National Institute of Technology Raipur												
Course of Study and Scheme of Examination							B. Tech. 3rd Semester				Branch: Mining Engineering	
S. No.	Subject Code	Subject Name	Periods per Week			TA	Examination Scheme				Total Marks	Credits
			L	T	P		MSE/MTR		ESE/ESVE			
							Theory	Prac.	Theory	Prac.		
1	MI10311AG	Geology – I	3	1	0	20	30		50		100	4
2	MI10312MI	Underground Mining Machinery-I	3	1	0	20	30		50		100	4
3	MI10313MI	Basics of Mining Engineering	3	1	0	20	30		50		100	4
4	MI10314MI	Engineering Materials	3	1	0	20	30		50		100	4
5	MI10315MI	Mining Environment-I	3	0	2	20	30		50		100	4
6	MI10306MA	Mathematics III	3	1	0	20	30		50		100	4
7	MI10347AG	Geology-I Lab	0	0	2	40		20		40	100	1
8	MI10348MI	Underground Mining Machinery-I Lab	0	0	2	40		20		40	100	1
												26

Geology-I

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Applied Geology	3-1-0, (4)	Core	MI10311AG

[Pre-requisites: Intermediate]

Course Objectives

The objective of the course is to provide basic understanding of major earth processes, theories; Geological structures, its operating process & forces, identification of minerals and rocks; Inferring rock origin from specimens' examination; Reading, drawing and interpreting geological maps and sections, geological concepts to the mining engineering students for economic, environmental, safe and sustainable mining operation.

Course Content

Unit-1 The Earth, its theories and process

Introduction to Geology: Definition, its branches, scope with its emphasis in mining engineering. Brief idea of the origin and the age of the Earth; internal structure of earth.

Geodynamic Theories & Processes: Basic idea on - Plate Tectonics, Palaeomagnetism& Sea-Floor Spreading, Continental Drift, Isostasy, Mountains, Volcanism, Earthquake and seismic zones in India.

Physical Geology & Processes: A preliminary idea on – Weathering, Rivers, Oceans, Under-ground Water, Wind Action, Glaciers, Lakes.

Unit-2 Mineralogy

Minerals: Definition, Physical Properties of Minerals, Classification of Minerals.

Rock Forming /Silicate Minerals: Introduction and preliminary study of Rock forming Mineral groups - Garnet, Pyroxene, Amphibole, Mica, Feldspar and Felspethoid with respect to the physical properties.

Non-Silicate Minerals: Study of economically important non-Silicate Minerals with respect to the physical properties.

Unit-3 Igneous and Metamorphic Petrology

Igneous Rocks: Definition, Elementary knowledge of Magma and its Crystallization; Origin, Textures, Structures and Classification of Igneous Rocks. Petrographic Description of Common Igneous Rocks.

Metamorphic Rocks: Definition, Agents and Types of Metamorphism; Depth zones, Facies and Grades of Metamorphism; Textures, Structures and Classification of Metamorphic Rocks. Petrographic Description of Common Metamorphic Rocks.

Unit-4 Sedimentary Petrology

Sedimentary: Definition and significance of Sedimentary Rocks.

Processes: Weathering, Transportation, Deposition and Lithification of sediments.

Sedimentary Rocks: Classification, Origin, Textures, and Structures of Sedimentary Rocks. Petro graphic Description of Common Sedimentary Rocks.

Unit-5Structural Geology

Rock Deformation: Concept of Rock Deformation; Attitudes of strata- Dip and strike; Study of Unconformity; Folds, Joints, Faults and their influence in Mining Operations.

Geological Maps: Concept of geological maps; Contours & Important terminology used for map; Topography and its representations; Making a geological section from the Geological maps and its description.

Course Materials

Required Text: Text books

1. G.B. Mahapatra, Text book of physical geology, CBS Publishers and distributers Pvt. Ltd. 1st Edition, 1994.
2. Kevin Hefferan& John.O'brien, Earth material, Wiley-Blackwell, 1st publication, 2010.

Optional Materials: Reference Books

1. Dexter Perkins, Mineralogy, Pearson Publication, 3rd Edition. 2011.
2. Philip kearey, Keeith A. Klepeis, Friderick J. Vine, Global tectonics, Wiley-Blackwell, 3rd Edition, 2009.
3. Kent C. Condie, Plate tectonics and crustal evolution, Butterworth-Heiremann, 4th Edition, 1997.
4. C.D. Gribble, Rutley's elements of mineralogy, Unwin Hyman Ltd., 27th Edition, 1988.
5. John D. Winter, Principles of Igneous and Metamorphic Petrology, Pearson Publication. 2ndEdition, 2010.

6. Marland P. Billings, Structural Geology, Prentice- hall of India, 3rd Edition, 1987.
7. M.K. Bose, Igneous Petrology, World press private ltd., 1st Edition, 1997.
8. R.G. Park, Foundations of structural geology, Chapman & Hall, 3rd Edition, 1997.
9. F.J. Pettijohn, Sedimentary rocks, Orient Longmans Pvt. Ltd., 2nd Edition. 1957.

Underground Mining Machinery - I

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Mining Engineering	3-1-0, (4)	Core	MI10312MI

[Pre-requisites: No]

Course Objectives

The objective of the course is to impart the knowledge of different types of haulage, winding and pumping machines used in mines.

Course Content

Unit-1 Wire Rope

Wire ropes - Application of wire ropes in Mines, selection and their installation; Space factor, Fill factor, Bending factor and Factor of safety, breaking load, capacity factor, critical depth, inspection;Rope deterioration ;Testing, Examination and Care of Wire ropes, Ropes splicing, capping and recapping.

Unit-2Haulage

Rope Haulages: Direct & Endless rope haulage, introduction to other systems of rope haulage, calculations, safety devices; Mine tubs, Mine cars, Links, Clips, and Rope Capel; Haulage road and manholes.

Locomotive haulage: Different types, construction, operation, application, maintenance, and their calculations; Track laying, Safety devices.

Man-riding systems in underground mines: Types, Construction and Safety devices.

Unit-3Drum Winding

Head gear arrangement, shaft fittings, safety devices, cages & skips, suspension gear arrangements; Head frames; types and fittings. Shaft fittings; signals, guides, Keps, cage receivers, protective roofing.Location of winding engine. Electric winders, winding drums; mechanical & electrical breaking, safety devices on winders, Electrical & Electronic methods of speed control, depth indicators; Multilevel winding; automatic contrivances, Torque-time & power-time diagram. Pit top and pit bottom arrangements.

Unit-4Skip &Koepe Winding

Skip - types & construction, pit top & pit bottom arrangements, advantages and disadvantages, Types of Koepe Winder, Koepe wheel, , Floating platforms, Two winders working in the same shaft, Winding with side by side and up and down sheaves, advantages and disadvantages. Multi-rope winding.Calculation of H.P.

Unit-5Pumping

Sources of mine water, types of pumps, design calculations, characteristics, operation, maintenance and selection, pump fittings, special types of pumps used in mines, dealing with acid water, slurry, drainage; lodgements, storage, designs and layout of dams, sumps, pumping problems.

Course Materials

Required Text: Text books

1. Elements of Mining Tech. Vol I &Vol III by D. J. Deshmukh
2. Mining Machinery by S. C. Walker
3. Underground Mining Methods Handbook by Hustrulid
4. Mine Hoisting by M.A. Ramlu, Oxford & IBH, 1996

Optional Materials: Reference Books

1. SME Mining Engineer's Handbook by Hustrulid

Basics of Mining Engineering

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Mining Engineering	3-1-0, (4)	Core	MI10313MI

[Pre-requisites: No]

Course Objectives

The objective of the course is to provide a basic introduction to the fundamental operations involved in mining engineering. Topics to be covered include types of drilling, types of mine openings, shaft sinking and introduction to both surface & underground mining methods.

Course Content

Unit-1 Exploratory Drilling

Drilling machines used for exploratory drilling viz. Rotary & Percussive, their attachments; Core Barrels; Conditions of applicability of drilling methods; Borehole Survey, Directional drilling, Underground methods of exploratory drilling.

Unit-2Drivage of Inclines/Drifts/Adits

Types of Openings; Choice of Openings; Location of Openings; Drilling, blasting, loading and transportation of muck during drivage of inclines/adits/drifts, Ventilation, lighting and drainage, Extension of center line; Organization and cycle of operations; Mechanized methods of drivages of inclines/adits/drifts.

Unit-3Shaft Sinking

Drilling, blasting, loading and transportation of muck, Ventilation, lighting and drainage, Extension of center line; Shaft lining and its design; Special methods of shaft sinking; Shaft boring; Deepening and widening of shafts. Upward drivage; Organization and cycle of operations.

Unit-4Introduction to Underground Mining

Definition of important terms, Mine development, Activities involved in development of a mine, Stages in the life of a mine, Introduction to unit operations in underground mining. Choice of method of mining, Introduction to various Underground Mining methods.

Unit-5 Introduction to Surface Mining

Definition of important terms, Advantages and disadvantages of surface mining, mineral deposits amenable to surface mining, Various surface mining methods, Introduction to unit operations in surface mining.

Course Materials

Required Text: Text books

1. Mining Engineer's Handbook Vol. 1 & 2, 2nd Edition: Edited by Harold Hartman
2. Elements of Mining Technology Vol. 1 & 3, D.J. Deshmukh
3. Modern Coal Mining, Samir Kumar Das
4. Coal Mining, R.D. Singh
5. Surface Mining, G.B. Mishra

Optional Materials: Reference Books

1. Mining of Mineral Deposits, Shevyakov

Engineering Material

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Mining Engineering	3-1-0, (4)	Core	MI10314MI

[Pre-requisites: No]

Course Objectives

The objective of the course is to introduce different types of engineering materials used in construction of various mining tools and equipments along with their structure and relevant mechanical and chemical properties.

Course Content

Unit-1 General

Introduction, Classification of Engineering Materials, Structure of Metals and Alloys, Iron-carbon phase diagram.

Unit-2Heat Treatment of Iron & Steel

Different Types Of Steels, their Properties and Uses, Different Types of Heat Treatment Techniques viz. Hardening, Annealing, Normalizing & Tempering and their Uses in Mining Industry.

Unit-3Wire Rope

Types and Construction, Wire Rope Lays, Non- Stranded Ropes, Selection of Wire Ropes, Ropes used for different purpose, Mass & Strength of Wire Ropes.

Unit-4Constructional Materials

Cements – Classification & Properties, Quick Setting Cement, Resin Capsule, R.C.C., Shot Encapsulization, Shotcreting, Brick & Stone Masonries, Hollow blocks, Application of Fly Ash in Mining - mine filling.

Unit-5 Engineering Behavior of Some Materials

Stress-Strain Curves of typical Engineering Materials, Elastic and Plastic Deformation, Fracture, Fatigue and Creep.

Course Materials

Required Text: Text books

1. Engineering Materials – Properties and selection by K. G. Budinski
2. Principles of Materials Science and Engineering: An Introduction by W.F. Smith
3. Introduction to Engineering Materials by B.K. Agrawal
4. Elements of Mining Technology by D.J. Deshmukh, Vol.I

Optional Materials: Reference Books

1. Engineering Materials by Surendra Singh
2. Concrete Technology by M.L. Gambhir

Mining Environment-I

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Mining Engineering	3-0-0	Core	MI10315MI

[Pre-requisites: No]

Course Objectives

The objective of the course is to provide basic understanding of mine environment; concepts of underground mine ventilation and mine illumination.

Course Content

Unit-1 Mine Atmosphere

Composition of Mine Atmosphere, Mine Gases, their Origin, Occurrence, Physiological effects and Detection, System for Monitoring of Mine Environment by Tube bundle apparatus and Telemonitoring systems. Analysis of Mine air by Haldane Apparatus, Gas Chromatograph, Methane Drainage.

Unit-2 Heat and Humidity and Dust

Heat and Humidity in Mine Atmosphere, their Sources and Effects, Cooling Power of Mine Air, Assessment of Comfort Conditions, Heat Stress, Air Conditioning of Mines, Spot Coolers.

Mine Dust:Classification, Physiological Effects, Measurement of Dust Concentration, Dynamics of Small Particles, Sampling of Air Borne Dust, prevention and Suppression of Dust.

Unit-3 Theory of Ventilation

Objects and Standards of Ventilation, Flow of Air in Ducts and Mine Roadways, Resistance of Air Ways, Laws of Ventilation, Chezy's and Atkinson's Equations, Equivalent Resistance and Equivalent Orifice of Mine.

Unit-4 Mine Ventilation and Ventilation Devices

Natural Ventilation Pressure and its Measurements, Thermodynamics of Natural Ventilation, Distribution and Control of Air Current, Doors, Regulators, Stopping and their Types, Air Crossings, Air Locks.

Unit-5 Flame Safety Lamps and Mine Illumination

Constructional details of Flame Safety Lamp, Gas Testing by Flame Safety Lamp, Types of Portable Lamps, their Maintenance and Examination, Lamp Room Design and Organization.

Lighting from Mains, Photometry and Illumination Surveys, DGMS Standards of Illumination for Underground and Open Cast Working.

Course Materials

Required Text: Text books

1. Mine Environment & Ventilation by G.B. Misra
2. Elements of Mining Technology by D.J. Deshmukh,Vol.II
3. Subsurface Mine Ventilation, by M. J. McPherson

Optional Materials: Reference Books

1. Advanced Mine Ventilation by Pramod Thakur
2. Mine Ventilation Engineering by C. J. Hall

Mathematics-III

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Mathematics	3-1-0, (4)	Core	MI10306MA

[Pre-requisites: Mathematics-I, Mathematics-II]

Course Objectives

To enable the students to apply the knowledge of Mathematics in various fields:

1. Introduce Fourier Series and Fourier Transform
2. Introduce concepts of Laplace Transform and its application in finding of the solution of differential equations and improper integral
3. Able to form and solve the partial differential equation using different analytical techniques with application in solution of wave, heat and Laplace equations
4. Introduce to probability and basic statistical data analysis

Course Content

Unit-1 Fourier series and Fourier Transform

Expansion of function as Fourier series, Functions having points of discontinuity, Change of interval, Even & Odd functions, Half-range series, Harmonic analysis, Fourier Transformation, Inverse transformation, Finite cosine and sine transforms.

Unit-2Laplace Transform

Definition, Transform of elementary functions, Properties of Laplace transform, Transform of derivatives and integrals, Multiplication by t^n , Division by t, Evaluation of Integrals, Periodic functions, Inverse Laplace transform, Convolution theorem, Application of Laplace transform to find solutions of ordinary differential equations.

Unit-3 Partial Differential Equations

Formation, Solutions by direct integration method, Linear equations of first order, Homogeneous linear equations with constant coefficients, Non-homogeneous linear equations, Method of separation of variables with application in solution of wave, heat and Laplace equations.

Unit-4 Introduction to Probability and Statistics

Definitions of Probability, Conditional Probability, Random Variables, Discrete and continuous probability distributions, Expectation, Mean & Standard deviation, Moment Generating Function, Binomial, Poisson and Normal distributions, Descriptive Statistics: Collection and classification of data, Measure of Central Tendency, Measure of Dispersion, Correlation, Line of Regression.

Course Materials

Required Text: Text books

1. Higher Engineering Mathematics by B. S. Grewal - Khanna Publishers.
2. Advanced Engineering Mathematics by Erwin Kreyszig - John Wiley & Sons.

Optional Materials: Reference Books

1. Advanced Engg. Mathematics by R. K. Jain and S. R. K. Iyengar–Narosa Publishing House.
2. Higher Engineering Mathematics by B. V. Ramana, McGraw Hill

Geology-I Lab

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Applied Geology	0-0-2	Core	MI10347AG

[Pre-requisites: Geology-I]

Course Objectives

The objective of this course is to provide a basic idea about

1. Identification, Practiced to and description of rock forming minerals and rocks; inferring origin of rock forming minerals and rocks, through specimens.
2. Practiced to, identification and description geological structures; Reading, drawing and interpreting geological maps and sections, through specimens and maps.
3. Educate the students to apply geological concepts in the mining engineering for economic, environmental, safe and sustainable mining operation.

Course Content

List of Experiments

1. Megascopic identification and description of Rock Forming Minerals.
2. Megascopic identification and description of important Igneous, Sedimentary, Metamorphic Rocks.
3. Practices on Basic Concept of Contours, Attitude of Beds, Width of Out crop, True and Apparent Dips.
4. Study of Geological Maps, preparation and description of Geological Cross Sections.

Underground Mining Machinery – I Lab

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Mining Engineering	0-0-2	Core	MI10348MI

[Pre-requisites:Underground Mining Machinery - I]

Course Objectives

The objective of this course is to provide a basic idea about construction and operational details of rope capels, rope splicing, clifton pulley, various safety devices on rope haulages, exhaust conditioner on a diesel locomotive, cage suspension gear, detaching safety hook, Lilly controller, various koepe arrangements, various types of skips, pit top and pit bottom arrangements for a skip, turbine pump, balancing disc used in mines.

Course Content

List of Experiments

1. Study of Different types of Rope Capels.
2. Study of Rope Splicing.
3. Study of Clifton pulley.
4. Study of various safety devices on rope haulages.
5. Study of Exhaust Conditioner on a diesel locomotive.
6. Study of Cage Suspension Gear.
7. Study of Detaching Safety Hook.
8. Study of Lilly Controller.
9. Study of Various Koepe Arrangements
10. Study of various types of skips.
11. Study of pit top and pit bottom arrangements for a Skip.
12. Study of Turbine Pump.
13. Study of a Balancing Disc.