

JHARKHAND RAI UNIVERSITY



MINING ENGINEERING

DIPLOMA



SYLLABUS

2022–2025

SEMESTER-V

Kamre | Ratu Road | Ranchi | Jharkhand

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DIPLOMA IN MINING ENGINEERING													
SEMESTER V													
S. No	Subject code	Name of Subject	Period			Evaluation Scheme				Subject	Credit	Hours	
			L	T	P	Assignment	T A	Total	ESC				
1	8D.301	Surface Mining	3	0	0	20	10	30	70	100	3	3	
2	8D.302	Mine Surveying II	3	0	0	20	10	30	70	100	3	3	
3	8D.303	Mining Machinery II	3	0	0	20	10	30	70	100	3	3	
4	8D.304	Mine Ventilation	3	0	0	20	10	30	70	100	3	3	
5	ELECTIVE I (Any one of the followings)												
	8D.331	Mine Environmental Engineering	3	0	0	20	10	30	70	100	3	3	
	8D.332	Mine Reclamation and Closure											
	8D.333	Mine Planning and Design											
6	40D.401	**Seminar in Executive Communication	2	0	0	20	10	30	20	50	0	2	
PRACTICAL / SESSIONAL													
1	8DP.302	Mine Surveying II Lab	0	0	2	0	30	30	20	50	1	2	
2	8DP.304	Mine ventilation & Environmental Engineering Lab	0	0	2	0	30	30	20	50	1	2	
3	8D.345	Practical Training Project I	0	0	0	-	-	-	-	50	2	2	
									Total	650	19	21	

- **** NOTE: Qualifying Non Credit Course & only Viva voce is conducted.**
- **MOOCS introduced through SWAYAM in all semester.**

Program: Diploma
Semester: Five

L	T	P	C
3	0	0	3

Course: Surface Mining

Course Code: 8D.301

Course Objective:

- Enables the students to apply the knowledge of mining machinery in their economic deployment for achieving the production targets in opencast mines.
- To introduce the various techniques for mine planning, geotechnical investigation and equipment management.
- To appreciate the modern trends in opencast mines, safety and environment.
- The students will have insight about the advanced techniques for mine planning, geotechnical investigation and equipment management and also will understand the modern trends in opencast mines, safety and environment.
- The students will have ability to classify and select the suitable surface mining methods and equipment based on site conditions. They will also have a concept of waste dump formations and slope failures in surface mines.

Unit I

Introduction to opencast mining: Classification of surface mining methods, classification based on mechanization .Factors affecting choice of opencast mining methods, Stripping ratio: Maximum allowable stripping ratio, overall stripping ratio, Break even stripping ratio. Advantages and disadvantages of opencast mining. Elements of Benches: Height, width, angle of slope, toe, crest, statutory provisions regarding height, width, angle of slope etc. Opening up of deposit:Unit operations involved, site preparation, Box cut, entry system in opencast mines. Opencast mine layout, factor determining choices of layout, overburden excavation, Disposal of overburden, overcasting etc, sample layouts for lime stone, copper, coal , iron ore deposits, method of work, machines required , manpower, OMS etc.

Unit II

Opencast mining machinery: Classification of Excavating equipments, selection, choices of opencast mining machinery, Excavators shovel, Rope shovel, hydraulic shovel, application, advantages, disadvantages, comparison Rope shovel and hydraulic shovel, operating parameter, output of a shovel. Various attachments to shovel, Specifications. Back hoe, operating parameter, application. Dragline, operating parameters, applicability, working, advantages, disadvantages, comparison with shovel. Specifications, Bucket wheel and Bucket chain excavators, Application, advantages & disadvantages, operation, working methods by Bucket wheel excavator, Rippers, Scrappers, bulldozer etc, Surface miner its application, working.

Unit III

Opencast explosives: Explosives used in opencast mine, AN/FO, slurry explosive, emulsion explosives, Heavy AN/FO explosive, LOX, their properties, composition etc. Boosters. Initiation system, non electric initiation system, Raydets, Nonel, shock tubes, electronic detonators, etc. Bulk explosive system, site mixed slurry, site mixed Emulsion, Bulk-loading system. Advantages, comparison. ANFO precautions while mixing, handling and use, Conditions for using bulk explosives.

Unit IV

Blasting practice in opencast mines: Bench blasting terminology, Blast hole geometry, hole depth, burden, spacing, sub grade drilling, bottom charge, column charge, stemming height. Factors to be considered while blast designing. Simple numerical on blast design for the bench of surfaces mine. Single

and multiple rows blasting their comparison, Sequence of blasting in single & multiple rows. Precautions while charging and firing of holes in deep hole blasting, deck charging, muffled blasting, control blasting techniques, secondary blasting/breaking in opencast mines, transport of Explosives in bulk.

Suggested Reading:

1. *Explosive and Blasting Techniques*, G.K. Pradhan
2. *Surface Mining Technology*, S.K. Das
3. *Elements of Mining Technology Vol I*, D.J. Deshmukh

Program: Diploma
Semester: Five
Course: Mine Surveying II

L	T	P	C
3	0	0	3

Course Code: 8D.302

Course Objective:

- The student will enable to carry out underground surveys and stope measuring.
- Plotting contour plans
- Understand advanced surveying techniques such as remote sensing and geodetic surveying.
- Enables the students to select and use suitable survey instruments for data needed in planning and executing the mineral extraction.

Unit I

Theodolite: Classification of theodolite, definitions and terms used in operating theodolite, Temporary adjustments of transit theodolite. Fundamental axes of theodolite, Measurement of horizontal and vertical angles, Observe magnetic bearing of a line, Use of theodolite for Prolonging a straight line, for lining in, Lay-off horizontal angle, Sources of errors in theodolite work and their elimination. Permissible errors in mine surveying. Theodolite traversing: Methods of traversing, by included angles & Deflection angles, Checks in closed & open traverse, Traverse computation: latitude, departure, Consecutive coordinates, independent coordinates, error of closure. Adjustment of closed traverse, balancing by Bowditch and transit rule, Gales Traverse table, Permanent adjustments of theodolite. (Only relationship of different axis of theodolite)

Unit II

Geodetic Triangulation: Basic principles, Triangulation figures, Classification, Base line measurement. Correction to Base line Measurement. (Elementary idea only). Tachometric surveying: Instruments, Requirement of a tachometer. Tachometric methods: Fixed hair method; Reduction formula for horizontal distance & elevation with horizontal sights. Setting out of curves: Classification of curves. Definition of various parts of curves, Elements of simple circular curve, Relation between radius of curve & degree of curve. Setting out curves by linear methods and single theodolite method, super elevation or cant. Purpose of super elevation, Study and use of Planimeter including digital planimeter.

Unit III

Underground surveying: Marking of underground stations, Correlation Survey- Direct traversing through incline, by plumbing wires in shaft, co planning method, Weisbach's triangle method, Weiss quadrilateral method, Gyro- theodolite method. Stope survey: Definition & Purpose of stope survey, Classification of stope surveying, Methods of stope surveying Stop survey flat deposit: Tape triangulation, Tie Method, instrumental method Stope survey in steeply inclined deposit. Stop survey in massive ore bodies, irregular in dip & shape.

Unit IV

Advances in mine surveying: Global Positioning System; Principle, The system, application in Opencast mine surveying, Advantages and Disadvantages. Total station; application in distance measurement, angle measurement, Electronic Distance Measurement; Principle of measurement, types etc. Gyro theodolite; principle of gyro, gyro attachments and Laser plummet. Dip & fault: Introduction, Definition of Dip, Strike Apparent dip, Full dip, Numerical for determining true and apparent dip, strategically thickness of seam. Definition of Fault. Normal fault, Reverse fault. Numerical on fault problems, connection of mine plan to national Grid.

Suggested Reading:

1. *Surveying and leveling* , T. P. Kanetkar
2. *Surveying & Levelling* , B.C. Punmia

Program: Diploma
Semester: Five
Course: Mine Surveying II Lab

L	T	P	C
0	0	2	1

Course Code: 8DP.302

List of Experiments:

1. Demonstration of theodolite reading the vernier.
2. Temporary adjustments of theodolite & measurement of horizontal angle by repetition method.
3. Measurement of horizontal angle by reiteration method.
4. Observation of magnetic bearing of a line by Theodolite by compass attachment.
5. Measurement of deflection angle by Theodolite by taking an open traverse of 4 – 5 sides.
6. Prolongation of a survey line with the help of a Theodolite.
7. Measurement of Vertical angles using theodolite.
8. To Find constants of a given tacheometer.
9. Determining the reduced level and horizontal distance of an in accessible object by Tachometer.
10. Setting out a simple circular curve by offsets from long chord
11. Setting out a simple circular curve by sub cord produced method.
12. Setting out a simple circular curve by (single Theodolite method) Rankine's method.
13. Demonstration of EDM.
14. Demonstration of micro optic theodolite.
15. Demonstration of Total station.

Program: Diploma
Semester: Five
Course: Mining Machinery II

L	T	P	C
3	0	0	3

Course Code: 8D.303

Course Objective:

- Enables the students to select appropriate machinery for various mining operations based on the production targets.
- The students will get exposure towards the material handling methods and systems and its principle to convey the minerals or materials from mines, plants and workshops.
- The students will have practical knowledge about underground machineries, ropes, and pit-top and pit-bottom layouts.
- Enables students about the conveyor system and its advancement.
- The students will have basic knowledge on motive power used in mines, pumping, rope haulage and other transport systems. They also will know about mine electrical engineering in all statutory aspects.

Unit I

Mine pumps: Sources of water in Mines, Classification of Mine Pumps, Reciprocating Pump, Single acting, double acting and Ram pumps. Centrifugal Pumps, Turbine Pumps, Installation of pump, Operation of pump, Fitting on pump, Starting and stopping of pump, Face pumps, Characteristics Curves of Centrifugal and turbine pumps, Calculations for pump discharge etc, Snoring of pump, its prevention, Water hammer.

Unit II

Coal Cutting Machine: Purpose of coal cutting machine, Classification of coal cutting. Machine, Different types of cut, Different parts of CCM, Introduction of continuous miner, Different types of mechanical Loaders. Drills for Coal and Stone: Various types, Jumbo drills.

Unit III

Electric Power Supply: Types of cables used in mines Permanent cable, Different types, construction Semi flexible cable, Different types, construction Flexible cable, Different types, construction. Cable care and maintenance during Use and storage.

Unit IV

Prime Mover for Mining Machinery: elements of mechanical power transmission -gear, belt, chain, coupling, clutch and brake.

Suggested Reading:

1. D.J. DESHMUKH VOL I, II
2. Mine pump, haulage, winding, S. GHATAK

Program: Diploma

Semester: Five

Course: Mine Ventilation

L	T	P	C
3	0	0	3

Course Code: 8D.304

Course Objective:

- Enables the students to understand the airflow in sufficient quantity and quality to dilute contaminants to safe concentrations in all parts of the facility where personnel are required to work or travel.
- Enables the students to understand the ventilation requirements.
- Students will be able in selecting appropriate mine fans and design suitable ventilation structures.
- To learn ventilation methods and strata monitoring instruments.
- The students will have better understanding about methods of ventilating longwall faces and Bord and pillar method of mining.

Unit I

Mine Air: Different Gases / Damps found in mines, Definition of damps, their threshold limits, physiological effects, source of production and detection, Degree of gassiness of seam. Flame safety lamps, its principle, construction, safety features, and comparison. Detection of Methane by flame safety lamp, MSA Methanometer its principle of working, construction. Principle of other method of detection of methane (description of equipment not required)

Unit II

Mine Climate: Purpose and standards of ventilation, standards for minimum & maximum velocity of air for different locations, Pressure, ventilating press, water gauge, Temperature, sources of heat in mines, Moisture content of mine air relative humidity, wet bulb temperature, measurement of relative humidity, Cooling power of mine air, determination of cooling power, methods of improving cooling power of mine air, effect of heat and humidity on miners.

Unit III

Natural Ventilation: Natural ventilation Pressure, geothermic gradient, Factors causing NVP, Effect of seasonal changes on direction of Natural ventilation, limitation of Natural ventilation. Motive column, calculation of natural ventilation pressure. Artificial Ventilation: *Different types of fans used in mines: centrifugal & axial flow, their principle of working, Exhaust & forcing type. Purposes of evasee & volute casing. Reversal of air current, and characteristics curves of fans. Fans in series and parallel, Comparison between axial flow & Centrifugal fan; exhaust & forcing Fan. Fan laws, Manometric efficiency overall efficiency, theoretical depression produced by fan. Numerical on fan laws.*

Unit IV

Distributions & coursing of Air in Mines: Laws of air flow in Mines, Atkinson's formula splitting, advantages & disadvantages, Numerical on splitting, equivalent orifice. Numerical on equivalent orifice. Ventilation appliances, Auxiliary ventilation: Different methods, advantages & disadvantages, hazards associated with auxiliary ventilation, precautions required .Booster fan: purpose, dangers associated, Precautions before installation. Numerical on Booster fan, Accessional and Descensional ventilation, Advantages and disadvantages. Ventilation Survey: scope and importance of ventilation survey, survey interval and location of survey station, ventilation plan. Measurement of quantity & pressure difference, anemometer, pitot static tube, Manometer, quantity survey.

Suggested Reading:

1. *D.J. DESHMUKH VOL I, II*
2. *Mine Environment & Ventilation, G.B. Mishra*
3. *Mine Disaster & Mine Rescue, M.A. Ramlu*

Program: Diploma

Semester: Five

Course: Mine Ventilation and Environmental Engg. Lab

Course Code: 8DP.304

L	T	P	C
0	0	2	1

List of Experiments:

1. Demonstration of CO-detector and measurement of carbon monoxide using CO-detector.
2. Demonstration of MSA Methanometer and measurement of methane using Methanometer.
3. Dismantling & assembling of different types of Flame safety lamps.
4. Detection of Methane using flame safety lamp.
5. Demonstration of whirling hygrometer and determination of relative humidity using whirling hygrometer.
6. Demonstration of Kata thermometer and determination of cooling power by Kata thermometer.
7. Demonstration of various ventilation devices.
8. Demonstration of vane Anemometer and determination of quantity by Anemometer.
9. Demonstration of velometer and measurement of air velocity by velometer.

ELECTIVE -I

Program: Diploma

Semester: Five

Course: Mine Environmental Engineering

L	T	P	C
3	0	0	3

Course Objective:

- Enables the students to understand the airflow in sufficient quantity and quality to dilute contaminants to safe concentrations in all parts of the facility where personnel are required to work or travel.
- Enables the students to understand the ventilation requirements.
- Students will be able in selecting appropriate mine fans and design suitable ventilation structures.
- To learn ventilation methods and strata monitoring instruments.
- The students will have better understanding about methods of ventilating longwall faces and Bord and pillar method of mining.

Unit I

Mine Fires: Surface fire and underground fires, their causes, detection and prevention. Classification of fires, Portable fire extinguishers their applicability, places of portable fire extinguishers in mines, maintenance of fire extinguishers. Spontaneous heating: Mechanism of spontaneous Heating, factors governing spontaneous heating, methods for study of spontaneous combustion of coal: crossing point method. Stages of spontaneous heating, Detection of spontaneous heating: Physical or sensory indicators, Precautions for prevention of spontaneous heating. Model standing orders in event of fire. Dealing with spontaneous heating & fires: Various methods, Sealing off: selection of site for fire stoppings, construction of fire stopping, fittings to stopping, inspection and maintenance of fire stoppings.

Unit II

Sampling from sealed off area: Sampling line, Methods of sampling from behind the fire stopping, frequency of sampling, Sampling accessible places: water, air displacement method, evacuated, sample, holder, type, Composition and behavior of gases in sealed off area, interpretation regarding condition of heating: Graham's ratio; interpretation regarding explosibility: Cowards Diagram. Elementary knowledge of gas chromatography, Re opening of sealed off area: Factors governing decision of reopening, methods of reopening, selection of methods of reopening, precautions to be taken while reopening. Fire damp explosion: Introduction, Composition of firedamp Modes of emission of Firedamp, Degree of gassiness, methane layering, Mechanism of fire damp explosion, Flammability of firedamp, lower and upper limit of explosibility of firedamp, factors governing limits of flammability, lag on ignition. Explosive limits of other flammable gases, Causes of fire damp explosion and its prevention. Characteristic of firedamp explosion.

Unit III

Coal Dust Explosion: Mechanism of Coal Dust explosion, Flammability limits of coal dust, factors governing explosibility of coal dust, Characteristics of coal dust explosion. Causes of coal dust explosion, Prevention of coal dust explosion. Generalized stone dusting, Quantity of stone dust, Types and properties of stone dust, stone dusting plan. Stone dust barriers, types of stone dust barriers, specifications and construction, location of primary and secondary types of barriers. Situations under which barrier may fail, maintenance and care of stone dust barriers.

Unit IV

Inundation: Surface and underground causes of Inundation and its prevention, water dams, bulkhead doors, Procedure of and precaution while approaching old water logged areas, pattern of bore holes, Dewatering, burn side safety boring apparatus, Standard of lighting in underground & opencast mines, cap lamps, its construction, maintenance and care, cap lamp room. Mine rescue: Introduction, classification of mine rescues apparatus, modern self contained breathing apparatus, its construction,

application and scope. Common tests of self contained compressed oxygen breathing apparatus, Chemical oxygen self-rescuers, gas mask, filter self-rescuers: their construction, application and limitations. Fresh air hose type breathing apparatus, Fresh air base: location, personnel & equipments required.

Suggested Reading:

1. *D.J. DESHMUKH VOL I, II*
2. *Mine Environment & Ventilation, G.B. Mishra*
3. *Mine Disaster & Mine Rescue, M.A. Ramlu*

Program: Diploma

Semester: Five

Course: Mine Reclamation and Closure

Course Code: 8D.332

L	T	P	C
3	0	0	3

Course Objective:

- Provide the basis for estimating the financial liability associated with a mining project. The objective of rehabilitating a typical exploration site is to minimize long-term environmental liability by maintaining geotechnical stability, restoring native ecosystems, striving to achieve a more beneficial land use, etc.
- Provide ideas and process about closing a mines, how to do reclamation and necessity of reclamation.

Unit I

Economical and technical aspects of reclamation of mined out land. Reclamation Methods: Back filling, outside dumps and their stability.

Unit II

Top soil handling, assessment of soil productivity potential, re-vegetation, factors for plant Growth, parameters for soil quality and their importance. Reclamation plan and land use plan, general requirements of protection of hydrologic balance.

Unit III

Erosion of soil, types of erosion, estimation of top soil erosion. Landscaping of disturbed land, estimation of reclamation cost and benefits, use of reclaimed land and structures.

Unit IV

Mine Closure Planning: Importance, methodology, statutes concerning mine closure. Land reclamation as post mining operation, Statutes concerning reclamation of mined out area.

Suggested Reading:

1. *Surface Mining Technology*, S.K. Das
2. *Elements of Mining Technology Vol I*, D.J. Deshmukh

Program: Diploma

Semester: Five

Course: Mine Planning & Design

Course Code: 8D.333

L	T	P	C
3	0	0	3

Course Objective:

- Understanding of the role and scope of geomechanics specialists in mining.
- A sound basis for management of the incorporation of geomechanics specialist advice for mine planning and operations is it from company or consultant sources.
- Awareness of the circumstances in which geomechanics specialist advice ought to be sought and applied, and of how that can be engaged and applied.
- The students will have knowledge on planning of opencast mining, underground mining and equipment utilization.

Unit I

Principle of the planning, short range and long range planning, role of planning in mining ventures, ore reserve estimation, economic block model.

Unit II

Mine Planning Input: Geological, mineralogical, structural, economical, environmental and technical inputs. Determination of optimum output, life of a mine and size of mine field based on economic consideration, Taylor's mine life rule, ultimate pit configuration.

Unit III

Optimum location of mine entries, theoretical considerations of opening and development of mine field. Production planning and scheduling, mine equipment planning, estimation of their numbers, infrastructure planning.

Unit IV

Mine Closure-ongoing and final. Feasibility report and project report - contents and preparation.

Suggested Reading:

1. *Coal Mining & Management Vol- I, S.P. Mathur & N.K. Singh*
2. *Modern concept of surface mining, D. Biswas*

Program: Diploma

Semester: Five

Course: Seminar in Executive Communication

Course Code: 40D.401

L	T	P	C
2	0	0	0

Course Objective To impart more advanced basic skills through intensive practice, in this unit again the students get opportunities to apply their general awareness and classroom learning to practical situation to achieve the targeted career goal in this increasingly competitive world Some of the career oriented units are Discussion Skills, Interview Skills, Job Search Strategies, Job Correspondence etc., they need to undergo,

- An average student acquires basic skills required for a cherished job.
- Their appreciative personality development becomes a value added attribute in their professional sphere.
- The course enhances communication, leadership and teamwork skills; and personal development skills using practical approach and exposure of students to the realities of the world
- To put greater emphasis on development of non-technical skills, such as flexibility, leadership and good communication.

Activity Based WORKSHOPS

- Debate
- Extempore
- Group Discussion
- Panel Discussion
- Presentation-Paper & Oral
- Reports: Survey Report, Project Report, Case Study

Suggested Readings:

1. Monippally, Matthukutty. M. 2001. *Business Communication Strategies*. 11th Reprint. Tata McGraw-Hill. New Delhi
2. Swets, Paul. W. 1983. *The Art of Talking So That People Will Listen: Getting Through to Family, Friends and Business Associates*. Prentice Hall Press. New York
3. Lewis, Norman. 1991. *Word Power Made Easy*. Pocket Books
4. Sen , Leena .*Communication Skills ; Eastern Economy Edition*
5. Ghanekar , Dr. Anjali . *Essentials of Business Communication Skills ; Everest Publishing House*
6. David Green . *Contemporary English Grammar, Structure & Composition ; MacMillan*
7. *Dictionary; Oxford*
8. *Dictionary ; Longman*

Websites

- www.tatamcgrawhill.com/digital_solutions/monippally
- www.dictionary.cambridge.org
- www.wordsmith.org
- www.edufind.com
- www.english_the_easy_eay.com
- www.englishclub.com
- www.english_grammar_lessons.com
- www.wikipedia.org/wiki/english_grammar

Program: Diploma
Semester: Four
Course: Practical Training Project I
Course Code: 8D.345

L	T	P	C
0	0	2	2

Course Objective:

- Enables the students to experience with the practical applications of the theoretical learning.
- The outcome at the place of work is always much more than what can be learned in the class room.
- To provide the students an opportunity to express their skills, academic knowledge, practical experience and ability to analyze problems.
- The aim of the project is to stimulate creative and innovative aspects of their technological learning.

Vocational Training in a Surface / Underground Mine of minimum 30 (Thirty) days to be taken at the end of Semesters.