

Report on Five Days of Self-Sponsored Online Short-Term Course “Innovative Solutions in Geotechnical Engineering: Technical Breakthroughs” held from 13th - 17th May 2024 in CED, NITJ

Theme of the STC

The Civil Engineering Department has organized a Five Day Self-Sponsored Online Short-Term Course (STC) on the topic **“Innovative Solutions in Geotechnical Engineering: Technical Breakthroughs” held from 13 - 17 May 2024**. The course was designed to disseminate the knowledge in the domain of civil engineering in general and role of Civil Engineers with respect to innovative solutions in Geotechnical Engineering. The main objective of the course was to demonstrate the latest trends, case studies, field challenges and related remedies in different fields of geotechnical engineering, such as slope stability problems, soil stabilization analysis, use of various geosynthetics and geotextiles in slope stability problems, characterization using dynamic approach, application of AI/ML in the rock engineering or mining problems.

Scientists, Academicians, Research Scholars and Masters Students from academia of reputed NITs and IITs as well as scientific organizations participated in this online STC. The program was designed in such a way to achieve the set objectives of the course in stipulated period of five days and to make the participants benefitted at the end.

The STC was enlightened by Professors from esteemed universities such as IIT Indore, IIT Dhanbad, CSIR-CBRI Roorkee and CSIR-CIMFR, Nagpur.

Following themes were covered under this phase:

- Advanced computational models used to simulate soil-structure interactions
- Cutting-edge site characterization techniques.
- Resilient design principles to mitigate the impact of climate change and natural disasters on geotechnical infrastructure
- Implementation of real-time monitoring systems to detect geotechnical issues

Itinerary of the STC

First day:

On the first day, the Online STC was inaugurated by Mr Kaushik Pandit, Senior Scientist, CSIR CBRI Roorkee, as its chief guest. The organizing team of the STC, Dr. Neelam Rani, Dr. Arya Anuj Jee, Dr. Abhishek Sharma, and Dr. Phibe Khalkho, were present. As the Inaugural Speaker, Mr Kaushik Pandit, Senior Scientist, CSIR CBRI Roorkee, was felicitated by the organising team.

Dr Neelam Rani briefly introduced the key objectives and themes of this Self-Sponsored One Week Online Short-Term Course. She also briefly introduced the eminent speakers and offered warm welcome to the participants. Dr. Phibe Khalkho also graced the inauguration with her valuable insights on the need to familiarise young students,

academicians, and research scholars with the recent advancements and challenges faced in geotechnical engineering.

After the inauguration, **Mr. Kaushik Pandit** delivered an expert lecture on “*Mitigation Landslide Risk Through Sustainable Hill Area Development.*” The speaker showcased meaning of landslides and various types of various landslides. The reasons for the vulnerability of landslides in hilly areas were elaborated. Some lessons learned from previous landslide disasters in India were discussed. Landslide Evaluation tools, including GeoEye, SkySat-1, and QuickBird-a- a very high-resolution imagery for landslide mapping, which is a prerequisite for risk assessment, were emphasized in the discussion. Landslide investigations along with the various models were shown for slope stability analysis. Various case studies showcase the utilization of the models for landslide hazard assessment and for predicting the onset of landslides.

In the afternoon session, **Dr. Akshay Pratap Singh, Assistant Professor, IIT Indore, India** delivered lecture on the topic, “*Behaviour of Cantilever Sheet Pile Walls*”. The speaker introduced about the various types of sheet pile walls. The speaker discussed his research work carried out numerically on cantilever sheet pile walls with and without infinite uniform surcharge load using various methods. Analysis of strip load subjected to cantilever sheet pile walls was also brought forth in the presentation.

Second day:

In the first session of day two, **Dr. Anil Kumar Sharma, Assistant Professor, NIT Patna, India**, talked about one of the most trending topics, “*Promoting Sustainability in Soil Stabilisation Techniques*”. The speaker emphasized how combining industrial wastes can be used in various geotechnical applications. Promoting natural materials like areca, bamboo, and natural fibers supports sustainable development. The use of locally available materials for ground improvement is encouraged. Additionally, the MICP technique is an emerging, sustainable method for soil improvement.

In the second session of day two, **Dr Shiv Shankar Kumar, Assistant Professor, NIT Patna, India** presented his research on the topic “*Soil Characterisation: A Dynamic Approach*” where the speaker discussed about how the onset of liquefaction was evaluated using the threshold limits of various parameters. Triaxial tests were conducted under different types of dynamic loading on the soil specimens and results were discussed. The modelling was also done and validated. Some of the seismic zone sites were considered for numerical modelling to predict the liquefaction.

Third day:

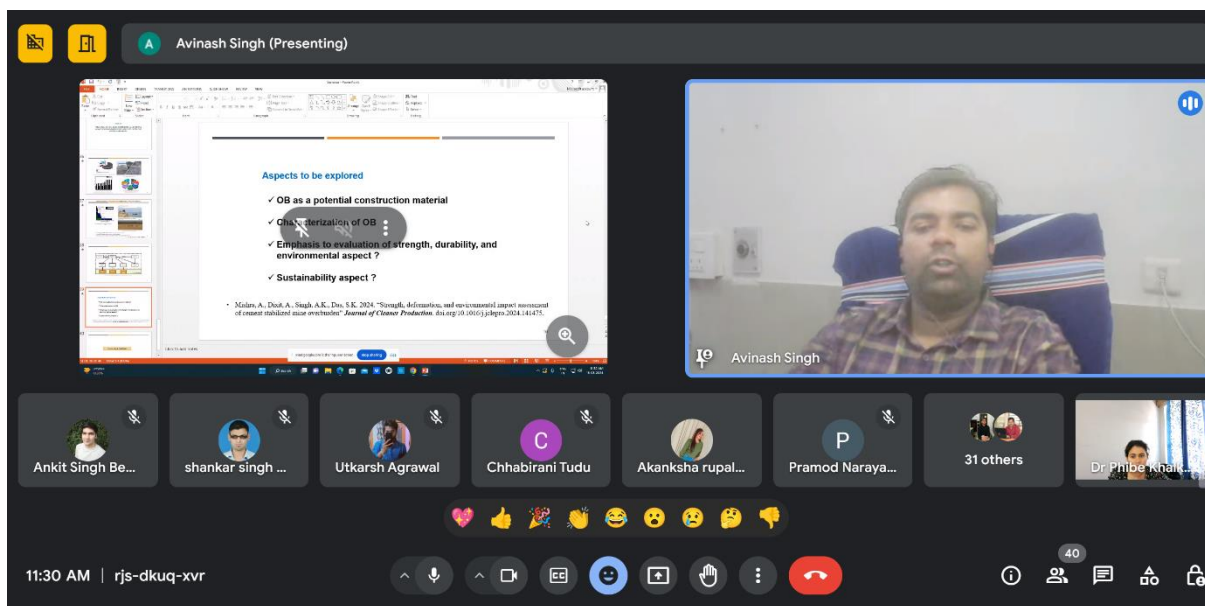
In first session of day three was honoured by **Dr Anindya Pain, Senior Scientist, CSIR CBRI Roorkee, India** who talked about the “*Geosynthetics Reinforced Slopes & Walls For Infrastructure Development*”. The speaker initially discussed about the problems arising causing to the need of utilisation of reinforcing soil. Various types of Geo-synthetics and the requirement on the basis of particular problem were discussed. Reinforcement of earth retaining structure, i.e., **RERS** and its pros and cons, design, design approaches and elements

were enlightened upon. Some practical case studies were presented bringing to notice the reinforcement of retaining structures.

The second session was illuminated by the presence of an eminent speaker, **Dr. Avinash Kumar Singh, IIT Dhanbad** discussed on one of the burning topics, “*Engineering Solutions for Sustainable World*”. The speaker elaborated various alternatives or replacement to conventional building materials. Three case studies were discussed by the eminent speaker:

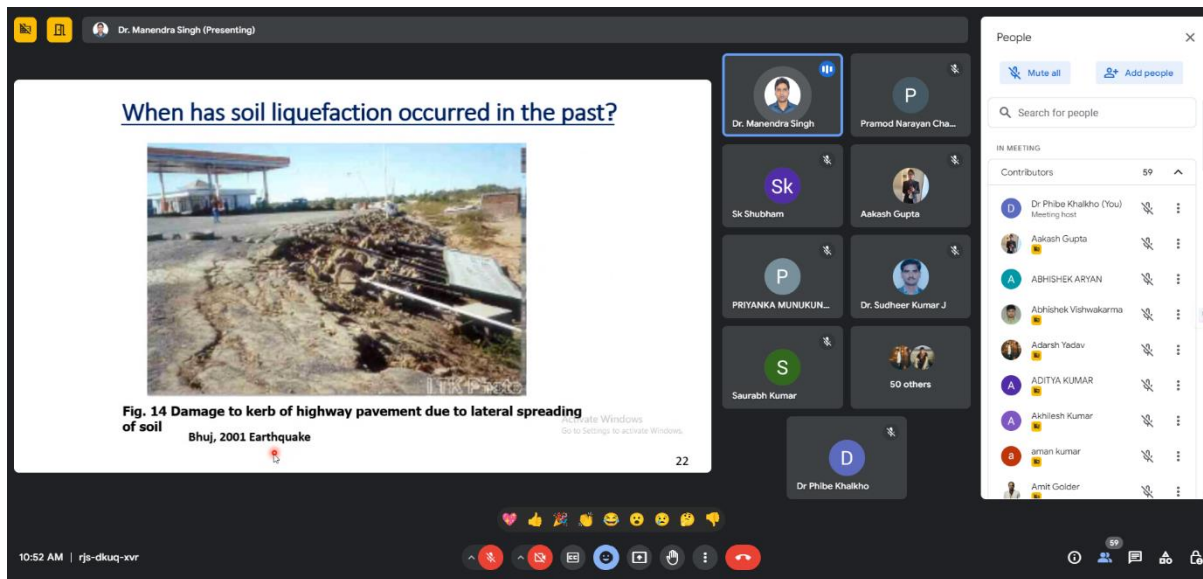
- Application of bio-based additives as replacement to conventional binders in construction of traffic infrastructures
- Application of Geopolymers
- Application of coal mines overburden as a potential /substitute/replacement/complementary to fine and coarse aggregates

The speaker ended the session posing the question using mines overburden as a potential construction material.



Fourth day:

In the first session of fourth day, **Dr Manendra Singh, Assistant Professor, NIT Hamirpur** delivered an expert talk on the topic “*Evaluation of Liquefaction Potential: Theoretical and Numerical Analysis*”. The eminent speaker shone some light upon the mechanism of liquefaction, evaluation of liquefaction potential by theoretical methods and the ground improvement methods for mitigation of liquefaction hazard. Various case histories were discussed in respect to the evaluation and prediction. The speaker ended the session by providing solutions of ground improvement methods for mitigation of liquefaction hazard.



The second session marked the lecture on *‘Methods of Ground Improvement’* by **Dr Suchit Kumar Patel, Assistant Professor, Central University of Jharkhand**. The authors discussed the various ground improvement techniques. The different methods of ground improvement techniques will help the geotechnical engineers in enhancing the properties of soil, ensuring stability, strength, and suitability for construction. These methods are applied to increase the bearing capacity, reduce settlement, and improve the overall performance of soil under various conditions.

Fifth day:

In the another session, **Dr. Jitendra Singh Yadav, Assistant Professor, NIT Kurukshetra**, delivered lecture on *“Numerical Investigation on the behaviour of helical piles”*. It was discussed by the author that how different parameters such as the effect of diameter of pile shaft (DS), diameter of helical plate (Dh), depth of pile (H), Inter-helical spacing ratio (S/Dh) and number of helix (m), and type of sand on the load-displacement behaviour of helical pile influence the behaviour of helical piles resting in cohesionless soils subjected to compressive load. The results were validated with the prevalent existing theories. An artificial neural network (ANN) was used to model the equation. It was inferred that with an increase in the pile depth, friction angle of sand, and diameter of pile shaft, the compression capacity of single and double helical piles was observed.

INTRODUCTION

- Helical Pile: Piles manufactured from high-strength steel consisting of a central shaft with one or more helical bearing plates
- Helical steel plates are welded to pile shaft in accordance with the intended ground conditions
- Helical piles have been widely used in engineering applications to provide **structural stability against axial compression, uplift tension, overturning moment and lateral force**
- Helical Foundation can be installed in confined spaces with minimal damage having **rapid installation and sustain load immediately after installation**

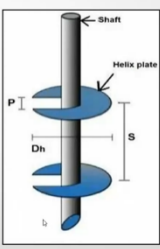
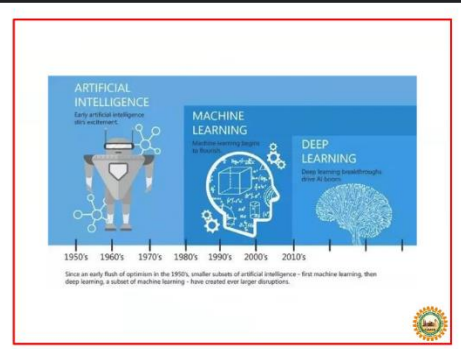


Fig. Basic geometrical

10:36 AM | rjs-dkuq-xvr

In the closing session, **Dr Saurav Rukhaiyar, Scientist, CSIR-CIMFR, Nagpur, India, delivered a lecture on ‘Machine Learning Application in Rock Engineering Problems’.** Various models of machine learning were discussed with respect to its application in machine learning such as Decion Tree, Support Vector Regression, K-Nearest Neighbor, Multi Adaptive Regression Spline. As per the requirement of a particular problem risen, the models can be varied. And how the analytical models were also compared for the validation. The future scope of the research area was also put in front identifying the challenges too.

Saurav Rukhaiyar (Presenting)



ARTIFICIAL INTELLIGENCE
Early artificial intelligence (AI) research

MACHINE LEARNING
Machine learning (ML) is the study of algorithms that learn from data

DEEP LEARNING
Deep learning (DL) is a subset of machine learning that uses neural networks with multiple layers

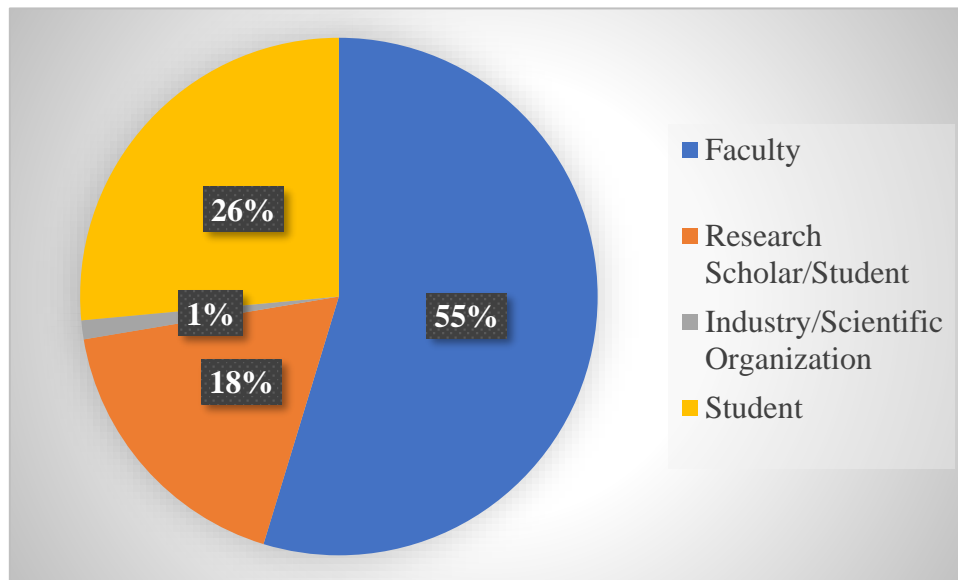
1950's 1960's 1970's 1980's 1990's 2000's 2010's

Since an early flash of optimism in the 1950's, smaller subsets of artificial intelligence - first machine learning, then deep learning, a subset of machine learning - have created ever larger disruptions.

3:07 PM | rjs-dkuq-xvr

Participant's Feedback

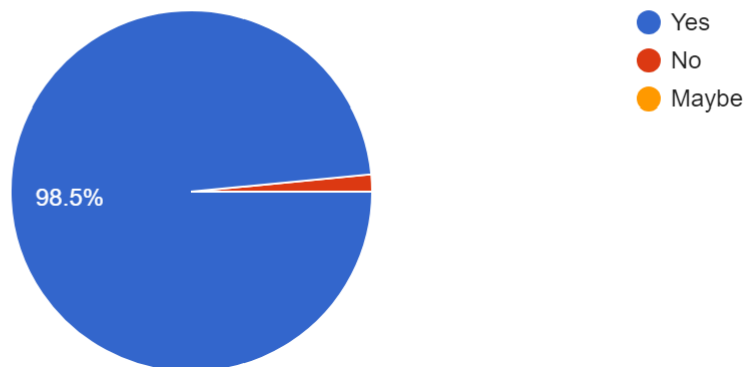
a) Background of the Participants



b) Feedback

Did the presentations and discussions meet your expectations?

65 responses



Were they informative and relevant to your interests?

65 responses

