Global Initiative of Academic Networks (GIAN)

A Two Weeks Course on "ENGINEERING SEISMOLOGY"

(Under the aegis of the Ministry of Education, Govt. of India)

August 05 – 17, 2025

Course ID: 2514003

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

Last Date for Registration July 31, 2025

Course Overview

Engineering Seismology focuses on the application of seismological principles in engineering. It involves studying the earthquake source and its magnitude, the propagation of seismic waves from the source to critical engineering locations, ground motion characteristics, and its assessment for engineering design purposes. This course provides an introduction to plate tectonics, Earth's structure, and geophysical methods, equipping students with the knowledge to evaluate earthquake hazards, understand the seismic behavior of a region, and estimate future seismic risks more effectively. The primary objectives of the course are as follows:

- Develop an understanding of seismic wave generation inside the Earth.
- Comprehend the internal structure of the Earth and the physical properties of the Earth's composition.
- Identify various wave phases on seismic records.
- Understand the principles of operation of seismometers and earthquake data recording systems.
- Analyze ground motion characteristics, Fourier, and response spectra.
- Analyze seismic data and compute various ground motion parameters.
- Relate ground motion characteristics to the design of structures and buildings.
- Compute probabilistic seismic hazards, seismic risks, and seismic design principles.

Faculty

Prof. Utpal Dutta

(Foreign Faculty)

Prof. Utpal Dutta graduated from the Indian School of Mines, now known as the Indian Institute of Technology (IIT) in Dhanbad, India, where he earned an M.Sc. (Tech) in Applied Geophysics in 1988. He completed his Ph.D. at the same institution in 1992. Following a brief one-year stint as a Research Fellow at the University of Delhi's South Campus, Dr. Dutta began his academic career as a Lecturer in Geophysics at Guru Nanak Dev University (GNDU) in Amritsar, India. He taught various undergraduate courses on Exploration and Solid Earth Geophysics during his tenure at GNDU from 1992 to 1998. In 1998, Dr. Dutta became a Visiting Research Scientist at the Geophysical Institute at the University of Alaska Fairbanks (UAF) in the USA. He researched urban earthquake hazards, seismic microzonation, and engineering seismology. By 2003, he took on the role of Research Associate at the Environment and Natural Resources Institute, with a joint appointment at the University of Alaska Anchorage (UAA) and the Geophysical Institute at UAF. In 2007, Dr. Dutta transitioned to the College of Engineering, joining the Civil Engineering department, where he is currently a Professor. Dr. Dutta has published nearly 60 technical papers in respected international journals and various conference proceedings, focusing on issues related to earthquake engineering, earthquake hazards, and urban seismic microzonation.

Prof. Mohit Agrawal

(National Faculty and Course Coordinator)

Prof. Mohit Agrawal is an associate professor in the department of Applied Geophysics at IIT (ISM) Dhanbad. Specializing in earthquake seismology and seismic hazards, he earned his Ph.D. in 2016 from Baylor University, USA, under Prof. Jay Pulliam and Prof. Mrinal K. Sen. Before this, he completed an integrated M.Sc. Tech. in Applied Geophysics from ISM Dhanbad in 2011. Dr. Agrawal has developed innovative techniques, including joint inversion of seismological datasets and velocity analysis of receiver functions, contributing to seismic hazard analysis and subsurface discontinuity mapping. His team excels in seismic microzonation, site characterization, and hazard mapping, particularly for India's Chhotanagpur plateau and other regions. He has installed broadband seismometers in challenging terrains like Meghalaya to monitor earthquake activity. Dr. Agrawal has led key projects, including SERB-funded Early Career (2017) and Core Research Grants (2020 and 2024), and a MATRICS (2023) project on resolving tectonic mysteries of subsurface features. He has contributed extensively to geophysical research and education, supervising numerous Ph.D. and M.Tech. students. His NPTEL course on earthquake seismology is highly regarded nationwide. An active member of leading geophysical societies, he has presented research at major global forums and collaborated with institutions like UT Austin, Colorado State University, Baylor University, University of Wyoming, etc.

You should attend if…

- You are executives, researchers, and engineers from private and public enterprises with an interest in learning the theoretical and computational aspects of engineering seismology.
- You are students (BSc/BTech/BS/MSc/M.A./MS/M.Tech/M.Sc.Tech./PhD), Research Scholars, Postdoctoral Fellows, Faculty, and Teachers from academic and technical institutions.

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About IIT(ISM) Dhanbad

The Indian Institute of Technology (Indian School of Mines), Dhanbad, spans an expansive 393-acre campus in the heart of India's prime coking coal belt, about 260 km from Kolkata. Established on December 9, 1926, by Lord Irwin, the then Viceroy of India, the institution was founded to address the need for skilled professionals in mining and related fields, with a focus on disciplines such as Mining and Applied Geology. In 1967, the Indian School of Mines (ISM) gained the status of a deemed university under Section 3 of the UGC Act, 1956. Over the years, it expanded its academic scope to include core engineering disciplines, becoming a comprehensive institution of global repute for engineering, science, and management education. On September 6, 2016, the Government of India elevated ISM to the status of an Indian Institute of Technology (IIT), renaming it the Indian Institute of Technology (Indian School of Mines), Dhanbad. A fully residential campus with world-class facilities, IIT(ISM) Dhanbad offers a diverse range of academic programs. These include B.Tech. (4 years) courses across 12 major engineering disciplines, integrated M.Tech. (5 years) programs in Applied Geology, Applied Geophysics, and Mathematics & Computing, as well as M.Tech., M.Sc., M.Sc. Tech, MBA, and Ph.D. programs. The institute has made significant contributions to India's growth in mining, mineral exploration, petroleum, and groundwater sectors, solidifying its position as a premier technological institute.

Course Fee

S. No.	Category	Amount (including GST)
1.	Students – B.Tech., B.A., B.Sc., M.Tech., M.A., M.Sc., Integrated M.Sc., M.Sc. (Tech.)	₹ 1,180/-
2.	Research Scholars, Post-doctoral Fellows	₹ 3,540/-
3.	Faculty and Teachers from Academic Institutions (Public and Private)	₹ 11,800/-
4.	Participants from industry/Research organizations (Public and Private)	₹ 23,600/-
5.	Students (Foreign)	US $ 350
6.	Industry Sponsors	₹ 35,400/-

Bank Details

Name of Bank: Canara Bank

Account Name:IIT ISM PROJECT AC

Account No.: 0986101009746

IFSC Code : CNRB0000986

IIT ISM PROJECT AC

SCAN

3101262600974 6@cnrb

- **Number of Seats are limited to 50 only.**
- **Last date for registration is 31st July 2025.**
- **All registered participants must fill out this google form**: Click Here

Accommodation

Details	Charges (including GST)
IIT (ISM) Guest House: A/C room on twin sharing basis per day (Exclusive of food)	₹ 672/-
Hostel: (Non-A/C room on twin sharing basis per day) (Exclusive of food)	₹ 236/-

APPLY NOW

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August 05 – 17, 2025

Schedule

Day-1	**Inaugural Function**	
	Lecture-1	**Introduction, The internal structure of the earth. Seismic Waves Measurements of Earthquakes, World Seismicity, Hazard** Prof. Utpal Dutta
	Lecture-2	**Seismic Source Characterization Reflection, Refraction of waves** Prof. Utpal Dutta
	Tutorial-1	**Earthquake location problems** Prof. Utpal Dutta
Day-2	**Lecture-3**	**Fourier Analysis and Properties of Fourier Spectra** Prof. Utpal Dutta
	Lecture-4	**Fast Fourier Transform, Sampling theorem, Nyquist Frequency, Inverse Fourier Transform** Prof. Utpal Dutta
	Tutorial-2	**Fourier Spectra computation, Convolution, auto and cross correlation** Prof. Utpal Dutta
Day-3	**Lecture-5**	**Seismic Sensors, strong motion sensors and Recorders, Seismic Networks** Prof. Utpal Dutta
	Lecture-6	**Ground Response Analysis, Ground Motion Parameters, Seismogram interpretation, seismic phases** Prof. Utpal Dutta
	Tutorial-3	**Ground parameters response computation** Prof. Utpal Dutta
Day-4	**Lecture-7**	**Basic formulation of solid mechanics in seismology, stress-strain, constitutive laws, equations of motions. Wave propagations** Prof. Utpal Dutta
	Lecture-8	**Empirical Ground Motion Characteristics, Site Classification** Prof. Utpal Dutta
	Tutorial-4	**Site response calculations, Introduction of Response spectra, Duhamel Integration.** Prof. Utpal Dutta
Day-5	**Lecture-9**	**Physics-based Ground Motion Modeling** Prof. Utpal Dutta
	Lecture-10	**Stochastic simulation** Prof. Utpal Dutta
	Tutorial-5	**Introduction of Probability and statistics** Prof. Utpal Dutta
Day-6	**Lecture-11**	**Dynamics of Soil properties** Prof. Utpal Dutta
	Lecture-12	**1-D ground motion analysis** Prof. Utpal Dutta
	Tutorial-6	**SHAKE Analysis** Prof. Utpal Dutta
Day-7	**Lecture-13**	**Ground motion attenuation: Prediction Equation** Prof. Utpal Dutta
	Lecture-14	**Seismic input to structures, Design response, seismic codes** Prof. Utpal Dutta
	Tutorial-7	**Single degree of freedom response analysis** Prof. Utpal Dutta
Day-8	**Lecture-15**	**Multi-degree of freedom, modal response** Prof. Utpal Dutta
	Lecture-16	**PSHA calculations, products, deaggregations, hazard analysis** Prof. Utpal Dutta
	Tutorial-8	**PSHA example** Prof. Utpal Dutta
Day-9	**Lecture-17**	**Seismic risk, ground motion selection, design code** Prof. Utpal Dutta
	Lecture-18	**Overview of surface wave methods, measurements of surface waves** Prof. Mohit Agrawal
	Tutorial-9	**Scaling of time series data, spectral matching** Prof. Utpal Dutta
Day-10	**Lecture-19**	**Dispersion of surface waves, MASW method** Prof. Mohit Agrawal
	Lecture-20	**Ambient vibrations, monitoring ground velocity changes through ambient noise correlations, HVSR, estimation of site response** Prof. Mohit Agrawal
	Tutorial-10	**Field example and modelling** Prof. Mohit Agrawal
Day-11	**Lecture-21**	**HVSR's field data collection and modelling** Prof. Mohit Agrawal
	Lecture-22	**Types, scales and components of seismic microzonation** Prof. Mohit Agrawal
	Tutorial-11	**HVSR modeling and interpretation** Prof. Mohit Agrawal
Day-12	**Lecture-23**	**Seismic Zonation of India** Prof. Mohit Agrawal
	Lecture-24	**Seismic Zonation of India (contd.)** Prof. Mohit Agrawal
Day-13	**Date of Examination**	August 17, 2025

Important

- Participants for the course will be selected on first come first served basis.
- Lectures (2 hours daily) | Tutorials and Homework (2 hours daily).
- All the participants will be provided course certificates.
- Tutorials and homework based on Python, MatLab, and other computational tools.

Course Coordinator

Prof. Mohit Agrawal

Associate Professor, Department of Applied Geophysics, Indian Institute of Technology (Indian School of Mines), Dhanbad-826004, INDIA.

Phone: 0326-223-5957, +918804172323 **Email**: mohit@iitism.ac.in

Local GIAN Coordinator

Prof. Sukha Ranjan Samadder

Associate Dean (Research & Development), Indian Institute of Technology (Indian School of Mines), Dhanbad-826004, INDIA.

Email: adrnd@iitism.ac.in

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Two Weeks Short Term Course on

ENGINEERING SEISMOLOGY

August 05 – 17, 2025 @ IIT(ISM) Dhanbad
Course ID: 2514003

Registration cum Accommodation Request Form

Name (Capital Letters): .....Gender (M/F) :.....

Qualification:.....Designation:.....

Category (Faculty/Scientist/Engineer/Officer/Industry Executive/Scholar/Student): .....

Organisation: .....

Mailing Address with PIN Code: .....

.....

Contact Details : Off :..... Res : .....

Mobile : ..... Email: .....

Payment : .....DD No. : .....Date : .....

DD in favour of **"Registrar, Indian Institute of Technology (ISM), Dhanbad"** payable at CANARA BANK, Saraidhela Branch, Dhanbad. (IFSC:CNRB0000986). **SB Account No: 0986101009746 OR NEFT/RTGS** (Please furnish the full details if NEFT/RTGS like Name of Account Holder, UTR No./Transaction ID, Name of Bank and Branch, Date and Amount of payment).

IIT (ISM) Guest House / Hostel accommodation required: YES / NO (on payment basis)

Accommodation Charges on Sharing Basis (Exclusive of Food) :

- ₹ 672/- per day in IIT(ISM) Guest House
- ₹ 236/- per day in Hostel .

Send filled form to :

Prof. Mohit Agrawal, Associate Professor, 5th Floor, New Academic Complex,
IIT (ISM) Dhanbad, Jharkhand-826004

E-mail scanned copy of filled form to: mohit@iitism.ac.in

Last Date of Registration: July 31, 2025