

MHRD Scheme on Global Initiative of Academic Networks (GIAN)

Online Course on "GLOBAL SEISMOLOGY"

May 09 – 18, 2022

Organized by Department of Applied Geophysics
Indian Institute of Technology (Indian School of Mines), Dhanbad, India



Last Date for Registration April 30, 2022

Course Overview

Number of participants for the course will be limited to eighty

Seismology is the study of energy propagation within the earth. As such, it relates to a number of important natural processes. It examines the source of energy, from earthquakes to nuclear tests, and provides a means to assess natural hazards. It also uses the energy from natural or manmade sources to investigate the 99% of the earth that is not directly accessible from the surface, from identifying buried natural resources to mapping out structures hundreds of miles below the surface.

The primary objectives of the course are as follows:

- Building a basic theoretical foundation for elastic wave propagation.
- Understanding wave propagation as it applies to the earth: surface and body waves, reflection and transmission, normal modes, etc.
- Using free tools to download and process seismic data such as Standing Order of Data and JWEED.
- Students will learn to compute receiver functions, dispersion curves and their modeling and inversion using real data.
- Hands on experience working with Linux, Bash Shell scripting, MATLAB, Seismic Analysis Code etc.

Course participants will learn these topics through online lectures and tutorials. Also case studies and assignments will be shared to stimulate research motivation of participants.

Faculty



Prof. Derek Schutt

Dr. Derek Schutt is an associate professor of geosciences at Colorado State University (USA). His research interests involve using seismology and geophysics to infer lithospheric and asthenospheric temperatures, compositions, fabrics and velocity structures. Currently he is part of two \$1M+ funded multi-institution collaborations. Dr. Schutt received his Ph.D. in 2000 at the University of Oregon, working with Eugene Humphreys. He was a Harry Wood postdoctoral fellow at the Carnegie Institution of Washington, working with Drs. David James and Paul Silver, then moved to a postdoctoral fellowship and research scientist position at the University of Wyoming, where he worked with Dr. Ken Dueker. Next, he took a position as a geophysics program director at the U.S. National Science Foundation. Dr. Schutt became an assistant professor at Colorado State University in 2008. Dr. Schutt also has a B.S. in math and a B.A. in physics.



Prof. Mohit Agrawal

Dr. Mohit Agrawal is an assistant professor in the department of Applied Geophysics at Indian Institute of Technology (Indian School of Mines), Dhanbad, India. He obtained his PhD in Earthquake Seismology from Baylor University, USA. He is interested in solving the unresolved tectonic mysteries of earth using the tools in seismology. His research group deploys seismographs in the regions of interest to collect earthquake data for several years. These seismological data are processed using new as well as conventional modelling and inversion techniques. Dr. Agrawal has attended several international and national conferences including those of the American Geophysical Union, Society of Exploration Geophysicists, Seismological Society of America, U.S. National Nuclear Security Agency (NNSA) in Albuquerque (New Mexico), and the Indian Geophysical Union Meeting (India). Agrawal has engaged in geoscience research at the University of Texas at Austin in Austin, TX; University of Wyoming in Laramie, WY; Colorado State University in Fort Collins, CO; and Baylor University in Waco, TX.

You should attend if...

- You are geophysicists, geologists, engineers & researchers from all private and public enterprises with an interest in learning the theoretical and computational aspects in Seismology.
- Students (BSc/BTech/BS/MSc/MS/MTech/M.Sc.Tech./PhD) and faculty from academic and technical institutions.

Course Registration

Step 1: One Time GIAN Registration

Visit <http://www.gian.iitkgp.ac.in/GREGN/index> and register by paying Rs 500/- (those who have already been registered and paid, need not pay again) then opt the course under course (Course ID: 191058C01) registration tab and save. After completing this process please inform to the course coordinator by e-mail. Course coordinator will confirm your attendance and then you must proceed to step-2 to pay the course fee.

Step 2: Participation Fee

- Participants from abroad : US \$300/-
- Industry/ Research Organizations: Rs. 3000/-
- Academic Institutions (Faculty): Rs. 2000/-
- Academic Institutions (Students): Rs. 1000/-
- The above fee is towards participation in the course, and the course material. Participants are encouraged to use their personal laptops with Linux installed in it.

Step 3: Course Fee Payment

By NEFT (Account holder name: The Registrar, Indian Institute of Technology (ISM) Dhanbad: Account No. 0986101009746; IFSC Code: CNRB0000986; Bank: CANARA BANK; Branch Name: Saraidhela Dhanbad) OR by sending a demand draft in favour of "Registrar, IIT(ISM) Dhanbad" payable at Dhanbad – 826004. OR you may use our following online payment option of Canara Bank to deposit the course fees on or before April 30, 2022. https://eps.eshiksa.net/DirectFeesv3/IIT_Dhanbad/index

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Course on GLOBAL SEISMOLOGY May 09 – 18, 2022



Schedule

| Day-1 | | Day-2 | | Day-3 | | Day-4 | | Day-5 | | Day-6 | | Day-7 | | Day-8 | | Day-9 | | Day-10 | |
|------------|---|---------------------------|---|------------|---------------------------------------|------------|--|------------|--------------------|--|----------------------------------|------------|----------------------------------|------------|---|------------|--|---------------------|--------------|
| | | Inaugural Function | | | | | | Lecture-9 | | Structure and composition of the earth | | | | | | | | | |
| Lecture-1 | Displacement potentials as solutions to the elastodynamic equation. | Lecture-3 | Surface waves | Lecture-5 | Normal Modes | Lecture-7 | Reflection Seismology | Lecture-9 | Prof. Derek Schutt | Lecture-11 | Anisotropy | Lecture-13 | Earthquakes and focal mechanisms | Lecture-15 | Receiver Functions computation and Analysis | Lecture-17 | Ambient Noise Processing-I | Date of Examination | May 18, 2022 |
| | Prof. Derek Schutt | Lecture-4 | Dispersion | Lecture-6 | Reflection seismology | Lecture-8 | Ray theory on a spherical earth | Lecture-10 | Prof. Derek Schutt | Lecture-12 | Earthquakes and Focal Mechanisms | Lecture-14 | The seismic source | Lecture-16 | H-κ stacking and Common conversion point stacking | Lecture-18 | Ambient Noise Processing-II | | |
| Lecture-2 | Ray parameter and reflection and Transmission | Tutorial-2 | Basic Unix/Linux command line programs | Tutorial-3 | Shell scripts, particularly bash. | Tutorial-4 | Getting seismic data | Tutorial-5 | Prof. Derek Schutt | Tutorial-6 | GMT I | Tutorial-7 | GMT-II | Tutorial-8 | MATLAB exercise for computation of receiver functions | Tutorial-9 | Computation of Green's Functions and extraction of dispersion curves | | |
| | Prof. Derek Schutt | HW-2 | Surface waves and command line basics. | HW-3 | Bash, normal modes, and shell scripts | HW-4 | Ray theory and structure and composition of the earth reading. | HW-5 | Prof. Derek Schutt | HW-6 | GMT and Anisotropy | | | | | | | | |
| Tutorial-1 | Installing a virtual machine and Unix basics | HW-1 | Displacement potential and Unix basics. | | | | | | Prof. Derek Schutt | | | | | | | | | | |
| | Prof. Derek Schutt | | | | | | | | | | | | | | | | | | |

Important

- ❖ Participants for the course will be selected on first come first served basis.
- ❖ **Timings (IST):** Lectures (07:30 AM– 09:30 AM) | Tutorials and Homework (19:30 PM-21:30 PM).
- ❖ All registered participants must fill this google form: [Click here](#)
- ❖ This is an online course. Nonetheless all participants will be provided physical certificates.

Patron

Prof. Rajiv Shekhar (Director)
Indian Institute of Technology (ISM), Dhanbad.

Co-Patron

Prof. P.K. Khan (Head)
Department of Applied Geophysics, Indian Institute of Technology (ISM), Dhanbad.

Course Coordinator

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Local GIAN Coordinator

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