Never Give up

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EMERALD

TECHNICAL MAGAZINE

Department of Mining Engineering

Dr. T. Thimmaiah Institute of Technology, K.G.F
Oorgaum, Karnataka
Accredited by NAAC with 'A' Grade

(Affiliated to Visvesvaraya Technological University, Belagavi
Approved by AICTE - New Delhi)

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About the Department

The Mining Engineering is one of the main branches of engineering situated amidst the century-old Kolar Gold Mines. Asia's largest mines, like Kudremukh Iron Ore and Neyveli Lignite, are situated at a distance less than 250 Kilometres. The Mining Engineering department has well-established labs and has an underground mine model, the only one of its kind in the State.

The department has a strong industry-institution interaction to enable exposure to the latest technological trends for students and teachers and to impart practical training at HGML, NMDC, etc.

National Institute of Rock Mechanics (NIRM) a research institute extends thefacility for the training of students in various project works. Recent additions to the laboratory include a sophisticated electronics survey station and electronic precision level. The department also has a computer laboratory for data processing.

Principal's Message

Dear Readers,

I am delighted to welcome you to the latest issue of "Emerald" student's Technical Magazine, a technical publication that showcases the latest developments and innovations in mining engineering. This magazine is an initiative of our Mining Engineering Department, which is one of the leading departments in our college and in our region.

I would like to congratulate and appreciate the efforts of Dr. Manas Mukhopadhyay, Head of the Department, and his editorial team for this magazine. They have done a commendable job in bringing out this issue, which features articles on topics such as mining practices, mine safety, mine environmental management, mine design optimization and more. The magazine also highlights some of the achievements and activities of our students, faculty, alumni and industry partners in mining engineering.

I hope you enjoy reading this magazine and find it informative and inspiring. I urge you to keep learning and exploring new horizons in your field. Mining engineering is a vital discipline that contributes to our national security and economic growth. You have a great opportunity and responsibility to make a positive impact on our society and our environment through your work.

Dr. Syed Ariff
Principal
Dr. T. Thimmaiah Institute of Technology, KGF

HOD's Message

Dear Readers,

I am delighted to welcome you to the fourth issue of "Emerald" Technical Magazine, a student-led publication that showcases the latest developments and innovations in mining field. This magazine is a platform for our students, faculty, alumni and industry partners to share their insights, experiences and achievements in mining engineering.

In this issue, you will find articles on topics such as mining practices, mineral production, mine environmental management, mine design optimization and more. You will also learn about some of the exciting projects and activities that our department is involved in, such as research collaborations, student competitions, outreach programs and alumni events.

I would like to thank the editorial team for their hard work and dedication in preparing this magazine. I would also like to thank all the authors who contributed their valuable content to this issue. Without their efforts, this magazine would not have been possible.

I hope you enjoy reading this magazine and find it informative and inspiring. I look forward to hearing your feedback and suggestions for future issues. Together, we can make this magazine a success and a source of pride for our department and our profession.

Sincerely,

Dr. Manas Mukhopadhyay

Head, Department of Mining Engineering

Chief Editor's Message

Dear Readers,

Welcome to the present issue of the "Emerald" Student Technical Magazine of Department of Mining Engineering, a publication dedicated to showcasing the latest research, innovations and achievements in the field of mining engineering. This magazine is created by and for students who are passionate about mining and its applications in various sectors of society. Our goal is to provide a platform for students to share their ideas, insights and experiences with their peers, professors and industry professionals. We hope that this magazine will inspire, inform and connect students who are interested in mining engineering and related disciplines.

In this issue, you will find articles on topics such as mining practices, mineral production, mine environmental management, mine design optimization and more. You will also learn about some of the exciting projects and activities that our department is involved in, such as research collaborations, student competitions, outreach programs and alumni events.

We would like to thank all the contributors, reviewers and advisors who made this issue possible. We are grateful for your support and encouragement.

We invite you to join us in this exciting journey of exploring the world of mining engineering. If you have any feedback, suggestions or questions, please feel free to contact us at hod.min@drttit.edu.in. We look forward to hearing from you and seeing your contributions in future issues.

Dr. Manjunath A.
Chief Editor

Student Editorial Members

Mr. Sanjay M
6th sem Mining

Mr. A. K. Naveen
4th sem Mining

Mr. Malathesh N.
6th sem Mining

Mr. Atayib Basharat Qureshi
4th sem Mining

Mr. Ravishankar R.
Student Editorial head, 8th sem Mining

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Technical Tips

Rockfall from Highwall Slope in Opencast Mine

by

- Dr. Raja S.

Rockfall phenomena have been widely studied for mountain valleys, roads, and highways. However, rockfall phenomena have also been studied for open pit mines, quarries, and highwall mines. In mining engineering, much research has been concentrating on analyses of general slope stability, given the potential economic impact of this aspect of mining. The history of rockfall incidents that occurred in the past 4 years, i.e., between 2019 and 2023, suggests that rockfalls in opencast mines led to the deaths of many individuals. And also, the problems that are faced due to rockfalls are not repetitive, but once they occur, they are disastrous in opencast mines. So, it is necessary to investigate the rockfall in an opencast mining industry.

Many factors affect the rockfall, such as the slope angle of the bench, the friction angle of the material, bench height, and bench width. It is also observed from the literature that the kinetic energy of rock fall helps determine the intensity of rockfall in a mine. Hence, this study focuses on investigating rockfall phenomena in a highwall open-cast mine, explicitly determining the kinetic energy of rockfall. A parametric study has been conducted to determine the effect of various bench parameters on the kinetic energy of rockfall. A predictive model is developed for determining the kinetic energy of rockfall with respect to various factors affecting the rockfall. The predictive model is also validated using three case studies of high-opencast mines. The results from the predictive model and the numerical model for the case study mines agree that the predictive model can predict the rock fall intensity for opencast mines. The study also aims to assess the potential risks posed to workers, equipment, and infrastructure in high-wall opencast mines. The findings provide valuable insights for implementing appropriate safety measures and developing effective strategies to mitigate rockfall hazards.

Student Projects

"Automatic Explosive Charging in Opencast Mines"

Dinesh Babu R, Santhosh M S, Shanjay Sharmaa K J, and Subash P
Under the Guidance of Dr. Raja S.

Abstract

Blasting is one of the unit operations in the conventional opencast mining method. Various parameters are responsible for proper blasting results, in that explosive charging is also essential. Charging of explosives, irrespective of the surrounding strata, results in the imbalance of explosive energy distribution, creating hazardous conditions and a pathway for the leakage of explosive gases. By this, the utilisation of explosive energy will be reduced and propels fly rock in some situations. This paper will discuss automatic explosive charging based on the drilling penetration rate to optimise the explosive charging in each blast hole in opencast mines.

Keywords: Automatic Explosive Charging, Penetration Rate, Drilling, Blasting, Explosive Energy

Student Projects

"Mine Safety Management - The synergic role of personal and sociotechnical characteristics on work injuries in Small Scale Quarries"

Afzal L, Anshadh A, Ravi Shankar R and Rufus N R
Under the Guidance of Dr. Manas Mukhopadhyay & Dr Manjunath A.

Abstract

The quarry sector plays a crucial role in the growth of Indian economy and also generates large number of employment. However, work-related injury rate in this sector is high, with a significant number of accidents occurring in small-scale quarries. There are many factors/parameters that have direct or indirect bearing on work-related injuries in quarries. This study, in particular, aims to investigate the influence of socio-technical parameters on work injuries in quarries. The study employs a perceptual approach to understand the relationship between depression, risk taking, physical hazard, work pressure, co-worker support, job dissatisfaction, and job stress on work injury. A DEMATEL analysis has been used to determine the parameters' direct and indirect effects on job injury. The objective of this study is to reduce work injury in the quarrying sector by providing insight into the factors that contribute to accidents. The results indicate that Production pressure is the most significant factor directly affecting work injury in small-scale quarries. Additionally, it emphasises indirect impacts of parameters on work injury. The findings of this study offer valuable information to policymakers and stakeholders to design interventions aimed at reducing work injury in the Indian quarrying sector.

Keywords: Indian quarrying sectors, Work injury, DEMATEL, Direct and indirect affects, Safety.

Student Projects

"Development and Validation of Fatigue Severity Scale for Mining Sector"

K Sathisha, Ramkumar R, S Kareemulla and Y Tharun Kumar Reddy
Under the Guidance of Dr. Manjunath A.

Abstract

The mining industry is characterized by long working hours, challenging working conditions, and high-risk operations, which can lead to fatigue among workers. Fatigue can have significant impacts on workers' health, safety, and productivity, and it is essential to have a reliable tool to measure fatigue levels in the mining sector. In this project, a fatigue severity scale was developed and validated for the mining sector using a questionnaire survey methodology. The survey was conducted among managers, workers, and supervisors to gather data on various aspects of fatigue, including tiredness, sleep quality, and concentration. The data obtained from the questionnaire survey was found to be valid and reliable, as indicated by a high Cronbach's alpha value. The fatigue severity scale was then developed based on the responses obtained from the survey. To validate the scale, confirmatory factor analysis (CFA) was conducted using the AMOS software. The fit of the model was assessed using the Comparative Fit Index (CFI), which measures the degree of fit between the model and the data. The results of the CFA revealed a good fit between the hypothesized model and the data, as indicated by a CFI value of 0.922, which is considered desirable. This suggests that the fatigue severity scale is a valid and reliable tool for measuring fatigue levels in the mining sector. Worker characteristics were analyzed for their correlation with the three types of fatigue (physical, mental, and emotional) using partial eta-squared values in SPSS software. The analysis identified the influence of each characteristic on each type of fatigue.

Keywords: fatigue, fatigue severity scale, confirmatory factor analysis.

Student Projects

"Analysis of Mine Ventilation Network in Longwall Panel Based on Methane Emission - A Case Study"

Malathesh N, Shashank H S, Sudeep M and Vinay Kumar H S
Under the Guidance of Dr. Raja S.

Abstract

Ventilation system in an underground mine plays an essential role in the working efficiency of the underground mine. Ventilation is the only aid to control the emission of methane, harmful gases, dust, and geothermal gradient. Among them, methane emission in an underground mine is a significant factor to be controlled using a ventilation system. The methane emission in the longwall working method is comparatively high to bord and pillar. Hence, the effect of mine ventilation on methane emission in longwall panels is studied. Manually studying the effect of ventilation in mines is unrealistic and very tedious in nature. Hence, in this study, the ventsim software is used to analyse the longwall ventilation system and methane emission rates after varying the quantity of air, pressure of air, and power of a forcing fan. A case study has also been considered, namely the K2 Longwall mine in the United States of America, for a parametric study, and the results suggest that the methane emission concentration can be reduced by increasing the quantity

Keywords: Ventilation System, Longwall Method, Methane Concentration, Pressure of air, Quantity of Airflow.

Student Projects

"Circular Failure Analysis in Surface Mines Using Limit Equilibrium Method- A Case Study"

M. Praveen Kumar, Sanjay M, V Kathiravan and Vidhya G
Under the Guidance of Dr. Manas Mukhopadhyay

Abstract

Mining operations involve various challenges, one of which is the stability of slopes in open pit mines. However, these slopes are prone to failure due to various factors such as geological conditions, mining-induced stress, etc. The analysis and prediction of slope stability play a crucial role in ensuring safe and efficient mining operations. The limit equilibrium method is a widely used approach for slope stability analysis in the geotechnical field. It assumes that the failure occurs when the driving forces of the slope exceed the resisting force along potential failure surfaces. In recent years, advanced software tools such as SLIDE facilitate applying the limit equilibrium method to slope stability analysis in mining projects. SLIDE software provides a user-friendly interface that allows interpreting the input data easily using various methods like the Janbu, Spencer, and Bishop methods. This software enables the evaluation of slope stability under various conditions and modes of failure.

Keywords: Slope Stability Analysis, SLIDE software, Limit Equilibrium Method, Bishop Method, Factor of Safety

Student Projects

"Study on Effects of Delay Timing on Fragmentation"

Anil Rao, G. Dodda Basappa and N. Santosha
Under the Guidance of Prof. John Gladious J.

Abstract

Optimized rock fragmentation is essential for minimizing downstream costs to mining operations. Rock fragmentation has always been an indicator for the efficiency of blasts in mines. Several suggestions have been made by blast operators and specialists to improve the rock fracturing mechanisms in order to obtain smaller fragments. The order of blast hole initiations together with the timing interval between holes has been observed to affect the blast results. Delay time is an important factor in the quality of bench blasting. The development and application of electronic detonators make it possible to control the timing of detonation by a highly precise delay time. It is an easily achievable way to seek a better blast fragmentation by controlling the delay time. This study evaluates the effects of short hole-to-hole delay times on rock fragmentation. Photographic fragmentation analysis and various delay times were used on the same bench blast, the effects of timing on fragmentation were determined. This analysis provides a representative understanding of timing effects on fragmentation in the field, different from previous blast models which

Keywords: rock fragmentation, delay time, electronic detonator.

Student Achievements

Dinesh Babu R, Santhosh M S, Shanjay Sharmaa K J, and Subash P of 8th Semester has won the First price in Dr.TTIT Project Expo 2023 conducted by Dr.TTIT Institution's Innovation Council on 20th May 2023 for the project titled "**Automatic Explosive Charging in Opencast Mines**".

Mining Engineers' Association of India organized "**Poster Competition**" on 'sustainability & Circular Economy' on the occasion of Indian Mining Day on 1st November 2022. Mining Department students participated in the event. **Mr. Lenus Leander**, 7th semester obtained **1st prize** and **Mr. Rufus N. R,** 7th semester obtained **2nd prize** in the **Poster competition.**

Student Achievements

Mining Engineers' Association of India organized "**Essay Competition**" on 'sustainability & Circular Economy' on the occasion of Indian Mining Day on 1st November 2022. Mining Department students participated in the event. **Mr. Anshadh A**, 7th semester obtained **1st prize** and **Mr. Ravishankar**, 7th semsester obtained **3rd prize** in the **Essay competition**.

Dr. T.T.I.T, KGF had organized 5th International Conference on Recent Trends in Technology, Engineering and Applied Science – **ICRTTEAS 2023** on 19th and 20th May, 2023 in hybrid mode. **Mr. Abhishek, Prashanth, Praveen and Earnest K** of 7th semester received **best paper award** for title "**A Case Study on the Mining Accidents Due to Unsafe Behaviour of Workers Involving Machinery**".

Student Achievements

On the occasion of CHIKKAMAGALURU JILLA UTSAVA 2023, Department of Mines & Geology, Chikkamagaluru requested our institute to prepare Opencast and Underground mine Models to display during Jilla Utsava 2023. In this regard, 2nd and 3rd year students (06 members) were selected to prepare models using plywood+PoP.

The prepared models were handed over to them at Chikkamagaluru office on 16th January. Entire expenses were taken care by Dept. of Mines & Geology (model preparation and transportation).

These models were displayed during CHIKKAMAGALURU JILLA UTSAVA 2023 (18-22 Jan, 2023). Dept. of Mines & Geology appreciated students for the beautiful model & felicitated the students with Cash of 15000/- and Memento.

Student Achievements

Student Achievements

Congrats

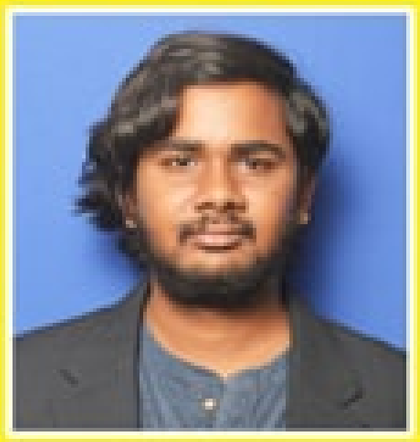
to the following students who have been placed in THRIVENI

RAMKUMAR
MINING

SAILOKESH
MINING

AJITH A
MINING

DEEPAKRAJ CHANDRAN
MINING



V LENUS LEANDER
MINING

NAVEEN M
MINING

LOKESH P
MINING

EARNEST KIRUBAGARAN R
MINING

Faculty Achievements

Dr, Manjunath A. and Prof. Paul Prasanna Kumar attended 7 days workshop training programme on "**Uses of Advanced Instruments and Numerical tools for Mining Engineering Applications**," held during 16th to 22nd Jan 2023, organized by the Department of Mining Engineering, Indian Institute of Technology (ISM) Dhanbad, under the banner of **DST-STUTI** Programme of Indian Institute of Technology (ISM) Dhanbad, funded by the Department of Science and Technology **(DST),** Government of India.

Prof. Paul Prasanna Kumar and Dr. Manjunath A published research paper title "Development of LoRa Communication System for Effective Transmission of Data from Underground Coal Mines", open assess Journal Processes 2023, Volume 11, Issue 6, 1691 (Q2 indexed journal).

Prof. John Gladious J, has undergone Innovation Ambassador (IA) training "**Advanced Level**" (Total 15 Session of 30 contact hours) conducted by MoE's Innovation Cell & AICTE dated 15 October 2022.

Dr. Manas Mukhopadhyay, has attended a Seminar on "**Revitalizing India through new age skills**" conducted by ICT Academy on 19th October 2022.

Department Event

A Guest lecture was delivered to the 3rd & 7th sem students of Mining Engineering by **Mr. Kumaresh A**., Deputy Manager, Hutti Gold Mines Limited, on topic "**Need of the Geotechnical Engineering in Mining**", on 9th November, 2022. Venue: Mechanical Seminar Hall, Dr. T.T.I.T, K.G.F. A total of 51 students benefited from the activity. It included a lecture for 2 hours followed by a question-and-answer session.

A Guest lecture was delivered to the 75 students and faculty members of Mining Engineering by **Mr. Kaarmegan N**., Deputy General Manager, Coal Mining Headquarters, NTPC, on topic "**An Overview – Coal Block Allocation to Mine Operation**", on 29th April, 2023. Google Meet link: https://meet.google.com/wag-nrxv-kzp

Department Event

A one-day workshop was hosted by the Department of Mining Engineering on 18.10.2022. As a part of the Memorandum of Understanding, Unitos Aero drone Solutions Private Limited conducted one day workshop on “Applications of Drones in the Mining Sector” for 7th sem students. A total of 53 students benefited from the activity. The workshop included a lecture for 2 Hours and followed by a practical session on flying the drone. Mr Pavel M S, Mr Maris and Mr Aswin have trained the students in flying the drone.

Department Event

THE 76th INDEPENDENCE DAY CELEBRATION CONDUCTED UNDER THE EMERALD MINING CLUB (EMC)

Fig: Lighting of lamp by dignitaries

On this occasion the official launch of the Emerald Mining Club Logo was carried out successfully in the presence of the Dignitaries: Vice Principal Dr. H G Shenoy, Dean Academics Prof. Ruckmani Divakaran and Dr. Manas Mukhopadhyay. The Official logo of the Emerald Mining Club was specially designed by Mr. Rufus NR, 8th sem student of the Mining Department.

Fig: Emerald Mining Club (EMC) Official Logo

Department Event

THE 76th INDEPENDENCE DAY CELEBRATION
CONDUCTED UNDER THE EMERALD MINING CLUB (EMC)

This Event was based on two aspects, First is the Independence Day celebrations and second the launching of the official Logo of Emerald Mining Club marking the reinvention of the EMC. Through this event, an awareness of our roles and responsibilities as Indian citizens was highlighted. This event is the first event conducted after the reinvention of this Club so, it shows the students the way to organize an event, participate, and be involved in various aspects of it, which might bring them managing skills and make them responsible Professional Engineers.

The Event positively marked the activities and events planned to be conducted under the Emerald Mining Club, which create more opportunities for students who do not come forward to participate in Co-Curricular Activities other than academics.

The Event was organized by the members of the Emerald Mining Club (EMC) Successfully. Mr. A K Naveen, Mr. Atayib Basharat Qureshi, and Mr. Uday Kumar G, Mr. Abdullah N (left to right), from the 2nd year Department of Mining Engineering.

Mining News

1. According to the Indian Bureau of Mines (IBM), India's mineral production rose by 12.3% in August 2023 compared to the same month in the previous year. The index of mineral production of the mining and quarrying sector for August 2023 was at 111.9, higher 12.3 per cent as compared to the year-ago period.
2. The Metals Company has announced its timeline for moving forward to collect metal nodules off the deep seafloor, which is more aggressive than what some stakeholders think is reasonable.
3. Accenture's Nishal Nair spoke about the early adoption of mining technology and the need for innovation within the field 3. The article highlights that the mining industry is at the forefront of new technologies, and innovation is essential to drive growth and sustainability.
4. According to a report by TechBullion, landfill mining can be a solution to mitigate pollution caused by high-tech gadgets.

Department Vision

"To excel in education, training and leadership skills to prepare the students for sustainable development of mining industries."

Department Mission

1. To provide a conducive environment in which students think, learn, conduct, innovate and apply.
2. To impart quality education for meeting the needs of the mining engineering profession and society, and achieve excellence through creative teaching learning and research.
3.To inculcate the spirit of sustainable development and conservation of natural resources through the advancement of technology in the exploration and production of minerals with due regard to health, safety and environment.

PEOs

1.Graduates shall have the ability to solve complex problems of mining by the application of sound engineering principles in their professional careers.

2. Graduates shall have the spirit of teamwork and inculcate the habit of lifelong learning for achieving professional excellence.

3. Graduates shall have in-depth knowledge in the entire value chain of the profession starting from exploration to beneficiation of mineral deposits in a coordinated manner.