

**MHRD Scheme on Global Initiative on Academic Network (GIAN)**  
**Presents a Course on**  
**QUASICONFORMAL MAPPINGS AND THEIR APPLICATIONS**

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## Overview

This course will, for the most part, focus on the following:

- notion of quasiconformality;
- theory of quasiconformal and related mappings;
- applications to composition operators and to eigenvalue estimates.

The value of quasiconformal mappings for the study of PDE's in the plane was recognized already at the early stages of the theory. Only quite recently it was observed that the techniques also apply for Calderon's inverse conductivity problem (that forms the basis for computer tomography). Generalizations of quasiconformal mappings have also been applied in nonlinear elasticity. Most recently, quasiconformal mappings have turned out to be of value in eigenvalue estimates for the Neumann ( $p$ -)Laplacian via composition operators.

The relevant themes from quasiconformal mappings and their applications will be introduced to the participants through a series of lectures and tutorials by the International faculty. The tutorial hours will mostly consist of problem discussion sessions. Examinations for interested student participants will be conducted over the weekend and course credit will be given to them. These lectures are intended to serve as a catalyst for gaining basic/fundamental knowledge and for generating new ideas for further collaborative activities in quasiconformal mappings and related topics. The program will provide an opportunity for fruitful interaction among researchers from India and from several other countries. Interaction with subject experts will also put special emphasis on exposure of PhD students and postdoctoral fellows to the latest trends.

## Objectives

The primary objectives of the course are as follows:

1. Exposing young participants to the fundamentals of Quasiconformal Mappings and their Applications.
2. Building in confidence and capability amongst the participants in the area of Quasiconformal Mappings and their Applications.
3. Providing exposure to problems and their solutions, through live discussions.

4. Enhancing the capability of the participants to identify recent research topics for further studies and research.

<b>Modules</b>	Schedule Dates: <b>December 11-16, 2017.</b> Lectures: 9:30 am to 12:30 pm; Tutorials: 3:00 pm to 5:00 pm. The number of participants for the course will be limited to fifty.
<b>Who can attend</b>	Students at all levels (BTech/MSc/MTech/PhD), engineers, researchers and faculty from academic and technical institutions.
<b>Registration Fees</b>	Bachelor's or Master's students: ₹ 1000 Research Scholars/PhDs: ₹ 2000 Post-Docs: ₹ 2500 Faculty, Scientists, Engineers from institutions: ₹ 3000 Delegates from Industry: ₹ 4000 Participants from abroad: \$ 200 <b>The fees include lunch, instructional materials, 24 hours internet facility. The participants will be provided with accommodation on payment basis.</b>

## The Faculty

**Professor Pekka Koskela** is currently working as a professor at University of Jyväskylä, Finland. He worked as a faculty at University of Michigan for three years starting from 1992. He has been appointed as a fellow in 1994 and a senior fellow in 1998 and in 2003 by Academy of Finland. He has also served as a visiting faculty in several institutions like Universidad Autonoma de Madrid in 1995, Universite Cergy-Pontoise in 1998 and Centre de Recerce Matematica in 1999. Apart from this, he has held many positions like Chairman of the Department of Mathematics and Statistics of University of Jyväskylä and Chairman of the instruction subcommission (ICMI) of the National Committee of Mathematics, 2005-2012. He is one of the leading mathematicians in the field “Geometric analysis and Geometric function theory”. He is well-known for his pioneer work on quasiconformal mappings and for several other works on mapping theory. He has published about 170 publications (MathSciNet) with about 3600 citations, including the second most cited publication published in 2000, in all of Mathematics, and the eighth most cited published in 1998. He is also a coauthor of two monographs: “Lectures on mappings of finite distortion” in Lecture Notes in Mathematics, 2014, and “Sobolev spaces on metric spaces: An approach based on upper gradients”, Cambridge University Press, 2015. He has given many invited talks in conferences including an invited talk in the analysis session of ICM 2010 and a plenary talk at the American Mathematical Society 2008 Fall Eastern Section meeting. He has been awarded with two prizes, Väisälä prize in 2001 and Magnus Ehrnrooth prize in 2012. He has been an editorial board member for various international journals including Acta Mathematica and



Conformal Geometry & Dynamics. He has also served as a referee for 95 different journals, including the leading journals Acta Math., Annals of Math., Invent. Math. and J. Amer. Math. Soc. and further Ann. Probab., Arch. Ration. Mech. Anal., Comm. Pure Appl. Math., Duke Math. J., Geom. Funct. Anal., J. Diff. Geom. He has supervised twenty students so far for their PhD degree.

## Course Coordinator:

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**Dr. Swadesh Kumar Sahoo** received his PhD degree from IIT Madras in 2008 and is currently working as an Associate Professor in the Discipline of Mathematics, School of Basic Sciences of IIT Indore. He was heading the Discipline of Mathematics from June 20, 2012 until September 24, 2015. His current administrative responsibility also includes Head, School of Basic Sciences at IIT Indore. His broad area of research is geometric function theory. He works on problems in the theory of univalent functions, special functions, quasiconformal mappings, and hyperbolic-type geometry. He has already supervised three students for their PhD degree and is currently supervising three more Ph.D. students. He has the total of 24 publications (MathSciNet) in reputed international journals with 51 citations. He received a research grant from National Board for Higher Mathematics (NBHM) for the period 2016-2019. He has been collaborating with researchers from India, Japan, China, United States, and Finland. He has successfully organised three international symposia and has been involved in several national and international events. He has participated and delivered a series of invited talks in several scientific events held in India, Japan, China, United States, and Ukraine. He has also served as an editor for special volumes of several conference proceedings.

Schedule	Morning Session	Afternoon Session
11 December 2017	Lecture 1: Definition of quasiconformal mappings.  Lecture 2: Examples of quasiconformal mappings.	Tutorial 1: Problem solving session with examples: based on Lecture 1 & Lecture 2.
12 December 2017	Lecture 3: Regularity properties.  Lecture 4: Mapping theorems.	Tutorial 2: Problem solving session with examples: based on Lecture 3 & Lecture 4.
13 December 2017	Lecture 5: Generalizations of quasiconformality I.  Lecture 6: Generalizations of quasiconformality II.	Tutorial 3: Problem solving session with examples: based on Lecture 5 & Lecture 6.
14 December 2017	Lecture 7: Invariant function spaces.  Lecture 8: Applications to eigenvalue estimates: Neumann- $(p-)$ Laplacian.	Tutorial 4: Problem solving session with examples: based on Lecture 7 & Lecture 8.
15 December 2017	Tutorial 5: Problem solving session with examples: based on Lectures 1-8.	
16 December 2017	Examination	