

report

REPORT ON

6-Days Short-Term Course on Inverse Problems and Imaging Techniques Sponsored by TEQIP Indian Institute of Technology Indore



Date: February 21-27, 2019, Sunday break, Venue: Helium Building (Room: SB 309), IIT Indore

Objectives:

The study of inverse problems and imaging techniques is an exciting area, not only because of the mathematical intricacies but also for the scope of this area in our daily life.

Such problems have potential applications in medical imaging, seismic imaging, oil-exploration and other fields. The major goal is to understand properties of an object from its response (to certain probing methods) measured on the boundary.

Determining the properties of the objects often correspond to determination of unknown coefficients in a partial differential equation (PDE) or inversion of certain maps or transforms. The mathematical tools required in this kind of study ranges over harmonic and microlocal analysis, theory of PDE, numerical methods for differential equations.

At the end of the course, the participants were expected to:

- have an understanding of the mathematical techniques used in the field of image reconstruction and inverse problems
- be aware of the state-of-the-art in the fields of inverse problems and imaging
- have an overview of the numerical techniques used in imaging.

Participants:

Total 20 participants attended this course, out of whom 13 were from TEQIP sponsored institutes, 4 were from non-TEQIP sponsored institutes and 3 were from IIT Indore.

Course Modules:

The following course modules were covered in this course:

- Basic theory of Fourier series, Fourier transforms and Radon transforms.
- Introduction to inverse problems
- Mathematical introduction to Image reconstruction techniques
- Mathematical theory of Electrical Impedance Tomography (EIT)
- Calderon type inverse problems

Speakers:

The sessions were conducted over a span of 6 days by 3 speakers (out of whom 1 expert was from TIFR-Centre for Applicable Mathematics, Bangalore). The details of the speakers are as follows:

- **Dr. Venkateswaran P. Krishnan** (TIFR-Centre for Applicable Mathematics, Bangalore)
- **Dr. Ashisha Kumar** (Discipline of Mathematics, IIT Indore)
- **Dr. Anupam Pal Choudhury** (Discipline of Mathematics, IIT Indore)



Group photograph of participants and speakers

Description of event:

A six days TEQIP sponsored course on "Inverse Problems and Imaging Techniques" was organized by the Discipline of Mathematics during 21st-27th February 2019. The course was organized by Dr. Md. Aquil Khan, Dr. Ashisha Kumar and Dr. Anupam Pal Choudhury. Dr. Venkateswaran P. Krishnan (from TIFR-CAM, Bangalore) was the guest speaker for this course.

A total number of 20 participants registered for this course (out of whom 13 were from TEQIP sponsored institutes, 04 were from non-TEQIP institutes, and 03 were from IIT Indore).

Prof. Pradeep Mathur, Director (IIT Indore) delivered the inaugural address and spoke about the history of TEQIP. He also emphasized about the importance of mathematics as a whole and the importance of such courses and workshops for targeted audience. Next, Dr. Md. Aquil Khan, HoD (Mathematics) spoke about the contributions of the Discipline of Mathematics, IIT Indore. The inaugural session was closed by Prof. Kiran Bala with a formal informative speech on TEQIP and the future plans of the TEQIP centre at IIT Indore.

The course sessions were conducted by three speakers and the distribution of the topics were as follows.

- Dr. Venkateswaran P. Krishnan introduced the students to different kinds of inverse problems that arise in the applications. During the course of his 4 lectures and 2 tutorials, he covered in detail the different mathematical techniques used in Image reconstruction problems.
- In his 4 lectures and 1 tutorials, Dr. Ashisha Kumar introduced the students to the theory of Fourier series, Fourier transforms and Radon transforms linking the various results to the lectures of Dr. Krishnan.
- Dr. Anupam Pal Choudhury, in his 6 lectures and 1 tutorial, introduced the students to the theory of distributions and also covered the mathematical theory of Electrical impedance tomography and Calderon type inverse problems.

On the last day, the course sessions were concluded with a brief feedback session followed by distribution of certificates to the participants.

The participants were very happy and excited with the lectures and interacted actively with the speakers. They expressed their satisfaction with the course content and other arrangements. They also mentioned that they would be looking forward to such courses in future.