JHARKHAND Rai University

JHARKHAND RAI UNIVERSITY

RANCHI

SYLLABUS

DIPLOMA

MINING ENGINEERING

SEMESTER V

2025 - 2028

JHARKHAND Rai University

SEMESTER V

DIPLOMA IN MINING ENGINEERING													
SEMESTER V													
				Evaluation Scheme				Subject	Period			Credit	Hours
S. No	Category	Subject code	Name of Subject	Assignment	T A	Total	ESC		L	T	P		
1	Professional Core Courses	8DPCCMiE301	Underground Metal Mining	20	10	30	70	100	3	0	0	3	3
2	Professional Core Courses	8DPCCMiE302	Mining Machinery II	20	10	30	70	100	3	0	0	3	3
3	Professional Core Courses	8DPCCMiE303	Mine Ventilation	20	10	30	70	100	3	0	0	3	3
4	Professional Core Courses	8DPCCMiE304	Mine Environmental Engineering	20	10	30	70	100	3	0	0	3	3
5	PROFESSIONAL ELECTIVE I	(Any one of the followings)		20	10	30	70	100	3	0	0	3	3
		8DPECMiEEL301	Mine Reclamation and Closure										
		8DPECMiEEL302	Environmental Aspects of Mining										
		8DPECMiEEL303	Mine Planning and Design										
6	Humanities and Social Sciences	8DHSMC301	**Human Values and Ethics	20	10	30	70	100	2	0	0	0	2
PRACTICAL / SESSIONAL													
1	Professional Core Courses	8DPCCMiE303P	Mine Ventilation Lab		30	30	20	50	0	0	2	1	2
2	Project	8DPROJMiE301	Practical Training Report II		-	50	50	100	0	0	0	2	0
						Total		650				18	19

** NOTE: Qualifying Non Credit Course

Program: Diploma
Semester: Five
Course: Underground Metal Mining
Course Code: 8DPCCMiE301

L	T	P	C
3	0	0	3

Course Objective:

- Enables the students to select suitable methods of working underground metal mines and decide the necessary parameters of mine construction.
- The students will have good knowledge about the various advanced methods of metal Mining and special mining techniques to overcome the field issues.
- To understand the various advanced and recent methods of metal mining.
- The students will have basic concept on metal mining methods, mine design, development and operations of metal mines. They will also know about novel methods of metal mining and its applications.

Unit I

Underground development: Terminology used in metal mines, Types of ore bodies, Types of ore bodies, Types of underground opening, location of openings, Opening up of a mineral deposit by vertical shaft, inclined shaft, Adit, Level interval, factor considered while deciding level interval/length of back, Drivages of raises and winzes, Driving manually, Modern methods Alimak, long hole method, Drop raising, raise boring, Common supports in metal mines.

Unit II

Unsupported Stoping Methods: Classification and choice of stoping, Methods, Open stoping methods, underhand, overhand, Breast stoping, sublevel stoping, Blast hole stoping, VCR , Shrinkage method, their conditions of Applicability, Sequence of Development, stoping operation, Cycle of operations etc. System of removal of ore from stope. Supported & caving methods: Artificially supported methods cut and fill, square set, stull stoping Methods. Their applicability, stope Preparation, stoping operation, cycle of operation, relative merits and demerits etc. Caving methods - Top slicing, Sublevel caving and block caving methods, applicability, stope preparation stoping, cycle of operation etc.

Unit III

Shaft Sinking**:** Size, shape, Factors considered for location of shaft, marking center, and shaft-centering arrangement, sinking of shaft below rock head- operation of drilling, charging and blasting and mucking operation. Disposal of debris, Shaft lining: Temporary lining, Permanent lining of shaft: Brick, monolithic, reinforced concrete lining, shaft tubing's etc, Walling scaffold, rider, ledge formation, underpinning, water garland crib etc. Special method of shaft sinking**:** Different special methods of shaft sinking, condition of applicability of each method, Description etc, Widening and Deepening of shaft.

Unit IV

Boring**:** Purpose of boring, classification of boring methods, applicability of boring methods, Drill Bits for various types of drilling/boring, Surface arrangement, assembly, working of Rotary boring, Screw and hydraulic feed mechanism, Core recovery, core barrels, Recover of broken tools, Bits, Bore hole survey, Deviation of boreholes.

Suggested Reading:

1. *Elements of Mining Technology Vol I, II, D.J. Deshmukh*
2. *Surface Mining, G.B. Mishra*

Program: Diploma
Semester: Five
Course: Mining Machinery II
Course Code: 8PCCMiE302

L	T	P	C
3	0	0	3

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
Course Code: 8PCCMiE303

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 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 coiling 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*

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Program: Diploma
Semester: Five
Course: Mine Ventilation Lab
Course Code: 8PCCMiE303P

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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.

Program: Diploma
Semester: Five
Course: Mine Environmental Engineering
Course Code: 8DPCCMiE304

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. M*ine* 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 & equipment's 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*

JHARKHAND Rai University

PROFESSIONAL ELECTIVE -I

Program: Diploma
Semester: Five
Course: Mine Reclamation and Closure
Course Code: 8DPECMiEEL301

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: Environmental Aspects of Mining
Course Code: 8DPECMiEEL302

L	T	P	C
3	0	0	3

Course Objective:

- Enable the students to understand the ill effect of mining activities on environment and how to reduce it.
- Upon completion of this course, the students can able to identify the new methodologies / technologies for effective utilization of renewable energy sources.

Unit I

Environmental aspects of Mining & associated Activities**:** Ecosystem structure and function, Effects on Biodiversity due to mining, Effects on water bodies, subsidence and its effect.

Unit II

Pollution and its effects: Air pollution: sources, and control measures, Noise and vibration: Sources and control measures. Water pollution: Preventive and control measures, acid rain. Soil pollution: its effect, prevention and control measures.

Unit III

Reclamation: Land Degradation due to mining & its reclamation. Various methods of reclamation and process.

Unit IV

Resource depletion: Exploitation of natural resources, over drafting, overexploitation, Environmental impact of the coal industry, exporting of hazardous waste

Suggested Reading:

1. *Mining and its Environmental Impact- R E Hester, R M Harison*
2. *Mining Environmental handbook- Jerrold J Marcus*

Program: Diploma
Semester: Five
Course: Mine Planning & Design
Course Code: 8DPECMiEEL303

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: Human Values and Ethics
Course Code: 8DHSMC301

L	T	P	C
2	0	0	0

Course Objective:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of human beings.
- To introduce students to information about some key aspects of Indian culture and ethics.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.

Unit I

1. **VALUE CRISIS IN CONTEMPORARY INDIAN SOCIETY**
   - 1.1 Value Crisis at the Individual Level
   - 1.2 Societal Level
   - 1.3 Intellectual Level
   - 1.4 Cultural Level
   - 1.5 Value – What are they?
   - 1.6 The Indian Concept of Values.
   - 1.7 Modern Approach to the Study of Values.
   - 1.8 Aesthetic Sensibilities

Unit II

2. **MORAL AND ETHICAL HUMAN VALUES**
   - 2.1 Bases for Moral Judgment
   - 2.2 Some Canons of Ethics.
   - 2.3 Virtue Ethics.
   - 2.4 Ethics of Duty.
   - 2.5 Ethics of Responsibility
   - 2.6 Factors to be considered in Making Ethical Judgments.
   - 2.7 Different Meanings of Human Values
   - 2.8 A New Approach to Human Value ,Freedom, Creativity Love &Wisdom

Unit III

3. **MORAL VALUES IN PROFESSION**

3.1 What is a Profession?
3.2 Professional Ethos
3.3 Code of Professional Ethics
3.4 Practicing the Code
3.5 Corporate Social Responsibility
3.6 The Larger Domain of Human Values
3.7 Institutionalizing Ethics and Human Values

Unit IV

4. **GENDER SENSITIZATION**

4.1 Socialisation of women
4.2 Just Relationships, being together as equals
4.3 Declining sex ratio, demographic consequences
4.4 Women's work, its politics and economics, fact and fiction, unrecognized and unaccounted work
4.5 Domestic violence, eve teasing and harassment. Is home a safe place?

Recommended Texts:

1. *Dr. Rajan Mishra, Human Values: Laxmi Publications Pvt. Ltd.*
2. *S. Dinesh Babu, Professional Ethics and Human Values; Laxmi Publications Pvt. Ltd.*
3. *P.S. Rathore. Business Ethics And Communication; S.Chand Publishing*
4. *Dr. K.Alex. Managerial Skills; S. Chand Publishing.*
5. *Dr. M. Adithan, Study Skills For Professional Students For Higher Education , S.Chand Publishing*
6. *Govindarajan M "Professional Ethics and Human Values."*
7. *R.R. Gaur and R. Sangal " A Foundation Course in Human Values and Professional Ethics"*

Websites:

- www.tatamcgrawhill.com/digital Solutions/ monopoly
- www.schandedutech.com
- www.laxmipublications.com

Program: Diploma
Semester: Five
Course: Practical Training Report II
Course Code: 8DPROJMiE301

L	T	P	C
0	0	0	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.