



SYLLABUS OF UNDERGRADUATE DEGREE COURSE

Mining Engineering



Effective for the students admitted in year 2021-22 and onwards.

**B.Tech.:MiningEngineering
3rdYear-VSemester**

THEORY											
SN	Category	Course Code	Course Title	Hours			Marks			Cr	
				L	T	P	Exm Hrs	IA	ETE		Total
1	DC	5MI4 – 01	Surface Mining	3	0	0	3	30	70	100	3
2		5MI4 – 02	Underground Coal Mining	3	0	0	3	30	70	100	3
3		5MI4 – 03	Mine Ventilation	3	0	0	3	30	70	100	3
4		5MI4 – 04	Dimensional Stone Mining	3	0	0	3	30	70	100	3
5		5MI4–05	Mine Economics	3	0	0	3	30	70	100	3
6	DE	5MI5 –11	Remote Sensing and GIS	2	0	0	2	30	70	100	2
		5MI5 – 12	Tunnel Engineering								
		5MI5 – 13	Numerical Methods and Simulation								
7		5MI5 – 14	Mining Closure Planning	2	0	0	2	30	70	100	2
		5MI5 – 15	Mine optimization/ Mine Systems Engineering								
		5MI5 –16	Rocks Excavation Engineering								
SubTotal				19	0	0		210	490	700	19
PRACTICAL&SESSIONAL											
8	DC	5MI4 – 20	Surface MiningLab	0	0	2	-	60	40	100	1
9		5MI4 – 21	Underground Coal Mining Lab	0	0	2	-	60	40	100	1
10		5MI4 – 22	Mine Ventilation Lab	0	0	2	-	60	40	100	1
11	UI	5MI7–30	IndustrialTraining	0	0	1	-	60	40	100	3
12	UGE/CA	5MI8 – 00									1
Sub-Total				0	0	7		240	160	400	7
TOTAL OF V SEMESTER				19	0	7		450	650	1100	26

L:Lecture, T:Tutorial, P:Practical, Cr:Credits ETE:End Term Exam, IA:Internal Assessment

**B.Tech.: Mining Engineering
3rd Year-VI Semester**

THEORY											
SN	Category	Course Code	Course Title	Hours			Marks			Cr	
				L	T	P	Exm Hrs	IA	ETE		Total
1	DC	6MI4 – 01	Metalliferous Mining	3	0	0	3	30	70	100	3
2		6MI4 – 02	Mine Planning and Design	3	0	0	3	30	70	100	3
3		6MI4 – 03	Mine Hazard and Management	3	0	0	3	30	70	100	3
4		6MI4 – 04	Mineral Processing	3	0	0	3	30	70	100	3
5		6MI4 – 05	Mine Legislation	3	0	0	3	30	70	100	3
6	DE	6MI5 – 11	Disaster Management in Mines	2	0	0	2	30	70	100	2
7		6MI5 – 12	Experimental Stress Analysis								
8		6MI5 – 13	Slope Engineering								
SubTotal				17	0	0		180	420	600	17
PRACTICAL & SESSIONAL											
9	DC	6MI4 – 20	Metalliferous Mining Lab	0	0	2		60	40	100	1
10		6MI4 – 21	Mine Planning and Design Lab	0	0	2		60	40	100	1
11		6MI4 – 22	Mineral Processing Lab	0	0	2		60	40	100	1
12	UI	6MI7 – 50	Mini Project	0	0	3		60	40	100	2
13	UGE	6MI8 – 00									2
Sub-Total				0	0	9		240	160	400	7
TOTAL OF VI SEMESTER				19	0	9		420	580	1000	24

L: Lecture, T: Tutorial, P: Practical, Cr: Credits, ETE: End Term Exam, IA: Internal Assessment

**5MI4 – 01: Surface Mining****Credit: 3Max.****3L+0T+0P****Marks: 100(IA: 30,ETE: 70)****End Term Exam: 3Hours****Course Objectives**

1. Understand the basic concept of surface mining and associated methods.
2. Learn various aspects of drilling and blasting, Excavation and Loading practices in open cast mines.
3. Study of different transport systems in opencast mines, factors influencing choice of transport system.
4. Various reclamation methods for different types of surface mines and : Factors influencing stability of slopes
5. Learn application of various heavy earth moving machinery and their selection criteria.

Course Outcomes

1. An understanding of various design parameters associated with different methods of surface mining.
2. Ability to design blasting round to have desired productivity with minimum damaging effect.
3. Ability to select appropriate equipment for excavating, loading and transporting material in opencast mines.

SN	Contents	Hours
1	Surface Mining: General information, Basic definitions, Terms, Advantages and disadvantages. Main parameters of surface mine and their determination, Opening up of mines by surface methods, driving of ingoing trenches, laying of communication routes, system of disposal of overburden, removal of cover rocks, factors influencing selection and characteristics of opencast work.	6
2	General surface mining method, basic layouts, choice of mining method. Major operations in surface mining.;Ground Preparation: Bull dozing, scrapping, grading, ripping. Drilling: Criteria for selection and performance of different types of drilling equipments and drill bits, drilling patterns: inclined drilling. Blasting: Explosives, multi-row blast design, secondary blasting, over-casting by explosives Controlled Blasting	8
3	Excavation and Loading: Factors influencing choice of excavating and loading machines, their performance in different ground conditions, Power shovel, Dragline, BWE, BCE, Front end loaders, Backhoes, Surface miner.	6
4	Transport: Comparative study of different transport systems in opencast mines, factors influencing choice of transport system, optimization of load haul operations, Dumpers, Coal haulers, Belt conveyer, In pit crushing and conveying, High angle conveyors, Pipe line transportation.	6
5	Storage: Stock piling and re-handling, spreaders, reclaimers. Reclamation: Various reclamation methods for different types of surface mines. Drainage: Sources of water assessment of drainage requirements, drainage patterns.	6
6	Slope Stability: Factors influencing stability of slopes, mechanics of slope failures, stability analysis, methods of improving stability of slopes, protection and monitoring, Influence of pit slope on mine economics.	4
7	Recent methods and techniques adopted in surface mining. Use of computer in surface mine design, planning & operation.	4
Total		40

TEXT BOOKS

1. S.K. Das, Surface Mine Technology
2. G.B. Mishra, Surface Mining Pub: Dhanbad Publisher, Dhanbad..
3. Howard, L.Hartman, Introductory Mining Engineering, Pub: John Willey & Sons
4. Sushil Bhandari, Engineering Rock Blasting Operations. Pub: A.A.Balkema Publisher Old post Road, Brook field, VTO5036, USA.

REFERENCE BOOKS

1. SME handbook on Surface Mining
2. Surface Mining by E. P. Pflieger
3. Opencast Mining Unit Operations by V.V. Rzhnevsky

**5MI4 – 02: Underground Coal Mining****Credit: 3**
3L+0T+0P**Max. Marks: 100(IA: 30,ETE: 70)**
End Term Exam: 3Hours**Course Objectives**

1. To introduce underground coal mining methods, both conventional and specialized
2. To impart knowledge on recent UG coal mining technologies to the students
3. To help students in designing and planning of underground operations

Course Outcomes

1. To understand the details of development of a mine for exploitation of underground coal deposits
2. Analyze design requirements of Underground Coal Mining Methods
3. Apply different support systems including stowing techniques for underground mines for stability of workings

SN	Contents	Hours
1	Status of coal industry and deposit factors affecting choice of mining methods Stratified deposits, their origin and distribution; Characteristics of roofs, floors and associated rocks. Factors influencing choice of Methods: Classification of mining, systems and their relative application, layout and development of mines, mechanized development layout, type of machinery, personnel; cycle of operation.	8
2	Bord and Pillar Method – Development: Design and development of a district, bord and pillar, room and pillar methods, with conventional and continuous mining techniques; panel system.	6
3	Bord and pillar Method – Extraction: Pillar extraction by caving and stowing methods; mechanised extraction of pillars, shaft pillar extraction, systematic supports, surface, underground and face arrangements for stowing.	6
4	Longwall Method : Advance and retreat methods, continuous and cyclic systems, extraction with different machines-ploughs, shearers, design of longwall workings, optimum length of face, size of panel, gates, support system, personnel, organisation and safety measures, salvaging in longwall.	8
5	Specialised methods: Problems of working thick & thin seams, multi slices, sublevel caving, horizon mining, gallery blasting method, contiguous seam working, working steeply inclined seams, working under surface structures and seams liable to spontaneous heating, outburst and bumps, etc.	8
	Underground Coal Gasification: Basic principal; methods of gasification; scope of application. Coal Bed Methane extraction methods and their applicability.	4
	Total	40

TEXT BOOKS

1. R.D. Singh, Principles & Practices of Modern Coal Mining Pub:- New Age International Pvt.Ltd. New Delhi
2. T..N. Singh, Underground winning of coal. Pub: Oxford & IBH, New-Delhi
3. Singh & Dhar, Thick Seam Mining, Pub: : Oxford & IBH, New-Delhi
4. Samir Kumar Das, Modern coal mining. Geeta book store, Dhanbad.
5. Prof. J. G. Singh; “Underground Coal Mining Method” Braj-Kalp Publisher, Varanasi

REFERENCE BOOKS

1. William A. Hustrulid, Richard Bullock; “Underground Mining Methods” SME Publication
2. MSHA; “Underground Coal Mine Blasting” ISEE Publication Cleveland, Ohio

**5MI4 – 03: Mine Ventilation****Credit:3**
3L+0T+0P**Max. Marks: 100(IA: 30,ETE: 70)**
End Term Exam: 3Hours**Course Objectives**

1. Describe and apply the principles of fluid flow for underground ventilation systems.
2. Describe and apply laws of natural and mechanical ventilation systems.
3. Design and analyze ventilation systems for mines.

Course Outcomes

1. Comprehend and analyze the environmental hazards in underground mines and outline the ventilation control measures that detect, monitor, minimize and/or manage these hazards.
2. Apply the principles of fluid flow in an underground mine ventilation system
3. Network analysis and selection of fans
4. Conducting ventilation surveys for planning and designing a suitable mine ventilation system

SN	Contents	Hours
1	Mine Gases: Mine atmosphere its composition, Pollution of mine atmosphere, air-mine gases, toxicity of gases. Origin, occurrence, physical, chemical and physiological properties of various gases and their detection.	6
2	Heat and Humidity in Mines: Rock temperature geothermic gradient auto-compression, Humidity, its determination and effects. Metabolism and respiration. Climate conditions, Kata thermometer assessment of comfort conditions. Control of temperature and humidity in deep mines. Air-conditioning in mines.	6
3	Ventilation: Necessity and standards for ventilation, Flow of air in ducts and mine roadways, resistance of airways. Laws of ventilation: Chezy's and Atkinson's equation. Equivalent resistance of mines, equivalent orifice, mine characteristics.	8
4	Natural ventilation and its measurement, Thermodynamics of ventilation and determination of pressure volume diagram, Mine fans, principal types, their construction and working, characteristics and suitability; booster and auxiliary fans, venturi and air jets. Installation of fans, air locking arrangement, design of evasee, parallel and series operations of mines fans.	8
5	Coursing, distribution and regulation of air current and splitting in underground working; Ventilation of dead ends by auxiliary systems, Forcing and exhausting fans, ascensional and descensional, homotropical and antiropal ventilation.	6
6	Measurement of air flow and pressure ventilation survey and related instrumentation, Calculation concerning to fans and ventilation of mines, Network problems. Use of computer in ventilation network design, maintenance & analysis.	6
Total		40

TEXT AND REFERENCE BOOKS

1. G.B. Mishra. Mine Environmental Engineering. Pub: Dhanbad Publisher, Dhanbad
2. L.C. Kaku. Numerical Problems on Mine Ventilation. Pub: Punam Publisher
3. Howard, L.Hartman. Introductory Mining Engineering, Pub: John Willey & Sons
4. Mutmansky&Weng. Mine ventilation & Air conditioning. Pub: John Willey & Sons
5. S. P. Banerjee. "Mine Ventilation" Lovely Prakashan, Dhanbad

**5MI4 – 04: Dimensional Stone Mining****Credit:3**
3L+0T+0P**Max. Marks: 150(IA: 30,ETE: 70)**
End Term Exam: 3Hours**Course Objectives**

1. Illustrate various properties of dimensional stones.
2. Assess and explain various statutory requirements for effective mining of dimensional stones.
3. Understanding the prevalent methods of dimensional mining, their advantages and limitations

Course Outcomes

1. To acquire knowledge to excavate blocks of marble, granite, sandstone etc.
2. Detailed understanding of various methods of dimensional stone mining including diamond wire saw, blind cut technique etc.

SN	Contents	Hours
1	Resources of Marble, Granite, Slate, Sandstone and Limestone as Dimensional stones in India vis-à-vis world, uses, Marketing and Export. Allotment of lease and other legal aspects.	8
2	Geological, Mineralogical and physico mechanical properties of dimensional stones, criteria for selection of dimensional stone deposit.	6
3	Mining: Convention mining of sandstone, Limestone, Marble and Granite. Wire saw, chain saw, hydraulic splitting flame jet cutting, water channeling and breakage by chemicals etc. Blasting in dimensional stone mines. Development of mine, mine layout, Block yield.	10
4	Processing: Dressing, Sawing, Gangs saw, circular saws, preparation and mounting of blade/discs and segments. Polishing Manual Mechanical, various types of polishing machine. Abrasive: Type, use and selection, shaping. Tile preparation, automatic tiling plant.	10
5	Environmental impact of mining and processing of dimensional stones, secondary use of quarried land and waste of the industry.	6
Total		40

TEXT AND REFERENCE BOOKS

1. Rathore S. S., Bhardwaj G. S., Jain S. C.; “Dimensional Stone Technology” Himanshu Publication New Delhi
2. Rathore S. S., Laxminarayana V.; “Safety and Technology in Marble Mining and Processing in New Millennium” Proc. of National Workshop held march 10-11 200 Udaipur.
3. Rathore S. S., Gupta Y. C., Parmar R. L.; “Recent Development in Machinery and Equipment for Dimensional Stone Mining” held Dec. 13-14, 2003 at Udaipur.
4. India Stones, Business Magazine on Indian Stone Industry, Pub. ICONZ Communications, 203, Mahaveer Residency, 15 Main J. P. Nagar, 5th phase, Bangalore

**5MI4 – 05: Mine Economics****Credit:3**
3L+0T+0P**Max. Marks: 100(IA: 30,ETE: 70)****End Term Exam: 3Hours****Course Objectives**

1. To familiarize the student regarding the mineral resources and its utilization for profit.
2. To learn about the investment and return from the mineral-based industries.
3. Development of understanding on mineral economics vis-à-vis NMP
4. Understanding of budgetary control and valuation of mineral deposits

Course outcomes

1. To understand the procedures for estimation of reserves and grades
2. To introduce mining entrepreneurship, Principles of company law etc. for mine valuation
3. To enhance the knowledge related to wages and incentives, purchases, stores and inventory control etc.

SN	Contents	Hours
1	Introduction :: Economic importance of the mineral industry; mining economy, Economic challenges in mining industry, Role of State governance in the mining industry; national mineral policy. Royalty, taxes and duties; imports and exports.	6
2	Mineral resource concept, classification and estimation. Conservation of mineral resource, scope and limitations. Small scale mining and its socio-economic significance. Mineral Information System.	6
3	Evaluation of Mineral Deposits: Standard controlling factors, calculation of grade, tonnage and tonnage factor, mineable ore limits, Ore classification.	6
4	Loss of mineral in mining: Classification and incorporation of losses; coefficient of completeness of mineral extraction; dilution and recovery.	6
5	Cost of mining: Capital and operating costs; factors affecting operating cost; methods of estimating future costs; standard cost and forecast; budget and budgetary control.	4
6	Mine Sampling : Theory of sampling, method of sampling employed in different cases, precaution to be taken; Reduction, Calculation of overage reef values and widths; average stopping values and width and average milling values and widths; estimation of average-tonnages and value in mine-percentage sorted, percentage recovered, sampling procedure and precaution of sampling alluvial deposits and dumps, estimation of reserves.	6
7	Mine Valuation: Different methods and their application; depreciation and amortization and redemption of capital; Life of mine; its present value, Reports on valuation.	6
Total		40

TEXT AND REFERENCE BOOKS

1. Park , A text book of Mine Valuation..
2. W.A. Hustrulid, Underground Mining Methods Handbook.
3. Rendu, An Introduction to Geostatistical Methods of Mineral Evaluation.
4. R.T.Deshmukh, Mineral and Mine Economics, Myra Publisher , Nagpur, 1986.
5. R.K. Sinha and N.L. Sharma, Mineral Economics, Oxford & IBH Publishers , UK, 1970.
6. O.P. Khanna, Industrial Engineering and Management, DhanpatRai , Delhi, 1993.
7. R.N.P. Arogyaswamy, Courses in Mining Geology, Oxford & IBH Publisher , UK, 1973

**5MI5 – 11: Remote Sensing and GIS****Credit:2****2L+0T+0P****Course Objectives**

1. How to manage and use GIS and Remote Sensing to work in real time
2. Understand the basic concept of Remote Sensing and know about different types of satellite and sensors.
3. Understand different components of GIS and Learning about map projection and coordinate system.
4. Develop knowledge on conversion of data from analogue to digital and working with GIS software.

Course Outcomes

1. Understand the principles of aerial and satellite remote sensing, Understand the basic concept of GIS and its applications, know different types of data representation in GIS
2. Understand and Develop models for GIS spatial Analysis.
3. Apply knowledge of GIS software and able to work with GIS software in various application fields
4. Apply knowledge of GIS and understand the integration of Remote Sensing and GIS

Max. Marks: 100(IA: 30,ETE: 70)**End Term Exam:2Hours**

SN	Contents	Hours
1	Remote Sensing: Introduction to Remote Sensing, Terminology in Remote Sensing, Types of Remote sensing, advantage and disadvantage of remote sensing data, Electromagnetic radiation atmospheric. Windows remote sensing platforms and sensors systems, path-row referencing system, remote sensing data product, procedure for obtaining satellite data. Hardware and software related to remote sensing.	6
2	Different types of platforms, sensors and their characteristics, Orbital parameters of a satellite, Multi concept in remote sensing. Image Interpretation and analysis: Elements of visual image interpretation, Digital image pre-processing, radiometric correction, geometric correction, resolution of remote sensing data, image enhancement, contrast enhancement, spatial filtering band rationing image classification supervised and unsupervised classification, remote sensing applications in forestry, geology, hydrogeology, Land use and land cover mapping.	6
3	Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation, ground truth – collection and verification, advantage of multiband and multiband images. Digital image Processing concept.	6
4	Geographic Information System (GIS): Fundamental of GIS: Basis concept including definition and history of GIS, Essential Elements of GIS, Uses and users of GIS, General GIS Applications, Geodesy, Grids, Datum's and projection systems, GIS Data structure, Data Formats, GIS layers and Digitization overview of GPS and its application, Hardware and software related to GIS.	8
5	Raster and vector Based GIS: Raster based GIS, Definition of Raster Based GIS, Spatial Referencing Definition and Representation of Raster Data. Vector based GIS, Definition and concept of vector based GIS, Data structure, Data Capture and Basic operations of spatial analysis, advantages and disadvantage in raster and vector based GIS, Introduction to network in GIS, GIS Project Planning Management and Implementation.	8
6	Application of GIS in Map revision, Land use, Agriculture, Forestry, Archaeology, Municipal, Geology, water resources, soil Erosion, Land suitability analysis, change detection, Use of GIS in Mining.	6
Total		40



TEXT&REFERENCE BOOKS

1. Remote Sensing and GIS: B.Bhatta
2. Remote Sensing and Image Interpretation : T.M. Lillensand and R.W. Keifer
3. Principles of Remote Sensing : P.J. Curren
4. Principles of Geographical Information systems for land Resources Assessment : P.A. Baurrough
5. Manual of Remote Sensing, Vol.2 : American Society of Photogrammetry and Remote Sensing
6. Geographical Information systems Management Perspective : Stan Aromof

**5MI5 – 12: Tunnel Engineering****Credit: 2**
2L+0T+0P**Max. Marks: 100(IA: 30,ETE: 70)****End Term Exam: 2Hours****Course Objectives**

1. Understanding of tunnel drivage methods, ground support, transport and ventilation
2. Evaluate tunnel excavation method from technical and production aspects
3. Analyze cost and time for ordinary tunnels based on risks and construction management principles
4. Carry out a tunnel ventilation

Course Outcomes

1. Design tunnels, rock support and grouting and evaluate the most important issues in the procedure
2. Evaluate tunnel excavation method from technical and production aspects
3. Analyze cost and time for ordinary tunnels based on risks and construction management principles.

SN	Contents	Hours
1	Tunneling: Introduction about tunnels, functions, advantages and disadvantages of tunnels compared to open cuts, Criteria for selection of size and shape of tunnels, consideration in tunneling, geological investigation, tunnel alignment, tunnel shafts, pilot tunnels. Advantages of twin tunnels and pilot tunnels, portals and adits.	8
2	Conventional method of Tunneling: Drilling, Blasting, Loading and Transport of Muck, Supports, Ventilation, Drainage, and Equipments. Drivage work in varying ground conditions using conventional methods	8
3	Fast tunneling: Dill jumbos, trackless mucking and transportation units. Tunnel boring machine	8
4	Tunneling In soft ground: General characteristics of soft ground, shield methods, needle beam method and NATM method of tunneling in practice.	8
5	Tunneling (rock bolting and guniting), Safety measures, Ventilation in tunneling, Lighting, Drainage.	8
Total		40

TEXT BOOKS

1. Driving Horizontal Workings and Tunnel, by Pokorovski, Mir Publishers, 1980.
2. Harbour, Dock and Tunneling Engineering by R. Srinivasan Published by R. C. Pattii, Chal'otar Book Stall, Station Road TulsiSada, Arland (W. Rly), India.

REFERENCE BOOKS:

1. Rock Mechanics and Design in Mining and Tunneling, by Bieniawski, Z.T., Rotterdam A.A. Balkema, 1984.
2. Drilling and Blasting of Rocks, by Carlos L Jimeno, A.A. Balkema/Rotterdam/Brookfield 1995.
3. Hoek, E., Brown, E. Underground excavations in Rock, CRC Press, 1980.
4. Hoek, E. and Brady, J. D. Rock Slope Engineering, Taylor and Francis, 1981
5. Nick Barton, Tunnel Boring Machines, 2000

**5MI5 – 13: Numerical Methods and Simulation****Credit: 2**
2L+0T+0P**Max. Marks: 100(IA: 30,ETE: 70)**
End Term Exam: 2Hours**Course Objectives**

1. Introducing of various numerical methods and techniques.
2. To develop basic understanding of different properties of Elastic Rock Models.
3. To study the theories of failure and approaches used for open pit and underground designs
4. To apply the numerical techniques for various rock engineering and design situations

Course Outcomes

1. To have knowledge on Elastic Rock models, Finite and Boundary element method.
2. Comprehensive design of underground openings and numerical methods of Geo mechanics.

SN	Contents	Hours
1	Introduction to Elastic Rock models: Fundamentals; Elastic, homogenous isotropic, non linear elastic and elasto-plastic models.	10
2	Finite Element Method- the concept, formation of mesh elements and finite difference patterns solution; Discretization and elementconfiguration; Element stiffness, assemblage and solution.	10
3	Boundary element method: The concept, discretization, different methods of solution for isotropic and infinite media.	10
4	Scope and application of numerical methods and simulation in mining and geo-mechanics: design and analysis of excavations, stopes, pits, barriers, walls, pillars, supports, slopes, roadways, machine components and structures etc.	10
Total		40

TEXT&REFERENCE BOOKS

1. Kidybinski A. & Kwasniewski M. (Eds); Modelling of Mine Structures, A.A. Balkema, Rotterdam, 1988.
2. Kidybinski A. &Dubinski J. (Eds); Strata Control in Deep Mines, A.A. Balkema, Rotterdam, 1990.
3. Obert,L.andDuvall,W.I.,Rock Mechanics and Design of Structure in Rock John Wiley and Sons Inc., New York, 1967.
4. Vutukuri, V.S. and Lama, R.D., Handbook on Mechanical Properties of Rocks, Vol.I, II, III and IV, Transtech Publication Berlin,1974/78.



5MI5 – 14: Mining Closure Planning

Credit: 2
2L+0T+0P

Max. Marks: 100(IA: 30,ETE: 70)
End Term Exam: 2Hours

Course Objectives

1. The student in understanding the principles, processes and methodologies associated with mine closure planning and workout and develop mine closure plans and layouts.

Course Outcomes

1. Recognize and discuss the multi-disciplinary components of mine closure.
2. Formulate the specifics of a closure plan for a mine by way of studies, meetings, reports and deliberations.
3. To develop a mine closure strategy and supervise the implementation of a mine closure.

SN	Contents	Hours
1	Introduction: Mine Closure Planning and its components, need of Closure Planning in mining ventures; technical information for Closure Planning.	6
2	Issues in mine closure planning. Different mine closure operations. Role of regulatory authorities and mine operator in mine closure. Post-mining site rehabilitation programme	8
3	Principles, planning, financial provisions, implementation, standards for closure criteria, systems approach for mine closure and development of closure plan.	8
4	Factors to be considered, Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) preparation, Mine Closure Planning.	8
5	Legal provisions for environmental protection – various acts, rules and regulations and various legal aspects of mine closure planning. Its advantages and amendments. Guidelines from Ministry of Environment, Forest and Climate change. Preparation of a Mine Closure Plan.	10
Total		40

TEXT&REFERENCE BOOKS

1. Mineral Deposit Evaluation: A practical approach by Alwyn E. Annels 1991
2. Guidelines for preparation of Mine Closure Plan issued by Indian Bureau of Mines
3. SME Mining Engineering Handbook 2nd Edition Howard L. Hartman

**5MI5 – 15: Mine optimization/ Mine Systems Engineering****Credit: 2****2L+0T+0P****Max. Marks: 100(IA: 30,ETE: 70)****End Term Exam: 2Hours****Course Objectives**

1. Identify and develop operational research models from the description of the real time system.
2. To create mathematical models that are useful to solve optimization problems.
3. Develop abilities to design and develop the analytical models for planning, scheduling and controlling projects.

Course Outcomes

1. Mine Systems Engineering presents the theoretical principals and practical applications through understanding of systems individually and in integration.
2. It covers planning and valuation methodologies applicable to metal and coal mining projects.
3. The students will explore and apply basic manual procedures, algorithms, computer applications and mathematical models for strategic mine planning

SN	Contents	Hours
1	Introduction to Systems Engineering : Concept of system, components and system environment; classification of systems; systems analysis; creative aspects of planning and design; factors influencing creativity; techniques for generating alternative ideas/solutions	8
2	Mathematical Programming Methods : Linear programming - definition/elements, assumptions and limitations of LPP; graphical solution; geometry and algebra of simplex method; interpretation of simplex table; application of linear programming for solution of mining problems related to production, blending, scheduling. Transportation and Assignment Problems; Mathematical modelling and solution algorithm; application to mining problems.	8
3	Project Management with PERT & CPM : Network Models Assumptions of PERT and CPM; art of drawing network; redundancy and identification of redundant jobs; algorithm for calculation of critical path and identification of critical jobs; criticality index; statistics related to PERT; probability of completing a project by a due date; lowest cost schedule; case examples application to mining problems	8
4	Decision Analysis : Decision problems; model formulation; decision analysis based on expected monetary value and utility value. Optimisation techniques and queueing theory.	8
5	Simulation : Introduction and concept; scope and limitation; system type versus simulation technique; generating input data; Monte-Carlo simulation; deterministic and stochastic simulation of various systems in mines.	8
Total		40

TEXT BOOKS:

1. Cummins .Mining Engineers Handbook, Vol. II SME, AIME, New York, 1979.
2. Sharma J.K. Mathematical Models in Operations Research. Tata Mcgraw-Hill, New Delhi, 1989.
3. Taha H.A. – Operations Research and Introduction, Mc. Millan. ISBN -0-02-418940-5.

REFERENCE BOOKS

1. Hiller and Liberman, Introduction to Operation Research, Mc. GrawHill V Edition.
2. S.D. Sharma – Operations Research, Kedarnath, Ramnath& Co.
3. Philips, Ravindran and Soleberg – Principles of Operations Research – Theory and Practice, PHI.
4. KanthiSwarup& Others – Operations Research, Sultanch and Sons.

**5MI5 – 16: Rocks Excavation Engineering****Credit: 2**
2L+0T+0P**Max. Marks: 100(IA: 30,ETE: 70)****End Term Exam: 2Hours****Course Objectives**

1. To understand earth materials and their excavation methods
2. Understanding and relating the physico-mechanical properties of rock to the excavation methods
3. To understand the principles, advantages and limitations of various excavation techniques.

Course Outcomes

1. To access and analyze various earth material in terms of their physical and mechanical properties
2. To determine the effect of forces on rock material and cutting.
3. To identify the operational parameters for efficient rock excavation.

SN	Contents	Hours
1	Introduction: Concepts and historical developments and design in rock excavation, factors affecting rock fragmentation, mechanism of rock breakage and fractures. Rock Fragmentation: Method of rock fragmentation - explosive action, cutting, ripping and impacts.	6
2	Mechanical Properties of Rocks: Application of compression, tensile and multi - axial strength, index test and abrasivity, anisotropy, elasticity, porosity, lamination, bedding joints in rock fragmentation process. Principles of Rock Cutting Technology: Drilling and its various types i.e., rotary, percussive; rotary - percussive mechanism of rock percussion, theory of single tool rock cutting, crack initiation and propagation, breakage pattern.	10
3	Rock cutting picks, discs and rolls cutter. Water jet cutting. Method of assessing drillability and cuttability of rock.	6
4	Principles of Excavation Machines: Roadheaders, TBMs' cutters loaders, Bucket Wheel Excavators, draglines and Continuous Miners	6
5	Rock Cutting Tools: Cutting tool material - different types relative application and their choice, tool shape and size, specific energy consumption, tool wear, drill bit types.	6
6	Effect of operational parameters on tool performance and replacement of cutting tools of excavating machines	6
Total		40

TEXT BOOKS

1. R. E. Goodman, Introduction to Rock Mechanics, John Wiley and Sons, 1980 , Indian edition available
2. Deb and Varma, Fundamentals and Applications of Rock Mechanics, PHP India
3. Rock Fragmentation by Blasting,” B.Mohanty, Module 4, A.A. Balkema, Rotterdam, 1996.
4. Rathore S. S., Gupta Y. C., Parmar R. L.; “Recent Development in Machinery and Equipment for Dimensional Stone Mining” held Dec. 13-14, 2003 at Udaipur.

REFERENCE BOOKS

1. Franklin and Dusseault, Rock Engineering, Barnes and Noble
2. J. C. Jeager and N. G. W. Cook, Fundamentals of Rock Mechanics, Chapman and Hall, 1979



3. Rock Mechanics for Underground Mining, 2nd edition, Brady and Brown, Kluwer Academic Publishers, 1993

5MI4 – 20:Surface Mining Lab

Credit: 1

Max. Marks: 100 (IA: 60, ETE: 40)

0L+0T+2P

Course Objectives

1. Understand the basic concept of surface mining and associated methods.
2. Learn various aspects of drilling and blasting practices in open cast mines.
3. Learn application of various heavy earth moving machinery and their selection criteria

Course Outcomes

1. Ability to design road/ramp to open a deposit and layouts for hilly deposits of vein and bedded forms.
2. Ability to design various types of layouts and deposit by opencast ND underground mining
3. To learn various techniques used in over cast from cost benefit benefit and Measurement of blasting vibrations with Blastmate series.
4. To knowledge about drilling equipments and excavated through underground mining.

Contents of the Subject

1. Designing an approach road/ramp to open a deposit by surface mining.
2. Various techniques used in over cast from cost benefit point of view.
3. Designing various layouts for hilly deposits of vein and bedded forms.
4. Designing various types of layouts for deposits below the general ground level.
5. Designing of various types of layouts for placer deposits.
6. Designing a deposit by opencast mining, which has been partially excavated by underground mining.
7. Performance and choice of drilling equipment in surface mine working.
8. Designing the blast hole charging, taking into consideration various parameters.
9. Measurement of blasting vibrations with Blastmate series III equipment and its analysis.
10. Prediction of nuisances due to blasting and their controlling measures.



5MI4 – 21: Underground Coal Mining Lab

Credit:1
0L+0T+2P

Max. Marks: 100 (IA: 60, ETE: 40)

Course Objectives

1. Understand the mode of access to reach coal seams and choice of mine seam
2. Gain knowledge of bord and pillar method of mining
3. Gain knowledge of longwall method of mining.
4. Knowledge of extracting of thick coal seams by special methods

Course Outcomes

1. Ability to identify mode of access to reach coal seam and choice of mining method
2. Ability to design bord and pillar method of mining
3. Ability to design longwall method of mining.
4. Ability to design the extraction of thick coal seams by special methods.

Contents of the Subject

1. Design of Bord and pillar method of mining with caving technique.
2. Design of Bord and pillar method of mining with stowing technique.
3. Design of layouts of longwall advancing Panel.
4. Design of layouts of longwall retreating Panel.
5. Study the design parameters of powered support in longwall mining.
6. Blasting gallery technique for excavation of thick seams.
7. Various filling materials and their comparative properties and application.
8. Sand collection techniques at the river sides.
9. U/g Gasification of coal
10. Exercise on simultaneous development and depillaring.



5MI4 – 22:Mine Ventilation Lab

Credit: 1
0L+0T+2P

Max. Marks: 100 (IA: 60, ETE: 40)

Course Objectives

1. The students learn the determination of various ventilation parameters in underground mines viz. gases, psychometric properties
2. The students learn to carry out ventilation surveys

Course Outcomes

1. Ability to determine hazardous gases and psychometric properties of air.
2. Ability to carry out ventilation surveys and interpret the results.
3. Ability to plan underground ventilation.

Contents of the Subject

1. Different gases found in coalmines, metal mines and their permitted limits as per the mining regulations. Effect of these gases when found in excess.
2. Various types of methanometers used in mines and their selection criteria.
3. Various types of CO-detectors used in mines and their selection criteria
4. Measurement of relative humidity with the help of various types of hygrometer.
5. To find the effect of heat, humidity and air velocity with the help of Kata-thermometer.
6. Various air circuits with resistance in series and parallel.
7. Calculation for the installation of main ventilation fan and its reversal arrangement.
8. Design the evasee of ventilation fan in different working conditions.
9. Designing auxiliary ventilation system and their comparative performance.
10. Measurement of air velocity with the help of anemometer, velometeretc, measurement of temperature, pressure etc.



5MI7 – 30:Industrial Training

Credit: 3
0L+0T+2P

Max. Marks: 100 (IA: 60, ETE: 40)



6MI4 – 01: Metaliferrous Mining

Credit:3
3L+0T+0P

Max. Marks: 100(IA: 30,ETE: 70)
End Term Exam: 3Hours

Course Objectives

1. Understanding of different types of underground metal mining methods and their variants.
2. Understanding of modern trackless underground metal mining and designing.
3. Assessment of choice and selection of suitable metal mining method.

Course Outcomes

1. Understand the fundamentals and advanced concepts of metal mining.
2. Proficiency in planning, designing, operation and scheduling of underground metal mining.
3. To develop the understanding of various variants of underground metal mining methods in field-scale.

SN	Contents	Hours
1	Present status of Indian metal mining industry Mine Structures : Construction of mine portals, shaft insets and plats; ore and waste bins; skip-pockets, engine chambers, ore passes, chutes, garages, grizzlies. Underground chambers and sumps and other subsidiary excavations. Secondary Breaking : Conventional, electrical and mechanical methods.	5
2	Stoping Methods : Selection of stoping methods, classification of different stoping methods. Stope layouts and stope preparation work with different stopping methods. Haulage and dumping, ventilation loading, underground crushing.	6
3	Open stopping method-Room and Pillar, sub-level, Shrinkage, Blast Hole and Vertical Crater Retreat, Stopping and their variations. Supported stopping methods Timber, Post and Pillar, square set, cut and fill and their variations.	9
4	Supported stoping : Material of backfill and their procurement; sand gathering plant, theoretical aspects of slurry transportation; preparation, transport and placement of hydraulic backfill with and without cement; rock and concrete fills, surface arrangement for storage and mixing; pneumatic and mechanical methods of backfill.	10
5	Caving Stopping methods Top slicing, sub-level caving, block caving and Their variations. Design and construction of draw points, mechanics of draw and draw control procedures, recovery and dilution. Stopping of superimposed veins and parallel ore bodies. Combined methods. Use of Computers in design and operation.	10
Total		40

TEXT AND REFERENCES BOOK:

1. Howard, L.Hartman, Introductory Mining Engineering, Pub: John Willey & Sons
2. Cummins & Givens, SME Mining Engineering Handbook, Vol. I & II, Pub: A.I.M.M. New-York
3. Ramlu et al, Computer in mineral industry. Pub: Oxford & IBH, New-Delhi
4. W.A. Hustrulid, Underground mining methods handbook, Pub: Society of mining engineers of the American Institute of Mining Metallurgical and Petroleum Engineers, Inc. New-York
5. Metalliferous Mine Surveying Fedrickm Wini Berg, 2nd edition Mining Publications, London, 1935

**6MI4 – 02: Mine Planning and Design****Credit:3**
3L+0T+0P**Max. Marks: 100(IA: 30,ETE: 70)**
End Term Exam: 3Hours**Course Objectives**

1. To create awareness on various features of mine planning.
2. To impart in-depth knowledge on preparation of feasibility report and detailed project report with reference to latest amendments in Indian mining laws.
3. To enable the students in planning of the mines for required production, productivity etc., both for underground and surface mining.

Course Outcomes

1. Students can understand basic principles of mine planning for development and extraction of minerals
2. Students will be able to plan and design underground and surface mines fulfilling the requirements of concerned statutory requirements.
3. Students will be able to understand the importance and preparation of feasibility and DPR for mining projects.

SN	Contents	Hours
1	Introduction: Mine planning and its components, role of planning in mining ventures; technical information for mine planning; reserve estimation. Technical and economical consideration in opening of deposits of open cast and Underground methods. Different modes of entries to mine underground deposits and their selection optimum size shape and location of these mine entries. Mineral inventory and ore reserves. The basic difference cut off grade, its determination. Grade Tonnage curves and their computation.	8
2	Surface Mine Planning : Bench geometry and mine layouts, planning steps; determination of mine size and Taylor's mine life rule; ultimate pit configuration; mining programme; haul road design	8
3	Underground Mine Planning : Mining system and sub-systems; optimal geometrical size of a mine; planning and scheduling of production. Determination of optimum. Size of mine, life of mine, rate of production and mining losses, Optimisation of mine design on economic considerations.	8
4	Feasibility study: its functions and preparation of feasibility report for metallic and non-metallic minerals.	8
5	Details Project Repot Dividing mining properties into parts panels and level. Size of panel, level interval, size of long wall face. Pit limit Design Determination of ultimate open pit configuration by various methods. Use of Computer in mine planning and design	8
Total		40

TEXTBOOKS

1. J Bhattacharya,, Principles of Mine Planning,, Allied Publishers Pvt Limited, New Delhi, 2003
2. W.Hustrulid and M.Kuchta, Open Pit Mine Planning and Design, A.A.Balkema Rotterdam, 1995
3. K. S. Stout, Mining Methods and Equipment, McGraw hill New York, 1980
4. T. N. Singh,, Underground winning of Coal,, Oxford and IBH New Delhi, 1992

**6MI4 – 03: Mine Hazard and Management****Credit:3**
3L+0T+0P**Max. Marks: 100(IA: 30,ETE: 70)****End Term Exam: 3Hours****Course Objectives**

1. To make students conversant with types of hazards and their occurrence in underground mines.
2. To impart knowledge about the causes and mitigation measures for various hazards.
3. To provide details of rescue operations to be conducted after disasters.
4. To understand the problems of mine dust and illumination including the assessment and mitigating measures.

Course outcomes:

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

S. No.	Contents	Hours
1	Mine fires and spontaneous combustion: Surface fires, its effects; causes and prevention; underground fires: spontaneous combustion; its causes, detection and preventive measures; accidental fires causes and prevention. Physical and chemical characteristics of coal liable to spontaneous heating, Detection by practical and scientific method, preventive measures and dealing with underground fires.	8
2	Study of atmosphere behind sealed off area, factors of conditions for reopening; different method of reopening, difficulties, dangers and safety measures various mean for fires fighting. Fire fighting organization.	8
3	Explosion: methane layering. Types, causes of explosions and preventive measures. Fire damp explosion limits of explosibility of fire damp, factor affecting the limit of explosibility, sources of initiation of fire damp explosion. Coal dust explosion, relative inflammability of coal dust, its measurements. Factors affecting relative inflammability; safeguards against coal dust explosion, watertreatment, stone dust and dusting; stone dust and water barriers, water gas explosion causes and safety measures.	8
4	Mine inundations: causes; precautionary measures; precautions to be taken while approaching old workings. Burnside boring apparatus. Design and construction of water dams; recovery of flooded mines. Dewatering of old working. Water blast dangers and precautions.	8
5	Mine rescue and recovery work: different type of rescue equipments; test on rescue apparatus. Rescue station, recovery and first aid appliances. Training of personnel and organization of rescue station; rescue and recovery work in connection with mine fire, explosion and other conditions. Problems of radiation in atomic mineral mines.	8
Total		40

TEXT BOOKS

1. Mine Ventilation & Environment, Misra, G.B., Dhanbad Publishers, Dhanbad, 1994
2. Elements of Mining Technology Vol. 2–2016. by D. J. Deshmukh
3. Subsurface Ventilation and Environmental Engineering Authors: McPherson, M.J. 1993
4. Mine Disasters and Mine Rescue Ramlu M. A. 2006, 2nd Edition.

REFERENCE BOOKS



1. Occupational Safety and Health: Fundamental Principles and Philosophies by Charles D. Reese
2. Safety in Mines by Kejriwal, B. K. (2002)

6MI4 – 04: Mineral Processing

Credit:3
3L+0T+0P

Max. Marks: 100(IA: 30,ETE: 70)
End Term Exam: 3Hours

Course Objectives

1. Expose the mining engineer to various aspects of beneficiation of ores and industrial minerals for value addition.
2. To introduce mineral processing characteristics of minerals, “concentrations, physico-chemical principles, flow sheets for beneficiation of various minerals.

Course outcomes

1. To impart knowledge to understand the relevance and practices of beneficiation ores and coal .
2. To understand the concept of value upgradation for main product and for byproduct recovery for the societal use.
3. To know various techniques of mineral processing including theory, application and their limitations and environmental implications.

SN	Contents	Hours
1	Communication and Liberation: Theory and practice of crushing and grinding. Sizing and Classification: Laws of setting of solids in fluid; laboratory methods of sizing and interpretation of sizing data, Industrial sizing by screens. Types of classifiers. Classification as means of sizing/concentration.	8
2	Gravity concentration Methods : Jigging, flowing, Film concentration like spirals and shaking table, Heavy Media Separation Theory, application and limitations of each method. Introductory Froth Flotation :Physico-Chemical principles underlying flotation-reagents, flotation of sulphides, oxides and non-metalics.	8
3	Electrical Methods of Concentration : Electrostatic and Magnetic methods. deposits.	8
4	Dewatering and drying: Thickening, filtration and drying coal washing, coal washability, crushing, sizing and cleaning of coal.	8
5	Sampling : Importance and methods used in Ore-Dressing. Simplified Flow Sheets: Beneficiation of coal and simple ores of copper, lead, zinc, Iron and manganese with reference to Indian	8
Total		40

TEXT BOOKS:

1. Introduction to Mineral Processing – V. Malleswar Rao
2. Mineral Processing – B A Wills
3. Ore Deposits of India – Their distribution and processing. Rao, T C and Gokhale, KVG.

REFERENCE BOOKS:

1. Mineral Processing – S.K. Jain.
2. Principles of Mineral Processing- Maurice C. Fuerstenau and Kenneth N. Han



6MI4 – 05: Mine Legislation

Credit:3
3L+0T+0P

Max. Marks: 100(IA: 30,ETE: 70)
End Term Exam: 3Hours

Course Objectives

1. To familiarize with Coal and Metal Mining Rules and Regulations.
2. To familiarize with Mines Act and Mines Rules applicable to Indian Mines

Course outcomes

1. To introduce General principles of Mining Law including various acts, rules, regulations, and bylaws.

SN	Contents	Hours
1	Introduction: General principles of mining laws, development of mining laws in India. Sources of legislations, mining laws of India.	4
2	General provisions of Mines and Minerals(Regulation and Development Act 1957, Mineral Concession Rules 1960, Mineral Conservation and development Rules 1988 Salient features of Mines Act 1952, Mines Rules 1955,	6
3	Additional provisions Indian Electricity Rules 1956 applicable to mines, Workman Compensation Act, Mine Chreche Rules, Pit Head Bath Rules, Vocational Training Rules 1966, Mies Rescue Rules 1985	6
4.	General provisions of Coal Mines Regulations 1957 and some important by-laws and standing orders for coal mines General provisions of Metalliferous Mines Regulations 1961 and some important by-laws and standing orders for coal mines Safety and Health in Mines.	8
5.	Occupational hazards of mining and diseases; accidents and their classification; statistics of fatal and serious accidents; frequency rates and severity rates of accidents; cause-wise analysis; basic causes of accident occurrence; investigations into accidents and accident reports; in-depth study of accidents due to various causes;. Cost of Accidents.	8
6.	Emergency measures and emergency organization, Disaster Management Plans for major disasters of explosions, inundation etc. Measures for improving safety in mines, risk assessment	8
Total		40

TEXT AND REFERENCE BOOK:

1. Rakesh and S. D. Prasad, Legislation in Indian Mines: A Critical Appraisal, Mrs Asha Lata Varanasi, 5th edition, 1990 , Vol-I and Vol-II
2. V. K. Malhotra, Mineral Concession Rules-1960, Malhotra Bros., Patna, Supplementary Ed., , 1993
3. L.C.Kaku, A study of Mine Management, Legislation and general safety, Lovely Prakashan, 2020 , Dhanbad

**6MI5 – 11: Disaster Management in Mines****Credit:2**
2L+0T+0P**Max. Marks: 100(IA: 30,ETE: 70)**
End Term Exam:2Hours**Course Objectives**

1. Develop an understanding of the key concepts, definitions a key perspectives of All Hazards Emergency Management and Understand the Emergency/Disaster Management Cycle.
2. Have a basic understanding for the history of Emergency Management.
3. Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery and the role of public private partnerships.

Course outcomes

1. Explain the disaster management and analyze the method of prevention.
2. Explain the impacts of disaster on development and apply contingency plan of disaster management.
3. Create the prevention chart for various disasters and Explain the overall prevention and mitigation measures.

SN	Contents	Hours
1	Introduction Definitions:- Hazard, Risk, Vulnerability, Disaster-Meaning, Nature Importance, Dimensions and scope of Disaster Management; Disaster Management Cycle, The Disaster Management Act 2005	8
2	Natural Disasters related to mining and Mineral Industry- Meaning and nature of natural disasters, their type and effects; Hydrological Disasters Due to fire, explosion, toxicity and radiation; Chemical hazards: Geological Disasters- Earthquake, Tsunamis, Landslides, Avalanches, Volcanic eruption and mudflow	8
3	Cause of occupational diseases – dust, fumes, gases and vapours, green house gas emission, Climatic change, Global change, Sea level rise, Ozone Depletion	8
4	Hazard analysis and health management; ventilation and lighting, Electrical and mechanical systems, Instrumentation; Emergency planning, Personal protective devices, Maintenance procedure; Emergency mine safety; Legal aspects of safety,	8
5	Management information system and its application in monitoring disaster in mines, safety and health; Hazop Analysis	8
Total		40

TEXT BOOKS

1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Singh B.K., 2008, Handbook of Disaster Management: techniques & Guidelines, Rajat Publication.
3. Ghosh G.K., 2006, Disaster Management ,APH Publishing Corporation.

REFERENCE BOOKS

1. Disaster Management- J. P. Singhal, Laxmi Publications.
2. Disaster Management - Dr. Mrinalini Pandey, Wiley India Pvt. Ltd.
3. Disaster Science and Management- Tushar Bhattacharya, McGraw Hill Education (India) Pvt. Ltd.
4. Disaster Management: Future Challenges and Opportunities - Jagbir Singh, K W Publishers Pvt. Ltd.

**6MI5 – 12: Experimental Stress Analysis****Credit: 2**
2L+0T+0P**Max. Marks: 100(IA: 30,ETE: 70)**
End Term Exam: 2Hours**Course Objectives**

1. Describe the Mechanical, optical, pneumatic and electrical strain gauges for strain measurement and factors influencing strain sensitivity in various materials.
2. Describe the measurements by using Plane Polariscopes for theory of photo elasticity etc. brittle coating method.

Course outcomes

1. Explain the measurement of strain under static and dynamic loads
2. To understand the theory of optics as related to photoelastic behavior of light
3. Create awareness about the fixing of gauges and temperature effects in bonded gauges and measure of stress in stress gauges

SN	Contents	Hours
1	Photoelasticity: Light and Optics as Related to Photoelasticity Behavior of Light, Polarized Light, Plane Polarizers,, Wave Plates, Arrangement of Optical Elements in a Polariscopic, Constructional Details of Diffused Light and Lens – Types.	6
2	Theory of Photoelasticity: The Stress Optic Law in Two Dimensions at Normal Incidence, Effects of a Stressed Model in a Plane Polariscopes, Effects of a Plane Model in a Circular Polariscopes with Dark and Light Field Arrangements. Analysis	6
3	Techniques: Isochromatic Fringe Patterns, Isoclinic Fringe Patterns, Compensation Techniques, separation Techniques, Sealing Model to Prototype Stresses. Three Dimensional Photoelasticity: Locking in Model Deformation Slicing the Model and Interpretation of the Resulting Fringe Pattern, Effective Stresses. the Shear	8
4	Difference Method in Three Dimensions.; Strain Measurement Methods: Basic Characteristics of a Strain Gauge, Types of Shell Gauge, Moire Method of Strain Analysis, Grid Method of Strain Analysis.	6
5	Electrical Resistance Strain Gauge: Factors Influencing Strain sensitivity in Metallic Alloys, Gauge Construction Temperature Compensation, Factors-Influencing Gauge Section Gauge Sensitivity and Gauge Factor, Correction for transverse Strain Effects, Semiconductor Strain Gauges. Rosette Analysis - three element rectangular Rosette. the Delta Rosettee, the Four Element. The Delta Rosette, The Stress Gauge, Strain Circuits, Potensiometer Circuits, The Wheatstone Bridge.	8
6	Brittle Coating Method: Coating Stresses, Failure Theories Brittle Coating Crack Patterns Produced by Direct Loading Brittle-Coating Crack Patterns Produced by refrigeration Techniques, Brittle Coating Crack, Pattern Produced by Releasing the Load, Double Crack Pattern, Crack Detection, Load-Time Relation and Its influence on the threshold Strain Effects of a Biaxial stress Field	6
Total		40

TEXT BOOKS

1. J. W. Dally and W. F. Riley, Experimental Stress Analysis - 2nd Ed. MGH.
2. Mubin, Experimental Stress Analysis, Khanna, 2003

REFERENCE BOOKS

1. Dureli. An Introduction to Experimental Stress and Strain Analysis.
2. Srinath et. al. An Introduction to Experimental Stress Analysis - MGH.

**6MI5 – 13: Slope Engineering****Credit: 2**
2L+0T+0P**Max. Marks: 100(IA: 30,ETE: 70)**
End Term Exam: 2Hours**Course Objectives**

1. To understand the basics of slope stability of natural and manmade slopes.
2. Ability to understand and identify conditions affecting slope stability, and evaluate the stability in qualitative, quantitative, and stochastic manners
3. To understand and plan stabilization measures for designing stable slopes to remediation of unstable slopes.
4. To identify appropriate monitoring methods for prediction and remediation of slope issue

Course outcomes

1. Ability to judge and assess factors affecting slope stability of natural and manmade structures.
2. Capacity to evaluate qualitatively and quantitatively the stability of slope under various failure regimes.
3. Understanding and application of various slope stabilization and monitoring techniques.

SN	Contents	Hours
1	Introduction, Basic Mechanics of rock and spoil slope failures, Engineering issues of slope failure and stabilization, Geological data collection. Geophysics for open pit sites, Shear Strength, Groundwater flow.	8
2	Design of slopes, Rock mass properties: various properties, data collection, stereographic projections, Ground water: Role of ground water flow, influence of ground water on slope stability, evaluation of ground water conditions in slopes	8
3	Plane failure : general conditions and failure analysis , Wedge failure: general conditions and failure analysis , Circular failure: general conditions and failure analysis , Toppling failure: general conditions and failure analysis	10
4	Rock slope stabilization techniques, Geotechnical Instrumentation and Monitoring aspect of Waste dump stability analysis	5
5	Monitoring of slopes. Blasting practice for rock slopes.	5
6	Economics and Planning consideration	4
Total		40

TEXT BOOKS

1. Duncan C. Wyllie and Christopher W. Mah, Rock Slope Engineering, SponPress , ISBN 0-203-57083-9
2. Abramson, Lee, Sharma and Boyce, Slope Stability and Stabilization Methods, John Wiley and Sons

REFERENCE BOOKS

1. Duncan, J. Michael, Soil strength and slope stability, Wiley , ISBN: 9781118651650
2. RocScience, Rocscience Web Resources, Online



6MI4 – 20: Metalliferous Mining Lab

Credit: 1
0L+0T+2P

Max. Marks: 100 (IA: 60 ETE: 40)

Course Objectives

1. To learn various unit operations carried out in the metalliferous mining.
2. To expose the basic operations of different heavy earth moving machinery deployed in the metalliferous mining.
3. To impart practical experience to the student for gaining deeper understanding of the various activities and principles metalliferous mining

Course Outcomes

1. Select suitable method for metalliferous deposits for given geological, physic-mechanical properties of rock
2. Comprehend the knowledge on working of various stoping for different unit operations in the metalliferous mining.
3. Understand the methods of caving and vertical crater retreat techniques and mine excavation of gold deposit at deeper depth aspects related to mining

Contents of the Subject

1. Designing sub-level stoping for a ore body width varying 10-15 mts.
2. Design of blast hole stoping and its comparison with sub-level open stoping.
3. Designing of Cut and fill stopes for different Indian deposits.
4. Design of Shrinkage stopes.
5. Application of Vertical crater retreat method of mining in moderate strength of wall rocks.
6. Sub-level caving and block caving methods for deeper deposits.
7. Square-set stoping for excavation of manganese ore deposit.
8. Stopping techniques used in excavation of gold deposit at deeper depth.
9. Designing an underground metalliferous mine on given geological and physico-mechanical properties of rock.
10. Design of Post pillar method



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6MI4 – 21: Mine Planning and Design Lab

Credit: 1
0L+0T+2P

Max. Marks: 100 (IA: 60, ETE: 40)

Objective Outcomes

1. The objective of the course is to help the student in understanding the different mine planning and design which is presently in practice.

Course Outcomes

1. To be able to determine independently theore tonnage, grade and reserve, optimum mine size & annual output and life of mine
2. To ability for preparing Project planning and scheduling.
3. To know and ability to operate the instruments for a specific data for mine planning.

Contents of the Subject

1. Preparation of Feasibility Report.
2. Estimation of ore tonnage, grade and reserve
3. Determination of optimum mine size.
4. Determination of annual output and life of mine.
5. Design of final pit slope
6. Division of underground coal mine area.
7. Division of underground ore deposit having steep slope.
8. Designing of district and panel for underground coal mines.
9. Stope design for underground ore deposit.
10. Project planning and scheduling.



6MI4 – 22: Mineral Processing Lab

Credit: 1
0L+0T+2P

Max. Marks: 100 (IA: 60, ETE: 40)

Course Objectives

1. To understand the basic principle and mechanism of different equipment like Jaw and Roller crushers , ball mill and filter press which is applicable for mineral processing .

Course Outcomes

1. To know the working principle of grinding media in mineral processing.
2. To understand and have knowledge for filtration and crushing & grinding media.
3. Understanding and application of various types of classifiers and concept and apparatus of froth flotation.

Contents of the Subject

1. Jaw and Roll crushers and their comparison.
2. Gyratory crushers and their comparison.
3. The ball mill and its application.
4. Various types of classifiers.
5. Determination of various sized product with sieve shaker.
6. Concept and apparatus of froth flotation.
7. Process of thickening & filtration.
8. Wilfrey table
9. Filter press
10. Laboratory jig



6MI7 – 50: Mini Project

Credit: 2
0L+0T+3P

Max. Marks: 100 (IA: 60, ETE: 40)