

COURSE BOOK : B.Tech(Mining Engg)
(for Admission Batch of 2012 onwards)
Department of Mining Engineering
VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR – 440 011

I. General Information

The department of Mining Engineering is established in the year 1982-83. It offers Bachelor of Technology in Mining Engineering course. The course has been accredited by National Board of Accreditation earlier in 1996, 2001 and 2008 and was granted Grade “A” for five years both the time.

In its 30 years of existence 26 batches of students have passed out with about 450 students graduating. The performance of present and past students is comparable with that of any established institute.

The B Tech in Mining Engineering is a 4 year course run on semester pattern. A weightage of 40% of contact time is given for practical and 60% for theory. Assessment is based on sessional examinations, practical tests, final written examination, internal viva-voce examination, quality of field work, field reports, seminars and project work.. Assessment is 100% internal in case of practicals and 40% internal and 60% external in case of theory. The overall evaluation is 30% by internal assessment and 70% by external assessment. The course is regularly upgraded and now relative grading is in operation. Female candidates have been permitted to take up admission B Tech(Mining) Course. The department also offers M.Tech(by research) and Ph.D. level research

The department is housed in an independent building housing classrooms, laboratories, workshop, seminar and audio-visual rooms, office, stores and other facilities in about 1450 sq.meter area. The department has implemented a number of growth programmes funded by various agencies with a total funding of about 150 lakhs and has acquired good laboratory and computational facilities. A central library caters to the needs of the department.

The core faculty comprises of 1 Professor, 4 Associate Professors and 2 Assistant Professor. The core faculty is supported by 8 faculty members from other departments. The faculty is supported by 7 non-teaching staff.

The department enjoys an excellent rapport with the industry and offers variety of services and accrues about 15-18 lakhs per year as revenue. The faculty is actively involved in student activities, curriculum development, departmental and institutional planning, development and administrative activities, service to industry and society, implementation of growth programs research and development and in creating an enriching work culture.

The department aspires to create an internationally competitive teaching and research environment through faculty development, creation of advanced research facilities, acquiring collaborative projects and attracting scholars, increasing liaison with industry and maintaining a creative work culture.

Vision (Department) :

To create an environment conducive for attaining professional competence in the field of Mining Engineering and to provide specialised training for developing need-based human resource, while fostering within students and staff committed to academic, social and professional development.

Mission (Department) :

To maintain the standard of mining education and commitment for basic research and applied research in the diverse fields of mining, excavation engineering and other interdisciplinary areas and continuously striving to be recognized internationally for education, research and service to the mining and allied industry.

Goals:

- To train students to acquire knowledge in the areas of mining engineering processes, systems and technologies.
- To develop curriculum and instructional programs in mining engineering in tune with need of the time.
- To generate new knowledge through research and development and to disseminate it.
- To modernise laboratories and to establish research facilities in the emerging areas.
- To promote faculty and staff development for updating and acquiring new knowledge and improving professional competence.

- To provide technical services to the mining industry.
- To provide guidance and counseling to students and to establish fruitful linkage with alumni.

Programme Educational Objectives (PEOs):

The graduate shall be able to;

1. Demonstrate the knowledge in the areas of mining engineering processes, systems and technologies looking into industry and research needs by exposing them to the latest technology.
2. Understand the practical aspects of the mining industry and an appreciation for mining as a profession with regards to safety, technology, blasting and environment looking into economics and production.
3. Apply knowledge in the application of engineering principles pertaining to mine planning, decision making and systems and invoke the desire for continuing education, research, intellectual and professional development and creativity.

Programme Outcomes (POs):

1. An ability to design a safe mining practices through understanding various mining subjects.
2. Formulate a system, component, or process to meet desired needs of mining engineers within realistic constraints such as economic, environmental and social.
3. An ability to collaborate with multidisciplinary sciences and its application to mining.
4. Identify and formulate the scheme to solve technical problems.
5. Understanding of professional responsibility and skill.
6. Broad based mining education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context in long term.
7. Recognition of the need for conservation of reserves and development of safe technology survival in global environment.
8. Ability to use the techniques, skills, and modern engineering tools necessary for mining engineering practices.
9. To understand engineering and management principles and its application through most rational approaches for the extraction of minerals.

II. Faculty , Department of Mining Engg. , VNIT, Nagpur

| Name | Qualification | Email - Id |
|--|--|---|
| I. L. Muthreja , Associate Professor & Head | M.Tech(Mine Planning and Design), ISM | muthreja2158@rediffmail.com , ilmuthreja@mng.vnit.ac.in |
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III Scheme of Examination : B,Tech : Branch Mining Engg. Four year/Eight Semester Course

Following is the credit requirement. Each subject or course has certain number of credits. The student has to complete credit requirement of 320 to be eligible for the B.Tech. Core courses are mandatory, where as student will have the option to select the subject from the subjects offered.

| Undergraduate Core (UC) | | Undergraduate Elective (UE) | |
|-------------------------|--------|-----------------------------|--------|
| Category/Courses | Credit | Category | Credit |
| Basic Sciences (BS) | 36 | Dept.Electives(DE) | 62-80 |

| | | | |
|------------------------------------|------------|------------------|------------|
| Engineering Arts and Sciences (ES) | 42 | Open Courses(OC) | 0-6 |
| Humanities and Social Sciences(HU) | 10 | Humanities(HM) | 0-12 |
| Dept. Core(DC) | 152 | - | - |
| Sub Total | 240 | Sub Total | 80 |
| Grand Total UC + UE | | | 320 |

I Sem. and II Sem. are common to the all branches of Engineering

| Course Code | Course | L-T-P | Credit | Remarks |
|----------------------------|------------------------|-------|-----------|----------|
| Basic Sciences (BS) | | | | |
| PHL101 | Physics | 3-0-0 | 6 | I/II Sem |
| PHP101 | Physics | 0-0-2 | 2 | I/II Sem |
| CHL101 | Chemistry | 3-0-2 | 6 | I/II Sem |
| CHP101 | Chemistry | 0-0-2 | 2 | I/II Sem |
| MAL101 | Mathematics – I | 3-1-0 | 8 | I/II Sem |
| MAL102 | Mathematics – II | 3-0-0 | 6 | I/II Sem |
| | Total (BS) Core | | 36 | |

(L-T-P : weekly classes of Lecture-Tutorial-Practical)

| Engineering Arts and Sciences (ES) | | L-T-P | Credits | Remarks |
|------------------------------------|------------------------|-------|-----------|----------|
| AML151 | Engineering Mechanics | 3-0-0 | 6 | I/II Sem |
| AMP151 | Engineering Mechanics | 0-0-2 | 2 | I/II Sem |
| EEL101 | Electrical Engineering | 3-0-0 | 6 | I/II Sem |
| EEL101 | Electrical Engineering | 0-0-2 | 2 | I/II Sem |
| MEC101 | Engineering Drawing | 3-2-0 | 8 | I/II Sem |
| CSL101 | Computer Programming | 3-2-0 | 8 | I/II Sem |
| MEP102 | Workshop | 0-0-4 | 4 | I/II Sem |
| | Total (ES) Core | | 42 | |

| Humanities and Social Sciences(HU) Core | | | | Remarks |
|---|----------------------|-------|-----------|--------------|
| HUL101 | Communication Skills | 2-0-2 | 6 | I/II/III Sem |
| HUL102 | Social Science | 2-0-0 | 4 | I/II/III Sem |
| | Total HU Core | | 10 | |

| III Semester | | | | IV Semester | | | |
|--------------|------------------------------------|-------|---------|-------------|----------------------------------|-------|---------|
| UG CORE | | | | UG CORE | | | |
| Code | Course | L-T-P | Credits | Code | Course | L-T-P | Credits |
| CEL284 | Mining Geology | 3-0-0 | 6 | MNL262 | Mine Surveying | 3-0-0 | 6 |
| CEP284 | Mining Geology | 0-0-2 | 2 | MNP262 | Mine Surveying | 0-0-2 | 2 |
| MNL261 | Introduction to Mining Technology | 3-0-0 | 6 | MNL263 | Underground Metalliferous Mining | 3-0-0 | 6 |
| MEL291 | Mechanical Engg | 3-0-0 | 6 | MNL264 | Mining Machinery - I | 3-0-0 | 6 |
| | | | | MNP264 | Mining Machinery - I | 0-0-2 | 2 |
| | | | | MAL404 | Probability and Statistics | 3-0-0 | 6 |
| | UG Electives | | | | UG Electives | | |
| MNL473 | Mine Management Information System | 3-0-0 | 6 | CEL384 | Advanced Mining Geology | 3-0-0 | 6 |
| MNL471 | U/G space technology | 3-0-0 | 6 | CEP384 | Advanced Mining Geology | 0-0-2 | 2 |
| | Open Courses | | | EEL285 | Industrial Electrical Engg | 3-0-0 | 6 |
| | HM | | | | Open Courses | | |

| V Semester | | | | VI Semester | | | |
|------------|---|-------|---------|-------------|---|-------|---------|
| UG CORE | | | | UG CORE | | | |
| Code | Course | L-T-P | Credits | Code | Course | L-T-P | Credits |
| MNL362 | Mining Machinery II | 3-0-0 | 6 | MNL267 | Underground Coal Mining | 3-0-0 | 6 |
| MNL265 | Mine Ventilation and Climate Engineering | 3-0-0 | 6 | MNL268 | Surface Mining | 3-0-0 | 6 |
| MNP265 | Mine Ventilation and Climate Engineering | 0-0-2 | 2 | MNL363 | Mine Hazards and Rescue | 3-0-0 | 6 |
| MNL266 | Rock Engineering | 3-0-0 | 6 | MNP363 | Mine Hazards and Rescue | 0-0-2 | 2 |
| MNP266 | Rock Engineering | 0-0-2 | 2 | MNL364 | Ground Control In Mines | 3-0-0 | 6 |
| MML385 | Mineral Processing/Dressing | 3-0-0 | 6 | MNP364 | Ground Control In Mines | 0-0-2 | 2 |
| | | | | MNC366 | Survey Camp (Sessional) | 0-0-2 | 2 |
| | UG Electives | | | | UG Electives | | |
| MNL469 | Mass Production Technology for underground Coal | 3-0-0 | 6 | MNL467 | Geostatistics | 3-0-0 | 6 |
| MNL468 | Advanced Mine Surveying | 3-0-0 | 6 | MNL475 | Blasting Technology for mining & Const. | 3-0-0 | 6 |
| MNL468 | Advanced Mine Surveying | 0-0-2 | 2 | MNP475 | Blasting Technology for mining & Const. | 0-0-2 | 2 |
| MNL480 | Advanced UG Metal Mining & Design | 3-0-0 | 6 | MNL477 | Novel Mining Methods | 3-0-0 | 6 |

| VII Semester | | | | VIII Semester | | | |
|--------------|----------------------------------|-------|---------|---------------|--------------------------------|-------|---------|
| UG CORE | | | | UG CORE | | | |
| Code | Course | L-T-P | Credits | Code | Course | L-T-P | Credits |
| MNL461 | Surface Mine Environment | 3-0-0 | 6 | MNL462 | Mine Legislation and Safety | 3-0-0 | 6 |
| MNP461 | Surface Mine Environment | 0-0-2 | 2 | MNL463 | Mine Management | 3-0-0 | 6 |
| MNL474 | Computer Applications in Mining | 3-0-0 | 6 | MNL470 | Mine Planning | 3-0-0 | 6 |
| MNP474 | Computer Applications in Mining | 0-0-2 | 2 | MND452 | Project Phase -II | 0-0-4 | 8 |
| MNL464 | Mining Economics | 3-0-0 | 6 | MNC462 | Training Seminar (Sessional)** | - | 4 |
| MND451 | Project Phase -I | 0-0-2 | 4 | | | | |
| MNC461 | Mine Visits (Sessional)* | 0-0-2 | 2 | | | | |
| | UG Electives | | | | UG Electives | | |
| MNL465 | Mine System Engineering | 3-0-0 | 6 | MNL472 | Mine Safety Engineering | 3-0-0 | 6 |
| MNL466 | Rock Excavation Engineering | 3-0-0 | 6 | MNL478 | Mine Automation | 3-0-0 | 6 |
| MNL476 | Rock Slope Engineering | 3-0-0 | 6 | | | | |
| MNL479 | Advanced Surface Mining & Design | 3-0-0 | 6 | | | | |

NOTE: Theory and Practical should be cleared separately and Grades will be awarded separately

* Three mine visits during the course
 ** Three trainings of one month duration each in opencast, underground coal and underground metal mines during the course

MINING DEPARTMENT
AS PER SCHEME IMPLEMENTED WITH EFFECT FROM ADMISSION BATCH
2012

B.TECH. MINING ENGINEERING: Syllabus

MINING DEPARTMENT
(AS PER SCHEME IMPLEMENTED WITH EFFECT FROM ADMISSION BATCH 2012)

B.TECH. MINING ENGINEERING: Syllabus

Sub code – CEL284 (3-0-0)

Sub- Mining Geology

Course Objectives :

To Understand the Internal structure of earth
Teach fundamental geomorphic and dynamic processes on the Earth
To know about the rocks and minerals and their properties.
To study various geological structures and impacts on mining
To Know prospecting and subsurface exploration methods
To generate the sub surface profiles from geological maps and plotting structures.

Content: Introduction to science of Geology; its various branches and its application in mining engineering. Geotectonics: internal structure of earth, Continental Drift theory and Plate Tectonics, Isostasy, Earthquakes, Earthquake and seismic zones in India and Volcanism.

Structural Geology: Mode of rock failure and mechanism of deformation. Attitude of strata, Dip : True and apparent, Strike. Folds : Elements, terminology, descriptive, morphological and genetic classification. Joints : Classification, joint mapping, frequency diagrams. Faults: Mechanism of formation, elements, terminology, geometric and genetic classification.

Mineralogy: Definition and classification of Minerals. Silicate structures. Structure, chemical and physical properties of following mineral groups; Silica, Felspar, Pyroxene, Amphibole, Mica and Clay minerals.

Petrology : Introduction to Petrology, Rock Cycle, Rock forming Minerals. Igneous petrology; Elementary knowledge of Magma and its consolidation & rock formation. Mode of occurrence, textures, structure, classification of Igneous, Sedimentary and Metamorphic rocks.

Stratigraphy: Principles of stratigraphic Correlation, Stratigraphic units and Geological Time Scale.

Principles of Prospecting and Exploration, Geophysical and geochemical prospecting

Economic Geology, Study of important metallic and non-metallic deposits of India. Introduction to geology of Indian Coalfields

Reference Books

- | | |
|--|-----------------------|
| 1. Engineering Geology | : B.S.S. Narayanswamy |
| 2. Principles of Engineering Geology | : KVGK Gokhale |
| 3. Fundamentals of Engineering Geology | : F.G.Bell |
| 4. Structural Geology | : M.P. Billings |
| 4. Principles of Stratigraphy | : Ravindra Kumar |
| 6. Courses in Mining | : RNP Arogyaswamy |

Course Outcomes:

The students will be able to

1. Understand the Internal structure of earth and structural geology
2. Know about the rocks and minerals and their properties.
3. Understand various geological structures and impacts on mining
4. Generate the sub surface profiles from geological maps and plotting structures.

Sub code-MNL261(3-0-0)

Sub – INTRODUCTION TO MINING TECHNOLOGY

Course Objectives :

Students will be made aware about the rudimentary aspects of mining engineering
Imparting knowledge of basic mining operations and unit operations about the mechanisation

Contents:

Introduction: Important mineral resources, Importance of Mining and its consequences.

Basic terminology : Surface Mining, Underground coal and metal such as Mine, Mining, surface mining, underground mining, mineral, rock, ore, mineral deposit, beds, coal seam, veins, strike and dip, hanging wall, footwall, bench, haul road, bench slope, pit slope, overburden, dump, stripping ratio, shaft, adit, incline, tunnel, cross cut, drift, level, winze, raise, stope, dip and rise, level, face, panel, pillar, gallery, roadway .

Phases of mining: Prospecting to reclamation

Brief description of elements of an opencast mine; ramp, haul roads, benches, production cycle, dumping of overburden and backfilling. Brief description of Board and Pillar development, and Longwall (advancing and retreating) methods of coal mining.

Introduction to underground metal mining methods. Brief description of underhand, overhand, cut and fill, and sub level stoping methods of metal mining.

Introduction to Oil Mining Opening up of deposits; mode of entry- adit, shaft, decline, and combined model ; their applicability and comparison.

Drifting : Small and medium size tunneling and drifting; drivage work in varying ground conditions using conventional methods – drilling, blasting, mucking, transportation, supports, services and cycle of operations
Mechanical methods of drivage of roadways and tunnels

Shaft sinking : site selection, shaft sinking preparatory arrangements, drilling and blasting, mucking, hoisting, ventilation, pumping, lighting, supporting of sides, complete cycle of operations, special methods of sinking to be used in difficult ground conditions, deepening and widening of shafts, modern techniques of shaft sinking
Drilling for production of minerals from surface and underground mines, rotary, percussive and rotary-percussive drilling, short and long hole drilling equipment, mechanism of drilling, different types of bits, bit wear, drilling performance

Explosives; types of explosives- their composition and properties; selection of explosives; manufacture, transport, storage and handling of explosives; testing of explosives, destruction of explosives

Blasting: Mechanism of rock fragmentation by blasting; blasting accessories, exploders; blasting practices in opencast and underground mines

Reference Books

Introductory Mining Engineering :H L Hartman

Coal Mining Methods :S K Das

SME Mining Engineer's Handbook :Hustrulid

Course Outcomes:

The students will be able to understand the

1. Basic terminology of mining and mechanics of blasting
2. Various phases of underground and open cast mining
3. Various operations involved in drifting and shaft sinking
4. Various types of explosive and their use in mines

Sub code-MEL291 (3-0-0)

Sub-MECHANICAL ENGINEERING

Contents:

Power Transmission General Principles; Power transmission by belts [flat and V], ropes, chains and gears. Ratio of tensions, centrifugal tension, slip and creep in belts [explanation of terms only.] Power transmitted by belts. [When C.F. tension is neglected] and chain drives; power transmitted by chains, simple problems; Belt and rope materials, power transmitted by gears, type of gears.
Brakes and Dynamometers: Band brake, block brake, band and block brake, single and multiple disc clutches, transmission and absorption type dynamometers.
Bearings and Couplings: Main types of bearings and couplings, anti friction bearings.

Lubrication: Laws of friction for dry and lubricated surfaces, methods of lubrication of bearings

Thermodynamics : Laws of thermodynamics, concept of entropy, methods of heating and expansion of gases, internal energy, external work done, total heat of gas, change of entropy during different methods, representation on PV and TQ diagram.

Air Standard Cycles : Carnot, Otto, Diesel and Joule's cycles. Air Standard efficiencies, and mean effective pressure, representation of PV and TQ diagram.

Internal Combustion Engines : Classification based on types of fuel and working cycles, working of four stroke and two-strokes cycles. IC Engines; Their merits and demerits, study of parts of petrol and diesel Engine viz. fuel pump, injector and carburetor, Brief description of ignition system, cooling system, and lubrication system of IC Engines. Study of multi-cylinder engines. PV diagram, testing of IC engines, and thermal efficiencies, simple problems.

Air Compressors : Reciprocating and Rotary compressors single and multistage compressors, inter cooler, after cooler, receiver clearance volume and volumetric efficiency. Refrigeration and air conditioning: Bale –Coleman refrigerators, vapor compression and absorption refrigerators, psychrometry charts, introduction to comfort air-conditioning

Reference Books

| | |
|----------------------------|------------------|
| Theory of Machines | : S.S.Ratan |
| Theory of Machines | : Shigley |
| Engineering Thermodynamics | : P.K.Nag |
| Thermal Engineering | : P.L.Ballaney |
| Thermal Engineering | : V.M.Domkundwar |
| Theory of Machines | : R.S.Uhurmi |

Course Outcomes:

The students will be able to understand the

1. General Principles of Power Transmission
2. Concepts of Thermodynamics and Internal Combustion Engines
3. Air Standard Cycles and Air Compressors

Sub code-MNL262 (3-0-0)

Sub-MINE SURVEYING

Course Objectives :

Students will be given the basic idea of principles of surveying and mine surveying
Students will be trained in handling the various survey instruments used in general and mine survey, through practicals and demonstrations.

Contents:

Surveying: Definition, objective, classification and principles of surveying. Linear measurement: Instruments for measuring distances, ranging survey lines. EDM: Principle of measurement; types; corrections; selection of equipment; total station. Miner's Instrument: Miners' Dial, Abney level, Clinometers, Suspension Compass, and Gyro-theodolite:

Angular measurement: Prismatic compass - principle and construction; bearing of lines; local attraction; magnetic declination. Theodolite: Essentials of the transit and modern micro-optic theodolite; measurement of horizontal and vertical angles; theodolite traversing, traverse calculations, adjustment of the traverse; computation of co-ordinates; temporary and permanent adjustments.

Levelling: Definition of leveling terms; leveling instruments; different types of leveling; booking and reduction methods; differential, profile, cross-sectional and reciprocal leveling; underground leveling; shaft depth measurement. Contours: Characteristics, methods of contouring and uses of contours; problem solving.

Control Surveys: Tacheometry:- Principle and classification of tachometry; stadia tachometry; distance and elevation formulae. Triangulation: classification, reconnaissance, measurement, procedures for angles and base-line; GPS and its application in mine surveying. Theory of errors, Calculation of most probable values, adjustment of observations.

U/G Surveying: - Correlation: Methods of correlation - direct traversing in inclined shaft, correlation in vertical, single and two shafts. Stope Surveying: Purpose, methods of survey in moderately and steeply inclined ore bodies, flat and vertical ore bodies/seams.

Curve setting: Elements, laying of simple circular curves on surface and belowground. Transition curve and super elevation. Development surveys: Setting a point of known coordinate, control of direction and gradient in drifts, tunnels, raises and winzes; application of lasers; Problems of underground traversing. Legal requirements as to mine plans in India, preparation and preservation of plans and sections, representation of geological and other features on mine plans and sections

Reference Books

1. Surveying Vols. I, II, III :Dr. B.C.Punmia
2. Surveying Vol I and II :Dr T.P.Kanetkar
3. Metalliferous Mine Surveying :Winniberg

Course Outcomes:

The students will be able to understand the

1. Basic terminology of Surveying
2. Various types of levelling
3. Various operations involved field surveying and curve setting.

UNDERGROUND METALLIFEROUS MINING

Course Objectives:

- Gives understanding of metal mining methods with respect to development and extraction
- Provides methodology for selection of metal mining methods, methods of driving underground openings
- To appraise the special mining techniques and problems

Contents:

Present status of Indian metal mining industry, scope and limitations of underground mining; classification and choice of stoping methods

Choice of level interval and block length- shape, size, position ; excavation and equipping of shaft station, grizzly, ore/waste bin, main orepass system, underground crushing and loading stations, underground chambers, sump and other subsidiary excavations; arrangements for dumping into main orepass

Cross-cuts, drifts, and declines: their shape, size and position

Raises and winzes - their shape, size and position; excavation process -ground breaking, mucking, ventilation and support; modern methods of raising - Alimak and longhole method including vertical crater retreat method of raising, raise boring - systems and their details; modern methods of winzing;

Secondary breaking at grizzly - conventional and mechanized methods

Open stoping – room and pillar, sublevel, large diameter blast hole/DTH, shrinkage and vertical crater retreat methods - their applicability, stope layouts, stope preparation, ground breaking, mucking, ventilation and supporting, haulage and dumping

Supported stoping – post and pillar, square set, longwall, cut and fill- their applicability, stope layouts, stope preparation, ground breaking, mucking, ventilation and supporting, haulage and dumping

Caving stoping – top slicing, sublevel caving, and block caving; their applicability, stope layouts, stope preparation, ground breaking, mucking, ventilation and supporting, haulage and dumping

Mining of parallel and superimposed veins Pillar recovery

Dilution, loss and recovery in stoping

Specialised methods : Solution mining, in-situ leaching, borehole mining, underground retorting

Problems of deep mining and their remedial measures, design and layout of stopes in rock burst prone areas

**Reference Books: **

- 1 Introductory mining engg :by H.L.Hartman
2. Underground mining methods handbook, :by Hustrulid SME publication
3. Metalliferrous mining of ores :by Borosov et.al.
4. SME Mining Engineering Handbook, Edited :by H.L.Hartman SME publication

Course Outcomes:

1. Students will gain the knowledge about various development headings, opening with their shape, locations and its driving technology
2. Students can will learn about the unit operations and stoping parameters through models and visuals
3. Students will develop a skill to select the method of metal mining based on geomining parameters

Sub code-MNL264(3-0-0)

Sub-MINING MACHINERY-I

Course Objectives :

Students will be imparted the knowledge about mining machinery used for transport of mineral and materials on surface and underground.

students will be trained through assignments, demonstration and practicals through study of models

Contents:

Pit-Top and Pit-Bottom Circuits : Simple pit-bottom circuits, pit-top circuits, tippers, screening and handling plants, railway sidings.

Wire Ropes : Wire ropes of different types and their construction and selection, space factor, fill factor, bending factor and factor of safety. Rope deterioration, estimation of size of rope, rope capping, recapping and rope splicing.

Heat Treatment: Heat Treatment of steel and steel alloys, properties, uses and application. Rope

Haulages : Types of rope haulages, selection, computations, and safety devices. Mine tubs, mine cars, links, clips and rope capel. Application of rope haulages. Track laying and maintenance.

Locomotives: Different types ; diesel, electric trolley wire , construction and operation, application and maintenance. Locomotive haulage computations, safety devices. Track laying and maintenance Manriding systems in underground mines: Types, construction and safety devices. Conveyors: Construction and operation of belt, chain and cable belt conveyors. Conveyor computations. High angle conveyors, shiftable conveyors, Head frames; types and fittings. Shaft fittings; signals, guides, Keps, tilting platform, cage receivers, protective roofing. Suspension gear, cages, and skips.

Winding : Drum and friction winding with their variations and limitations, duty cycle, torque time diagrams and computations. Multilevel and deep winding. Drives for winding.

Safety devices on winders; emergency braking, over speed control, slow banking, depth indicators, automatic contrivances. Aerial ropeways: Types, construction, application and operation, safety devices.

Reference Books

Mine Winding & Transport : Walker
SME Mining Engineer's Handbook : Hustrulid
Underground Mining Methods Handbook : Hustrulid
Mine Hoisting : M.A.Ramlu, Oxford & IBH, 1996

Course Outcomes:

The students will be able to

1. Understand various surface layouts, wire ropes construction and size selection and its deterioration
2. Transport systems in mines – its various features in detail, safety devices, braking systems and related calculation.
3. Winding systems in mines – drum winder. There important features –construction, mechanical & electrical braking, safety features and torque time diagram.
4. Winding systems in mines – friction winder There important features –construction, mechanical & electrical braking, safety features and torque time diagram.
5. Aerial Ropeway – construction, safety features and calculation.

Sub code-MNL265 (3-0-0)

Sub-MINE VENTILATION AND CLIMATE ENGINEERING

Course Objectives :

To develop expertise in designing ventilation system for an underground mine.

To develop cost effective planning of a ventilation system.

Contents:

Composition of Mine Atmosphere: Mine gases - production, properties, effects and detection; sampling and analysis of mine air; methane content; methane drainage; methane layering; flame safety lamp and its uses; methanometer; radon gas and its daughter products; continuous monitoring of gases

Heat and humidity : Sources of heat in mines; effects of heat and humidity; psychrometry, kata thermometer; heat stress, air-conditioning

Natural ventilation : Seasonal variations, calculation of NVP from air densities and thermodynamic principles

Air Flow through Mine Openings: Laws of flow, resistance of air ways, equivalent orifice, distribution of air; flow control devices; automation and remote control of ventilation installations; ventilation surveys; permissible air velocities in different types of workings

Mechanical Ventilation : Types of mine fans; theory, characteristics and suitability of fans; selection, testing and output control; fans in series and parallel; forcing and exhaust configurations; reversal of flow; fan drifts, diffusers, evasees

Ventilation planning: Planning of ventilation systems and economic considerations; ventilation layouts for mining of coal and ore deposits; ventilation of workings/stopes using heavy blasting; calculation of air quantity required for ventilating a mine; calculation of total mine head; network analysis principles and computer applications

Booster fans, auxiliary ventilation, recent developments in mine ventilation, venturi blowers; ventilation of deep mines - underground and open pit; standards of ventilation; ventilation cost calculations

Reference Books:

Mine Ventilation : G. B. Mishra
Sub-surface mine ventilation : Macperson
Mine ventilation and air-conditioning in mines : Harman

Course Outcomes:

The students will be able to understand the

1. Various gaseous pollutants including radon gas in metalliferous and coal mines. Their toxic effects, detection and means of their reduction in mine atmosphere. Statutory requirement of ventilation standards to be maintained.
2. Salient features of heat and humidity, their effect on working efficiency of miners, measurement and reducing both to tolerable limits.
3. Natural ventilation and its limitations. Types of Mechanical ventilators, various ventilation devices, selection, installation, working and necessary calculation including expenditure and necessary statute.
4. Live case studies of mine ventilation, quantity & necessary pressure requirement, ventilation planning in underground coal and non-coal mines, auxiliary ventilation devices for improvement in ventilation.
5. Computer application in solving complicated ventilation circuits and special problems associated with deep underground and deep opencast mines.

Sub code-MNL266 (3-0-0)

Sub-ROCK ENGINEERING

Course Objectives :

Mining structures are made in the rock hence rock characterization and support design becomes immense need of mining graduates. Behaviour of rock is governed by rock properties and structural discontinuities in the rock. The students are acquainted with the determination of the strength properties of, both absolute and index properties

Contents :

Introduction, Intact rock and Rock mass Properties: Introduction to Rock Mechanics; Determination of physical properties, strengths, strength indices and static elastic constants; parameters influencing strength; abrasivity, hardness .

Concept of stress and strain in rock, Analysis of stress, strain and constitutive relations in isotropic and anisotropic rocks. Introduction to elementary rock mass classifications based on strength, hardness, RQD.

Static and Dynamic properties of rock and rock mass, Determination of strength properties of rock, determination of dynamic properties of rock Propagation of elastic wave in rock media; determination of properties and elastic constants. Creep deformation and strength behaviour, creep test and rheological models, Failure criteria for rock and rock mass : theories of rock failure; Coulomb, Mohr and Griffith criteria; empirical criteria.

Stresses in Rock and Rock reinforcement techniques: In situ stresses, methods of determination including over-coring and hydro-fracturing methods. Terminology used in rock reinforcement, pressure arch theory, support and reinforcement principles and design; classification of mine supports

Distribution of stress patterns around mine openings. Introduction to methods of stress analysis. Predictive methods for mine design, principles of classical stress analysis, closed form solutions for simple excavation shapes

Introduction to computational methods of stress analysis - rock modeling, analytical and physical modeling, finite element, boundary element, distinct element methods and hybrid computational schemes.

Physico-mechanical properties of soil: Physical properties including consistency and gradation; classification of engineering soils; engineering properties of soils, compressibility, consolidation, compaction and strength.

Reference Books:

Manual on rock mechanics : Ramamurthy & Sharma , CBIP Publ.
Rock Engineering : John Franklin and Maurice Dusseault, McGraw-Hill Publ. comp
Rock Mechanics for hard rock mining : Jumikis

Course Outcomes:

1. To make students conversant with different types of rock mass with regard to design of excavations and methods of designing
2. To acquaint students with various types of supports and reinforcements as well as permanent supports of excavations
3. To make them conversant with ground control and subsidence problems and preventive measures.
4. To understand the knowledge basic of stress analysis, rock modelling and soil mechanics to be applied for design of rock structures.

Sub code-MNL362 (3-0-0)

Sub-MINING MACHINERY-II

Course Objectives :

To acquaint the students with various types of surface and underground mining and modern mechanical excavation machines

Contents:

Coal cutting machines, shearers, coal ploughs, lump breakers, road headers, TBMs, raise and shaft borers, continuous miners, stage loaders; their main features and applicability
Loading machines - rocker shovel, SDL, LHD, gathering arm loader, shuttle car, LPDTs, scraper ; their main features, applicability, selection and production capacities
Opencast Machinery - Shovels, draglines, dumpers, wheel loaders; their main features, applicability, selection and production capacities;
Underground coal and rock drills, jumbo drills, rock bolting machines.
Small and large diameter surface blasthole drills, rippers and scrapers, road graders, dozers; their construction, application, selection, and operation
Continuous surface mining equipment- bucket wheel excavators, surface miners, spreaders, dredging equipment; their main features, applicability, selection and production capacities
Pumps : Types of mine pumps, application and related computations.
Miscellaneous Mining Equipment: Power pack and Hydraulic System, Truck Despatch System, Stacker Reclaimer, Rock Breakers, Impact Hammers, Slurry Pumps, Equipment used in Shaft Sinking, In-pit Crushers

Reference Books :

SME Vol on Underground Mining Methods Handbook Ed. Hustrulid
E. Lopez Jimeno, C. Lopez Jimeno, Ayala Carcedo

Drilling and Blasting of Rocks, 1995, CRC Press
Ratan Raj Tatiya

Surface and Underground Excavations – Methods, Techniques and Equipment, Taylor & Francis (2005)

Surface Mining Equipment by JW Martin, TJ Martin, TP Bennett, KM Martin; Publ – Martin Consultants, Inc, Golden Colorado 80402

Course Outcomes:

The students will be able to

1. Understand the necessity, construction, applications and selection of various winning machines in underground excavation including, coal formation and tunnels.
2. Understand the necessity, construction, applications and selection of various loading machines in underground excavation including coal formation and tunnels.
3. Understand the necessity, construction, applications and selection of various drilling machines in underground & surface excavation along with roof bolting machines.
4. Understand the necessity, construction, applications and selection of various surface mining machines.
5. Understand the necessity, construction, applications and selection of various ancillary equipments. Construction and selection of various type of pumps used in underground and opencast mines and calculations.

Sub code-MML385 (3-0-0)

Sub-MINERAL PROCESSING

Course Objectives :To acquaint the students with
identification of Ores/Minerals
working principle and mechanism of Crushing and Grinding Operations
separation of minerals by Jigging, Tabling and Heavy media separation
froth flotation operation for upgradation of ores/minerals, Electrostatic/Magnetic separation operations

Contents:

Mineral beneficiation and its role in mineral exploration and conservation with special reference to Indian economic minerals

Theory and practice of crushing and grinding, conventional units and their performance and choice

Laboratory techniques, interpretation and plotting of data, industrial screens and classifiers, dry and wet processes

Importance of sampling and methods used in mills

Picking, washing and classification

Theory and applications of sinks and float, jigging and flowing film concentration-methods and equipment used.

Physico-chemical principles, flotation reagents, flotation machines and circuits, application to common sulfide, oxide and oxidized minerals

Principles, operation and field of application.

Dewatering and drying : thickening, filtration and drying.

Methods of coal washing, washability curves

Simplified flowsheets for the beneficiation of coal and typical ores of copper, lead, zinc, iron and manganese with special reference to Indian deposits

Brief description of leaching methods.

Course Outcomes:

The students will be able to

1. Understand the working principle and mechanism of Crushing and Grinding Operations
2. Understand the basic principles of separation of minerals by Jigging, Tabling and Heavy media separation
3. Understand froth flotation operation for up gradation of ores/minerals, Electrostatic/Magnetic separation operations

Sub code-MNL363 (3-0-0)

Sub-MINE HAZARDS AND RESCUE

Course Objectives:

to make students conversant with types of hazards viz. Fires, Explosion and Inundation which can take place in underground mines

to give knowledge in details about the causes and mitigation measures for each of the hazard

to provide details of rescue operations to be conducted in mines after disasters

to make students understand problems of mine dust and illumination including the assessment and mitigating measures

Contents:

Mine Fires : Causes of mine fires; spontaneous combustion - mechanism, susceptibility indices, factors affecting spontaneous combustion; detection and prevention of spontaneous heating; accidental fires – causes and prevention; dealing with mine fires - direct and indirect methods, fire stoppings; fires in quarries, coal stacks and waste dumps.

Mine Explosions : Firedamp and coal dust explosions – mechanisms, causes and prevention; stone-dust and water barriers; investigations after an explosion.

Inundation : Causes and prevention, precautions and techniques of approaching old workings; safety boring apparatus, pattern of holes; design and construction of water dams, shaft dams, emergency bulk heads, strengthening of dams

Rescue and Recovery : Rescue equipment and their uses, rescue stations and rescue rooms; organization of rescue and recovery areas, re-opening of sealed-off workings

Illumination in mines- it's effect on safety, efficiency and health ; common types of safety lamps & their uses and limitations, maintenance and examination of lamps, their charging, cleaning, lighting, re-lighting ; lamp room design and organization; lighting from mains – different types of illumination devices; illumination of pit bottoms, main roads, faces, pump houses and haulage rooms; standards of illumination in underground and opencast mines
Airborne respirable dust in underground mines - generation, dispersion, measurement and control; classification, physiological effects, dust measurement, sampling of air-borne dust

Course Outcomes:

1. To familiarize with the concept of hazards in mines and rescue operations
2. To understand the basic mechanism of hazards
3. To develop the ability of analyzing complex engineering problems associated with hazards
4. To be competent in designing components and processes dealing with hazards.

Sub code-MNL364 (3-0-0)

Sub-GROUND CONTROL IN MINES

Course Objectives :

To make students conversant with different types of rockmasses with regard to design of excavations and methods of designing

To acquaint students with various types of supports and reinforcements as well as permanent supports of excavations

To make them conversant with ground control and subsidence problems and preventive measures

Contents:

Design and Stability of Structures in Rock : Intact rock and rock mass classification systems; criteria for design and support of underground excavations; energy released by making an underground excavation; design of single and multiple openings in massive, stratified and jointed rock mass; Estimation of support requirement.

Mine pillars and their classification, pillar stresses, pillar design, stability analysis of pillars.

Timber and Steel support: Prop/post, various types of chocks, cross bars, lagging, forepoling; load bearing capacity of timber supports; setting up of timber supports, bulkheads, treatment and preservation of timber. Steel set - rigid and yielding types; shaft tubbing, wire mesh, steel lining, screw jacks and ratchet jacks; improvised steel props, friction props, hydraulic props; link bars and chocks, powered supports

Active Supports: Rock bolts and dowels - different types and uses; mechanics of bolting. Anchored rockbolts Slot and wedge type, expansion shell type, grouted point anchor type. full column anchors, wooden and fiberglass dowels, mechanical full column anchors, split sets/friction rock stabilizers, installation and testing of rock bolts. Cable bolting — its installation and applications.

In situ constructed support - Poured monolithic and reinforced concrete lining; guniting and shotcreting. Materials of backfill and their procurement; sand gathering plant; theoretical aspects of slurry transportation; preparation, transport and placement of hydraulic backfill with and without cement; rock and concrete fills; surface arrangement for storage and mixing; pneumatic and mechanical methods of backfilling.

Subsidence : Causes and impacts of subsidence; mechanics of surface subsidence, discontinuous and continuous subsidence; monitoring, prediction, control and management of subsidence.

Caving of Rockmass : Caving characteristics of rocks; cavability index. Rockburst : Phenomenology of rockbursts; prediction and control of rockbursts; bumps and gas outbursts.

Surface Mine Slope Stability : Types of mine slope; influence of pit slope on mine economics; common modes of slope failure; factors influencing slope stability; slope stability assessment techniques; stability of analysis of slopes; measures to enhance slope stability; protection and monitoring of slopes.

Reference Books :

Hoek, E and Brown, E.T. (1980) : Underground Excavation in Rock, The Institution of Mining and Metallurgy, London

B.H.G.Brady, E.T.Brown : Rock Mechanics for Underground Mining, George Allen & Unwin, London

M. Jeremic : Strata Mechanics in Coal Mines (1985), Taylor & Francis

Course Outcomes:

The students will be able to

1. Classify the rock based on their engineering properties
2. Understand applicability of different types of supports.
3. Understand various phases of stowing and back filling.
4. Predict and control the subsidence, rock burst and bumps
5. Analyze the stability of slopes

Sub code-MNL267 (3-0-0)

Sub-UNDERGROUND COAL MINING

Course Objectives :

Gives understanding of coal mining methods with respect to development and extraction
- Provides methodology for selection of coal mining methods, methods of driving underground openings
To appraise the special mining techniques and problems

Contents

Introduction ; status of coal reserves, grade and rank of coals available in India, status of coal mining in India, mining conditions in Indian coalfields; choice of mining methods

Development: Bord and Pillar, and Room and Pillar Mining; design of bord & pillar workings, the panel system, panels and inter-panel barriers, size of pillars and galleries; methods of driving galleries; layouts for different combinations of loading and transport systems including continuous systems

Depillaring: preparatory arrangements for depillaring; sequence and manner of extraction of pillars; mechanized pillar extraction, setting and withdrawal of supports; airblasts; partial extraction

Longwall Mining : Evolutionary development of longwall mining, its application, layouts, development and extraction by conventional and mechanised methods; design of longwall workings - face length and panel length; salvaging of longwall faces. Thick seam mining: multi-section mining, slicing methods, sublevel caving, integrated sublevel caving, blasting gallery method, thick seam extraction by cable bolting, hydraulic mining

Contiguous seam working: working under surface structures and water bodies, harmonic mining; shaft pillar extraction; horizon mining
Gasification of coal

Course Outcomes:

The students will be able to understand the

1. Basic technology of coal mining
2. Various operations involved in depillaring
3. Various operations involved in Longwall Mining and Contiguous seam working

Sub code-MNL268 (3-0-0)

Sub-SURFACE MINING

Objectives :

Develop students into design and construction of surface mines under various geo-environmental conditions. To expose students to the modes of conversion of underground mines into surface mines and reclamation practices.

Contents

Role of surface mining in mineral production in India, elements of surface mine planning- height, width, and slope of benches, overall and ultimate pit slopes, stripping ratio, cut off grade, different mining costs and preliminary evaluation of surface mining prospects

Types of surface mining systems: — applicability, limitations, advantages, disadvantages

Opening up of Deposits – different systems of opening of deposits, site preparation, box cut, formation of benches, and haul roads Layouts using different combinations of main excavation, loading and transportation systems
Blasting: Blasting practices and design in surface mines

Extraction Methods : Extraction of subsurface deposits - bedded deposits, massive deposits, pipe type, cap type and vein type deposits; mining of beach sands, placer mining, dimensional stone mining Layouts with In-pit crushing and conveying, surface miners Surface mining of coal seams developed by underground methods, surface mining over underground workings, mining in fiery strata, deep mining problems Dump Formation : Types of waste dump - internal and external; dump formation methods and equipment Reclamation methods by using different combination of equipment

Course Outcomes:

1. The students will be able to understand the
2. Importance of surface mining in today's mineral requirement and world mineral production of various minerals from surface mines.
3. Understanding viability of surface mining and its design aspects.
4. Various systems of surface mining and their applications. Opening of deposits under various conditions and haul road design
5. Mining of deposits under various conditions using various equipment combination with layouts including in-pit-crushing technology. Problem solving of mine design covering – development, production, equipment capacity & strength calculation and layouts.
6. Blast design under various geo-mining conditions with live problem solving.
7. Conversion of underground developed to surface mines – its related problems and design of mines.
8. Construction of external and internal dumps with problems.
9. Reclamation and with real life problems.

Sub code-MNL461 (3-0-0)

Sub-SURFACE MINE ENVIRONMENT

Course Objectives:

To make student conversant with prevailing environmental legislation in India
to provide knowledge in details about various sources of pollution in surface mines and mitigating measures against each source
to make student conversant with social impacts and aspects of getting approvals and permissions for running mining industry

Contents

Environmental issues in mineral industry — national and global; ambient environment mining complexes; environmental impacts of mineral exploitation - underground and opencast mining and associated activities.

Societal Environment : Societal environment and its management including resettlement and rehabilitation; socio-economic impacts; sustainable development; concept of carrying capacity based planning. Ecological environment and its management including biological reclamation. Land

Environment : Visual impacts; landscape analysis; land use; landscape planning; physical reclamation and subsidence management.

Air Pollution : Air pollution - sources, monitoring and control

Water Regime: Availability; water quality; water pollution treatment and water management.

Waste Management : solid wastes - generation, treatment and disposal

Noise and Vibrations : Causes, precautions, measurement, prevention and reduction. Blasting :

Environmental aspects of blasting.:

Environmental Administration in India: Administration and Management, preparation of Environmental Management Plan. Environmental audit, salient features of Environment Protection Act

Reference Books

Environmental Impact of Mining : Stocks
Mining and Environment : Dr. B.B.Dhar
Mine Environment : Dhar and Thakur

Course Outcomes:

The students will be able to understand the

1. Environmental issues in mineral industry
2. Issues related to air and water pollution
3. Environmental issues related to blasting
4. Management of environment

Sub code-MNL464(3-1-0)

Sub-MINING ECONOMICS

Course Objectives :

To make students conversant with the minerals as an economic commodity, their contributions in the national economy

To acquaint them with various types of business organizations and mobilization of funds for the exploitation of the various mineral resources

To acquaint them with the concepts of mineral resources and reserves, the methods of evaluation of mineral resources in various stages of development

Contents

Introduction : Economic importance of the mineral industry; mining economy, risky nature of the mining industry; State and the mining industry; national mineral policy

Mineral resource - concept, classification and estimation. Mineral inventory -concept, characteristic features, composition and economic significance; estimation of life index. Economics of mineral exploration and production Mineral price and pricing, price index. Mineral consumption and substitution; market survey and demand analysis. Conservation of mineral resource - scope and limitations.

Forms of business organization- Private and public enterprises, acquisition and merger. Mine finance : Capital and its importance, sources of finance, shares, debentures and the cost of capital, various forms and formation; Royalty, taxes and duties; imports and exports.

Mine Sampling : Definition, purpose and scope; sampling methods and computations; reliability of mine sampling. Loss of mineral in mining : Classification and incorporation of losses; coefficient of completeness of mineral extraction; dilution and recovery.

Geostatistical application for grade and reserve estimation

Cost of mining : Capital and operating costs; factors affecting operating cost; methods of estimating future costs; standard cost and forecast; budget and budgetary control.

Mine examination and valuation : Examination and valuation of mines/mineral properties; Hoskold and modern concepts, present value computation;.

Economic feasibility studies : Need for economic analysis; techno-economic analysis data estimates; methods of investment appraisal; risk analysis; societal versus private interest economic evaluation.

Reference Books

1. Mineral Economics : KK Chatterjee
2. Mineral Economics : R.T.Deshmukh
3. Valuation and Examination of mineral Property : Parks
4. Indian Mineral Year Book – Indian Bureau of Mines

Course Outcomes:

1. Students will have knowledge about various inventory of minerals and aspects of mineral economics
2. Students will develop some skill in financial managements of mineral industry

Sub code-MNL465 (3-1-0)

Sub-MINE SYSTEMS ENGINEERING

Course Objectives :

Student will be imparted with the basic knowledge of system engineering and its application to mining engineering. Various operations research and system engineering tools and their application to mining engineering, knowledge has been given to the students through the live examples.

Contents

Introduction to Systems Engineering : Concept of system, components and system environment; classification of systems; systems analysis; creative aspects of planning and design; factors influencing creativity; techniques for generating alternative ideas/solutions

Mathematical Programming Methods : Linear programming - definition/elements, assumptions and limitations of LPP; graphical solution; geometry and algebra of simplex method; interpretation of simplex table; application of linear programming for solution of mining problems related to production, blending, scheduling.

Transportation and Assignment Problems : Mathematical modelling and solution algorithm; application to mining problems.

Project Management with PERT & CPM : Network Models Assumptions of PERT and CPM; art of drawing network; redundancy and identification of redundant jobs; algorithm for calculation of critical path and identification of critical jobs; criticality index; statistics related to PERT; probability of completing a project by a due date; lowest cost schedule; case examples
application to mining problems

Decision Analysis : Decision problems; model formulation; decision analysis based on expected monetary value and utility value. Optimisation techniques and queueing theory.

Simulation : Introduction and concept; scope and limitation; system type versus simulation technique; generating input data; Monte-Carlo simulation; deterministic and stochastic simulation of various systems in mines.

Reference Books

ORT Applications : Kulkarni

Course Outcomes:

1. Students will acquire knowledge about different modelling techniques for mining and allied applications
2. Students will acquire some simulation knowledge useful for decisions making and management
3. Students will acquire knowledge about Project Management with PERT & CPM

Sub code-MNL466 (3-0-0)

Sub- ROCK EXCAVATION ENGINEERING

Course Objectives :

Advance processes of excavation techniques are covered

Contents

Introduction: Scope and importance of rock excavation engineering in mining and construction industries; physico-mechanical and geotechnical properties of rocks vis-a-vis excavation method; selection of excavation method.

Drilling : Mechanics of rock drilling; design and operating parameters of surface and underground drilling; evaluation of drill performance; drillability of rocks; mechanism of bit wear; bit selection; problems of drilling; economics of drilling.

Blasting: Mechanics of rock fragmentation by explosives; advancement in explosives and blasting technique; their selection criteria for rock excavation; blast design for surface excavations and optimization;

Advanced blasting techniques; blast performance evaluation; cast blasting; techno-economic and safety aspects of surface and underground blasting; advances in blast design for underground excavations; control blasting; computer aided blast designs; review of tunnel blasting techniques, recent advances and novel techniques of blasting

Rock Cutting: Theories of rock tool interaction for surface excavation machinery; design of cutter head - rippers, dozers, scrapers, BWE. Continuous surface miners, auger drills;

Theories of rock tool interaction for underground excavation machinery; design of cutter head - ploughs, shearers, roadheaders, continuous miners and tunnel boring machines: selection criteria for cutting tools; advanced rock cutting techniques - high pressure water jet assisted cutting. Recent Developments in rock excavation machinery.

Reference Books:

- | | |
|---|---------------------------|
| 1. Blasting Practices | : G.K.Pradhan |
| 2. Explosives and Blasting Practices in Mines | : Dr. Sameer Kumar Das |
| 3. Drilling | : G. Chugh |
| 4. SME – | Mining Engineers Handbook |
| 5. Surface Mining – SME | |
| . Introduction to Mining | : Hartman |

Course Outcomes:

The students will be able to understand the

1. Concepts of drilling and Blasting
2. Advanced blasting techniques
3. Theories of rock tool interaction and Rock Cutting

Sub code-MNL467 (3-0-0)

Sub- GEOSTATISTICS

Course Objectives :

Students are made conversant with basic statistical and geostatistical methods
Application of these tools are made with reference to mineral grade calculations

Contents

Classical statistics, random distributions, normal and lognormal theory. Concept of geo-statistics and its application to mining
Spatial statistics, Covariogram, definitions, estimation, fitting
Variogram, semi-variogram, definition, estimation, experimental variogram, fitting; application, uses of variogram.
Various model of variograms: random model, spherical model, exponential model, gaussian model,
Linear model, logarithmic or de Wijsian model, parabolic model
Nugget effect, its implication on model, anisotropies
Numerical calculation of variogram, and graphs for one, two and three dimensions
Krigging method for grade and reserve estimation.
Krigging estimator, krigging error, point krigging, block krigging, optimal valuation
Use for geostatistical software for various application
Case studies of grade estimation

Reference Books

1. Geostatistics – Methods and Applications : Rendu J.M.
2. Open Pit Planning – SME

Course Outcomes:

The students will be able to understand the

1. Statistical distributions – random, normal and lognormal and its importance in mining environment.
2. Variogram, co-variogram calculation. Different models of variogram like random spherical, spherical, exponential, Gaussian, Linear, logarithmic and Parabolic - their application, Nugget effect and its implication on model.
3. Grade and reserve estimation for mineral deposits.
4. Case studies on various geostatistical models, grade estimation

Sub code-MNL468 (3-0-0)

Sub- ADVANCED MINE SURVEYING

Course Objectives :

Students are made aware about the modern survey equipment and methods for precision survey

Contents

National Grid: Map Projections; Cassini, Lambert's Polyconic, UTM, transformation of coordinates.

Geodesy: Good, spheroid and ellipsoid, geocentric, geodetic and astronomical coordinates, orthometric and dynamic heights.

GPS, principle, operation, application to mine survey and face monitoring.

EDM, Total survey station, principle and application to mine survey,

Laser profilers, opencast mine survey

Survey for construction of excavations, chambers, installation of headgear, haulages, hoisting engine, sub-station, pump stations etc.

Gyro-theodolite, principle, application to mine survey

Subsidence survey

Remote sensing, Photogrammetry, satellite imaging, GIS application to mining

Computer aided drawings of plans and sections

Reference Books

Mine Surveying by Mason

Metalliferous Mine Surveying by Winigerg

Surveying Vols I, II & III – by Punmiya

Surveying & Levelling Vols I & II by Kanetkar and Kulkarni

Course Outcomes:

1. Learn advanced tools for mine surveying
2. Students will be trained in handling the various advanced survey instruments
3. Learn various calculations required for planning
4. Will work with team spirit

Sub code-MNL463 (3-0-0)
Sub-MINE MANAGEMENT

Course Objective :

The students are made conversant with management, organization, structures, personnel management and managerial behaviors etc.

Contents

Introduction of management : Evolution of management, theory and practice, principles of scientific management; objectives of management - administration and management , Levels of management organization, types of organisation; structures of mining organization from mine to corporate sectors, legislative aspects of mining organization..

Personnel Management : Objectives and principles, Various functions of management like employment, development, relation and retention. Recruitment, Interview techniques, Selection, training and EDP, job evaluation and performance appraisal, Human resources and . Manpower Planning in mines.

Communication : Role of communication in mining organizations, types and its importance, two way personal communications; communication networks.

Behavioural Sciences for Management : Human needs, various theories of motivations; causes of conflicts in organization, sources of conflicts, dealing with conflicts, role of PRO

Leadership: Essential qualities of leader, Leadership models, types of leaders, functions of leaders, group dynamism, individual and group behavior, leader and mass communication.

Industrial Psychology: Definitions, objectives and applications; study of individual differences, traits and personality theories; job satisfaction and morale, determining factors, and steps for improvement; study of work groups, characteristics and types; psychological tests and their uses.

Industrial Relations : Industrial disputes, definitions and causes; industrial discipline, grievance, causes, and grievance settling machinery in industry,; trade union movement, trade unions collective bargaining; adjudication, workers' participation in management.

Production Management: Determination of norms and standards of operations by work study; analysis of mine capacities and capabilities; production planning, scheduling and control, short and long term planning; productivity, its concept and measurement.

Materials Management : Importance and role of material management, management organization,; purchase and stores management; Inventory Management : Introduction; components, scope and limitations; nature of inventory; ABC analysis of inventory control, classical E. O. Q. model; E. O. Q. model inventory optimization

Introduction to various managements: Financial Management . sources of capitals, accounting principles and budget and budgetary control. Introduction to Project management, principles and functions. Introduction to office management, introduction to quality management , quality circles, six sigma management

Reference Books :

1. Principles of Management by Kulkarni and Chopde
2. Industrial Engineering and Production Management by M. Mahajan, Dhanpat Rai Group publ.
3. Personnel management and industrial relations, by Varma and Agarwal, Educational publisher, New Delhi
4. Principles of Management by Gupta, Dhanpat Rai group

Course Outcomes:

1. To know managerial aspects of mines and its organization and structures,
2. To understand the fundamentals of principles of management
3. Application of management principles in mining industries
4. To study the behaviour science , industrial psychology and motivations etc human aspects

Sub-MINE LEGISLATION AND SAFETY

Course Objectives :

To acquaint the students with the prevailing legislative set ups governing the allocation of the exploration and mining rights

To acquaint them with the safety, health, and technical aspects of mining activities

To acquaint them with the methods of accident investigation, disaster management etc and modern day tools of accident prevention

Contents

Introduction: General principles of mining laws, development of mining laws in India. Sources of legislations, mining laws of India. General provisions of Mines and Minerals(Regulation and Development Act 1957, Mineral Concession Rules 1960, Mineral Conservation and development Rules 1988

Salient features of Mines Act 1952 , Mines Rules 1955, Additional provisions Indian Electricity Rules 1956 applicable to mines, Workman Compensation Act, Mine Chreche Rules, Pit Head Bath Rules, Vocational Training Rules 1966, Mines Rescue Rules 1985

General provisions of Coal Mines Regulations 1957 and some important by-laws and standing orders for coal mines

General provisions of Metalliferous Mines Regulations 1961 and some important by-laws and standing orders for coal mines

Safety and Health in Mines: Occupational hazards of mining and diseases; accidents and their classification; statistics of fatal and serious accidents; frequency rates and severity rates of accidents; cause-wise analysis; basic causes of accident occurrence; investigations into accidents and accident reports; in-depth study of accidents due to various causes;. Cost of Accidents.

Emergency measures and emergency organization, Disaster Management Plans for major disasters of explosions, inundation etc. Measures for improving safety in mines, risk assessment

Reference Books

1. Indian Mining Legislation – A Critical Appraisal : Rakesh & Prasad
2. NIOSH Publications
3. DGMS Circulars : L.C.Kaku
4. Safety in Mines : A survey of accidents, their causes and prevention by Prof. Kejriwal

Course Outcomes:

The students will be able to understand the

1. General principles of Mining Laws and their history
2. Salient features of Mines Act and mines rules
3. General provisions of CMR 1961 and MMR 1961
4. Legal aspects of safety and health of Mine workers.

Sub code-MNL470 (3-0-0)

Sub-MINE PLANNING

Course Objectives:

to make students conversant with aspects of mine planning
to develop skill of planning of mining operations
to develop expertise in mine design

Contents

Principles of planning, Features of mine planning, planning for new projects and reconstruction planning, short range and long range planning, phases of mine planning, project implementation and monitoring, types of reserves & their inter-relationship, geological reports, weather, topography, drainage and climate report
Fixing the mine boundary- surface and underground, size of mine, limited and unlimited reserves, optimum designed capacity, reserve allocation. Dividing mine into various panels, stope, panel dimensions
Mine entries: types, their application, location, selection shape and size opening. Planning for pit top and pit bottom layouts, choice of layout
Infrastructure planning: CHP/mineral handling plant, workshop, power, water requirement, communication
Method of mining: factors to be considered, surface v/s underground, selection of various methods of extraction, production estimation, production potential of different panels, fixing the target mine
Transportation planning: alternatives, choice of men, material and mineral transport systems, essential requirement, and selection
Ventilation planning: objectives, steps, essential features of ventilation system, different types of ventilation systems, network solutions, economics of ventilation
Drainage planning: assessment of make of water, drainage layout, design of sumps, selection of pumps and pumping capacity
Manpower planning,
Planning for mine closure and post mining land use planning

Reference Books

1. Coal Mine Planning : S.P.Mathur
2. Coal Mining Methods : S.P.Mathur
3. Underground Mining Methods Handbook : Hustrulid
4. Introductory Mining Technology : Hartman

Course Outcomes:

1. To understand various components of mine planning
2. To learn general planning principles
3. Design of various components of mine system
4. Plan and design an overall mine

Sub code-MNL471 (3-0-0)

Sub- UNDERGROUND SPACE TECHNOLOGY

Course Objectives :

students are made conversant with the importance of underground space and the methods of its creation
utilization of the underground space for mining and civil purpose

Contents

Need and importance of underground space creation, types of underground excavations- tunnels, caverns, shafts.
Applications of underground excavations: storage, transport, military etc.

Equipment: Roadheading machines, their selection, operation for underground excavation
Shaft Boring machine and Tunnel Boring Machine: construction and operation

Drill for underground excavations: drill jumbos

Site investigation, various shapes and sizes, selection of method of excavation

Excavation by drilling and blasting: Tunnels, caverns, shafts, Method of excavation and design of blasting round, cycle of operation

Excavation by mechanical means : excavation in soft ground and hard rock by TBM and cutting methods, their layouts

Hazards in underground excavations

Parameters for design of underground excavations, Design and selection of support and reinforcement for underground excavation, Consideration for swelling and squeezing rock conditions, rock burst prone zones, seismic zone and soft ground

Environmental problems in rock excavations, causes and preventions, ventilation and illumination in excavations.

Reference Books

- 1 SME underground mining methods Handbook
- 2 Storage in excavated rock and caverns
- 3 Design parameters for underground construction
- 4 Geo- technical instrumentations in Civil Engg.
- 5 Tunneling and Underground space technology, Elsevier

Course Outcomes:

The students will be able to

1. Understand the need and importance of underground space technology
2. Understand the applicability of various types of underground excavating machines and drilling patterns
3. Understand the hazards of underground excavations and environmental problems
4. Select and design the underground support for different mining conditions

Sub code-MNL472 (3-0-0)

Sub- MINE SAFETY ENGINEERING

Course Objectives :

students are imparted with the knowledge regarding importance of safety and safety management in mines various tools of risk, audit, safety practices, safety codes applicable to the mining operations are covered

Contents

Safety management systems in Indian mining industry; engineering aspects of safety management. Basic concept of risk, reliability and hazard potential; elements of risk assessment; statistical methods; control charts; appraisal of advanced techniques - fault tree analysis, failure mode and effect analysis, quantitative structure - activity relationship analysis; fuzzy model for risk assessment. Measurement of safety efficiency; safety audit methods; safety records management. Safety legislations, Safety meetings, constitution of safety committees, functions, pit safety committee Ergonomics, Safety practices in various operations, blasting , drilling, equipment and machine handling, site specific safety, ground control, ventilation and gases; safety codes, implementation and monitoring of safety programmes. Recent Trends of development of safety engineering approaches. Safety training

Reference Books

1. Mine Safety : Prof. Kejriwal
 2. Occupational Safety and Health in Industries and Mines : C.P.Singh
 3. Indian Mining Legislation – A Critical Appraisal : Rakesh & Prasad
- ** Safety in Mines : A survey of accidents, their causes & prevention (1901 to 2000)

Course Outcomes:

1. Students will gain the idea about preparation of safety management plan and risk calculation
2. Students can will learn the various steps of safety audit
3. Students will develop a initial skill to monitor the safety related to mining

Sub code-MNL473 (3-0-0)

Sub- MINE MANAGEMENT INFORMATION SYSTEM

Course Objective :

Making students conversant with the Management Information System and developing expertise in creating Mine Management Information System

Contents :

Information as a Resource: Introduction to information management, concept of management information system, planning of information resources

Computer based information management systems, information methodologies and tools, system approach to various operations in mines, analysis of systems

Computer fundamentals for information system, database and database management systems, data mining, data ware house, data banks, data storage and handling. Relational and other data bases

Capturing of information, on-line, off line, pre-processing, formatting etc, Forms and layout. Data processing systems; data communication, data loggers etc.

Mine management information system: Production information, human resource information, geological information, geo-technical information, environmental information, survey information, stores and inventory information, Marketing, financial etc.

Decision support systems for mine managers, reporting, models, expert systems, office automation, network layout of computer nodes and data communication

Reference Books

1. Mine Safety : Prof. Kejriwal
2. Occupational Safety and Health in Industries and Mines : C.P.Singh
3. Indian Mining Legislation – A Critical Appraisal : Rakesh & Prasad

Course Outcomes:

1. Students will get initial knowledge about database and its preparation
2. Students can will develop skill handling database software
3. Students will get the idea about database and MIS application to mining

Sub code MNL479(3-0-0)

Sub: ADVANCED SURFACE MINING & DESIGN

Course Objectives :

Making students conversant with the advances in surface mining technology
Developing expertise in planning of surface mine system and its design

Contents :

Openpit Optimisation considering Ultimate pit slope, cutoff grades and stripping ratio
Optimum Production Scheduling
Planning and Design of Surface coal mines, Planning and design of Open pit Mines, Planning of Hill Mining
Design of Surface mines Using Inpit Crushing, Surface Miners, Rock Breakers, Design of Highwall Mining
Advances in Loading, Hauling and transportation equipment (Shovel, Draglines, Dumpers, Cross-pit Conveyors, Skip Transportation etc), Application and design of Truck Dispatch System, Application of GPS in surface mining
Design of Waste Dumps and Tailing Ponds, Design of Haul roads, Design of Drainage System. Monsoon preparation in surface mines
Design of large scale bench blasting: coal and non coal: cast blasting, coyote blasting, chamber blasting, Estimation of Mining Cost for surface mines

Reference Books:

Fundamentals of Open Pit Mine Planning & Design: Hustrulid, W. and Kuchta, M.
Surface Mining : Kennedy, B.A., 2nd Edition, SME, New York, 1990
Surface Mining Technology, : Das, S.K., Lovely Prakashan, Dhanbad, 1994
SME Mining Engg. Hand book Vol.I and II: Cummings, A.B. and Given, I.V., New York

Course Outcomes:

The students will be able to understand the

1. Cut-off grade, ultimate pit slope angle and break-even-stripping ratio. In the light of this information ultimate pit design they will learn.
2. Planning and design of opencast coal mines, opencast metal mines and hill mining – involves layout, equipment calculation.
3. Different loading and transport equipments – their technical combination based on output capacity.
4. Design of waste dumps, haul roads, drainage system.
5. Design of various blasting practices need based.

Sub code MNL477(3-0-0)

Sub: NOVEL MINING METHODS

Course Objectives :

Making students conversant with the various novel mining techniques
Developing the understanding the details of these techniques

Content:

Review of various experimental mining procedures, including a critical evaluation of their potential applications. Mining methods covered include deep sea nodule mining, in situ gasification of coal, in situ retorting of oil shale, solution mining of soluble minerals, in situ leaching of metals, geothermal power generation, oil mining, nuclear fragmentation, slope caving, electro-thermal rock penetration and fragmentation.

Borehole mining: Borehole mining of coal, uranium, sulphur. Drilling, maintenance services, Jet Cavitations, fracturing, Solution Mining of important minerals, leaching
Coal bed methane: Coal Fundamentals and Geology, Key Coal Properties, Coal Permeability, Measurement of Coal bed Gas Content, Elements of a CBM, Isotherms, and Recovery Factor, Development Considerations, Well Design and Drilling, Gas Recovery & Well Performance
Coal gasification: Introduction to gasification: Chemical reactions, Process technologies: Coal Liquefaction, Underground gasification – principles and potential, Conversion of coal to syngas, Impact of coal properties on gasification, Production of coal for gasification: mining and beneficiation perspective, Conversion of syngas to a variety of chemical products, Conversion of coal to syngas via the Sasol process, Environmental aspects around a gasification plant, relevance of coal gasification and its future potential as an environmentally sound technology in the co-production of energy and chemicals with CO₂ minimisation.

Hydraulic mining: Introduction, Process of hydraulic mining, hydro monitors, water jets, surface and underground layouts, merits and impacts

Dimensional Stone mining: Introduction and stone mining in India, cutting and control blasting technology, damage measurement during mining, marble and granite mining, cobbles and building stone mining

Ocean floor mining : Deep ocean exploration, sea bed mining, ocean floor nodules mining, technology, dredgers and other machines for mining and transport

Mining in the space : lunar mining, asteroid mining, automatic and robotic machines, future of space mining, Impacts

Reference Books :

1. Underground Mining Methods by SME publication Hustrilid
2. Introductory Mining Engineering : Hartman 2nd Edition
3. Society of Mining Engineering Handbooks –Vol. I and II

Course Outcomes:

The students will be able to understand the

1. Technology for methane drainage and coal gassification
2. Technology for hydraulic mining and deep sea mining.
3. Latest Mining methods such as Nuclear fragmentation, Mining in space dimensional mining etc.

Sub code MNL478 (3-0-0)

Sub : MINE AUTOMATION

Course Objectives:

Making students conversant with methods of automation in mines

Understanding various control systems and automation of various systems in surface and underground mines

Content:

Scope and role of automation in mining operation and human related factors.

System engineering approach and use of operational data from mining equipment and its use the mining process.

Data communication and modern computerised control systems

Data formats and IREDES, mine process data, AGV technology

Basic foundations for automation of mining equipment.

Navigation, surface navigation and GNSS (satellite navigation), mine planning tools, etc

Automation of drilling and drill rig, drilling process.

Automation of underground loading and transportation systems.

Automation in tunnelling projects.

Automation in monitoring of environments in longwall and continuous mining system

Automation of transportation system in surface mining.

Use of robotics in mining for production and disaster management purpose

Reference Books:

Society of Mining Engineering Handbooks –Vol. I and II

Introductory Mining Engineering: Hartman

Underground Mining Methods Handbook: Hustrulid (SME NY, 1994)

Course Outcomes:

The students will be able to understand the

1. Scope and role of automation in mining operation
2. Data communication and modern computerised control systems
3. Use of latest techniques used for mine automation.

Sub code CEL 384(3-0-0)

Sub: ADVANCED MINING GEOLOGY

Course Objectives :

To Understand the Internal structure of earth
Teach fundamental geomorphic and dynamic processes on the Earth
To know about the rocks and minerals and their properties.
To study various geological structures and impacts on mining
To Know prospecting and subsurface exploration methods
To generate the sub surface profiles from geological maps and plotting structures.

Content :

Principles of Prospecting and Exploration: Geophysical methods; Electrical, Seismic, Magnetic and Radar methods of exploration. Geo-Chemical methods; dispersion, mobility, anomaly, pathfinder elements, sampling methods. Exploratory drilling, different methods and applicability. Borehole logging, orebody modelling.

Engineering Geology: Engineering properties of rocks in context to geology. Rock discontinuities and their bearing on rock performance and rock mass failures. Geology of natural slopes. Geological characteristics influencing subsidence and rock bursts.

Stratigraphy: Physiographic and Tectonic Divisions of India. General review of Stratigraphy of India detailed study including economic potential of Archean, Cuddapah, Vindhyan, Gondwana, Deccan Traps and Tertiary systems of India.

Geo-Hydrology: Hydrologic Cycle and equation, Vertical zones of sub-surface water, water table, aquifers, aquicludes, aquifuges and aquitards. Confined and unconfined aquifers. Influents and effluents, seepage, springs. Hydrologic properties of rocks; porosity, permeability. Occurrence and movement of Groundwater, Darcy's Law, water table maps and their usages, Hydrographs.

Economic Mineral deposits. Processes of Ore genesis; magmatic concentration, Hydrothermal, contact metasomatism, residual concentration etc. Syngenetic and epigenetic deposits. Controls of ore localization. Metallogenic Epochs and provinces.

Remote Sensing and Geographical Information System: Introduction to remote sensing technology, Analog and digital data products, remote sensing satellites, application of remote sensing for mining operations. Introduction to GIS and its applications.

Reference Books:

Principles of Engineering Geology : KVGK Gokhale, BS Publications
Fundamentals of Engineering Geology : F.G.Bell, BS Publications
D.K. Todd : Groundwater Hydrology
Principles of Stratigraphy : Ravindra Kumar
Courses in Mining : RNP Arogyaswamy
Environmental Geology : K.S. Valdiya
Rock Mechanics : B.P. Verma
Remote Sensing : F.A Sabins

Course Outcomes:

The students will be able to understand

1. The Internal structure of earth, fundamental geomorphic and dynamic processes on the Earth
2. The rocks and minerals and their properties.
3. The various geological structures and impacts on mining
4. To Know prospecting and subsurface exploration methods
5. And generate the sub surface profiles from geological maps and plotting structures

Sub Code MNL480 (3-0-0)

Sub code: ADVANCED UG METAL MINING & DESIGN

Course Objectives :

Students are made conversant with special and advanced mining methods and their design and planning

Content:

Development- size of stope, level interval
Classification and Selection of stoping methods
Design and locating the orepass and levels

Design of stopes: Stope design and production planning, scheduling

Ring drilling, fan drilling design
Mechanisation and Selection of equipment
Methods of extraction of pillars
Deep mining problems
Mine fills, pastefill, cemented fills

Case studies : Indian and mines from other countries

Mine costing

1. Techniques in Underground Mining - Selection : Richard E. Gertsch et al, SME 1998
2. Underground Mining Methods: Engineering Fundamentals and International Case Studies : A. Hustrulid, 2001
3. Introductory Mining Engineering : Hartman
4. Underground Mining Methods Handbook : Hustrulid (SME York, 1994)

Course Outcomes:

1. Students will get ideas about the advancement of metal mining methods with regards to mechanization and automation
2. Students will be trained to select the method of mining based on geo-mining data
3. Student will develop initial skill to stope design

Sub Code: MNL469(3-0-0)

Sub : MASS PRODUCTION TECHNOLOGY FOR UNDERGROUND COAL

Course Objectives :

Students are made aware about bulk production technology and its application in coal in the world and India in particular

Status of coal mining in India and abroad, Need for mass production technology for Indian coal
Continuous Mining Technique: Applicability, Layout for development and depillaring, Design, Equipment required and their Selection, System analysis , Cycle of operation, Case studies
Longwall Mining: Applicability, various layouts, System analysis and system design, Equipment and their selection, Types of cut, ground control, cycle of operation, Case studies

Reference Books:

SME Mining Engineers' Handbook : W A Hustrulid, SME, USA

Underground Mining Method Handbook : W A Hustrulid, SME, USA

Longwall Mining : S.S.Peng, John Wiley

Ground Control in Mines : S.S.Peng, John Wiley

Course Outcomes:

1. Student will have in-depth knowledge of advanced techniques of underground coal mining
2. They will be able to design such systems
3. Develop technical skill for operation of such systems
4. Will be ready to take up advanced research in coal mining on long term basis

Sub Code MNL476 (3-0-0)

Sub: ROCK SLOPE ENGINEERING

Course Objectives:

to make student conversant with slope stability problems
to develop skill in slope stability analysis by various methods
to deal with slope stability problems in mines and in general

Contents

Basic Concepts: Engineering issues of Slope stability, Basic terminology, Slope failure causes and process, basic mechanism of slope failure

Rock mass properties: various properties, data collection, stereographic projections

Ground water: Role of ground water flow, influence of ground water on slope stability, evaluation of ground water conditions in slopes

Plane failure : general conditions and failure analysis

Wedge failure: general conditions and failure analysis

Circular failure: general conditions and failure analysis

Toppling failure: general conditions and failure analysis

Rock slope stabilization techniques, Geotechnical Instrumentation and Monitoring

Aspect of Waste dump stability analysis

Reference Books :

Rock Slope Stability, Charles A Kliche (SME publication)

Rock Slope Engineering, Hoek & Brown SME

Slope Stability in Surface mining, WA Hustrulid, SME

Course Outcomes:

1. Learning basic slope stability in mining operations as well as civil excavation
2. Developing expertise in slope stability analysis
3. Expertise in management of slopes
4. Expertise in Dump Management

Sub code MNL 475**Sub: Blasting Technology for Mining and Construction 3-0-2**

History and use of explosives: blasting and its applicability to mining and construction industry. Role of blasting in production of minerals and in construction industry. Blasting inputs and outputs, Controllable and non controllable parameters. Blast Economics, blasting costs and role of fragmentation with blasting costs, cost optimization, Environmental impact of blasting

Characteristics and constituents of explosives, Mechanics of blasting, Basics of Explosives and their classifications as low explosives, high explosives and blasting agents Indian classification of explosives. Properties of explosives for their selection, Testing of explosives for safety. Standards of storage and handling of explosives, Provisions in Explosives Act and legal aspects of explosives

Various Pattern of holes for drives and drift, roadways, underground storage and tunnels, pattern of holes for surface excavation, Blasting accessories and tools. Initiation system and firing sequences. Blasting operation in surface and underground coal mines, metal mines, drifts, shaft, tunnels and caverns. Safety precautions during blasting, blasting fumes.

Rock explosive interaction, Various rock fragmentation theories. Role of rock parameters, explosive parameters and blast design parameters on blasting. Evaluation of blasting results, techno economic evaluation of fragmentation, fragmentation Analysis of production blasts, fragmentability and productivity. fragmentation and costs, effect of structural discontinuities on blasting results, Use of various software like wipfrag, wipjoint, Blastware, Blast Information Management Systems etc.

Optimization of blast designs for tunnels, caverns, nuclear waste disposal and other domestic purpose. Blast design for surface workings and opencast mines. Blast design for non coal and coal mines. Ground vibrations, fly rock and noise due to blasting. Minimization of environmental damages due to blasting.

Controlled blasting techniques for surface blasting and underground blasting, Use of innovative techniques in blasting like, air deck, cushion blasting, underwater blasting, blasting near sensitive structures, cast blasting etc. use of blasting techniques for demolition of structures.

Reference books:

Engineering rock blasting operations : S. Bhandari, A. A. Balkema Publ.
Rotary drilling and blasting in large surface mines : B.V. Gokhale, CRC press, A. Balkema Publ.
Explosive blasting technology : G.K. Pradhan, Mintech Publ. Bhubaneswar
Rock blasting effects and operation : P.PalRoy, Oxford and IBH Publ.
Explosives and blasting practices in mines : S.K. Das
Surface mine blast evaluation : Thote and Pradhan, Mintech publ. Bhubaneswar

Course Outcomes:

1. to understand the basic characteristics of explosives
2. to know the mechanism of rock breakage utilization of explosives energy.
3. Conduction of blasting operation in mine and its safer aspects.
4. design of optimum blast and control measures

B.Tech(Mining) Scheme

| Departmental Core (DC): compulsory | | L | T | P | Credits |
|---|--|----------|----------|----------|----------------|
| CEL284 | Mining Geology | 3 | - | - | 6 |
| CEP284 | Mining Geology | - | - | 2 | 2 |
| MNL261 | Introduction to Mining Technology | 3 | - | - | 6 |
| MNL262 | Mine Surveying | 3 | - | - | 6 |
| MNP262 | Mine Surveying | - | - | 2 | 2 |
| MNL263 | Underground Metalliferous Mining | 3 | - | - | 6 |
| MNL264 | Mining Machinery - I | 3 | - | - | 6 |
| MNP264 | Mining Machinery - I | - | - | 2 | 2 |
| MNL265 | Mine Ventilation and Climate Engineering | 3 | - | - | 6 |
| MNP265 | Mine Ventilation and Climate Engineering | - | - | 2 | 2 |
| MNL266 | Rock Engineering | 3 | - | - | 6 |
| MNP266 | Rock Engineering | - | - | 2 | 2 |
| MML385 | Mineral Processing/Dressing | 3 | - | - | 6 |
| MNL362 | Mining Machinery II | 3 | - | - | 6 |
| MNL363 | Mine Hazards and Rescue | 3 | - | 2 | 6 |
| MNP363 | Mine Hazards and Rescue | 3 | - | - | 2 |
| MNL364 | Ground Control In Mines | 3 | - | - | 6 |
| MNP364 | Ground Control In Mines | - | - | 2 | 2 |
| MNL267 | Underground Coal Mining | 3 | - | - | 6 |
| MNL268 | Surface Mining | 3 | - | - | 6 |
| MNC366 | Survey Camp (Sessional) | - | - | 2 | 2 |
| MND451 | Project Phase -I | - | - | 2 | 4 |
| MNC461 | Mine Visits (Sessional)* | - | - | 2 | 2 |
| MNL461 | Surface Mine Environment | 3 | - | - | 6 |
| MNP461 | Surface Mine Environment | - | - | 2 | 2 |
| MNL462 | Mine Legislation and Safety | 3 | - | - | 6 |
| MNL463 | Mine Management | 3 | - | - | 6 |
| MNL464 | Mining Economics | 3 | - | - | 6 |
| MNL470 | Mine Planning | 3 | - | - | 6 |
| MNL474 | Computer Applications in Mining | 3 | - | - | 6 |
| MNP474 | Computer Applications in Mining | 3 | - | 2 | 2 |
| MNC462 | Training Seminar (Sessional)** | - | - | - | 4 |
| MND452 | Project Phase -II | - | - | 4 | 8 |
| | Total | | | | 152 |

| Departmental Elective (DE) (54-60 Credits) | | | | | |
|--|---|---|---|---|-----|
| EEL285 | Industrial Electrical & Electronic Engg | 3 | - | - | 6 |
| CEL384 | Advanced Mining Geology | 3 | - | - | 6 |
| CEP384 | Advanced Mining Geology | - | - | 2 | 2 |
| MNL465 | Mine System Engineering | 3 | - | - | 6 |
| MNL466 | Rock Excavation Engineering | 3 | - | - | 6 |
| MNL467 | Geostatistics | 3 | - | - | 6 |
| MNL468 | Advanced Mine Surveying | 3 | - | - | 6 |
| MNL468 | Advanced Mine Surveying | - | - | 2 | 2 |
| MNL469 | Mass Production Technology for underground Coal | 3 | - | - | 6 |
| MNL471 | U/G space technology | 3 | - | - | 6 |
| MNL472 | Mine Safety Engineering | 3 | - | - | 6 |
| MNL473 | Mine Management Information System | 3 | - | - | 6 |
| MNL475 | Blasting Technology for mining & Const. | 3 | - | - | 6 |
| MNP475 | Blasting Technology for mining & Const. | - | - | 2 | 2 |
| MNL476 | Rock Slope Engineering | 3 | - | - | 6 |
| MNL477 | Novel Mining Methods | 3 | - | - | 6 |
| MNL478 | Mine Automation | 3 | - | - | 6 |
| MNL479 | Advanced Surface Mining & Design | 3 | - | - | 6 |
| MNL480 | Advanced UG Metal Mining & Design | 3 | - | - | 6 |
| | | | | | 102 |
| NOTE: | Theory and Practicals should be passed separately and Grades will be awarded separately | | | | |
| * Three mine visits during the course ** Three trainings of one month duration each in opencast, underground coal and underground metal mines | | | | | |