

Jharkhand University of Technology
Ranchi, 834010



SYLLABUS

**For Diploma Program in
Mining Engineering**

(Effective from 2024-25)

DEPARTMENT OF MINING ENGINEERING

(3rd – SEMESTER)

OPENCAST MINING

1. Rationale:

The objective of this course is to provide students in mining engineering with the necessary knowledge to design safe, scientific, efficient and environmentally responsible opencast mining operations.

The techniques of extracting minerals from the earth are changing rapidly with recent developments in mining industry. Stress is being given for winning of deposits by the employment of heavy machineries.

The teachers while teaching are supposed to give demonstration of present mining technological situations and challenges in mining fields with reference to above mentioned mining technological aspects.

2. Course Outcomes/Skill Sets:

CO-01	Apply the concepts in the design and development of opencast mining.
CO-02	Plan and supervise drilling and blasting operations in mining following safe practices.
CO-03	Choose the excavators for different Mining activities.
CO-04	Analyze other Mining equipments and transportation equipments ,and various Opencastmine layouts.

3. Course Content:

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
1	1	1,2,3,7	1. The limitations, of Opencast mining, 2. An idea of Placer mining, Sluicing, Auger mining, Hydraulic mining and Dredging, 3. Factors affecting choice of opencast mining methods. (Conditions Favouring Adoption of Opencast Mining) ultimate pit limit, Stripping Ratio and Quarriable limit.	1. Compare opencast mining with underground mining.	1. Point out the considerations during preparation of the pre-feasibility Report. 2. Describe the various Opencast Mine Terminologies with a simple sketch.
2	1	1,2,3,6,7	1. Factors considered for designing and planning a surface mine, design of bench height in manual and mechanized Opencast mining, merits and	1. Identify the factors affecting Choice of Mode of Entry.	1. Collect the information which is necessary for height and width of benches

			demerits of Larger bench heights. 2. Factors considered for designing and planning a surface mine, design of bench width in manual and mechanized Opencast mining, 3. Factors considered for designing and planning a surface mine, design of bench Slope in manual and mechanized Opencast mining,		2. Study the bench height and width of few OCM mines in India
3	1	1,2,3,4,7	1. The design of haul roads, 2. The points to be borne in mind while constructing drainage system on haul roads, control measures of water in an OCM. 3.The safety measures to be taken on Haul roads,	1. Identify the problems created by water	1. Study of factors governing Rock Slope stability. 2. Procedure for designing openpit slope.
4	2	1,4	<i>Construction and working of</i> 1. Well hole drill. 2. Down the hole drill(DTH) 3. Wagon drill	1. Analyse the factors considered in selecting drills for an opencast mine,	1. Study of Wagon drill 2. Study of DTH
5	2	1,2,3	1. Selection of various blast Parameters-Burden, Spacing 2.Depth of hole, bench height, 3.Diameter of hole, Sub grade drilling, Stemming material,	1. List out the factors influence the blast design	1. Study of different Burden and spacing Designs. 2. Study of different Burden and spacing Designs.
6	2	1,3	1.The Properties of explosives, 2.Different types of explosives used in o/c mines, ANFO, 3.Cartridges (Slurries & Emulsion), Site Mixed Slurry/Emulsion Explosives /Bulk Explosives, LOX.	1. Classify explosives.	1. Magazine - layout, construction & safety features. 2. The calculation of charge per hole and powder factor,
7	2	1,2,4	1. Deck charging, Transportation of explosives, 2. The secondary blasting Pop shooting and Plaster shooting. 3. Initiation devices: detonators,	1. Compare Low explosive and High Explosives.	1.Sequence of Blasting- single row, multiple rows, series, parallel, parallel-series, series-parallel. 2.Initiation patterns for shots fired in an open face.
8	3	1,2,3,4	1. Safety fuse, Detonating Fuse, shock tubes. 2. Study of controlled blasting techniques. 3. Study of controlled blasting techniques.	1.Identify various initiation devices.	Study of controlled blasting techniques. 1.Pre splitting 2.Cushion blasting
9	3	1,3,4	1. The construction and operation of Dipper shovel (rope	1. The factors governs the	1. Study of Dipper shovel with a Sketch.

			shovel and hydraulic shovel), their comparison, 2.Operation and working principle of dragline and dragline bucket. 3. Operation and working principle of Front-end Loader (Wheel Loader).	selection of excavators.	2. Study of Dragline with a Sketch.
10	3	1,3,4	<i>Construction and operation of</i> 1. Bucket wheel excavator, 2. Back hoe. 3.Continuous Surface Miner.	1.List the conditions for the use of BWE, Continuous Surface Miner, and Back hoe.	<i>Describe with neat sketch of:</i> BWE Continues Surface Miner Back-hoe.
11	4	1,4,7	<i>Construction & working of</i> 1. Rear discharge 2.Side discharge 3.bottom discharge Dumpers	1.Comparision of dumpers	1.Sketches of Dumpers. 2. Learn the safety devices in Dumpers,
12	4	1,2,3,4,	1. The factors which decide the haulage equipment, (The salient points for selection of transporting System.) <i>The principle of operation and uses of:</i> 2.Bull-dozer 3.Scraper.	1.Compare the limitations of Bulldozer and Scraper and Ripper	1.Neat Sketch of Bulldozer, Scraper. 2. Draw a layout for a surface limestone mine with an output of10000 tonnes/day in a flat deposit. Assume your own conditions.
13	4	1,2,3,4,7	1. Box cut, location of box cut, the layout of Dipper shovel and Dumper combination, 2. Layout for dragline working along with shovel and dumper, 3. Principles of Reclamation.	1. List out the factors which decides the layout of OCM	1. Draw a layout for a surface coal mine with an output of 1000 tonne/day in a deposit having a gradient od 4°. Assume your own condition. 2. Visit any mechanised opencast mine and draw a layout of it.
Total in hours			39	13	52

Reference:

Sl. No.	Description
1	1. T. N. Singh, <i>Underground winning of Coal</i> , Oxford and IBH New Delhi, 1992
2	2. Y. P. Chacharkar, <i>A study of Metalliferous Mining Methods</i> , Lovely prakshanDhanbad,1994
3	1. I. C. F. Statham, <i>Coal Mining Practice</i> , Caxton eastern agencies, Calcutta, Reprint, 1964
4	D. J. Deshmukh, <i>Elements of Mining Technology</i> , Vol. - I & II, EMDEE publishers Ranchi, Revised edition, 2000
5	S. K. Das, <i>Modern Coal Mining Technology</i> , Lovely Prakshan, Dhanbad, 1992
6	R. D. Singh, <i>Principles & Practices of Modern Coal Mining</i> , New age international New Delhi, 1997
7	B. C. Arthur, <i>SME Mining Engineers Hand Book</i> , American Institute of Mining, Metallurgical and Petroleum Engineers New York, 1973.

Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Models of detonators and other initiating devices.		
2	Models of excavators to suit the curriculum		
3	Models of Opencast mine layouts.		

U/G METALIFERROUS MINING

1. Rationale

The objective of this course is to provide students in mining engineering with the necessary inputs to carryout safe, scientific, efficient and environmentally responsible underground metalliferous mining operations.

The techniques of extracting minerals from the earth are changing rapidly with recent developments in mining industry. Stress is being given for safety and winning of deposits by the employment of latest machineries.

The teachers while teaching are supposed to give demonstration of present mining technological situations and challenges in mining.

2. Course Outcomes/Skill Sets:

CO-01	Carry out Drilling and Blasting practices Underground
CO-02	Carry out the Drivage of underground developmental openings.
CO-03	Analyse the Special methods of Shaft sinking.
CO-04	Choose the method of Stoping and Sampling.

3. Course Content:

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
1	1	1,4	1. Explosives: Constituents of explosives, 2. Low & High Explosives: Gun Powder, ANFO, 3. Detonators & Accessories-Plain detonator	1. Compare Low explosives and High explosives.	1. Distinguish the Physical properties affecting choice of Explosives. 2. Analyze the qualities desirable in an ideal explosive.
2	1	1,2,4	1. Delay electric detonator, advantages of delay detonators, 2. Common causes of accidents from explosives, 3. Misfired shots & blown out shots-causes and remedial measures,	1. Point out the Major advantages of non-electric detonators.	1. Categorize the various Detonators. 2. Explain the Ohm Meter, Shot firing cables, Exploders-types, construction and safety features.
3	1	1,2,4	1. Calculation of explosive quantity, powder factor. 2. Free faces.	1. List out and identify the	1. Distinguish various Shot-firing tools,

			3. Precautions during Blasting.	Shot firing tools.	2. Preparation of charge, Write the procedure for firing shots,
4	2	1,2,3,4	<i>Breaking Ground in Development:</i> Application advantages and disadvantages of: 1. Wedge cut 2. Burn cut 3. Coromant cut.	1. Conditions which affect the result of a blast.	1. Compare Direct & Indirect initiation 2. Compare Drilling patterns for Rectangular and Circular shaft.
5	2	1,2,3,4	<i>Application advantages and disadvantages of:</i> 1. Drag cut 2. Fan cut 3. Pyramid cut	1. Compare the various drilling patterns.	Analyse in detail various drilling patterns in developmental openings.
6	2	1,4	1. Construction and working of Jack hammer, 2. Air leg, Airline lubricator. 3. Drifter.	1. Compare Jack hammer with Drifter.	1. Demonstrate design of hammer drill. 2. Demonstrate the use of Air leg and Lubricator.
7	3	1,3	1. The Piling system, Caisson method, 2. Freezing method, 3. Cementation process of shaft sinking.	1. list the special method of sinking with their conditions.	<i>Compare:</i> 1. Pneumatic caisson and 2. Cementation process of shaft sinking.
8	3	1,3,4	1. Principles kept in mind when opening up a deposit. Different Raising Methods- 2. Drop rise, Alimak rise climber, 3. Centre stack, Compartment method	1. Relative merits and demerits of various methods of rising.	Analyse the various Raising methods underground
9	3	1,4,	1. The loading of trucks in development 2. Shovel type loader 3. A Tipler	1. List out the various underground haulage systems.	Study of Various types of Tipping trucks.
10	4	1,2,3	<i>Different stopping methods</i> 1. Underhand stopping, over hand stopping, 2. Shrinkage stopping, 3. Cut & fill method of stopping,	1. Compare shrinkage stoping and Cut and fill method of stoping.	<i>Explain the following method of stoping with neat sketches.</i> 1. Cut and Fill method 2. Shrinkage stoping
11	4	1,2,3	1. Sub-level stopping, 2. Long Hole stopping their application, preparation, working, merits & demerits. 3. Rock burst - causes and preventive measures.	1. Compare Sub-level and Long hole stoping.	<i>Explain the following method of stoping with neat sketches.</i> 1. Sub level method 2. Long hole stoping
12	4	1,2,3	<i>Important Metalliferous u/g mines</i> 1. Kolar gold mines- problems of deep mining. 2. Manganese ore mine- Bherveli (Balaghat). 3. Mosabani copper mines. Khetri copper mines.	1. Give a comparative study between coal and metal Mining.	<i>Contrast of important Metalliferous u/g mines:</i> 1. Kolar gold mines- problems of deep mining. 2. Manganese ore mine- Bherveli (Balaghat).

13	4	1,2,4	1. Sampling- purpose and various uses, Sampling Methods-trench, Pit, Drill, 2. Channel, Bulk and Chip sampling. 3. Assaying-Introduction assay map, assay plan factor, assay values, grade value, tenor, type of grade value.	1. Compare the different methods of Sampling.	1. Calculations based on average assay value. 2. Estimation of ore reserves
Total in hours			39	13	52

Reference:

Sl. No.	Description
1	T. N. Singh, Underground winning of Coal, Oxford and IBH New Delhi, 1992
2	Y. P. Chacharkar, A study of Metalliferous Mining Methods, Lovely Prakshan Dhanbad, 1994
3	I. C. F. Statham, Coal Mining Practice, Caxton eastern agencies, Calcutta, Reprint, 1964
4	D. J. Deshmukh, Elements of Mining Technology, Vol. - I & II, EMDEE publishers Ranchi, Revised edition, 2000
5	3. S. K. Das, Modern Coal Mining Technology, Lovely Prakshan, Dhanbad, 1992
6	R. D. Singh, Principles & Practices of Modern Coal Mining, New age international New Delhi, 1997
7	B. C. Arthur, SME Mining Engineers Hand Book, American Institute of Mining, Metallurgical and Petroleum Engineers New York, 1973.

Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Models of Explosives, Detonators and initiating devices		
2	Models of Drilling Machines, drill bits, Air leg, Airline Lubricator.		
3	Models of at least two stoping methods.		

MINE SURVEYING-I

1. Rationale

The diploma holders in Mining and Mine Surveying will be responsible to carry out survey of the mine area in open cast as well as underground so that efficiency in planning for the development of the mining area & proper development of the mine be obtained.

The subject provides him elementary knowledge of surveying as chain survey, compass survey, level survey and theodolite survey with reference to mining and mine surveying.

As far as possible teachers while teaching is supposed to give demonstration of different type of surveying and instruments used in each survey and preparation of survey plan.

2. Course Outcomes/Skill Sets:

CO-01	Conduct Surveying using chains and Chain surveying instruments.
CO-02	Conduct Surveying using Compass and instruments in compass surveying
CO-03	Use of instruments in levelling and conducting experiments on methods of levelling.
CO-04	Concept of contour, its uses and methods of contouring. Compute area and volume of irregular figures.

3. Course Content:

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
1	1	1,2,4	1. Objectives of surveying, primary divisions, 2. Classifications, and principle. 3. Mine Surveying, Appointment of mine surveyor.	1. Compare various methods of Surveys.	Study of: 1. Variety of Plans and Sections. 2. Basic Units.
2	1	1,2,4	1. Duties and Responsibilities of Surveyors. 2. General requirement of Plans and Sections. 3. Types of Plans.	1. Preparation of plans by Surveyors.	1. Statutory provisions. 2. Conventions for preparing Plans and Sections.
3	1	1,2,4	1. Purpose, Accessories, Principles of chain surveying, 2. Instruments for Chaining. 3. Different operations, Ranging,	1. Compare different types of Chains.	1. Measurement of distance by ranging and chaining. 2. Locating various object by chain & cross staff survey

4	1	1,2,4	1. Cross staff survey simple problems, 2. Errors & corrections in chain surveying, 3.Obstacles in chain line.	1.Compare different types of Cross-Staff.	1. Practice Cross-staff Survey. 2. Determination of area of polygon by chain and cross staff survey.
5	2	1,2,4	<i>Angles, Bearings and Azimuths.</i> 1.Angles, Bearings, Conversion of Bearings. 2.Fore and Back bearings and Conversions 3.Meridians.Calculations of Angles from Bearings.	1.Compare RB and WCB.	1.Calculation of Angles from Bearings. 2.Draw a neat sketch of Prismatic compass and Describe it.
6	2	1,2,4	1.Magnetic dip and Declination 2.Simple problems, Local attraction, 3.Open and closed traverse, checks, Errors	1.Checks on open and closed traverse.	Measurement of bearings of sides of traverse with prismatic compass and computation of correct included angle.
7	3	1,2,4	1. Terms used in leveling, types of levels, 2. Bench marks, 3.Temporary adjustments of level	1.Demonstration of level.	1. Study of Dumpy level. 2. Temporary adjustments of level
8	3	1,2,4	1. Concept of B.S, I.S, F.S, C.P, H.I and remarks, 2. Simple leveling and differential leveling Reduction of levels i) Plane of collimation method 3. ii) Rise and fall methods	1.Compare PC and Raise and Fall method of Reduction of levels.	Determination of elevation of various points with dumpy level by collimation plane method and rise & fall method.
9	3	1,2,4	1. Different types of leveling - fly leveling, check leveling, 2. profile leveling, cross sectioning, 3. Errors in leveling and precautions,	1.Compare various Bench marks.	1. Fixing bench mark with respect to temporary bench mark with dumpy level by fly leveling and check levelling. 2. Plotting of longitudinal and cross section,
10	3	1,2,4	1.Shaft depth measurement 2.Levelling to establish underground Bench mark. 3.Trigonometrical levelling	1.Advantages of Trigonometrical levelling.	1.Stimulate the method for establishing underground bench mark. 2.Determination of elevation of point by trigonometric levelling.
11	4	1,2,4	1. Concepts of contour and terms used in contouring, 2. characteristics of contour Methods of contouring,	1. List the uses of contours.	1. Methods of Contouring, 2. Contour plan of given area.

			3. Interpolation by arithmetical method.		
12	4	1,2,4	1. calculation of capacity of the reservoir. 2. Computation of Area of Irregular figures using Trapezoidal & Simpson's rule - problems. 3. Volumes of Irregular solids- using Trapezoidal & Prismoidal Rule -	1. Compare Trapezoidal & Simpson's rule	1. Survey Office, Survey Office layout. 2. Computation of Area of Irregular figures using Trapezoidal & Simpson's rule
13	4	1,2,4	1. Various methods of plotting a survey. 2. Methods of Enlarging and Reduction of Plans. 3. Planimeter.	1. Demonstrate Planimeter, Eidograph and Pentagraph	1. Determination of area of irregular figure by using Planimeter 2. Study of The Eidograph Pentagraph.
Total in hours			39	13	52

Reference:

Sl. No.	Description
1	Mine Surveying and Levelling, <i>Vol. I, II & III</i> by Ghatak, COALFIELD PUBLISHERS, Ukhra, Burdwan, W.B.
2	W. Schofield and M. Breach, <i>Engineering Surveying</i> , Sixth edition, 2007, ELSEVIER, B & H.
3	B. C. Punmia, <i>Surveying, Vol - I, II, III</i> , Laxmi Publication, New Delhi, 12th Edition, 1990
4	V. Maslov, <i>Geodetic Surveying</i> , Mir Publication, Moscow, Revised edition, 1980.
5	Fedorov, <i>Elementary Plane and Mine Surveying</i> , Mir Publication, Moscow, Revised Edition, 1986.
6	V. Natarajan, <i>Advanced Surveying</i> , B. I. Publication, Bombay, First edition, 1976.
7	T. P. Kanetkar, <i>Surveying and Levelling</i> , Pune Vidyarthi Griha Prakashan, Reprints, 1995.
8	S. K. Roy, <i>Fundamentals of Surveying</i> , Printice Hall of India Pvt., New Delhi, Third Printing, 2004

Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Quantity
1	Auto / quick setting / Dumpy level with accessories	
2	Metric chains 30m	
3	Arrows	
4	Tape 15m	
5	Tape 30 m	
6	Ranging rods	
7	Cross staff, French cross staff, open cross staff, line ranger, optical square, prism square,	
8	Prismatic compass Surveyor compass	

MINING GEOLOGY-II

1. Rationale

The Mining Engineers have to plan, carryout extraction of rocks / mineral deposits economically, which involves knowledge and skills of nature and quantum of such deposits based on proper studies and assessment.

This course empowers students with such necessary knowledge and skills of geological deposits and its estimation for economical mining.

2. Course Outcomes/Skill Sets

CO-01	Distinguish the fundamental concepts of Structural geology.
CO-02	Analyze the Economic Minerals and the Indian Mineral Resources to carryout Mining operations.
CO-03	Appraise the Importance of coal and occurrence of water underground
CO-04	Prepare Maps and distinguish geological features and Compare methods of Exploration.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
1	1	1,3,4	1. Dip and Strike, Apparent dip and True dip. 2. Folds- Elements of folds, 3. Anticline and Syncline, Limbs, Axial of folds,	1. Demonstrate the parts of Folds.	Distinguish the following with a neat sketch. 1. Anticline 2. Syncline
2	1	1,3,4	1. Types of folds- Symmetrical, Asymmetrical, 2. Overturned, Recumbent, Isoclinal, Plunging folds, 3. Anticlinorium, Synclinorium , Open fold, Close fold ,Dome and Basin.	1. Differentiation of various folds	1.Distinguish the various types off folds with sketch. 2. Distinguish the various types off folds with sketch.
3	1	1,3,4	1. Faults Fault Terminology, Fault- Plan, Hade, Dip and strike, Throw, Heave, Slip, Hanging wall and foot wall.	1.Demonstrate different parts of Fault.	1.Distinguish the various types off Faults with sketch.

			2. Classification of faults- Normal and reverse faults, 3. Dip fault, strike fault and Oblique faults, High and low angle faults, Parallel faults, Step- faults, Graben, Horst, Radial faults, Peripheral faults.		2.Distinguish the various types off Faults with sketch.
4	1	1,3,4	1. Unconformities- definition, Types Angular unconformity, Disconformity, Nonconformity. 2. Joints- Classification- Strike joints, Dip joints, Oblique joints, Bedding joints, 3. Master Joints, Sheet Joints and columnar joints.	1.Demonstrate different parts of joint.	1.Distinguish the various types off joints with sketch. 2.Distinguish the various types off joints with sketch.
5	2	1,3,4	1. Concept of: Mineral, Gangue and Tenor of ores, 2. A brief outline of the classification of ore deposits. 3. Magmatic ore deposit Early magmatic, Late magmatic	1. Classify the formation of mineral deposits.	Recognize the following: 1. Compare the formation of Mineral deposits. 2. Early magmatic, Late magmatic
6	2	1,3,4	1. Pegmatic deposits, Sublimation deposits, Contact metasomatic deposits, 2. Hydrothermal deposits classification of hydrothermal deposits, 3. Cavity filling deposits, types of cavity filling deposits, replacement deposits, types of replacement deposits.	1.Compare Hydrothermal, Cavity filling and replacement deposits.	Recognize the following: 1. Hydrothermal deposits, 2. Cavity filling deposits, types of cavity filling deposits,
7	2	1,3,4,7	1. Sedimentation deposits, evaporation deposits, Residual deposits, 2. Mechanical concentration deposits (Placer deposits), types of placer deposits. 3. Oxidation and super gene enrichment deposits, metamorphic deposits	1.List out the conditions favors formation of Placer deposits	Recognize the following: 1. replacement deposits, types of replacement deposits. 2. metamorphic deposits
8	2	1,3,4,7	1. A brief account of the origin, occurrence, distribution in India and economic use of the following ores and minerals Gold, Iron-ore, 2. Manganese ore, Copper ore, 3. Aluminum ore, Chromite.	1. Summarize the place of occurrence of Gold, Iron-ore, Copper ore, Chromite.	Recognize the following: 1. Sedimentation deposits 2. Types of placer deposits.
9	3	1,3,4,7	1. Rank of coal, classification of coal Peat, Lignite, Bituminous, Anthracite and Cannel coal. 2. Banded constituents of coal, chemical properties of coal, structural features of coal seams.	1. Classify the coal seam based on its Rank.	Analyze the following: 1.Rank of Coal. 2. In situ theory, Drift theory, formation of coal

			3. Origin of coal In situ theory, Drift theory, formation of coal preservation,		
10	3	1,3,4,7	1. Elementary idea of ground water, Sources of ground water, Occurrence of ground water. Hydrological cycle. 2. zone of aeration, saturation, star table, hydrological properties of rocks 3. porosity and permeability, Aquifer.	1. Classification of Sub surface water.	Analyze the following: 1. Wells and Springs. 2. Water bearing Formations
11	4	1,3,4,7	1. Exploration: A brief outline of the various methods, Drilling of Boreholes. 2. Geophysical methods: Ground-Penetrating Method, Electrical methods, Electromagnetic method, Resistivity method, Seismic methods, 3. Gravity method, Magnetic Method. Advantages and limitations of each methods.	1. Enumerate the various Geophysical methods.	Analyze the following: 1. Magnetic Method
12	4	1,2,3,4,7	1. Remote sensing an introduction, application in various fields, 2. G.P.S. (Global Positioning System), 3. G.I.S. (Geographic Information System).	1. Appreciate GPS and GIS.	Draw Sections along given line and to describe Order of Super Position, Structural features and Geological history. 1. Start from simple maps, like only Contours, Contours with Beds horizontal beds which are inclined. 2. Maps with intrusions-Like Sill, Dyke and Batholith.
13	4	1,2,3,4,7	1. A map., the types of Maps- Geological and Topographical maps. 3 Contour, Contour interval, Horizontal Equivalent, and Profile.	1. Learn the Geological History of given maps	Draw Sections along given line and to describe Order of Super Position, Structural features and Geological history. 1. Maps with faults. 2. Maps with unconformities.
Total in hours			39	13	52

Reference:

Sl. No.	Description
1	P. K. Mukherjee, A Text Book of Geology, The World Press Pvt. Ltd., 9th Edition, 1982.
2	H. H. Read, Rutley's Elements of Mineralogy, CBS Publishers and Distributors, 26th Edition, 1984
3	Bateman, A.M., Economic Mineral Deposits, John Wiley and Sons, 1956
4	Arogyaswamy, R.N.P., courses in Mining Geology, Oxford and IBH Co., New Delhi, 1988. Engineering Geology- Parbin Singh
5	P. B. Marland, Structural Geology, Prentice Hall of India Pvt. Ltd., 3rd Edition, 1990.
6	D. E. Salisbury & W. E. Ford, A Text Book of Mineralogy, Wiley Eastern Limited, 4th Edition, 1992.
7	Krishnaswamy, S. Indian Mineral Resources, Oxford and IBH Publication Company, New Delhi, 1984.
8	G. W. Tyrrel, The Principles of Petrology, B. I. Publications Pvt. Ltd., 1989.
9	G. B. Mahapatra, Text Book of Physical Geology, CBS Publishers and Distributors, 1st Edition, 1990.
10	R. Kumar, Fundamentals of Historical Geology and Stratigraphy of India, Wiley Eastern Limited, 1992.
11	Umopathy, R.M., Text book of Mining Geology, Daltsons, 2002.

Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars
1	Various types of rock structural models showing dip, strike, fault, fold and joints.
2	A set of 25 common Ore forming Minerals as mentioned in the Practical

(4th – SEMESTER)

MINE ENVIRONMENT AND VENTILATION

1. Rationale:

Mining industry is one of the industries causing environmental pollution and chances of severe accidents. Certain bindings are imposed through regulations on mining industry for safe workings and to control hazards associated with mines.

Students are required to be more acquainted with the major problems associated for mine workers in connection with comfortable working conditions and various sources of problem creating agents.

As far as possible teachers while teaching are supposed to give practical examples of the typical mining fields and expose the students to the actual mining sites.

2. Course Outcomes/Skill Sets:

CO-01	Recognize the percentage of toxic and inflammable mine air and employ its threshold limits, Identify the precautionary measures for Mine fire,
CO-02	Identify the causes and carry out the precautionary measures for Mine Explosion. Analyse the different Rescue apparatus and Recovery methods,
CO-03	Employ the principles to predict the Mine climate underground. Identify the causes and carry out the precautionary measures for Mine Inundation and Miner's diseases
CO-04	Measure the underground quality and quantity of air and Analyse the different Mine lightings.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
1	1	1,2,4,7	1. Normal air compositions, return air compositions, oxygen, nitrogen, 2. Occurrence, Physical, Chemical properties, and physiological effects of: carbon dioxide, black damp, and 3. white damp.	1. Describe various kinds of damps.	Procedure of determining the percentages of carbon monoxide using various types of detectors.
2	1	1,2,4	Occurrence, properties, physiological effects of 1. Stink damp 2. Fire damp 3. After damp	1. Describe the detection of Stink damp.	1. Study of determination of firedamp by automatic detectors: Ringrose and Naylor spiralarm 2. Study of determination of firedamp by non-automatic detectors: Mc. Luckie and M.S.A. Methanometer.
3	1	1,2,4,7	1. Mine Fires: Classification, causes, preventive measures. 2. Spontaneous heating: governing factors, symptoms and preventive measures. 3. Collection of samples behind fire seals, Reopening of sealed off area.	1. Analyse the GAS behind stoppings.	1. Distinguish various types of fire extinguishers and their applicability. 2. Interpret CO/O ₂ and CO ₂ /O ₂ deficiency ratio.

4	2	1,2,4,7	<p>1.Fire damp explosion: causes and preventive measures, methane layering and methane drainage.</p> <p>2.Coal dust explosion: causes and preventive measures.</p> <p>Factors affecting in-flammability of coal dust, treating coal dust by watering and stone dusting, stone dust barriers.</p> <p>3.Intrinsically safe“ and flame proof enclosures”.</p>	1.Practice the Coward’s diagram,	<p><i>Study of Construction of</i></p> <p>1. Stone dust barriers and</p> <p>2. Water barrier</p>
5	2	1,2,4,6,7	<p>1. Human respiratory system.</p> <p>2.Construction, working principle of smoke helmet and hose mask,</p> <p>3. self-contained breathing apparatus</p>	1.Compare Smoke helmet with Hose mask.	<p>Explain the operation of:</p> <p>1. smoke helmet and hose mask</p> <p>2.Study of self-contained breathing apparatus,</p>
6	2	1,4,6,7	<p>1.Gasmask,</p> <p>2.Self-rescuer, Reviving apparatus.</p> <p>3. Rescue station, rescue operations in mines. Fresh-Air-Base.</p>	1.Demonstrate Gas mask and SCBA.	<p>Procedure of working and use of:</p> <p>1.Study of Gasmask,</p> <p>2.Practicing Resuscitation methods</p>
7	3	1,4,7	<p>1.Causes and precautions of mine Inundation from surface water and underground water,</p> <p>2. Causes and preventive measures of Nystagmus, Ankylostomiasis, dust hazards in mines,</p> <p>3. Pneumoconiosis, Silicosis, Asbestosis, siderosis, Anthracosis, Symptoms of lung diseases,</p>	1. List the precautions while approaching water logged areas.	<p>1. Study of Burn side safety boring apparatus.</p> <p>2. Sketch and learn different types of water dams.</p>
8	3	1,4,7	<p>1.The objects of mine ventilation, causes of rise of temperature in mines, geothermal gradient, sources of heat in mine air, sources of moisture in mines, uses of thermometer in mining,</p>	1.Point out the effect of heat and humidity on the efficiency of mine worker.	<p>Conduction of ventilation survey for quality of air using</p> <p>1. Hygrometer and</p> <p>2.Katathermometer</p>

			2.Humidity, Hygrometry, 3. Cooling power of a mine air and Kata thermometer.		
9	3	1,2,4,7	1.Downcast and Up-cast, natural ventilation, conditions favorable to natural ventilation,2.Motive column: derivations and numerical problems, 3.limitations of natural ventilation, NVP,	1. List the factors influencing the production of natural ventilation,	1. Construction and working of Surface air conditioning plant and 2. spot coolers: construction and working
10	3	1,4,7	1.Splitting of air, numerical problems on calculating quantity of air flow, ventilation doors, their location. Homotropical and Antitropical ventilation, 2.constructions., Atkinson's equation, Booster and Auxiliary fans. 3. Auxiliary ventilation: forcing, exhaust and overlap system.	1. Describe the Construction and working Centrifugal and Axial- flow fan.	1. Describe Ventilation doors, Regulators, Ascensional and Descensional ventilation. 2.Air crossings, the ventilation of a face by brattice partitions
11	4	1,4,7	Scope and importance of ventilation survey, Pressure measuring instruments with sketch and procedure of using: 1) Barometer 2) Aneroid barometer 3) vertical manometer and inclined manometer and Pitot tube.	1.Collect different method of Ventilation (Sketches) of headings from internet.	1. The procedure of using the following velocity measuring instruments: (a) Anemometer (b) Velometer. The procedure of finding the quantity of air flow. 2. Pitot tube. Water- Gauge.
12	4	1,4,7	1.The importance of light in mines, standards of lightings, 2.modern cap lamps, maintenance of cap lamps, 3.lamp room.	1.Point out the Statutory requirements of lightings	Flame safety lamp: 1.Construction 2.Handling(assembling and dissembling)
13	4	1,2,4,6,7	1. Flame safety lamp- Principle of construction, working, 2. Handling and maintenance of FSL. 3. Transmission of heat: Conduction, Convection and Radiation.	1.Demonstration of Flame safety lamp.	<i>Procedure of determining Methane by using Flame Safety Lamp.</i> 1. Accumulation test 2. Percentage test
Total in hours			39	13	52

Reference:

Sl. No.	Description
1	Elements of Mining Technology, Vol-2, D.J.Deshmukh
2	Mine fires, Rescue, Recovery and Inundation, M A. Ramulu
3	Mine ventilation, S. Ghatak
4	Mine Environment and Ventilation, G.B. Mishra
5	Mine Environment and Ventilation, G.B. Mishra
6	UMS Volumes
7	Mines Rescue rules
8	Mine ventilation by- Hartman
9	Statham series

Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Hygrometer, Kata thermometer, Barometer, Pitot tube, Anemometer, Velometer, Inclined manometer		Each 01
2	Model or Chart of Gas mask, Self-contained Breathing apparatus.		Each 01
3	Charts of Human respiratory system and Artificial respiration methods,		Each 01
4	Portable type Firefighting equipments		Each 01
5	Chart of Coward's diagram		01
6	Flame Safety lamp.		02

MINE MACHINERY

1. Rationale

The mining engineers are generally responsible for the mine developments, mining activities supervision etc. In this process they have to use different machines and hence are expected to know about all types of machinery used in mining industries and their applications, operational parameters, safety features etc.

The course provides students basic knowledge and skill about various types of wire ropes, winding system, u/g machineries, loading and hauling machines, hoisting machines and various safety devices used in mines, their installation operation and safety feature of all the machines.

The teachers are supposed to give demonstration of functioning of working models in the laboratory as well as machineries in operation at the actual mining site.

2. Course Outcomes/Skill Sets:

CO-01	Analyse the wire ropes for different Mining operations. Learn the shaft fittings and suspension gear and Carryout the rope capping operations.
CO-02	Apply the suitable winding for a mine and follow safety measures to operate hoisting and transport System
CO-03	Select appropriate rope and locomotive haulages for various mining operations.
CO-04	Select appropriate Pumps , conveyors, and other transport systems for various mining operations.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
1	1	1,2,4	1. Construction, selection, of wire ropes 2. factor of safety, of wire ropes 3. Causes of deterioration of wire ropes,	1. Compare different lays of wire ropes.	Analyse the various constructions of wire ropes.
2	1	1,2,4	1. Use and care of wire ropes 2. Storage and handling, examination of wire ropes. 3. Examination of wire ropes.	1. List out the uses of Wire ropes.	1. Study of laboratory tests for wire ropes 2. Procedure of rope splicing,
3	1	1,2,3,4	1. Headgear: purpose, height, types. 2. Headgear pulley, fleet angle. 3. Cages and accessories, guide shoes, interlocking wedge cappel,	1. Identify the forces acting on headgear	1. Study of headgears 2. Procedure of white metal cappel.
4	2	1,3,4	1. Ormerod detaching hook, king detaching hook. 2. Safety catches in headgear, Keps, skip winding. 3. Shaft guides: rigid and flexible guides	1. a) Compare skip winding with Cage winding. b) Compare Rigid guide and flexible guides.	<i>Describe the construction and working of:</i> 1. Suspension gear 2. King Detaching Safety Hook.

5	2	1,3,4	<p>1. Application, construction, advantages and disadvantages of: Cylindrical drum, conical drum,</p> <p>2. cylindro-conical drum, bi-cylindro-conical drum.</p> <p>3. Tower mounted friction winder, ground mounted frictionwinder.</p>	<p>1. a) Compare Drum winder and Frictional winders.</p> <p>b) Compare tower mounted and Ground-mounted Friction winders</p>	<p><i>Describe the construction and working of:</i></p> <p>1. Cylindrical drum, conical drum, cylindro-conical drum, bi-cylindro-conical drum.</p> <p>2. Mechanical brakings.</p>
6	3	1,3,4	<p>1. Construction, application, advantages of: Direct rope haulage,</p> <p>2. Main and Tail rope haulage,</p> <p>3. Endless rope haulage</p>	<p>1. Choose the haulages for various mining conditions. (Choice of haulages.)</p>	<p><i>Describe the construction and working of:</i></p> <p>1. Main and Tail rope haulage,</p> <p>2. Tensioning arrangements for endless rope haulage.</p>
7	3	1,3,4	<p>1. Gravity rope haulage</p> <p>2. Mine Track: Rails, sleepers, ballast, curves, crossings and turnouts.</p> <p>3. Mine Track: curves, crossings and turnouts.</p>	<p>1. Essentials of a good haulage track.</p>	<p>1. Rope clips</p> <p>2. Safety devices on haulage roadways.</p>
8	3	1,3,4	<p>1. Advantages, conditions for the use, tractive factors of Locomotive haulages.</p> <p>2. Construction, application and advantages of: Diesel locomotives,</p> <p>3. Battery locomotive, Man-Riding Haulage</p>	<p>1. Compare the relative merits and demerits of Locomotives.</p>	<p><i>Construction and working of</i></p> <p>1.LHD</p> <p>2.Rocker Shovel.</p>
9	3	1,3,4	<p>1. Trolley wire locomotive, Cable reel locomotive,</p> <p>2. Compressed air locomotive,</p> <p>3. Steam locomotive and Aerial ropeway</p>	<p>1. Advantages of Aerial ropeway.</p>	<p>1. Study of Battery charging station,</p> <p>2. Learn the working of Exhaust conditioners,</p>
10	4	1,3,4	<p>1. Belt conveyors: Construction and essential parts</p>	<p>1. List the reasons for</p>	<p>1. Study of belt conveyer</p>

			2. Safety devices on belt conveyor, 3. Advantages and disadvantages of nylon belt conveyor.	increased use of Conveyors.	2. Safety devices on belt conveyor.
11	4	1,3,4	1. Troughed belt conveyor Construction, application of: 2. Cable belt conveyor, 3. Rope belt conveyor,	1. Advantages of Troughed belt conveyer and cable belt conveyor	Study of tension arrangements of belt conveyers.
12	4	1,3,4	<i>Construction, application of:</i> 1. Shaker Conveyor, 2. Scraper chain conveyor, 3. Flexible chain conveyor.	1. Advantages and disadvantages of Shaker Conveyor, Scraper chain conveyor, and Flexible chain conveyor.	Study of Construction of 1. Scraper chain conveyor, 2. Flexible chain conveyor.
13	4	1,3,4	1. Construction, attachments, application, working, advantages and disadvantages of: Reciprocating pump, 2. Centrifugal pump and Turbine pump, 3. Submersible pump, Mono Pump,	1. Type of pumps used in mines,	1. Study of fittings and attachments of Centrifugal pump. 2. Study of fittings and attachments of Reciprocating pump
Total in hours			39	13	52

Reference:

Sl. No.	Description
1	Elements of Mining Technology, D. J. Deshmukh, Volume-3, Denett & Co., 2011
2	Mining & Mining Machinery, S. F. Walker, Nabu Press, 2010
3	Surface mining, G. B. Mishra, Dhanbad Pub., 1978
4	Mine Pumps Haulage and Winding, S. Ghatak, Lovely Prakashan Pub.
5	Heavy Earth Moving Machinery, Amitosh Dey, Lovely Prakashan Pub.
6	Caterpillar Earthmovers, Bill Robertson, Iconografix USA July 2004.
7	Heavy Earthmoving Equipments, Eric C Orleman, Motorbooks International, October 11.

Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Models of Head gear, sheave wheel		
2	Models of Rope Capel, King detaching hook, Suspension gear.		
3	Models of cage, cage shoes, Keps, safety catches.		
4	Models Drum winder, friction winder, Post brakes, Caliper brakes		
5	Centrifugal and reciprocating pump.		
6	Different constructions of wire ropes, Rope guides.		
7	Models of any one Rope haulage, belt conveyer, shaker conveyer.		
8	Models of Haulage track, crossings, turn-outs, safety devices, tubs		

MINE SURVEYING-II

1. Rationale:

The Mine Surveyor will be responsible to carry out survey of the mine area in open cast as well as underground so that efficiency in planning for the development of the mining area & proper development of the mine be obtained.

The survey measurements increased in importance by the precalculation of direction and height of the mines in relation to mines safety and operation.

In view of changing climate of the Industry a mine surveyor will be required to provide a liaison between operational and planning officials.

As far as possible teachers while teaching is supposed to give demonstration of different types of surveying and instruments used in each survey and preparation of survey plan.

2. Course Outcomes/Skill Sets:

CO-01	THEODOLITE TRAVERSING Apply the skills to conduct traverse survey & to find the area.
CO-02	TRIANGULATION Carry out the triangulation survey and also analyze their various problems and corrections.
CO-03	CORRELATION Correlate the surface and underground features by mine survey.
CO-04	TACHEOMETRIC SURVEYING Carry out the tachometric survey and also analyze its various problems.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
1	1	1,2,4	1. Construction of Transit Theodolite. 2. Definitions and terms 3. Use of theodolite in Mine surveying.	1. The Reading of circles.	1. Description of Vernier Theodolite. 2. Carry out temporary adjustment of Vernier transit theodolite.
2	1	1,2,4	<i>Measurement of Horizontal angles.</i> 1. Ordinary method 2. Repetition method 3. Reiteration method	1. Compare Repetition and Reiteration method.	1. Measure the horizontal angle by repetition method in the field. 2. Measurement of horizontal angles theodolite by method of Reiteration
3	1	1,2,4	1. Measurement of vertical angles. 2. Continuous Azimuth method of theodolite traversing 3. The Double Foresight Method of Theodolite traversing. Sources of error in theodolite traverse.	1. State the fundamental axis of theodolite with their relationship.	1. Measurement of vertical angle. 2. Determination of horizontal distance between two inaccessible points with theodolite.

4	1	1,2,4	1. Qualities of good telescope, Defects of simple lenses, 2. Types of eye pieces, Internal and external focusing telescope. 3. Rectangular Co-Ordinates.	1. Compare: plotting by Co-Ordinates and Protractor.	Locating given building by theodolite traversing
5	1	1,2,4	1. Closing error 2. Balancing the traverse by Bowditch's method 3. Transit method.	1. Compare: various methods of balancing the traverse.	Conduct the closed traverse, 1. plot it by rectangular co-ordinates and 2. find its area.
6	1	1,2,4	<i>Numerical problems on:</i> 1. Determining Length and Bearing of closing line. 2. Length and Bearing of closing line. 3. Calculation of area by co-ordinates.	1. <i>Numerical problems on:</i> Determining Length and Bearing of closing line.	Conducting a closed traverse of a given area and balancing it by (i) Bow ditch's Rule & ii) Transit Rule
7	2	1,2,4	<i>Triangulation:</i> 1. Classification of Triangulation System. 2. Selection of site for base line, 2. Numerical problems on applying correction for base line.	1. List out the corrections required for the base line.	1. Describe the procedure for the Measurement of base line. 2. Routine of triangulation survey, selection of triangulation stations and site for base line,
8	3	1,2,4	<i>Correlation:</i> 1. Purposes and Classification. 2. Shaft plumbing for Correlation. 3. The Co-planning method.	1. Distinguish the use of Correlation survey.	Simulate conditions for a correlation, survey on surface and Find out the bearing and distance of a baseline by (i) Approximate alignment method
9	3	1,2,4	1. The Co-planning method 2. Weisbach Triangle method 3. Correlation by two shafts.	1. Compare the Co-planning method	Simulate conditions for a correlation, survey on surface and

				and Welsbach Triangle method of Correlation.	Find out the bearing and distance of a base line by (ii) Exact alignment method
10	3	1,2,4	1. Numerical problems on Correlation 2. Numerical problems on Correlation 3. Numerical problems on Correlation	1. Distinguish the Instruments required for Correlation survey.	Numerical problems on Correlation
11	4	1,2,4	<i>Tacheometry</i> 1. Principles of Tacheometry- Determination of stadia constants, 2. Reduction Formula for Horizontal Distance and Elevation. Stadia method. (Staff held vertical) ii) With Horizontal Sights. iii) With Inclines Sights.	1. List the advantages and Disadvantages of Tacheometry.	1. Determination of Stadia Constants. 2. Determine Horizontal distance and Elevation with staff held Vertical by Stadia method (Line of sight horizontal)
12	4	1,2,4	1. Tangential Tacheometry – finding the elevations and distances. (Staff held vertical) ii) With Horizontal Sight. iii) With Inclines Sight.	1. Brief out the role of Surveyors in Mines.	Determine Horizontal distance and Elevation with staff held Vertical by Stadia method (Line of sight is inclined)
13	4	1,2,4	Numerical problems on stadia and tangential systems	1. List the provisions of duties and responsibilities of Mine Surveyor according to MMR/CMR.	Determine Horizontal distance and Elevation with staff held Vertical by Tangential method (All Three cases)
Total in hours			39	13	52

Reference:

Sl. No.	Description
1	Mine Surveying and Levelling, <i>Vol. I, II & III</i> by hatak, COALFIELD PUBLISHERS, Ukhra, Burdwan, W.B.
2	W. Schofield and M. Breach, <i>Engineering Surveying</i> , Sixth edition, 2007, ELSEVIER, B & H.
3	B. C. Punmia, <i>Surveying, Vol - I, II, III</i> , Laxmi Publication, New Delhi, 12th Edition, 1990.
4	V. Maslov, <i>Geodetic Surveying</i> , Mir Publication, Moscow, Revised edition, 1980.
5	Fedorov, <i>Elementary Plane and Mine Surveying</i> , Mir Publication, Moscow, Revised Edition, 1986.
6	V. Natarajan, <i>Advanced Surveying</i> , B. I. Publication, Bombay, First edition, 1976.

7	T. P. Kanetkar, <i>Surveying and Levelling</i> , Pune Vidyarthi Griha Prakashan, Reprints, 1995.
8	S. K. Roy, <i>Fundamentals of Surveying</i> , Printice Hall of India Pvt., New Delhi, Third Printing, 2004.

Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Engineers Chain 30 m		
2	Tapes 30m.		
3	Theodolite with accessories		
4	Arrows		
5	Ranging rods		

U/G COAL MINING (METHOD OF WORKING)

1. Rationale:

The objective of this course is to provide students in mining engineering with the necessary knowledge to carry out safe, scientific, efficient and environmentally responsible Underground Coal Mining operations.

The teachers are expected to demonstrate various methods with the suitable models and/or Mine visit.

2. Course Outcomes/Skill Sets:

CO-01	Choose the methods of access to coal deposits underground.
CO-02	Select and design most suitable method of coal extraction techniques
CO-03	Plan the Longwall advancing and Longwall retreating method of working a coal seam and Adopt the different stowing methods.
CO-04	Know the Coal face mechanization and Appreciate the special method of working a coal seam.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
1	1	1,2,3	1. Classification of the coal seams based on its thickness, inclination, gassiness and depth. 2. Definitions of different Coal Mining terms, 3. Bord & pillar system – Applicability, demerits and demerits of Bord and Pillar method.	1. Classify the coal mining methods.	1. Prepare layouts of Bord and Pillar method. 2. Illustrate the layout of Panel system of working coal seam
2	1	1,2,3	1. Applicability of panel system, factors influencing the size of panel system, General considerations, factors influencing the number of openings of panel, Merits and demerits of panel system	1. Factors which influence the choice of coal mining methods.	1. Prediction of size of pillars,
			2. Drivage of galleries: manual and mechanical, 3. Drivage of galleries: manual and mechanical,		2. Procedure for Drivage of gallery Mechanised method.
3	1	1,2,3	1. Different methods of development systems along dip, 2. along strike, crosscuts 3. Steeply dipping seams.	1. Compare different methods of opening up the deposits.	1. Describe the Gathering Arm Loader. 2. Construction and working of Gathering Arm Loader
4	2	1,2,3	1. Important terms, sequence of operations, methods of depillaring for different roof conditions. 2. local fall & main fall. 3. Premature collapse and normal collapse,	1. Point out the preparatory arrangements carried out before depillaring	1. Procedure of depillaring for different roof conditions. 2. Procedure of depillaring for different roof conditions.

5	2	1,2,3	<ol style="list-style-type: none"> 1. Air blast-precautions. The Indications of (Roof weight) roof collapse 2. Precautions against fire during and after depillaring- 3. Precautions against inundation during depillaring. 	1.Factors influencing choice of Pillar extraction techniques.	<ol style="list-style-type: none"> 1.Explain the Procedure of depillaring of seam unto 3M thickness. 2.Principles of Pillar extraction Techniques.
6	3	1,2,3	<ol style="list-style-type: none"> 1. Elements of Longwall face 2.The factors which influence the layout of Longwall face 3. Long wall advancing- limitations, development of gate roads, merits and demerits 	1.Compare Longwall method with Bord and Pillar method.	<ol style="list-style-type: none"> 1.Prepare a lay out of mechanized long wall face advancing with stowing, 2. Prepare a Layout of Variants of Long wall face.
7	3	1,2,3	<ol style="list-style-type: none"> 1. Long wall retreating-merits, demerits, limitations. 2. Barry face. 3. Cyclic and non-cyclic long wall workings. 	1. Compare Longwall advancing and Longwall retreating method.	<ol style="list-style-type: none"> 1. Prepare a layout of mechanized long wall retreating with stowing 2. Prepare a Layout of mechanized long wall retreating with caving
8	3	1,2,3	<ol style="list-style-type: none"> 1. List the factors which governs the length of Long wall face 2. Factors which influence the choice of Coal mining methods 3. Qualities of good stowing materials. 	1.Comparative advantages and disadvantages of ploughs and shearers.	<p>Continuous Mining Machines for Longwall Faces.</p> <ol style="list-style-type: none"> 1.Shearer 2.Coal Plough
9	3	1,2,3	<p>Goaf Control:</p> <ol style="list-style-type: none"> 1.Caving. 2.Strip Packing 3.Solid packing or Stowing. 	1.Compare different Goaf control methods.	<p>Study of:</p> <ol style="list-style-type: none"> 1.Stage Loader 2. Explain with sketch Chock shield support.
10	4	1,2,3	<ol style="list-style-type: none"> 1. Hydraulic, Pneumatic& Mechanical stowing, 2. General arrangement of a sand stowing plant – layout of panel with stowing 3. Dangers and precautions while working below goaved areas. 	<ol style="list-style-type: none"> 1.a) Compare Hydraulic, Pneumatic& Mechanical stowing. b) Compare caving and stowing. 	<ol style="list-style-type: none"> 1. Distinguish the General arrangement of a sand stowing plant at surface. 2. Pressure Arch in Longwall Workings.
11	4	1,2,3,4	<ol style="list-style-type: none"> 1.Roof supports: Factors affecting the load bearing capacity of wooden props. 2. Choice of supports. 3. Principles of Designs of Friction Props, Roof bolts, Hydraulic Props. 	1. Compare timber supports with other supports.	<ol style="list-style-type: none"> 1. Explain Various roof bolts, 2. Roof Stitching.

12	4	1,2,3,4	1. Horizon mining - 2. Hydraulic mining-merits and demerits, applicable conditions. 3. Hydraulic transport	1. Merits and limitations of hydraulic Mining	1. Self-Advancing Walking supports 2. Layout of Hydraulic coal mining.
13	4	1,2,3	1. Underground gasification of coal-applicable conditions. 2.Principles of underground coal gasification 3.Opening up of Coal seams for underground coal gasification.	1. Merits and limitations of Coal Gasification.	1. Explain the Layout of U/G coal gasification. 2. Explain the Layout of U/G coal gasification.
Total in hours			39	13	52

Reference:

Sl. No.	Description
1	T. N. Singh, Underground winning of Coal, Oxford and IBH New Delhi, 1992
2	Y. P. Chacharkar, A study of Metalliferous Mining Methods, Lovely Prakshan Dhanbad, 1994
3	I. C. F. Statham, Coal Mining Practice, Caxton eastern agencies, Calcutta, Reprint, 1964
4	D. J. Deshmukh, Elements of Mining Technology, Vol - I & II, EMDEE publishers Ranchi, Revised edition, 2000
5	S. K. Das, Modern Coal Mining Technology, Lovely Prakshan Dhanbad, 1992
6	R. D. Singh, Principles & Practices of Modern Coal Mining, New age international New Delhi, 1997
7	B. C. Arthur, SME Mining Engineers Hand Book, American Institute of Mining, Metallurgical and Petroleum Engineers New York,

Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Model of Bord and Pillar method of working a coal seam.		01
2	Model of Longwall method of working a coal seam		01
3	OHP-Computer, with internet facility to learn the working of coal face machineries		01
4	Charts showing the Hydraulic and gasification method of working a coal seam.		each 01