**5th International Structural Integrity Conference and Exhibition**

**(SICE-2024)**

**Pre-Conference Workshop:** Role of Rock Mechanics in Mining

**Lecture 1**: Instrumentation and Monitoring of Strata in Underground Mines

**Coordinator**: Dr. Ritesh D. Lokhande, Associate Professor and Head, Dept. of Mining Engineering, VNIT.

**Abstract**:

 The imperative need for instrumentation and monitoring of roof and strata in underground mines arises from the critical necessity to ensure operational safety, enhance productivity, and protect both human and environmental health. The inherent instability of geological formations in underground mining environments can lead to catastrophic events such as roof collapses and strata displacements, necessitating real-time data acquisition and analysis. Advanced instrumentation, including extensometers, convergence meters, and microseismic monitoring systems, provides essential insights into the behavior of the roof and surrounding strata. These instruments measure displacement, stress changes, and acoustic emissions, facilitating the early detection of potential failures. The continuous monitoring of geomechanical conditions enables mine operators to implement proactive measures, thereby preventing accidents and significantly reducing the risk of fatal incidents and injuries among workers. The integration of automated and remote monitoring technologies has revolutionized underground mining. These technologies ensure continuous, real-time monitoring with enhanced data accuracy and reliability, while minimizing human exposure to hazardous zones. This leads to improved operational efficiency by reducing downtime and optimizing resource allocation. Economic considerations further underscore the importance of monitoring systems. Early detection of structural instabilities allows for cost-effective maintenance and repair, reducing financial burdens associated with large-scale collapses and production interruptions. Additionally, consistent monitoring extends the longevity of mining equipment and infrastructure, contributing to lower operational costs and increased profitability. Environmental sustainability is also addressed by advanced monitoring systems, as they enable the assessment and mitigation of mining activities' impact on surrounding strata. This responsible approach preserves ecological balance and ensures compliance with environmental regulations. These practices enhance mine safety, operational efficiency, economic viability, and environmental sustainability. Adopting state-of-the-art monitoring technologies is essential for addressing the complex challenges of underground mining, fostering a safer and more productive mining environment.

**Lecture 2**: Experimental Techniques and Laboratory Practices in Rock Mechanics

**Coordinator**: Dr. Nikhil N. Sirdesai, Assistant Professor, Dept. of Mining Engineering, VNIT.

**Abstract**:

 The evaluation of rock properties is crucial for effective mining operations, encompassing a range of physical, mechanical, microscopic, and index characteristics. Physical properties such as density, porosity, and ultrasonic wave velocities play a fundamental role in determining the suitability of rock for mining. Density impacts the weight and handling of extracted materials, while porosity influences fluid storage and movement within the rock matrix. Ultrasonic wave velocities provide insights into the rock's elasticity and potential fracture zones, aiding in stability assessments. Mechanical properties are vital for understanding rock behavior under stress. Uniaxial compressive strength (UCS) measures the rock's ability to withstand axial loads, a critical factor in determining excavation strategies and support design. Indirect tensile strength, often assessed via the Brazilian test, evaluates the rock's tensile resistance, which is essential for predicting crack initiation and propagation. Cohesion and the angle of internal friction, derived from shear tests, describe the rock's shear strength and stability under different stress conditions, informing slope stability and failure analysis. Microscopic properties, including minerology and morphology, offer detailed insights into the rock's composition and texture. Minerology involves identifying the mineral constituents, which affect the rock's mechanical strength, durability, and chemical reactivity. Morphology examines the grain size, shape, and distribution, influencing the rock's porosity, permeability, and overall mechanical behavior. Index properties serve as practical indicators for preliminary assessments and comparisons. The point load index provides a quick estimate of rock strength, correlating with UCS. The Schmidt rebound hammer index assesses surface hardness and elasticity, offering a non-destructive means of evaluating rock quality. The CERCHAR abrasivity index quantifies the wear potential of rock on drilling and cutting tools, essential for estimating tool life and maintenance costs. The slake durability index measures the resistance of rock to disintegration when subjected to moisture cycles, indicating long-term durability in varying environmental conditions. Comprehensive evaluation of these properties ensures informed decision-making in mining operations, optimizing safety, efficiency, and cost-effectiveness.

**Lecture 3**: Rock–Tool Interaction: Influence of Physico-Mechanical Properties and Performance Prediction Techniques

**Coordinator**: Dr. Anupam A. Kher, Assistant Professor, Dept. of Mining Engineering, VNIT.

**Abstract**:

 Interaction between rock and metallic tools is frequently witness in mining & mineral, geotechnical, and oil & gas industries. The advent of several advanced mechanized excavators, borers and crushers has led to an increase in output, efficiency, and productivity within these sectors. However, improper judgement and selection of tools, their design and type of metal leads to rapid wear and tear of the tools during operation, thereby impacting the overall project costs and timeline. To overcome such problems, it is imperative to understand the dynamics of rock-tools interaction and the factors that influence the interaction. This study presents a brief overview of the various rock parameters that influence the interaction with mechanized tools. Abrasivity models have been analyzed by correlating the CERCHAR abrasivity index (CAI) with physico-mechanical properties of rock. Thereby, performance prediction techniques have been presented for road-headers (RH), continuous miners (CM) and tunnel boring machines (TBM) using such correlations.