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NOVEMBER 2024

Monthly Newsletter of Department Of Applied Geophysics

GEOSPECTRUM

INSIDE THIS ISSUE

SPOTLIGHT ON RESEARCH EXCELLENCE

From the HoD's desk

Welcome to the 2nd edition of our Department of Applied Geophysics newsletter. Since our inception in 1957, we have developed into a pioneering department dedicated to advancing knowledge and expertise in geophysical sciences inside country as well as in global space. With programs at the undergraduate, postgraduate, and doctoral levels, we prepare our students to address complex geophysical challenges, contributing significantly to the fields of energy, resource management, geohazards and sustainability. Our curriculum emphasizes both foundational knowledge and cutting-edge advancements, enabling our graduates to excel globally.

Our research focus encompasses seismology, near surface geophysics, seismic studies, rock and fluid physics, remote sensing, formation evaluation, potential fields, ground water and environmental geophysics, with an increasing integration of artificial intelligence, machine learning, and sustainable resource management. Equipped with advanced laboratories and facilities, including a Seismological Observatory and specialized labs for seismic data processing, mining geophysics, global optimization, and rock physics, we are at the forefront of research and development in applied geophysics. Oiur department has storng expertise in Near Surface Geophysics; Environmental Geophysics; Mining Geophysics; Archaeological Geophysics, Engineering Geophysics and Geotechnical Modelling

A cornerstone of our department is collaboration. Through strategic partnerships with industry leaders and research institutions, we provide our students with real-world experience and access to state-of-the-art technologies. The Subsurface Resource Characterization Group (sRCg), for instance, is a recent initiative dedicated to exploring innovative solutions for subsurface exploration and environmental sustainability. This group develops software tools and methodologies that enhance subsurface analysis and resource estimation.

Our department's outreach efforts and workshops are designed to strengthen our engagement with the geoscience community and to foster knowledge sharing and skill development among students and professionals. Through our continuous work in early warning systems for geohazards, we are dedicated to creating safer, more resilient communities. As we look to the future, our commitment remains to excellence in education, impactful research, and meaningful contributions to the geoscience sector. Thank you for supporting the Department of Applied Geophysics at IIT (ISM) Dhanbad as we strive to lead in geophysical innovation and knowledge.

Warm regards,
Prof. Sanjit Kumar Pal
Head of the Department
Department of Applied Geophysics, IIT (ISM) Dhanbad

FACULTY SPOTLIGHT

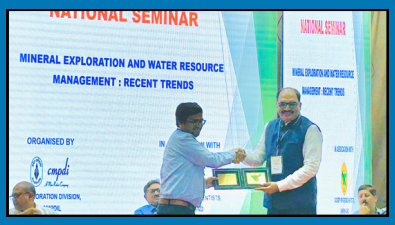
FACULTY ACHIEVERS:

Prof. Mohit Agrawal

Publications:
Kasaundhan, H., Singh, D.K., Agrawal, M., 2024. Deciphering the crustal anisotropy and mantle flow beneath the Indo-Burma ranges from the harmonic decomposition of the receiver functions. Physics of the Earth and Planetary Interiors 107183. https://doi.org/10.1016/j.pepi.2024.107183

Oral Talk:
Delivered an oral talk on "**Exploring the Crustal Structure in Northeastern India Using Seismic Ambient Surface Wave Tomography**" at the 61st Annual Convention of Indian Geophysical Union (Dec 3-5, 2024), Banaras Hindu University, Varanasi.

Prof. Saurabh Datta Gupta, from our Department of AGP, along with Prof. Rajeev Upadhyay, Dept. of CE-PT-I/1 and Dr. Karan Durga Prasad, PRL, Ahmedabad, has been awarded project titled "**Analogous Studies and Geo-Physical Modeling of Moon/Mars**" by the Indian Space Research Organization (ISRO). This project is valued at ₹33,28,660.



Prof. Partha Pratim Mandal delivered a presentation titled "Multi-Disciplinary Analysis of Geological, Geomechanical, and Hydrological Factors in Underground Coal Gasification Feasibility" at the **National Seminar on Mineral Exploration and Water Resource Management: Recent Trends, organized by CMPDI and SGSJ**

Prof. Swarandeep Sahoo

Mukherjee, P., & Sahoo, S. (2024). Coherent flow structures and magnetic field patterns in rotating spherical shell convective dynamos: A data-driven approach. Physics of Fluids, 36(11). https://doi.org/10.1063/5.0235675

Sharma, D. K., & Sahoo, S. (2024). On the onset of thermal convection in a rotating spherical shell with spatially heterogeneous heat source distribution. Physics of Fluids, 36(12). https://doi.org/10.1063/5.0241806

NEW FACULTY AT THE DEPARTMENT:

Prof. Ujjal K. Borah
Assistant Professor

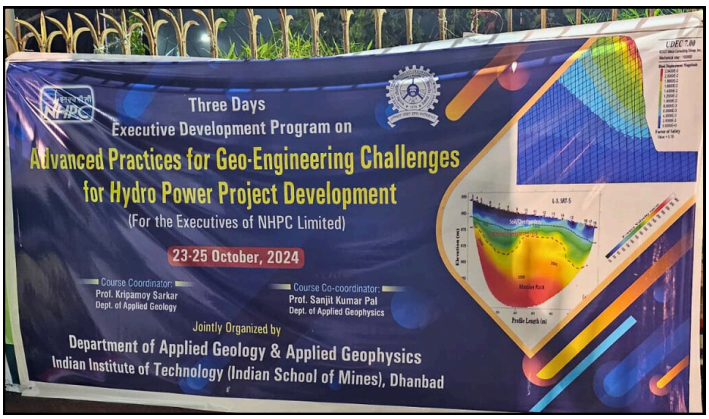
SHORT BIO

Ujjal Kumar Borah received MSc-Tech (2012) in Applied Geophysics from Indian School of Mines (now Indian Institute of Technology), Dhanbad, and PhD (2019) in Geophysics from CSIR-National Geophysical Research Institute, Hyderabad. He has joined the department on 28th October, 2024 as Assistant Professor (Grade-I).

Prior to this appointment he served as Project Scientist-B at ESSO-National Centre for Earth Science Studies, Thiruvananthapuram; Senior Technical Officer-II at CSIR-National Geophysical Research Institute, Hyderabad and Assistant Professor at Gauhati University, Guwahati. His general research interests include Mathematical and Theoretical Geophysics, Magnetotelluric investigation for solid earth, resource and geothermal explorations; Seismotectonics, and Near-Surface Geophysics.

FACULTY SPOTLIGHT

EDP COURSE



Prof. Sanjit Kumar Pal and Kripamoy Sarkar conducted a Three-Days Training Programme on "Advanced Practices for Geo-engineering Challenges for Hydro Power Project Development" held on Oct 23-25th, 2024.

Executives of NHPC limited congregated here at IIT (ISM) Dhanbad for Professional Development Program on Advanced Practices for Geo Engineering Challenges for Hydro Project learnt about the Tunnel Excavation Methodologies, Blast Design for tunnel excavation and seismic hazards etc.

The occasion was the inaugural day of three-day training which began today at the Executive Development Centre (EDC) lounge of the institute with the inaugural session during which Dr. Pijush Pal Roy, former outstanding scientist of CSIR-CIMFR Dhanbad and Director (Actg.) of CMERI Durgapur was present as Chief Guest in presence of Prof. Sukumar Mishra, Director, IIT (ISM) who presided over the function.

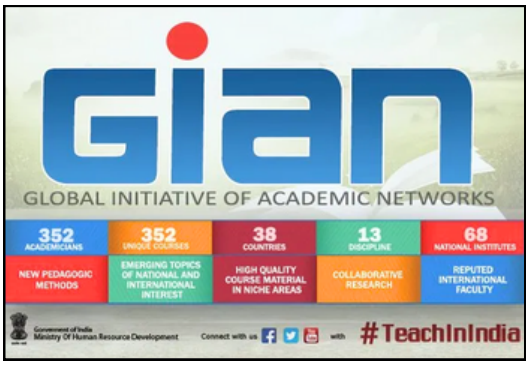
Speaking during the occasion, Dr. Pijush Pal Roy said that such programs help the participants to have a wholistic idea of the geo engineering challenges for Hydro Power Project Development.

ALUMNI CORNER:

Dr. Bappa Mukherjee, currently serving as Scientist B at the Wadia Institute of Himalayan Geology, Dehradun, recently visited our institute to **gain practical experience in MASW, SRT, and GPR survey techniques** under the guidance of **Prof. S. K. Pal.** During his visit, he actively participated in field surveys conducted both on campus and at external sites, including Ithkori and Koderma. Dr. Mukherjee also undertook the comprehensive processing of the acquired MASW, SRT, and GPR data.

His commitment and technical acumen have yielded significant outcomes, notably the preparation of two manuscripts: **"A Brief Review of MASW and SRT Techniques: Acquisition, Processing, and Interpretation" and "A Comparative Analysis of Geophone Frequency Effects on Subsurface Feature Resolution."** These manuscripts are slated for communication to reputed journals for publication.

FACULTY SPOTLIGHT



Global Initiative of Academic Networks (GIAN)

Govt. of India approved a new program titled Global Initiative of Academic Networks (GIAN) in Higher Education aimed at tapping the talent pool of scientists and entrepreneurs, internationally to encourage their engagement with the institutes of Higher Education in India so as to augment the country's existing academic resources, accelerate the pace of quality reform, and elevate India's scientific and technological capacity to global excellence.

Prof. Mohit Agrawal

GIAN Course Approved and Sanctioned:
A two-week GIAN Course on "Engineering Seismology" approved and sanctioned by the Ministry of Education with a total cost of Rs. 9.96 Lakhs.

***Foreign Faculty**: Prof. Uptal Dutta*

Prof. Saumen Maiti

Inverse Methods and Machine Learning Applications in Geosciences - **A GIAN course will be coordinated by Prof. Saumen Maiti, with Prof. Mrinal K. Sen** serving as the foreign faculty for this 5-day in-person course.

***Foreign Faculty**: Mrinal K. Sen*

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.

GIAN
Ministry of Education Govt. of India
IIT ISM DHANBAD
Legacy that Inspires the Future

Course ID: 2414024
Ref. No.: GIAN/S-24-25/188 Dated: 22-11-2024
One Week GIAN Course On
Inverse Methods and Machine Learning: Applications in Geosciences
Last Date for Registration June 16, 2025
EDC, IIT(ISM) Dhanbad
June 23 – 27, 2025

Foreign Faculty: Prof. Mrinal K. Sen

Name: Prof. Mrinal K. Sen
Designation: Professor
Department: Earth and Planetary Sciences and Institute for Geophysics
University/Institute: University of Texas at Austin, Austin, TX, USA
Email: mrinal@utexas.edu
Phone: +15124710466

Mrinal K. Sen is a professor of Geophysics at the Department of Earth and Planetary Sciences and the Institute for Geophysics at the University of Texas at Austin He also holds the Shell Companies Foundation Centennial distinguished Chair in Geophysics. During 2013 and 2014, Prof. Sen served as the director of the National Geophysical Research Institute, Hyderabad, India. He received his integrated M.Sc degree from ISM Dhanbad and PhD. from the University of Hawaii at Manoa, USA, in 1987. Prof. Sen is known internationally for his work on theoretical and computational seismology and geophysical inversion. He has published over 200 peer-reviewed journal papers and two books on Geophysical Inversion. He has received many awards including the Honorary membership of the Society of Exploration Geophysicists (SEG) 'for extraordinary contributions as a geophysicist, educator, and author', the 'Joseph C. Walter award for research excellence, the 'distinguished educator award' at the University of Texas, Decennial Gold Medal of the Indian Geophysical Union, the Hari Narayan Award of the Geological Society of India, and the distinguished alumnus award from ISM and the University of Hawaii at Manoa. He is the recipient of the 2018 Virgil Kaufman gold medal of the SEG for making significant advancements in the sciences of exploration geophysics in the last five years. His recent works include: uncertainty quantification using trans-dimensional Hamiltonian Monte Carlo methods, error analysis of finite difference and finite element methods, and Physics-based machine learning for seismic data analysis. He is the SEG's 2024-25 Distinguished Instructor short course's global instructor.

National Faculty & Course Coordinator: Dr. Saumen Maiti

Name: Dr. Saumen Maiti
Designation: Associate Professor
Department: Department of Applied Geophysics
University/Institute: Indian Institute of Technology(Indian School of Mines) Dhanbad
Email: saumen@iitism.ac.in
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Saumen Maiti is an Associate Professor at Dept. of Applied Geophysics, IIT(ISM) Dhanbad. He did his graduation in Physics Honors from Narendrapur Rama Krishna Mission Residential College under University of Calcutta in 1999. He obtained his M. Sc. Tech in Applied Geophysics from Indian School of Mines (ISM), Dhanbad in 2002. He did his PhD in Geophysics from CSIR-National Geophysical Research Institute (NGRI)/degree awarded by Osmania University in 2009. Dr. Maiti served Central Water and Power Research Station (CWPRS), Pune during 2005-2007.He was selected for JSPS-KAKENHI Exchange Programme for East Asian Young Researchers, Kyoto University, Japan in 2009. He served Indian Institute of Geomagnetism(IIG), Mumbai as "Fellow" during 2007-2012 and was promoted there as "Reader" on January 2013. He has developed multiple linear and powerful non-linear modelling framework using Machine Learning(ML) and Artificial Intelligence (AI) that can be used for regression, prediction and classification problems in exploration geophysics/applied geophysics. He has published more than 38 research papers in international peer reviewed refereed journals. He has supervised 8 PhD students and 50 int-M.Tech/M.Sc.Tech (AGP)/M.Tech(ESE) students. His research is sponsored by Ministry of Earth Sciences (MoES) ad Science and Engineering Research Board (SERB)/DST, Govt. of India. He is a recipient of prestigious Krishnan Gold Medal, awarded by Indian Geophysical Union (IGU) in 2013. Dr. Maiti has conducted numerous training courses and delivered lectures in national/international conference/meeting. He was a Panellist, on the Theme "*Inversion and Machine Learning Techniques for Geophysical Data*" of the VAIBHAV Summit, session V13H4SZ on 17 Oct 2020, https://vaibhav.gov.in/v11.php.

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FACULTY SPOTLIGHT

FAREWELL TO OUR RENOWNED PROFESSOR:

Prof. Arun Singh
Former Assistant Professor

SHORT INTERVIEW

Provide a brief bio along with a picture of yours.

I completed my PhD in Computational Geophysics in August 2018 from the Department of Earth Sciences, IIT Roorkee. From July 2016 to December 2020, I served as a Geophysicist at the Geological Survey of India. In January 2021, I joined IIT (ISM) Dhanbad, before shifting to IIT Roorkee in 2024.

Share your 4-year journey in the department of Applied Geophysics, IITISM Dhanbad. Any specific mention about faculty, students with whom you built an excellent bonding.

My 4-year journey in the Department of Applied Geophysics at IIT (ISM) Dhanbad has been incredibly enriching, both professionally and personally. This department has provided me with a very conducive environment to work and thrive. I am particularly grateful for my association with Prof. U.K. Singh and Prof. Khan, whose guidance during my initial days in the department have been invaluable. I cherish some of the most wonderful memories with the faculties of the department. Those light banters with Partha, Mohit, Giri, Anand, and Upma over a cup of tea at 'Nescafe' forming the core memories at IIT ISM Dhanbad, with special mention to Niptika and Srinivas who have been my friends and partners in exploring the best parts of the campus, Dhanbad and beyond.

To all my students—UG, PG, and PhD—whose enthusiasm, drive, and commitment to work, has been motivational for me. Their curiosity and dedication in class and during the winter field trainings made mentoring a truly rewarding experience. These relationships and bonds, that I have built during my time at IIT (ISM) will be forever cherished.

Suggestion to future students who are aspired to build career in Geophysics

For students aspiring to build a career in geophysics, my advice is to develop a strong foundation in physics, and computational skills, as these are critical tools for solving geophysical problems and they will become more important with the emergence of AI/ML in geosciences.

They should embrace curiosity and take initiative and be more proactive to identify their true interests. They should actively participate in fieldwork, internships, and research projects to bridge the gap between theoretical knowledge and practical application. Also, Networking is equally important—build connections with faculty, peers, and professionals in the field, as these relationships can open doors to collaborative opportunities and valuable guidance. Stay updated with the latest developments in geophysics and be willing to adapt and learn new technologies, as the field is constantly evolving.

Why you chose your career in Applied Geophysics?

I chose a career in Applied Geophysics because it offers a unique blend of science, technology, and exploration (potential field work in all kinds of terrains). Applied Geophysics stands at the intersection of theory and application, and I was drawn to its potential to address real-world challenges—whether it's exploring natural resources or assessing geohazards. The opportunity to develop computational tools to image the subsurface geophysical model using inverse theory further solidified my interest.

Besides academic what do you love most?

Besides academics I love to read non-fiction (especially Indian history and culture), cook, travel and meet new people.

What do you going to miss most at IIT(ISM) Dhanbad?

What I will miss most about IIT (ISM) Dhanbad is the vibrant and close-knit community that made my time there so special. The engaging discussions over a cup of tea, created an environment that was both intellectually stimulating and personally fulfilling.

I will also miss the enthusiastic, curious, and loving students. Their inquisitiveness often challenged me to think differently and enriched my own learning.

Beyond academics, the green campus, good people, and the countless memories of shared laughter will always hold a special place in my heart. It's not just the place but the people and experiences that have left a lasting impression on me.

Arun Singh's cherished moments in the department.

The batch of 2026 (Int.Mtech and Msc. Tech) with Arun Singh

ACHIEVEMENTS AT THE DEPARTMENT

STUDENT ACHIEVERS:

Dhiraj Kumar Singh orally presented his research at the Conference on Integrated Earth (CITE)-2024, organized by the Earth and Climate Science Department (Sept 01-02, 2024), IISER Pune Campus. His presentation title was **"Exploring Seismic Lithospheric Anisotropy in Northeast India through Harmonic Decomposition of Receiver Functions".**
He also presented his research at the National Conference on ROCK DEFORMATION AND STRUCTURES (RDS) 8 Under the aegis of the Structural Geology and Tectonic Studies Group India (SGTSGI) in the dates between Oct 22-24, 2024. His presentation title was "Investigating Seismic Crustal Anisotropy and Mantle Deformation in Northeast India via Harmonic Decomposition of Receiver Functions".

Abhishek Kumar, a Senior Research Fellow in our department, has made significant contributions to the field of geophysics.

- **Collaborative Doctoral Program:** Abhishek was selected for a fully-funded PhD program at Curtin University, Australia.
- **EAGE Conference:** Abhishek's research on explainable AI for GPR data inversion invited for publication in Geophysical Prospecting.
- **Research Publication:** Abhishek published a groundbreaking paper on applying explainable AI to GPR data inversion in IEEE Geoscience and Remote Sensing Letters.

Dinesh Munda (Junior Research Fellow) presented on the topic "**Machine Learning-Based Mineral Prospectivity Mapping: A Comprehensive Approach for Exploring Critical Minerals in Jharkhand and Its Surroundings**" at the National Seminar on Mineral Exploration and Water Resource Management: Recent Trends, organized by CMPDI and SGSJ.

Pradeep Shukla delivered an oral presentation on "**Salt-Rock Time-Dependent Deformation Forecasting: A Cutting-Edge Deep Learning Approach**" under the session Time-Dependent and Dynamic Rock Mechanics at the International Geomechanics Conference (IGC), 2024, held in Kuala Lumpur, Malaysia.

Aditya Chowdhury and Drishti Sen from our department excelled at the **2024 SEG Challenge Bowl.**

Their team, **GeoDynAmo**, secured **1st Place in the SEG Asia Pacific Challenge Bowl and achieved 2nd Place in the World Finals held during IMAGE in Houston, Texas**. Aditya attended in person, while Drishti Sen participated virtually, showcasing seamless teamwork.

This achievement reflects the strength of IIT (ISM) Dhanbad's geoscience community on the global stage.

ACHIEVEMENTS AT THE DEPARTMENT

STUDENT ACHIEVERS:

DEPARTMENT AT GEOINDIA - 2024

Students presented their posters at the 6th South Asia Conference & Exhibition: GEO India held between 15-17 November 2024.

Title	Presenters
Seismic Bandwidth Extension - A Multi-Methodological Case Study	Kartik Gupta
A Physics-Informed Deep Learning-Based Method to Estimate Petrophysical Properties from Post-Stack Seismic Data.	Rounak Raha
Predicting formation pore pressure from well-log data with machine learning optimization algorithms in Krishna-Godavari (KG) Basin, India.	Susovan Das
Data-Driven Full Waveform Inversion (FWI): A Promising Approach for a Robust and Generalized Inversion.	Shubhajit Sengupta
Numerical simulation of geothermal reservoirs in India based on literature data.	Nandan Mukherjee
Site characterization for underground coal gasification through geoscientific analysis.	Rajkumar Mondal

Achievements:

- **Kartik Gupta** secured 1st prize in the JAM (Just a Minute) extempore speaking competition held at GEOIndia. He also received the 1st Runner-Up Award in the poster presentation Category.
- **Rounak Raha** received the 2nd Runner-Up Award in the poster presentation Category.








FACULTY TEAM

CHIEF EDITOR

PROF. SANJIT K. PAL
HOD
Department of Applied Geophysics

EDITOR

PROF. PARTHA PRATIM MANDAL
Assistant Professor
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AKANKSH SINHA - DESIGN, INT. MTECH
PRAGALBH DEEP - DESIGN, INT. MTECH
FARHAN ALI SHAH - CONTENT INT. MTECH

SHRUTI GUHA - CONTENT (HEAD), INT. MTECH
DINESH MUNDA - CONTENT, JRF
TANMAY SINGH - CONTENT, JRF
ANEESHA ROY - CONTENT, INT. MTECH

UNTIL NEXT TIME...