| Course Type | Course Code | Name of Course | L | T | P | Credit |
|---|---|---|---|---|---|---|
| DC8 | MNC 300 | SURFACE MINING | 3 | 0 | 0 | 9 |

**Course Objective**

The objective of the course is to provide an in-depth and comprehensive understanding of various types of surface mine operations, their operating principles to establish an efficient and cost effective surface mine design and operation.

**Learning Outcomes**

Upon successful completion of this course, students will:

- have an understanding of surface mining principles of various types of deposits such as stratified and non-stratified deposit in terms of its geological setting and mining methods.
- have an in-depth and comprehensive understanding of various types of equipment systems, continuous and non-continuous, used in Surface mining operations and their corresponding operating methods, such as Shovel-Dumper System, Dragline System, Bucket Wheel Excavator System, Surface Miner System, Dozer System, Scrapper System, Ripper Operation etc.
- have an in-depth understanding about the Economic aspects of various types of surface mining operations such as Shovel-Dumper Operation, Dragline Operation and Surface Miner Operation etc.
- have an in-depth understanding about the operational planning aspects of surface mining equipment systems and their implementations.
- be able to learn about the management of surface mining operation including the application of digital technology to establish an efficient and productive operation.

| Unit No. | Topics to be Covered | Lecture Hours | Learning Outcome |
|---|---|---|---|
| 1 | **Introduction**<br>Surface mining - Basic concepts, Applicability, Advantages and Disadvantages. Role of surface mining in total mineral production. Deposits amenable to surface mining vis-à-vis excavation characteristics, Surface mining unit operations; Surface mining equipment systems – classification, applicability, advantages and disadvantages. | 5 | The students will be exposed to the principles of surface mining operation in terms of geological settings, units of mining operations, surface equipment system etc. |
| 2<br>2.1<br><br><br><br><br><br><br><br><br><br>2.2<br><br><br><br><br><br>2.3 | **UNIT OPERATIONS OF SURFACE MINING**<br>**Ground Breaking Operation**<br>Drill and Blast Operations – Concept, Application, Selection, and limitation.<br>Aspects of Drilling – Size, type, productivity etc.<br>Aspects of blast design and Explosive Selection.<br>Economics of drill and blast operations.<br>Ripping operation – Applicability, Selection, Productivity and limitation. etc.<br>**Loading / Excavating operations**<br>Types of loading equipment, their selection and limitations such as - Shovels, Draglines, Bucket Wheel Excavators, Continuous Surface Miners. Front End Loaders, Scrappers, etc.<br>**Transport / Haulage operations**<br>Type and mode of transport and their selection criteria - Dumpers, Conveyors, and pipe Line | 5<br><br>2<br><br>4<br><br>2 | The students will learn about ground breaking operation of surface mining. Here, the students will be exposed to the basic planning and design of drill and blast operation, the detailed blast design, modelling and simulation etc. will be taught in a separate course of Advance Drilling and Blasting<br><br>The students will be exposed to various types of loading and Excavating equipment, and their principles and economics.<br><br>The students will be exposed to various types of loading and Excavating equipment, their principles and |

| Unit No. | Topics to be Covered | Lecture Hours | Learning Outcome |
|---|---|---|---|
| | Transport System. Operation, Application, Limitations. | 6 | economics. |
| 2.4 | **Dumping operations** Types of dumps and their formation - Internal and external dumps. Design of Dumps. | | The students will learn about the details of dumping operation in a surface mine. |
| 2.5 | **Auxiliary operations of surface mine** Power System, In-pit water management, pumping system, lighting, and communication infrastructure, Slope Stability Monitoring, Production planning, Quality control, Environment management and mine closure, Truck Dispatch system (TDS), Enterprise Resource Planning System (ERP). | | The students will learn about various auxiliary operations of surface mine to establish smooth and efficient operation. They will also be exposed to mine execution technologies such as TDS and ERP for management of surface mining operations. |
| 3 | **Mine Development and Mine Expansion** Opening up of mine – Ore access and box cut operation (location, geometry, design etc. of box cut). Pit expansion and push back operation, types of push back operation and factors affecting the push back operation. | 5 | The students will learn to start a surface mining operation and develop them efficiently. |
| 4 | **SURFACE MINING METHODS AND CORRESPONDING EQUIPMENT SYSTEM** | 2 | |
| 4.1 | Shovel-Dumper System: Mining methods for gently dipping stratified deposit such as Coal and Phosphate. Mining Methods and steeply dipping stratified deposits. | | The students will learn about designing the mining methods of stratified deposits under various geo-mining conditions. |
| 4.2 | Mining methods for extraction of UG developed coal seams. | 4 | The students will learn about designing the mining methods for high bench surface mining operations with Draglines and |
| 4.3 | Mining methods for high bench surface mining operation - (Dragline, Bucket Wheel Excavators etc.) Dragline mining methods: Simple Side casting, Extended Bench including the concepts of dozer push and cast blast. Concept of optimization of Dragline mining methods and | 1 | |
| 4.4 | digging sequence – Introduction of excavator simulation software. | 2 | Bucket Wheel Excavators. |
| 4.5 | Bucket wheel excavator mining methods and operations. | 1 | The students will learn about designing and executing selective mining methods in a surface mine. . |
| 4.6 | **Selective mining technique -** Application of Continuous Surface Miner. Economics of Surface Miner Technology | 1 | The students will learn about the surface mining methods of non-stratified deposits. |
| 4.7 | Mining methods and equipment system for non-stratified deposit. | 1 | The students will learn about the design and application of high-wall mining methods in an open cast coal mine. And Mining of Dimension Stones |
| 4.8 | High-wall mining operations in surface mine. Mining of Dimension Stones - Mining methods and Equipment System. | 1 | |

| Unit No. | Topics to be Covered | Lecture Hours | Learning Outcome |
|---|---|---|---|
| | Introduction to Mining of Asteroids. | | The students will be introduced to the Asteroid Mining System. |
| | **Total** | **42** | |

**Text Books**


1. Surface mining [edited by] Eugene P. Pfleider.American Institute of Mining, Metallurgical, and Petroleum Engineers, 1968, New York
2. Surface mining by Bruce A Kennedy; Society for Mining, Metallurgy, and Exploration (U.S.), Publisher: Littleton, Colo. : Society for Mining, Metallurgy, and Exploration, 1990.
3. Surface Mining Equipment Hardcover –1982 by James W. Martin
4. Surface Mining by G B Mishra
5. Introductory Mining Engineering – Howard L. Hartman and Jan M. Mutamansky, 2002
6. SME Mining Engineering Hand Book (Third Edition) – Peter Darling, 2011


**Reference Books:**


1. Open Pit Mine Planning & Design – W.Hustrulid and M. Kuchta
2. Surface Mining (Second Edition) – Bruce A. kennedy.
3. South African Colliery Manager's Association (SCMA) Hand book – 2005.
4. Technical literatures of various mining software deployed in global surface mining operation Technical research papers on subject.
5. SME Handbook by H L Hartman