



# UNDERGROUND MINING OF METALLIFEROUS DEPOSITS

## PROF. BIBHUTI BHUSAN MANDAL

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**INTENDED AUDIENCE :** Students of Mining Engineering, Mining Machinery, Mineral Processing, Earth Sciences (Geology/geophysics etc.)

**INDUSTRIES APPLICABLE TO :** All the Mining and allied industries

### COURSE OUTLINE :

Introduction to Metalliferous mineral deposits, exploration, deposit characterizations, understanding cut-off grade, dilution, optimum recovery, financial impacts etc.; Access to mineral deposits: Types of access and selection criteria, location, size and shape; Adits, Inclines, Declines, Shafts; Conventional and special methods of excavation, lining, deepening and widening.; Lateral and inclined development of openings to mineral blocks;

Levels, Drive, Drift, Crosscuts, Raising and Winzing etc, Classification and choice of stoping methods, Methods of stoping: open stoping, supported stoping – breast, underhand and overhand stoping, shrinkage stoping, cut and fill stoping method, sub-level stoping; Introduction to caving methods: top slicing, sub-level caving, block caving; Stope mechanization and level interval, Support: Rock bolting, Cable Bolting, Pillar Design; Backfilling: preparation, transportation of mill tailings and filling operation, Safety, Environmental issues and Case studies.

### ABOUT INSTRUCTOR :

Prof. Bibhuti Bhusan Mandal is an Associate Professor in the Department of Mining Engineering, Indian Institute of Technology, Kharagpur, India. He holds a Bachelor,°s Degree in Mining Engineering, M. Tech (Mining Engineering) and Ph.D. (ESE). He also holds the Mine Manager,°s First Class Certificate of Competency issued by the Directorate General of Mines Safety. Dr. Mandal has 22 years of experience in underground mechanized metal mining. Prior to joining I. I. T. KGP, Dr. Mandal worked in Hindustan Copper Limited (HCL/ICC) as Manager (Mines) and in Sikkim Mining Corporation as Deputy General Manager (Tech) and also as Deputy Director in the National Institute of Miners,°s Health, Nagpur (under Ministry of Mines, GoI) conducting and coordinating research on environmental and occupational health of mining community. In India, he has conducted pioneering research on equipment induced human vibration and widely published his research on noise and vibration. He currently teaches underground metal mining and Economics of mining enterprises at IIT Kharagpur.

Prof. Kaushik Dey is an Assistant Professor, Department of Mining Engineering Indian Institute of Technology, Kharagpur, India. He has obtained B.E. (Mining), M. Tech (Opencast Mining) and Ph.D. (Mining) prior to work in the field of Tunneling and Mining sector for few years. Prior to join I. I. T. Kharagpur, Dr. Kaushik Dey was an Assistant Professor in Department of Mining Engineering at National Institute of Technology, Rourkela and at Indian School of Mines, Dhanbad. His research area includes excavation of rock by blasting or by mechanical cutting, mining operations, surface mining, whole body vibration etc. He has published around thirty five research papers in different journals apart from many others presented in the national/international conferences.

### COURSE PLAN :

**Week 1:** Introduction to Metal Mining, their importance, financial impact etc

**Week 2:** Exploration, understanding cut-off grade, dilution, recovery etc

**Week 3:** Access to mineral deposits

**Week 4:** Development of openings

**Week 5:** Development of openings (continued)

**Week 6:** Choice of Stopping methods – qualitative and quantitative analysis

**Week 7:** Stopping methods

**Week 8:** Stopping methods (continued)

**Week 9:** Stopping methods (continued)

**Week 10:** Support technology

**Week 11:** Filling of stopes

**Week 12:** Safety, Environment and Case studies