| Course Type | Course Code | Name of Course | L | T | P | Credit |
|---|---|---|---|---|---|---|
| ESO | MNE 202 | INTRODUCTORY ROCK MECHANICS | 3 | 0 | 0 | 9 |

**Course Objective**

To impart the basic concepts, principles and techniques for developing a deep understanding of theoretical and applied rock mechanics in mining and allied field and to provide an overview of their application in ground control, and geo-engineering design.

**Learning Outcomes**

- Upon successful completion of this course, students will have an understanding of various engineering properties of rocks and soil; engineering behavior of rocks and soil; concept of Stress, strain and failure of rock; strength and deformability of rock mass; response of rock mass and soil to mine excavations; various strata control techniques in mining and rock engineering.
- Able to learn about the basics of theoretical and practical aspects of rock mechanics and its importance in the design & operation of surface and underground excavations for safe & productive mining operations

| Unit No. | Topics to be Covered | Lecture Hours | Learning Outcome |
|---|---|---|---|
| 1 | **Basic concept of stress, strain and failure of rock**<br>• Analysis of stress, Analysis of strain, Constitutive relations, Parameters influencing strength/stress-strain behavior<br>• Failure Criteria for Rock and Rock Mass Classical theories of rock failure: Coulomb's criterion, Mohr's criterion,<br>• Pre-mining state of Stress Stresses in rock mass, Factors influencing the in situ state of stress, Estimating in situ stresses;<br>• Overview of shear strength and compressibility of soil | 17 | Understanding of concepts of stress and strain and failure criteria for rock and rock mass.<br><br>Understanding of concepts of stress and strain; engineering behaviour of rocks and failure criteria for rock and rock mass.<br><br>Understanding of pre-mining stresses in rock and various methods of rock stress determination; its importance in mining applications and design of various surface and underground structures in rock. |
| 2 | **Rock mass Classification and soil characterisation**<br>• Physico-mechanical properties of intact rock<br>• Rock mass classification methods and their applications<br>• Soil classification methods and their applications | 10 | Understanding of various engineering properties of rocks and soil; rock mass classification and soil classification methods and their application in the design of structures in rock and soil |
| 3 | **Response of rock mass and soil to excavation**<br>• Response of rock mass to Excavations Underground, Induced stresses and displacements around single opening in rock mass;<br>• Ground support interaction analysis and reinforcement of ground (rock mass and soil), selection and design of support systems.<br>• Slope Engineering: Slope failure and causes; Basic approaches to slope stability | 9 | The students will learn about the response of rock mass and soil to mine excavations; design principles in rock excavation, selection of mining methods, mine pillar design, selection and design of support systems and rock slope stability analysis and design for various mining applications.<br><br>Understanding of instrumentation and monitoring systems used in surface and |

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| Unit No. | Topics to be Covered | Lecture Hours | Learning Outcome |
|---|---|---|---|
| | analysis and stabilisation<br>• Monitoring of Excavation Stability: Purpose and nature of monitoring, Instrumentation and monitoring systems - Load; Stress and Deformation measuring devices; Interpretation of monitoring data; Practical aspects of monitoring. | | underground mine excavation stability. |
| 4 | • Ground improvement; grouting, fore polling, pre-reinforcement, shotcreteing and other | 6 | Understanding of various ground improvement techniques and methods for safe mining operations |
| | **Total** | 42 | |

**Text Books**

1. Fundamental of Rock Mechanics by Jaeger, J.C. and Cook, NGW
2. Underground Excavation in Rock, Hoek, E and Brown, ET
3. Rock Mechanics for Underground Mining, Brady, BHG and Brown, ET
4. Introduction to Rock Mechanics, Goodman, RE.

**References:**

1. Comprehensive Rock Mechanics, Ed. Hudson
2. Coal Mine Ground Control: Syed Peng
3. Engineering Rock Mechanics-An Introduction and Principles: Pergamon, Hudson, J.P. and Harrison,J.P
4. Principal of Geotechnical Engineering, BM Das