



**KAKATIYA UNIVERISTY**  
**DEPARTMENT OF MINING ENGINEERING**  
**M.TECH (MINE PLANNING) PTPG SYLLABUS**  
**SEMESTER – II**

**SURFACE MINE PLANNING**

**UNIT-I**

**Introduction:** Stages/Phases of mine life; Preliminary evaluation of surface mining prospects; Mine planning and its importance; Mining revenues and costs, and their estimation; Mine planning components, planning steps and planning inputs. Pit Planning: Development of economic block model; Pit Cut-off grade and its estimation; Ultimate pit configuration and its determination – hand method, floating cone technique, Lerchs-Grossmann algorithm, and computer assisted hand method.

**Planning:** Open-pit optimization techniques for mine geometry and output, mine development phases, quality control and conservation. Output and manpower planning; calendar planning, mine scheduling, production scheduling. Feasibility Report - Contents and preparation.

**UNIT-II**

**Production planning:** Determination of optimum mine size and Taylor's mine life rule; Sequencing by nested pits; Cash flow calculations; Mine and mill plant sizing, Lanes algorithm for estimation of optimum mill cut of grade; Introduction to production scheduling.

**Equipment management:** Selection of mining system vis-à-vis equipment system. Machine availability, productivity, maintenance, maintenance scheduling, preventive maintenance, control and monitoring inventory. Workshops for HEMM. Power supply arrangements in opencast mines.

**UNIT-III**

**Blast Design:** Large dia holes, small dia holes, deep hole blasting, fragmentation, throw, noise, fly rock and dust. Blast patterns for various blasts, dragline blasting, monitoring of the blast undesired effects and controlling techniques.

**UNIT-IV**

**Design of highwall slopes and waste dumps:** Influence of pit slope on mine economics; Highwall slope stability analysis and design methodology; Stability analysis and design methodology for waste dumps.

**Design of haul roads:** Design of road cross section; Design of road width, curves and gradient; Haul road safety features and their design. Design of drainage system

**UNIT - V**

**Recent advances in surface mine:** Drilling, Blasting, Loading and Transport Operations. Selective extraction and dumping. Extraction of seams developed/extracted by underground methods. Highwall mining.

**Computer applications in surface mine:** Design of pit, Internal dump and external dump and embankments and others.

**Text / Reference books**

1. Cummings AB and Given IV. SME mining engg. hand book volume I and II, New York. 1994.
2. Das SK. Surface mining technology. Lovely prakashan, Dhanbad. 1994.
3. Das SK. Modern coal mining technology. Lovely prakashan, Dhanbad. 1994.
4. Hustrulid W and Kuchta M. Fundamentals of open pit mine planning and design, Elsevier. 1995.



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**MINE ENVIRONMENTAL PLANNING**

**UNIT - I**

**Mine fire, gases and dust:** Different methods of pressure balancing; fires in developed coal seams worked by opencast method and the control measures; gas content in coal seams; methods of determination of desorbable gas content; control of air borne respirable dust; environmental monitoring.

**UNIT – II**

**Ventilation thermodynamics:** Basics of mine thermodynamics; computation of psychometric properties of mine air; heat transfer in mine airways due to conduction, convection and radiation; heat transfer at wet surfaces; computation of rate of condensation and evaporation in mine airways; simple method of heat transfer in tunnels; heat and mass transfer in Bord and Pillar panels and development of equations for designing climatic condition; sources of heat in longwall panels; computation of heat load in mines; simulation of the climatic condition in longwall panels.

**UNIT - III**

**Ventilation Planning:** Central and boundary ventilation. U, W and Z air routes. Ventilation schemes for various methods of working. Estimation of the operating pressure and air quantity requirements of mine. Selection of the main fan. Series and parallel operation of fans. Design of fan drift and evasee.

**UNIT - IV**

**Network analysis:** Controlled flow models by critical path method, natural splitting solution problems by Hardy cross and other techniques.

**UNIT - V**

**Preparation of ventilation plans:** for underground mines. Control of heat, humidity, dust, fumes and other pollutants.

**Methane drainage:** Determination of methane, methane layer number, techniques for drainage and case studies

**Text / Reference books**

1. Mishra GB. Mine environment and ventilation. Oxford University Press. 1992.
2. Hartman HL. Mine ventilation and air conditioning. Wiley Interscience publication.1993.
3. Hall CJ. Mine ventilation engineering. Society of mining engineers, New engineers, New York, 2<sup>nd</sup> Edition. 1992.
4. Vutukuri VS. Mine environment engineering, Trans tech publishers. 1986.
5. McPherson MJ. Subsurface ventilation and environmental engineering. Chapman and hall publication, London. 1993.



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**ROCK EXCAVATION ENGINEERING**

**UNIT - I**

**Introduction:** Concepts, historical developments in rock excavation, systems, factors affecting the rock fragmentation, mechanism of rock breakage and fracture; their application to rock fragmentation methods for rock fragmentation – explosive action, cutting, ripping and impacts. Scope and importance of rock excavation engineering in mining and construction industries; physico-mechanical and geotechnical properties of rocks vis-à-vis excavation method; selection of excavation method. Rock breaking processes: Primary, Secondary and Tertiary, Energy consumption computations.

**UNIT - II**

**Rock mechanics :** Rock properties related to machining process; application of compressive, tensile and multiaxial strengths, index tests and abrasivity, anisotropy, elasticity, porosity, laminations, bedding and jointing in rock fragmentation process.

**UNIT - III**

**Rock cutting technology:** Mechanism of drilling – rotary, percussive, rotary, rotary percussive, mechanics of rock machining, theory of single tool rock cutting, crack initiation and propagation, breakage pattern, rock excavation by cutting action – picks, discs, roller cutters water jet cutting, methods of evaluation of drillability and cuttability of rocks. Advances in drilling equipment, pneumatic versus hydraulic, design and operating parameters of surface and underground drilling; evaluation of drill performance; mechanism of bit wear; bit selection; economics of drilling.

**UNIT - IV**

**Rock cutting tools:** Rock cutting tool materials, different types, relative applications and their choice, tool shape and size, specific energy consumption, tool wear, effect of operational parameters on tool performance, maintenance and replacement of cutting tools of excavating machines. Theories of rock tool interaction for surface excavation machinery rippers, dozers, scrapers, BWE, continuous surface miners, auger drills; theories of ploughs, shearers,–rock tool interaction for underground excavation machinery roadheaders, continuous miners and tunnel boring machines; selection criteria for high pressure water jet assisted–cutting tools; advanced rock cutting techniques cutting.

**UNIT - V**

**Rock excavating machines:** Excavating machines, principles, operation, applicability and technical indices of road headers, TBM'S coalface machines and bucket wheel excavators. Recent Developments in rock excavation machinery.

**Text / Reference books**

1. Cummings AB and Given IV. SME mining engg. vol. I and II, America. 1992.
2. Hartman HL. Introductory mining engineering. John Wiley and Sons, New York. 1987.
3. Chugh CP. Diamond drilling. Oxford-IBH. 1984.
4. Clark GB. Principles of rock fragmentation. John Wiley and Sons, New York. 1987.



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**SUBSIDENCE ENGINEERING**

**UNIT-I**

**Subsidence:** Various terminologies associated with subsidence, types of subsidence – sub critical, critical and super critical, factors affecting the subsidence, non effective width of extraction.

**UNIT-II**

**Theories of subsidence:** Vertical, normal, dome, beam, trough and continuum theory. Zones of movement in the overlying beds in various mining methods. Rock kinematics.

**UNIT-III**

**Subsidence survey and measurement techniques:** Leveling and linear measurements techniques; wire line method, time domain reflectometry (TDR) method and mechanical grouting method.

**UNIT-IV**

**Subsidence prediction methods:** Graphical method, analytical method, profile function, influence function, physical models and numerical methods. Subsidence control techniques, special mining layouts to minimize subsidence and impact of subsidence on structures.

**UNIT-V**

**Computer applications in subsidence:** prediction of subsidence for various mining methods: bord and pillar, blasting gallery, continuous miner technology, longwall mining and other metal mining methods using numerical modeling.

**Text / Reference books:**

1. Deb D and Verma AK. Fundamentals and application of rock mechanics. PHI publication, New Delhi. 2016.
2. Deb D. Finite element method: concepts and application in geo-mechanics, 2<sup>nd</sup> edition. PHI publication, New Delhi. 2012.
3. Obert L and Duvall WI. Rock mechanics and design of structures in rock. Wiley, Newyork. 1967.
4. Brady HG and Brown ET. Rock mechanics for underground mining, 3<sup>rd</sup> edition. Springer. 2006.
5. Singh RD. Principles and practices of modern coal mining. New age international publications. 1997.



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**MINE SAFETY MANAGEMENT**

**UNIT I**

**Mine accidents and their analysis:** Accident in mines;- different types, accident investigations; In-depth study of accidents due to various causes; and Human Behavioural Approach in mine safety, accident prevention and corrective action, accident proneness, creating and maintaining safety awareness, ZAP and MAP, job safety analysis, safety meeting and committee.

**UNIT II**

**Health and mine safety:** Definition of health and safety, management's role – function; evolution of management involvement, management's training, responsibility, cost of health and safety, role of labour organizations – Union impact and involvement, role of government – statutory controls and directions, spot and regular inspections, enforcement of standards, penalties for violations, collection and distribution of statistical data. Safety audit methods; Safety records management, Training of Miners. Recent trends of development of safety engineering approaches.

**UNIT III**

**Fault tree analysis:** Introduction – methodology, symbols and Boolean techniques, qualitative analysis, computerized methods, statistical analysis, safety information, systems design. Appraisal of advance Techniques - fault tree analysis, Failure–Statistical methods of Risk analysis: Appraisal of advanced techniques Mode and Effect Analysis (FMEA); Failure Mode Effect and Critical Analysis (FMECA)

**UNIT IV**

**Risk assessment and disaster management:** Principles, risk and hazard control, risk and hazard evaluation and data collection for identified health risks, exposure assessment and risk characterization, probabilistic risk analysis, risk management, safety culture, human factors, reliability evaluation, safety audit. Identification of causes of mine disasters, preventive action.

Concepts of Disaster, Types of Disaster and Dimensions of Natural and Anthropogenic Disasters (landslide, subsidence, fire and earthquake); Principles and Components of Disaster Management. Disaster Management and Mitigation, typical cases of mine disasters in India.

**UNIT V**

**Miner's occupational diseases and enquiry committee:** Miner's occupational health and diseases, preventive medical examinations, various types of injuries, compensable diseases, medical attention and removable of causative factors in the mines. Recommendations of inquiry committee carried out for safety and health issues in India.

**Text / Reference books:**

1. Brown DB. System analysis and design for safety. Prentice Hall. 1976.
2. Stranks J. Management systems for safety. Pitman publishing. 1994.
3. DeReamer R. Modern safety practices. John Wiley and Sons. 1959.
4. Wahab KA. New technology in health and safety. SMME. 1992.
5. Ericson CA. Fault tree analysis primer. Create Space Independent Publishing Platform. 2011.



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**MINE ENVIRONMENTAL PLANNING LAB**

1. Determination of air quantity.
2. Determination of air cooling power.
3. Detection of mine gases and construction of mine fans.
4. Performance of evasee.
5. Performance of fans in series and parallel.
6. Determination of weisbach coefficient.
7. Study and analysis of ventilation network.
8. Study of Fire extinguishers, rescue and reviving apparatus.
9. Study of various types of stopings and re-opening a sealed off area.
10. Konimeter, gravimetric dust sampler and personal dust sampler.