# Five Day Workshop on Advanced Techniques in Inverse Problem Solving: From Regularization to Deep Learning (Online)
## March 20-24, 2024
### (Under SSR Activities, SERB, DST, Govt. of India)

## Registration Form

Please follow the link to register:

https://forms.gle/ENcvLjxDp2orAZmUA

**Last Date to Register: 19-03-2024.**

## Organizing Committee

### *Patron*

**Prof. O. R. Jaiswal**

**Director, NIT Goa**

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## *Organized by*



**Department of Electronics and Communication Engineering**
**National Institute of Technology Goa**
**Cuncolim, Goa – 403703**

## About NIT Goa

The National Institute of Technology Goa (NIT Goa) stands as a distinguished technical institution in India, established in 2010 under the NIT Act of 2007 and its subsequent amendment in 2012. Recognized as an "Institute of National Importance," NIT Goa operates autonomously under the Ministry of Education (MoE), Government of India, with its campus situated in Cuncolim, South Goa. The institute is easily accessible via well-developed roadways, railways, and airways connecting it to various parts of the country. Committed to academic excellence, NIT Goa is dedicated to nurturing quality engineers and scientists.

NIT Goa offers undergraduate programs across five engineering disciplines:
1. Computer Science and Engineering (CSE)
2. Electronics and Communication Engineering (ECE)
3. Electrical and Electronics Engineering (EEE)
4. Civil Engineering (CVE)
5. Mechanical Engineering (MCE)

Additionally, the institute provides M.Tech. programs in:
1. Computer Science and Engineering (CSE)
2. VLSI
3. Power Electronics and Power Systems (PEPS)

Furthermore, NIT Goa offers Ph.D. degrees across multiple streams, including Engineering, Applied Sciences, Technology, and Humanities & Social Sciences.

Admission to the B.Tech. program is based on ranks obtained in the Joint Entrance Examination JEE (Main) and the scheme of Direct Admission to Students Abroad (DASA). The intake for B.Tech. programs varies, with 44 seats each allocated for Computer Science and Engineering, Electrical and Electronics Engineering, and Electronics and Communication Engineering, and 42 seats each for Civil Engineering and Mechanical Engineering. The

institute admits M.Tech. students through valid GATE scores, followed by CCMT (Centralized Counselling for M.Tech. Admissions), with a total intake of 80 seats across various specializations.

Moreover, NIT Goa offers Full-time Self-Financed (Non-GATE) M.Tech. programs to fill vacant seats after admission through CCMT, sponsored, and DRDO categories are completed.

## About Department of ECE

The Electronics and Communication Department at NIT Goa was established in 2010 with a focus on delivering comprehensive education and research opportunities in Electronics and Communication Engineering. The department offers B.Tech., M.Tech. specializing in VLSI, and Ph.D. programs in Electronics and Communication Engineering. Our primary objective is to equip students with both theoretical understanding and practical skills necessary for technology and research endeavors.

Covering a wide array of areas in Electronics and Communication Engineering, our department provides specialized courses and projects in VLSI, Communication and Networking, Signal Processing, Microelectronics, Electronics Design, and Electromagnetics. Our dedicated faculty members are deeply committed to teaching and research, striving to foster students' interest in exploration and innovation.

We take pride in our well-equipped laboratories, including Electronics Devices and Circuits Lab, Linear Integrated Circuits Lab, Digital Electronics Lab, Microprocessors and Microcontroller Lab, Microwave Engineering and Antennas Lab, and VLSI Lab. Additionally, we provide access to essential software tools such as Cadence, Silvaco, MATLAB, PSPICE, and KEIL to facilitate hands-on learning and research activities.

## About the Workshop

Inverse problems (IPs) have long been recognized as mathematically challenging due to their non-linear and ill-posed nature. These problems arise in various practical applications such as Microwave imaging, X-ray imaging, Diffusion optical tomography, and Ground penetrating radar. Addressing these challenges requires the application of suitable regularization and optimization techniques to achieve robust and stable solutions.

The course focuses on imparting both fundamental principles and recent advancements in regularization techniques and optimization algorithms tailored for solving inverse problems. Participants will gain insights into the theoretical foundations and practical applications of these methods.

In recent years, deep learning has emerged as a powerful approach in addressing regression and classification problems. Compared to conventional iterative methods based on optimization, deep learning methods offer significant advantages in terms of speed and image quality. With their inherent non-linear matching capabilities and efficient one-step testing procedures, deep learning techniques have become increasingly popular for solving inverse problems in real-time applications.

The course also delves into the fundamentals and recent developments of deep-learning techniques and algorithms. Participants will have the opportunity to engage in practical sessions, where they will gain hands-on experience in implementing algorithms using MATLAB programming. These practical sessions will reinforce understanding and enable participants to apply the learned techniques effectively in their respective domains.

## Workshop Objectives

1. Provide participants with an understanding of the mathematical challenges and practical applications of inverse problems (IPs).
2. Equip participants with knowledge and skills in regularization and optimization techniques for solving inverse problems.
3. Explore recent advancements in regularization techniques and optimization algorithms tailored for solving inverse problems.
4. Introduce participants to the emerging role of deep learning methods in solving inverse problems and highlight their advantages over conventional methods.
5. Provide hands-on experience through practical sessions focused on implementing algorithms using MATLAB programming.

## Resource Persons

Dr. Yaswanth Kalepu, IIITDM, Kurnool,

Dr. E. Mallikarjun, NIT Goa

Dr. Raviprasad KJ, NIT Goa

Dr. Venkatanareshbabu Kuppili, NIT Goa

## Registration Fees

There is no registration fee and the complete program is sponsored by SSR, SERB.

## Instructions

- ❖ The number of seats is limited to 50.
- ❖ Registration will be on first come first serve basis. Priority will be given to nearby colleges, Goa.
- ❖ The program will be conducted online.
- ❖ The link to join the online will be shared with registered students prior to the program.