| Course Type | Course Code | Name of Course | L | T | P | Credit |
|---|---|---|---|---|---|---|
| DE1 | **MND 400** | **ROCK EXCAVATION ENGINEERING** | 3 | 0 | 0 | 9 |

| **Course Objective** |
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| To provide advanced insights/concepts into various rock excavation processes applied to mining(surface and underground) and Quarrying |
| **Learning Outcomes** |
| Students will be able to design an excavation system (drilling, blasting and mechanical cutting) to meet the given production requirements in a safe and cost-effective manner. |

| Unit No. | Topics to be Covered | Lecture Hours | Learning Outcome |
|---|---|---|---|
| 1 | **Introduction**: Scope and importance of rock excavation engineering in mining and construction industries; physico-mechanical and geotechnical properties of rocks vis-à-vis excavation method; selection of excavation method. Rock breaking processes: Primary, Secondary and Tertiary, Energy consumption computations | 6 | Scope of rock excavation and the role of rock and rockmass properties in system design and selection, Energy consumption in different systems of excavation |
| 2 | **Drilling**: Advances in drilling equipment, pneumatic versus hydraulic, design and operating parameters of surface and underground drilling; evaluation of drill performance (Penetration rate); DRI, Drill energy utilisation index, mechanism of bit wear; BWI and CLI, bit selection; economics of drilling. | 8 | Design of drilling systems in varied rock conditions and estimating the drill performance parameters. |
| 3 | **Blasting**: Mechanism of rock breakage, pre-splitting, Blast hole pressure measurement, Explosives and their selection criteria (impedance matching); blast design for surface excavations and optimisation; blast initiation systems(timing design); blast performance evaluation; cast blasting; techno-economic and safety aspects of surface and underground blasting, Controlled blasting; advances in blast design for underground excavations: contour blasting; computer aided blast designs. Under water drilling and blasting | 12 | Key factors governing the blast design and explosive/initiating system selection.<br>Design of blasting system in varied rock conditions and estimating the performance parameters applied to surface and underground mining, Tunnelling and Quarrying. |
| 4 | **Rock Cutting**: Theories of rock tool interaction for surface excavation machinery - rippers, dozers, scrapers, BWE, continuous surface miners, auger drills; theories of rock tool interaction for underground excavation machinery - ploughs, shearers, roadheaders, continuous miners and tunnel boring machines; selection criteria for cutting tools; | 13 | Design of cutting systems in varied rock conditions and estimating the performance parameters, Mines, Tunnels and Quarries |
| 5 | **Recent Developments** in rock excavation machinery, advanced rock cutting techniques; high pressure water jet assisted cutting, PCF, Specific energy computations; abrasive jets | 3 | Advanced rock excavation techniques |

**Text Books:**

- Drilling and Blasting by C.L.Jimeno et al.
- Rock Explosives Engineering by Holmberg, Persson and Lee
- The Strength, Fracture, Workability of Coal, Evans and Pomeroy, Pergamon Press

**Reference Books:**

1. Rock blasting operations by Sushil Bhandari
2. Tunnel Boring Machines by N. Barton