric Problems. They would get to see beautiful geometric proofs using some basics of Mathematics. They will learn some aspects of regular surfaces in \mathbb{R}^3 , calculus of variations, etc. This course will serve as an interesting and beautiful motivation to study a branch of Mathematics called shape optimisation problems including the eigenvalue optimisation problems that deals with questions like "Can you hear the shape of a drum?"

Representative Publications

1. Hugh Howards, Michael Hutchings, and Frank Morgan, "The Isoperimetric Problem on Surfaces", Amer. Math. Monthly 106, (1999) 430-439.
2. I. Todhunter, "Spherical Trigonometry", Macmillan and Co. Ltd., London, 1949.
3. M. Berger, "Geometry II"
4. R. Millman and G. Parker, "Elements of Differential Geometry", Prentice-Hall Inc., New Jersey, 1977.
5. Y. D. Burago and V. A. Zalgaller, "Geometric Inequalities", Springer-Verlag, 1988.
6. N.D. Kazarinoff, "Geometric Inequalities", Random House and Yale University, 1961.
7. S C Bagchi, S Madan, A Sitaram, and U B Tiwari, "A first course on Representation Theory and Linear Lie Groups", University Press, 2000.
8. Manfredo Perdigão do Carmo, "Differential Geometry of Curves and Surfaces", Prentice-Hall Inc., New Jersey, 1976.
9. Online notes https://www.maa.org/sites/default/files/pdf/upload_library/22/Ford/blasio526.pdf

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Group Web Page: <http://www.iiserpune.ac.in/people/faculty-details/86>



IISER Pune is spread over a 100-acre area in Pashan, an educational and research hub of Pune, with several premier academic organizations in the vicinity.

Pune is connected by Air to all major cities across the country. The airport at Lohegaon doubles as an air force base. Pune is also well connected by trains and is accessible from Mumbai by road, which is a 3-hour drive. The Mumbai international airport has a regular taxi service to Pune. Regular bus service runs between the two cities as well.

Pune hosts a series of annual music festivals ranging from Indian Classical to Jazz and is home to renowned artists, musicians, and theatre groups that stage plays in Marathi and English. With the west coast just a couple of hours of drive away from Pune, several richly bio-diverse ecological hot spots are within reachable distances to Pune as are some of the spectacular beaches in this part of the country.



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