



**KALINGA
UNIVERSITY**

SCHEME & SYLLABUS FOR

Bachelor of Vocational Studies (B.Voc.)

Mining



Kalinga University, Naya Raipur, Chhattisgarh

B.VOC IN MINING

| Semester - I | | | | | | | | |
|----------------|---|-----------|-----------|----------|-----------|----------------|-------------------------|------------|
| Course Code | Course Title | Credits | L | T | P | Internal Marks | End Semester Exam Marks | Total |
| BVM101 | Communication Skills | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM102 | Fundamentals of Information Technology | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM103 | Elements of Mining Technology | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM104 | Elements of Mine Surveying | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM105P | Industrial Training/On Job Training/Workshop | 18 | 0 | 0 | 36 | 50 | 150 | 200 |
| Total | | 30 | 12 | 0 | 36 | 170 | 430 | 600 |

| Semester - II | | | | | | | | |
|----------------|---|-----------|-----------|----------|-----------|----------------|-------------------------|------------|
| Course Code | Course Title | Credits | L | T | P | Internal Marks | End Semester Exam Marks | Total |
| BVM201 | Underground Mine Environment | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM202 | Environmental Studies | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM203 | Surface Mining | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM204 | Strata Control and Roof Support | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM205P | Industrial Training/On Job Training/Workshop | 18 | 0 | 0 | 36 | 50 | 150 | 200 |
| Total | | 30 | 12 | 0 | 36 | 170 | 430 | 600 |

| Semester - III | | | | | | | | |
|----------------|---|-----------|-----------|----------|-----------|----------------|-------------------------|------------|
| Course Code | Course Title | Credits | L | T | P | Internal Marks | End Semester Exam Marks | Total |
| BVM301 | Mine Hazards-I | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM302 | Mine Surveying | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM303 | Wining and Working Coal | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM304 | Applied Geology | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM305P | Industrial Training/On Job Training/Workshop | 18 | 0 | 0 | 36 | 50 | 150 | 200 |
| Total | | 30 | 12 | 0 | 36 | 170 | 430 | 600 |

| Semester - IV | | | | | | | | |
|----------------|---|-----------|-----------|----------|-----------|----------------|-------------------------|------------|
| Course Code | Course Title | Credits | L | T | P | Internal Marks | End Semester Exam Marks | Total |
| BVM401 | Mine Hazards-II | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM402 | Underground Metalliferous Mining | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM403 | Wining and Working Metals | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM404 | Electro-technology in Mining | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM405P | Industrial Training/On Job Training/Workshop | 18 | 0 | 0 | 36 | 50 | 150 | 200 |
| Total | | 30 | 12 | 0 | 36 | 170 | 430 | 600 |

| Semester - V | | | | | | | | |
|----------------|--|-----------|-----------|----------|-----------|----------------|-------------------------|------------|
| Course Code | Course Title | Credits | L | T | P | Internal Marks | End Semester Exam Marks | Total |
| BVM501 | Advance Mining Geology | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM502 | Mine, Machinery and Maintenance | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM503 | Drilling and Blasting Practices in Mines | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM504 | Mine Fires, Explosion, Inundation, Rescue and Recovery | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM505P | Industrial Training/On Job Training/Workshop | 18 | 0 | 0 | 36 | 50 | 150 | 200 |
| Total | | 30 | 12 | 0 | 36 | 170 | 430 | 600 |

| Semester - VI | | | | | | | | |
|----------------|---|-----------|-----------|----------|-----------|----------------|-------------------------|------------|
| Course Code | Course Title | Credits | L | T | P | Internal Marks | End Semester Exam Marks | Total |
| BVM601 | Mine Economics and Beneficiation | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM602 | Open Cast Mining and Land Reclamation | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM603 | Mine Management Legislation and General Safety | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM604 | Advance Mine Surveying | 3 | 3 | 0 | 0 | 30 | 70 | 100 |
| BVM605P | Industrial Training/On Job Training/Workshop | 18 | 0 | 0 | 36 | 50 | 150 | 200 |
| Total | | 30 | 12 | 0 | 36 | 170 | 430 | 600 |

Program Outcomes (POs):

- **PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
- **PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
- **PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. -long learning in the
- Broadest context of technological change.
- **PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life

Program Educational Outcomes (PEOs):

- **PEO1:** To develop the analytical and logical aptitude among students to quickly adapt to new work environments, assimilate new information and problem solving.
- **PEO2:** To provide students with a sound foundation in the science, mathematics, engineering fundamentals and mining field applications.
- **PEO3:** A Diploma in engineering must have the background and necessary perspective to pursue graduate, postgraduate/doctoral/post-doctoral education. He must be able to work with professionals in related fields over the spectrum of Mining engineering especially planning, designing, executing and monitoring of various mining systems.
- **PEO4:** To provide exposure of new cutting edge technologies to the students and to motivate them to take up new challenges to solve the problems faced by society and nation through research and development.
- **PEO5:** To inculcate self-learning, discipline and leadership qualities with good communication skills in students and to introduce them to holistic approach of working in a team according to the codes of professional practice

Program Specific Outcomes (PSOs):

- **PSO1:** Apply science, engineering, mathematics to solve Mining and Mineral engineering problems
- **PSO2:** Demonstrate proficiency in use of software, hardware and field to be required to practice Mining engineering profession.
- **PSO3:** Use the concepts of Mining Engineering to design and implement Mine Machine design, Bore hole design. Geological Data, by DATAMINE and SURPAC.
- **PSO4:** Students will be able to design mine excavations and conduct mining operations under a variety of geo-mining environments.
- **PSO5:** Students will be fully equipped with skills and knowledge related to mine management, optimization techniques with multi-disciplinary skills for achieving sustainable development of mineral industry.

SEMESTER-01

BVM101

COMMUNICATION SKILLS

Course Objective:

- The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions. One of the critical links among human beings and an important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

Course outcomes:

- The purpose of this course is to introduce students to the theory, fundamentals and tools of communication
- To develop vital communication skills which should be integral to personal, social and professional interactions.
- One of the critical links between human beings.
- An important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal.
- In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

Unit 1:

06

- **Introduction:** Theory of communication, types and modes of communication, mediums and channels of communication, barriers to communication, English as a global language, the lingua franca, social influences on English

Unit 2:

06

- **Language of Communication:** Verbal and non-verbal (spoken and written) personal, social and business barriers and strategies intra-personal, inter-personal and group communication, varieties of English, language, accent, dialect, colloquialism, historical influences on English

Unit 3:

06

- **Speaking Skills:** Monologue, dialogue, group discussion, effective communication/mis-communication, interview, public speech, regional influences on English, convergence and divergence, linguistic imperialism

Unit 4:

06

- **Reading and Understanding** Close reading, reading analysis of a text - audience and purpose, content and theme, tone and mood, stylistic devices, structure comprehension- analysis and interpretation translation(from Indian language to English and vice-versa) literary/knowledge texts

Unit 5:

06

- **Writing Skills:** Documenting report writing making notes letter writing, writing tabloids, diary entry, open letters, essays, newsletter and magazine articles, skits, short stories, impersonating characters it will enhance language of communication, various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments, important reading skills as well as writing skills such as report writing, note taking etc. while, to an extent, the art of communication is natural to all living beings, in today's world of complexities, it has also acquired some elements of science. it is hoped that after studying this course, students will find a difference in their personal and professional interactions.

References:

- Fluency in English - Part II, Oxford University Press, 2006.
- Business English, Pearson, 2008.
- Language, Literature and Creativity, Orient Blackswan, 2013.
- Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr. Ranjana Kaul, Dr. Brati Biswas

BVM102

FUNDAMENTALS OF INFORMATION TECHNOLOGY

Course objective:

- This is a basic course for commerce students to familiarize with computer and its applications in the relevant fields and exposes them to other related courses of IT.

Course Outcomes:

- Gain a foundational understanding of key IT concepts, including hardware, software, and networks.
- Develop proficiency in using common computer applications, such as word processing and spreadsheet software.
- Explore the ethical and security considerations in IT, emphasizing responsible digital behavior.
- Acquire problem-solving skills by applying IT knowledge to real world scenarios.
- Prepare for further studies in IT or related fields by establishing a strong IT knowledge base.

Unit-1:

06

- **Computer characteristics:** Speed, storage, accuracy, diligence; digital signals, binary system, ASCII; historic evolution of computers;
- **Classification of computers:** microcomputer, minicomputer, mainframes, supercomputers;
- **Personal computers:** desktop, laptops, palmtop, tablet; hardware & software; von Neumann model.

Unit-2:

06

- **Hardware:** CPU, memory, input devices, output devices.
- **Memory units:** RAM (SDRAM, DDR RAM, RDRAM etc. feature wise comparison only); ROM-different types: Flash memory;
- **Auxiliary storage:** Magnetic devices, optical devices; floppy, hard disk, memory stick, CD, DVD, CD/DVD-Writer;
- **Input devices** - keyboard, mouse, scanner, speech input devices, digital camera, touch screen voice input, joystick, optical readers, bar code reader;
- **Output devices:** Display device, size and resolution; CRT, LCD, LED;
- **Printers:** Dot-matrix, inkjet, laser; plotters, sound cards & speaker.

Unit-3:

06

- **Software:** System software, application software; concepts of files and folders, introduction to operating systems, different types of operating systems: single user, multitasking, time-sharing multi-user; booting, POST;
- **Basic features of two GUI operating systems:** Windows & Linux (Basic desk top management); Programming Languages, Compiler, Interpreter, Databases;
- **Application software:** Generic features of word processors, spread sheets and presentation software; generic introduction to latex for scientific typesetting; utilities and their use; computer viruses & protection, free software, open source.

Unit-4:

06

- **Computer Networks and Internet:** Connecting computers, requirements for a network: server, workstation, switch, router, network operating systems; internet: brief history, world wide web, websites, URL, browsers, search engines, search tips; internet connections: ISP, dial-up, cable modem, well, dsl, leased line wireless and Wi-Fi connectivity ; email, email software features (send receive, filter, attach, forward, copy, blind copy); characteristics of web-based systems, web pages, web programming languages.

Unit-5:

06

- **Information Technology and Society:** Indian IT Act, intellectual property rights, issues. application of information technology in railways, airlines, banking, insurance, inventory control, financial systems, hotel management, education, video games, telephone exchanges, mobile phones, information kiosks, special effects in movies.
- **Programming Concepts & Techniques:** Program concept, characteristics of programme, stages in program development, tips for program designing, programming aids, algorithms, pseudo code, notations, design, flowcharts, symbols, rules, compiler & interpreter. introduction to programming techniques, top-down & bottom-up approach, unstructured, & modular programming, cohesion, coupling, debugging, syntax & logical errors, linking and loading, testing and debugging, documentation.

References:

- Programming in C, R.S. Salaria, Khanna Publishing House
- Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing House
- Handbook of Computer Fundamentals, N.S. Gill, Khanna Publishing House

BVM103

ELEMENTS OF MINING TECHNOLOGY

Course Objectives:

- To familiarize students with the historical evolution of the mining industry in India, focusing on Chhattisgarh, and to enable them to analyze the mineral wealth of the region in relation to its economic and industrial significance.
- To provide students with a comprehensive understanding of the techniques and processes involved in sinking shafts, including marking, support methods, and firing techniques, enhancing their knowledge of underground mine development.
- To equip students with the knowledge of various drifting and tunneling methods, both manual and mechanized, along with insights into essential aspects such as ventilation, drilling, blasting, and transportation systems in underground mining.
- To introduce students to a range of mining methods, including open-cast, bord and pillar, and Longwall methods, enabling them to understand the conditions, layouts, and operational processes associated with each technique.

Course Outcomes:

- By the end of this unit, students will have a comprehensive understanding of the history of the mining industry in India, with a focus on Chhattisgarh, and the mineral wealth of the region.
- At the end of this unit, students will be able to comprehend the process of sinking shafts in coal strata, including marking, support, and firing methods.
- By the conclusion of this unit, students will have a comprehensive understanding of drifting and tunneling methods, both manual and mechanized, and the associated ventilation, drilling, blasting, and transportation systems.
- Upon completion of this unit, students will be equipped with knowledge about various mining methods, including open-cast, bord and pillar, and Longwall methods.

Unit 1:

08

- **Introduction:** History of mining Industry and mineral wealth of India. Specially related with Chhattisgarh. Selection of site for opening mine
- **Modes Of Entry:** Different types of modes of entry. inclined, shaft, audit. Condition suitable to selection of a suitable mode of entry. Factors governing, shape, size and site of modes of entry. Compressions, suitability and advantages of each type of mode of entry.

Unit 2:

08

- **Sinking Operations:** Sinking of shaft in a normal coal strata. Marking of center of shaft. Temporary supports/lining permanent lining. Firing shots in sinking shaft. Introduction of special methods of shaft sinking.

Unit 3:

07

- **Drifting And Tunneling:** Introduction about drifting and tunneling. Methods of drifting and tunneling. Manual methods of drifting and tunneling Mechanized methods of drifting and tunneling. Ventilation drilling , blasting and mucking. Transportation systems in drifts and tunnels.

Unit 4:

07

Introduction to Methods of Working:

- Open cast mining condition suitable for limit of quarrying advantage and disadvantage
- Manual Quarrying, layouts. Semi mechanized and machines used, layouts, and related regulation.
- Introduction to different methods of coal mining, Bord and pillar method of working, condition suitable for general layouts, percentage of extraction, development, preparation for depillaring , depillaring operation, related regulation.
- Longwall methods of working suitability, favourable condition, longwall advancing method, layouts of single unit and double unit longwall face. Longwall retreating method, layout of single unit and double unit faces, related regulation.

References:

- Mining Environment and Ventilation by G.B. Mishra
- Selection Installation & Maintenance of mine pumps by Rakesh & Lal
- Elements of Mining Technology Vol I & II by D.J. Deshmukh

BVM104

ELEMENTS OF MINE SURVEYING

Course Objectives:

- To introduce students to the basic principles of surveying, explain the primary divisions and classifications of surveying, and help them comprehend the units of measurement used in surveying.
- To familiarize students with the principles and equipment used in chain surveying, teach them how to conduct chain surveys on various terrains, and enable them to handle challenges such as obstacles and errors in measurements
- To educate students about compass surveying techniques, the working of prismatic compass, measuring bearings, and conducting traverses using compass instruments while accounting for factors like magnetic declination and local attraction.

Course Outcomes:

- By the end of this unit, students will be able to understand the fundamental concepts of surveying, its purpose, and the factors affecting survey accuracy.
- Upon completing this unit, students will be capable of performing chain surveying operations, recording accurate field data, and correcting errors in chain measurements.
- At the end of this unit, students will have a comprehensive understanding of compass surveying, including the use of compass instruments, measuring bearings, detecting and correcting errors, and conducting traverses.

Unit 1:

08

- **Introduction:** Introduction to surveying, Definition and object of surveying Primary division of survey Classification of survey Principles of surveying Linear measurements Angular measurement Units of measurements, Linear and Angular Purpose of survey, degree of precision required for the purpose; nature and extent of survey, sources of error, time available for both field and office work, cost for survey.
- **Measurements of distances:**
 - ❖ **Methods of determining the distances.**
 - Direct
 - Commutative Methods.
 - ❖ **Direct measurements** - methods and instruments used for measuring distance.
 - ❖ Pacing, Passometer, Pedometer, Odometer, Speedometer, Perambulator, Judging distance, Time Measurement.

Unit 2:

08

- **Chain Surveying:** Purpose of chain surveying, principles of chain surveying. Equipments used in chain surveying. chain, tapes, ranging rods, arrows, pegs, mallet, cross, optical square, construction of optical square and uses. Different operations in chain surveying, ranging-direct and indirect, chaining on flat and sloping ground, offsetting perpendicular and oblique. Conducting chain survey over the given area. Recording field data. Plotting the chain survey. Conventional signs Obstacles in chaining. Errors in chain surveying. Corrections for in-correct length of chain. Simple examples on corrections. Test and Adjustments of chain.

Unit 3:

07

- **Compass Surveying:** Purpose of compass surveying. Construction and working of prismatic compass. Uses of surveyors and prismatic compass, Constructional details of surveyor's compass. Setting up the compass and taking observations Concept of:
 - ❖ **Meridians;** true, Magnetic and arbitrary meridians
 - ❖ **Bearings-** True, Magnetic and arbitrary, magnetic dip and declination.
 - ❖ **Systems of measuring the bearings** - whole circle bearing, reduced bearing (Q.B.), numerical problems on conversions of bearing. Fore bearing back bearing of alien. Concept of a traverse - open and closed traverse. Traversing with prismatic compass. Local attraction causes detection error and corrections. Local attraction causes detection error and corrections. Checks for and open and closed traverse. Calculation of included angles from bearing. Problems on effect of local attraction. Closing errors, plotting a traverse by included angles and deflection angle method. Error, precautions and adjustments in compass surveying.

Unit 4:

07

- **Plane Table Surveying:** General Introduction Purpose of plane table surveying. Equipments used in plane table surveying, plane table. Alidade - plane and telescopic. Operation of plane table, centering, level orientation. Important precautions while plane table surveying. Introduction about methods of plane table survey :
 - ❖ Radiation
 - ❖ Intersection
 - ❖ Traversing
 - ❖ Resection.Advantages and disadvantages of plane table surveying.
- **Computation Of areas And Volumes:**Computation of areas and volume of Irregular shapes by Simpson's Rule And by Bowditch Rule. Calculation of Volume of Heaps.

BVM105P

INDUSTRIAL TRAINING/ON JOB TRAINING/ WORKSHOP

SEMESTER-02

BVM201

UNDERGROUND MINE ENVIRONMENT

Course Objectives:

- To be aware about different mine gases and dangers associated with these gases above the permissible limit.
- To learn about different compositions of gases which are potentially dangerous.
- To learn about inflammable gas in mine and preventive measures to be taken.
- To perform different tests to detect different mine gases.
- To know about the hazard associated with respirable mine dust and control measures of the same.

Course Outcomes:

- Take precautions against different asphyxiating, toxic and noxious gases in mines.
- Deal with potentially dangerous damp.
- Take necessary precautions against accumulation of inflammable gas in underground mines.
- Execute the detection of different mine gases and measure the concentration of the same.
- Keep the mine working environment free from high heat and humidity.

Unit 1:

08

Atmospheric Air and Mine Air:

- Composition of atmospheric air and mine air
- Mine gases and their properties, sources, physiological effects, permissible concentration/ limit in percentage and PPM (Parts Per Million).
- Standards of ventilation in mine.

Damp:

- Blackdamp – Calculation of percentage of blackdamp from an analysis of a sample of mine air.
- Firedamp – Composition and threat
- Whitedamp, Composition and threat
- Stink Damp - Composition and threat
- Afterdamp - Composition and threat

Unit 2:

08

Firedamp:

- Emission of firedamp in U/G working- Factors, Gradual Exudation, Outburst - Prediction of outburst, Prevention of outburst, Gas Blowers - Dealing with Gas Blowers.
- Calculation of methane emission per tonne of coal mined.
- Statutory precautions against inflammable gas (under CMR-2017- Regulation: 166)
- Gassy seam of the First, Second and Third degree
- Streaming and layering of methane
- Methane Drainage

Unit 3:

07

Detection of Mine Gases:

- Flame Safety Lamp- Working principle, Description of various parts of FSL, Gas testing by FSL, Accumulation test & Percentage test, Precautions during gas testing, Limitations of FSL.
- Methanometer – working principle, detection procedure
- Carbon monoxide detector- detection procedure, Brief idea on Multi Gas Detector

Unit 4:

07

Heat and Humidity:

- Source of heat in mines, Geothermal gradient
- Dry bulb temperature, Wet bulb temperature, Humidity, Relative humidity, Measurement of Relative humidity - Hygrometer, Whirling Hygrometer.
- Kata Thermometer - Instrument description, working principle, Determination of cooling power using kata thermometer
- Effect of heat and humidity on human body
- Control measures against Heat and Humidity in underground mines.

Mine Dust:

- Airborne respirable dust- Sources and Control measures, Physiological effects
- Permissible limit of airborne respirable dust as per statute.
- Airborne respirable dust survey with personal dust sampler.

References:

- D.J. Deshmukh: Elements of Mining Technology Vol. 2
- G. B. Misra: Mine Environment and Ventilation, OXFORD UNIVERSITY PRESS
- C.M.R. 2017 & DGMS Circulars, S.P. Banerjee : Mine Ventilation

BVM202

ENVIRONMENTAL STUDIES

Course Outcomes:

- Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.

Unit 1:

06

Introduction to Environmental Studies:

- Multidisciplinary nature of environmental studies, Scope and importance; concept of sustainability and sustainable development.

Ecosystems:

- What is an ecosystem? Structure and function of the ecosystem;
- **Energy flow in an ecosystem:** food chains, food webs and ecological succession.
- **Case studies of the following ecosystems:** Forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit-2:

06

Natural Resources:

- **Renewable and Non--renewable Resources:** Land resources and land use change; Land degradation, soil erosion and desertification.
- **Deforestation:** Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- **Water:** Use and over--exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter--state).
- **Energy resources:** Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit-3:

06

Biodiversity and Conservation:

- **Levels of biological diversity:** genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots, India as a mega-biodiversity nation; Endangered and endemic species of India
- **Threats to biodiversity:** Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions;
- **Conservation of biodiversity:** In-situ and Ex-situ conservation of biodiversity.
- **Ecosystem and biodiversity services:** Ecological, economic, social, ethical, aesthetic and Informational value.

Unit-4:

06

Environmental Pollution:

- Types, causes, effects and controls; Air, water, soil and noise pollution, Nuclear hazards and human health risks
- **Solid waste management:** Control measures of urban and industrial waste. Pollution case studies.

Environmental Policies & Practices:

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- **Environment Laws:** Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit-5:

06

Human Communities and the Environment:

- **Human population growth:** Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies.
- **Disaster management:** floods, earthquake, cyclones and landslides.
- **Environmental movements:** Chipko, Silent valley, Bishnois of Rajasthan.
- **Environmental ethics:** Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

References:

- Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
- Gadgil, M., & Guha, R. 1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
- Gleeson, B. and Low, N. (eds.) 1999. *Global Ethics and Environment*, London, Routledge.
- Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
- Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
- Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science*, 339: 36--37.
- McCully, P. 1996. *Rivers no more: the environmental effects of dams*(pp. 29--64). Zed Books.
- McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic Press.
- Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
- Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. *Environment*. 8th edition. John Wiley & Sons.
- Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India*. Tripathi 1992.
- Sengupta, R. 2003. *Ecology and economics: An approach to sustainable development*. OUP.
- Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
- Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology: Voices from the Tropics*. John Wiley & Sons.
- Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
- Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
- Wilson, E. O. 2006. *The Creation: An appeal to save life on earth*. New York: Norton.
- World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University Press.

BVM203

SURFACE MINING

Course Objectives:

- To get introduced to the subject with Pros and Cons and to become familiar with different terms.
- To understand the procedure of mine opening.
- To become familiar with classification of Surface mines.
- To know about different machineries required for different mining activities.
- To understand the layout of surface mines.
- To know about the basic construction and safety arrangements of haul road and stability of spoil banks.

Course Outcomes:

- Understand as to where such Surface mining operation to be conducted and use different terms related to this operation.
- Carry out different mining operations in sequential manner.
- Classify Surface Mining Practice.
- Take the decision to deploy different HEMMs in different mining operations.
- Layout opencast mine under different mining conditions.
- Construct good haul roads and take preventive safety measures in spoil banks.
- Carry out Land reclamation procedure during and after mining operation.

Unit 1:

08

Introduction of Surface mining:

- Definition of Surface mining, Applicability
- Advantages and disadvantages
- Concept of bench , bench height , bench width, Bench slope angle, Average slope , ultimate pit slope.
- **Coal:** OB thickness ratio , stripping ratio, break-even stripping ratio, Factors controlling break-even stripping ratio and its improvement.

Opening of a mine:

- Site preparation, Box cut , Location of Box cut
- Factors affecting height & width of bench, Bench height and width in Manual and mechanized opencast working.
- Bench Slope : Slope stability- basic concept on structural Geological Information, Geomechanical Information , Ground Water / Geohydrography , Dynamic loading.

Classification of Surface Mines (basic concept only):

- Continuous mining, Semi continuous mining, Discontinuous or cyclic mining

Unit 2:

08

Different machineries used in Opencast Mines:

- **Single bucket excavators:**
 - **Shovel**– Description, Field of application, Principles of operation. Bucket fill factor, cycle time, angle of swing factor.
 - ❖ Bucket capacity calculation with the following data – cycle time, density of material (in tonne per cubic meter) , bucket fill factor and output target (of the machine) in tonne / hour.
 - **Dragline** - Description, Principles of operation and cycle of operation.
- **Multi-bucket excavator:**
 - Bucket wheel excavator- Description, Field of application, Principles of operation.
- **Surface miner** - Applicability and Limitations, Principles of operation
- **Dumpers:** Description, Operation and safety features
- **Dozers:** Description, Operations and field application
- **Auxiliary equipments:** Different auxiliary equipments used in opencast mines with operations;
- **Different combinations of earth moving machineries.**

Unit 3:

07

Opencast layouts:

- Layout with Shovel-Dumper combination
- Spiral layout

Haul Road and Spoil Bank:

- Construction, Safety arrangements and Advantages of good haul road;
- Spoil bank – Stability and Safety measures .

Unit 4:

07

Land Reclamation:

- Objectives and Methods

References:

- Surface Mining Technology – S.K.Das, Surface Mining – G.B.Misra, Elements of mining technology (Vol-I) - D.J.Deshmukh, Principles and Practices of Modern Coal Mining – R.D.Singh, C.M.R. 2017

BVM204

STRATA CONTROL AND ROOF SUPPORT

Course Objectives:

- Students should be able to understand the composition of mine atmosphere, recognize various mine gasses and their sources, and employ appropriate detection and monitoring techniques to ensure a safe working environment.
- Upon completing this unit, students should have the ability to assess the impact of heat and humidity on the mine atmosphere, calculate cooling mechanisms, and design air conditioning systems to maintain optimal comfort conditions in mining environments.
- Students should be capable of comprehending the principles of mine ventilation, measuring air quantity and pressure, analyzing air flow laws, and interpreting regulations related to air quality and dust monitoring in mines.
- Students should be able to grasp the thermodynamics of natural ventilation, apply distribution and control principles for air currents in mines, and understand the use of ventilation accessories to manage airflow.
- Students should possess the knowledge to identify lighting sources in mines, explain flameproof and intrinsically safe lighting concepts, and design efficient layouts for lamp rooms while ensuring proper care and maintenance of lighting equipment.

Course Outcomes:

- Understand mine atmosphere pollution, mine gases, methane drainage, and monitoring systems.
- Comprehend heat, humidity effects, cooling power, comfort conditions, and air conditioning in mines.
- Learn ventilation objectives, air measurement, flow laws, mechanical ventilation, and fan operations.
- Understand natural ventilation, air current control, and ventilation accessories used in mines.
- Identify lighting sources, underground lighting, flameproof, and intrinsically safe lighting, and lamp room management.

Unit 1:

08

Supports:

- Timber & Steel supports, Examination of Roof, Roof Bolting, Roof stitching, Cable Bolting
- Method of supporting Roadways
- Supporting under different Conditions Viz: Pit bottom, crossing , junctions, faulted area, longwall faces, depillaring areas and stopping areas.
- Support loads, Systematic Support Rules. Support plan, Support withdrawal

| | |
|--|-----------|
| Unit -2: | 08 |
| Powered Supports: | |
| <ul style="list-style-type: none">• Powered supports, Principle of Operation of Power supports, Classification of Power supports• Designation of Power Supports, Major Application of Power supports• Hydraulic fluids | |
| Unit 3: | 07 |
| Stowing: | |
| <ul style="list-style-type: none">• Principal methods of stowing• Their relative merits and applicability• Hydraulic stowing, Pneumatic Stowing, Mechanical Stowing• Hand Packing, Face arrangements, Pipe wear, Pipe Jams | |
| Unit 4: | 07 |
| Strata Control: | |
| <ul style="list-style-type: none">• Basic concepts of ground movement.• Rock Pressure due to narrow and wide excavation• Failure of roof and floor, Measurement of Strata movement• Definition of Rock burst, Bumps, Gas outbursts, Pot holes | |
| Subsidence: | |
| <ul style="list-style-type: none">• Basic concept of Subsidence• Damage and loss due to Subsidence• Vertical and lateral movements and their estimation• Angle of fracture and angle of draw• Factors affecting subsidence, Subsidence Control, Protection of surface Structures• Introduction of Protection Pillars including shaft pillars. | |
| References: | |
| <ul style="list-style-type: none">• Strata Control in Mines by Chang and Peng• Winning and Working of Coal by R.T. Deshmukh and D.J. Deshmukh• Modern Coal Mining Practices by R.D. Singh• D.G.M.S. Circulars (Tech.) 1995 Onwards, Longwall Mining by Syed. S. Chang and Peng | |

BVM205P
**INDUSTRIAL TRAINING/ON JOB TRAINING/
WORKSHOP**

SEMESTER-03

BVM301

MINE HAZARDS-I

Course Objectives:

- To learn about Mine Fires and detection of spontaneous heating in early stages.
- To know the methods of dealing with mine fires.
- To learn about firedamp explosions in underground coal mines and preventive measures to be taken for the same.
- To learn about the coal dust explosion in underground coal mines and preventive measures to be taken for the same.
- To learn about inundation of mines and preventive measures to be taken for the same.

Course outcomes:

After completing this course, student will be able to:

- Apply the acquired knowledge to take precautionary measures against occurrence of fire in mines and detect spontaneous heating in early stages.
- Apply the acquired knowledge to deal with mine fires with safety.
- Take necessary precautions against firedamp explosions in an underground coal mine.
- Take necessary precautions against coal dust explosions in an underground coal mine.
- Take necessary precautions against inundation of mines from surface and underground water.

Unit- 1:

08

Mine Fires:

- Fires– Conditions, Open fires: due to Electricity– Friction- Open lights- Blasting- other causes; Preventive measures.
- Fire due to spontaneous heating: Conditions; Crossing point temperature; Incubation period; factors governing spontaneous heating; Symptoms of spontaneous heating in underground mines; CO formed / Oxygen absorbed ratio and its interpretation; preventive measures against spontaneous heating.

Dealing with underground and surface mine fires:

- Immediate steps to be taken after break out of fire; direct method of dealing fire with water, sand or with other suitable fire extinguishers;
- Construction and purpose of temporary stopping and permanent stopping; Fittings provided in Stoppings; Sealing off a fire area; Pressure balancing;
- Intentional flooding: Flooding the fire area or the mine;
- Dealing with fires in coal pillars and in coal stacks;
- Different types of fire extinguishers.

Unit-2:

08

Firedamp explosion:

- Firedamp explosion in underground mine: Conditions, Explosive mixture (Limits of explosibility); various influencing factors.
- Le Chatelier Equation; Coward's diagram and its significance, Ignition temperature, Lag on Ignition
- Causes of firedamp explosion, preventive measures

Unit-3:

07

Coal dust explosion:

- Coal dust explosion: Conditions, limits of explosibility (inflammability), causes, factors affecting explosibility (inflammability) of coal dust and prevention of coal dust explosion.
- Treatment with incombustible dust and water in every part of a mine (not naturally wet throughout or not isolated by explosion proof stoppings), Sampling procedure of roadway mine dust;
- Stone dust barriers, water barriers, and triggered barrier

Unit-4:

07

Inundation:

- Causes of inundation from surface water and preventive measures;
- Causes of inundation from underground water and preventive measures;
- Causes of inundation in opencast mines and preventive measures;
- **Waterdams:** calculation of thickness of dam, construction;
- Approaching water logged workings, long-hole boring by burn side boring apparatus.

References:

- D.J. Deshmukh: Elements of Mining Technology Vol. 2.
- PRASAD and RAKESH: Legislation in Indian Mines: A Critical Appraisal– Volume II
- S. Ghatak : A Study of Mine Management, Legislation and General Safety
- C.M.R-2017
- DGMS Orders &Circulars

BVM302

MINE SURVEYING

Course Objectives:

- The course aims to provide students with a comprehensive understanding of miners' dial surveying techniques and levelling principles, enabling them to proficiently apply diverse surveying methods, accurately record and reduce survey data, identify and mitigate errors, adjust and maintain surveying instruments, and confidently perform traverse plotting, all while adhering to precision standards, thereby equipping them with practical skills essential for underground surveying and accurate construction planning.
- This course aims to develop expertise in subsidence surveys for mining and geotechnical applications. Participants will learn counter methods, interpolation techniques, and accurate parameter calculations. Emphasis on precautions, comprehensive plan creation, and practical map utilization will equip participants to contribute effectively to engineering projects influenced by ground subsidence.
- Develop the proficiency to perform precise angle measurements using various types of theodolites, encompassing the understanding of their fundamental components, temporary adjustments, reading methods, and calculation of least counts, enabling accurate data acquisition for surveying tasks.

Course Outcomes:

- Upon completion of this course, students will be able to effectively use dial instruments for underground surveying and perform accurate levelling measurements. They will understand the principles behind various surveying methods, demonstrate proficiency in taking precise measurements, and apply error reduction techniques to ensure reliable survey data.
- Upon completing this course, participants will be able to effectively conduct subsidence surveys, employ counter methods to analyze and interpret data, and generate accurate contour maps for subsidence areas. They will gain a comprehensive understanding of subsidence-related measurements, calculations, and mapping techniques, enabling them to contribute to mining and geotechnical projects with precision and expertise.
- By the end of this unit, students will be able to proficiently operate and apply various types of theodolites for precise angle measurements in surveying projects. They will demonstrate competence in setting up theodolites, making accurate readings, performing necessary adjustments, and effectively using the acquired data for surveying tasks.
- Upon completing this unit, students should be able to apply their knowledge of vocational training, refresher courses, and safety committees to enhance general safety in mining environments.

Unit 1:

Miners Dial:

- Introduction and general description.
- Taking bearing & observations with a dial.
- Method of dial Traversing -
 - a) Loose or free needle methods.
 - b) Fast or fixed needle methods
- Measurement of Included angles
- Fixing of underground survey station.
- Transfer of survey station from floor to roof and from roof to floor.
- Setting of instrument under roof station.
- Underground traversing with a dial.
- Marking of centre line of a gallery.
- Marking of centre line in a given direction.

Levelling:

- Introduction, purpose of levelling.
- Definition and terminology.
- Different types of levels.
- Principle and constructional details of Dumpy and Tilting level.
- Levelling staves , types of staves.
- Graduation and least count types of diaphragms.
- Adjustment of levelling instruments – Temporary and permanent.
- Concept of datum, Back sight, Fore sight, Station, Change point, height of instrument
- Level book, Booking of levels, Reduction of level.
- Height of instrument or collimation, Rise and fall, Arithmetical check.
- Differential levelling and check levelling.
- Problems on reduction of level.
- Balancing or equalizing of back sight and fore sight distance.
- Types of levelling.
- Errors in levelling and precaution to minimize the errors.
- Practical problems in levelling work as – Levelling across summits and depression, Across a wall.
- Degree of precision in levelling, closing error and its adjustment.
- Testing and adjusting of Dumpy and Tilting levels.
- Permanent adjustment of levels.
- Methods of Traversing and plotting of traverse.

Unit 2:

Counterling:

- Introduction and concept.
- Purpose of counterling.
- Object of counterling.
- Horizontal equivalent.
- Counter interval.
- Factors affecting counter interval.
- Characteristic of counters.
- Method of counterling – Direct method, Indirect method.
- Interpolation of contours methods:
 - a) Estimation method,
 - b) Arithmetical method.
 - c) Graphical method
- Plotting of contour maps.
- Use of contour Maps

Subsidence Survey:

- Definitions.
- Fixing of survey station.
- Transfer of colliery benchmark to the subsidence area.
- Determination of position of a survey station (longitudinal) displacement.
- Determination of reduced level of survey station.
- calculation of Subsidence – Lateral displacement, Vertical displacement.
- Precautions during subsidence survey.
- Preparation of subsidence plans and section.

Unit 3:

Theodolite:

- Introduction
- Classification of theodolite -
 - a) Transit and non –transit theodolites
 - b) Vernier theodolites
 - c) Microptic theodolites
 - d) Electronic theodolites.
- Essential parts of the transit vernier theodolites.
- Definition and the terms used.
- Fundamental axis of theodolites and their relationship.
- Temporary adjustment of theodolites
 - a) Setting over the stations
 - b) Levelling up the instrument
 - c) Elimination of parallax and focusing of object.
- Method of taking readings – Vernier reading, calculation of least count
- Measurement of horizontal and vertical angles – General method, Repetition method, Reiteration method
- Booking of readings
- Method of traversing, plotting survey work

Dip, Strike And Bore Hole Problems:

- Definition of borehole surveying
- Purpose of borehole surveying
- Definition of dip, strike, true and apparent dip
- Relation between true dip, apparent dip and angle between them
- Numerical problems on dip, strike and borehole surveying

Unit 4:

Mine Plans and Sections:

- General requirement of mine plans
- Types of plans and their scale
- Symbols used in mine plans
- Preparation of plans and sections
- Plotting of traverse
- Checking accuracy of old mine plans
- Planimeter and its uses
- Enlargement and reduction of plans
- Mines regulations concerning above topics

References:

- Surveying and leveling ,vol I & II by T.P. Karnetkar
- Surveying , vol I & II by B.C. Punamia
- Advance Surveying , Vol I & II by Alam Chand
- Advance surveying by D.C. Clark
- Surveying , vol I & II by Arora

BVM303

WINING AND WORKING COAL

Course Objectives:

- Develop a foundational understanding of layout concepts, grasping the significance of efficient and safe organization in underground operations.
- Analyze mining methods across various seam thicknesses, exploring adaptability in different conditions such as water bodies, railways, and gassy environments.

Course Outcomes:

- Students will be able to comprehend the various aspects of the board and pillar mining method, including its application in different seam thicknesses, challenging conditions, and potential hazards. They will understand the mechanized aspects of this method and compare its advantages and disadvantages with other mining techniques.
- Students will gain a thorough understanding of the longwall mining method, including its suitable working conditions, differences between advancing and retreating methods, and layout variations for single and double unit faces. They will be able to evaluate the applicability of ploughs and mechanized components in longwall mining.

Unit 1:

08

Introduction to Pit Top and Pit Bottom Lay Out:

- Ideal pit top and pit bottom layout.
- Tub circuit
- Study of pit top and pit bottom lay outs of important U/G mines of India.

Unit 2:

08

Boards And Pillar Method Of Working:

- **Board and Pillar method of Working under following.**
 - a) Working thin seams.
 - b) Working thick seams.
 - c) Working very thick seams in Sections.
 - d) Working contiguous thick seams.
 - e) Working below ponds, reverses, railways etc.
 - f) Working seams liable to spontaneous heating and / or highly gassy.
- **Mechanised bord and pillar working**
 - a) With SDL / tub combination LHD/Tub Combination. SDL/ Chain conveyor combination
 - b) Scraper// loader
 - c) Continuous miner-road headers, dint headers layouts.
- **Advantages of panel system over board and pillar.**

Unit 3:

07

Longwall Method Of Working:

- Suitable working conditions
- Comparison between Advancing and Retreating method of longwall working.
- Layout of single unit and double unit faces, roof support in the system.
- Single ended drum. Double ended drum. layouts, sumping method.
- Ploughs- applicability construction layout.
- Mechanized long wall mining
 - a) Layout
 - b) Conveyors
 - c) Drum Shearer

Unit 4:

07

Introduction To Horizon Mining:

- Conditions, suitability and limitation.
- Methods of working.
- Study of some horizon mining cases of India.

Thick Seam Working

- Multi section working with stowing (ascending order) | Multi section working in descending order.
- Multi section working with thick coal partings and caving. | French method of working thick seam.
- Problem in mining thick seam, choice of thick seam mining methods inclined slicing, horizontal slicing, diagonal slicing, transverse slicing, sublevel caving, Blasting gallery method, cable bolting method of thick seam extraction.

References:

- Mines planning for coal by S.P. Mathur | Surface Mining Technology by Sameer Kumar
- Coal Mine Ground Control Vol- II by Syed. S. Peng | Underground Winning of coal by T.N. Singh
- Mine Working Part I & II by H.N. Karmkar | Elements of Mining Technology, Vol.I by D.J.Deshmukh

BVM304

APPLIED GEOLOGY

Course Objectives:

- Understand the Earth's formation, its internal structure, and geological processes, including weathering, wind and river dynamics, earthquakes, and volcanoes.
- Develop proficiency in identifying common minerals based on their physical properties, enabling practical applications in geological exploration and research. concentration.

Course Outcomes:

- By the end of this course, students will be able to analyze the Earth's geological processes, including weathering, erosion, earthquakes, and volcanoes. They will be capable of explaining the Earth's internal structure and its dynamic nature, providing insights into geological events and their effects.
- Upon completing this course, students will be skilled in identifying common minerals based on their physical properties. They will be proficient in using mineral identification techniques, facilitating their involvement in geological studies, exploration, and practical applications in related fields.
- Upon completing this unit, students will have the capacity to identify different rock types based on their mineral composition, texture, and origin. They will be equipped to describe the formation history and potential geological significance of these rocks. This skill set will empower students to contribute meaningfully to geological studies

Unit 1:

08

Physical Geology:

- Solar system, origin of the earth, various hypotheses related to origin of earth.
- Age of the earth, various methods of age determination, radioactive methods and their advantages.
- Interior of the earth –crust, mantle and core.
- Weathering - physical weathering and chemical weathering. Exfoliation and spheroidal weathering.
- Work of wind – Erosion, Transport and Deposition ventifacts, Pedestal rocks, Sand dunes and Loess.
- Work of Rivers: Erosion Transport and Deposition, water falls, Meanders, oxbow lakes, Alluvial, fans, flood plains, Delta.
- Earth quakes : Seismograph, earthquake waves, classification of earthquakes, elastic rebound theory, Richter scale of earthquake intensity, Distribution of earthquakes
- Volcano: Types of volcanoes, Volcanic products, Volcanic cones, distribution of volcanoes.

Unit 2:

08

Mineralogy:

- Definition, Physical properties of minerals – Color, Streak, Luster, hardness, Habit, Cleavage, Fracture.
- Identification of common minerals- Orthoclase, Plagioclase, Augite, Hornblende, Biotite, Muscovite, Olivine, Quartz, Asbestos, Calcite, Dolomite, Corundum, Gypsum, Talc.

Unit 3:

Petrology:

- Classification of Rocks- Igneous, Sedimentary and Metamorphic.
- Igneous rocks – Acid and basic rocks, Textures of Igneous rocks- Glassy, Vesicular, Porphyritic, Coarse grained, Medium grained, Fine grained and Cryptocrystalline. Classification – Plutonic, Hypabyssal and volcanic rocks. Tabular Classification Igneous bodies- Batholithic, Laccolith, sill and Dyke, Lava flows, Common Igneous rocks – Granite, Syenite, Gabbro, Basalt, Trachyte and Rhyolite.
- Sedimentary rocks - definition , Classification, mechanically formed, Organically formed and chemically formed rocks, Sedimentary structures, Stratification, Lamination, graded bedding. Current bedding and ripple marks, common Sedimentary rocks- Conglomerate Sandstone, Shale, Mine stone and Breccia.
- Metamorphic rock – Definition, Agents of metamorphism- Heat, Uniform pressure, Directed Pressure, Chemically active fluids and gases. Structures and textures of Metamorphic rocks – Slaty, Schistose, Gheissose and Granulose. Common Metamorphic rocks – Slate, Schist, Gneiss, Quartzite and Marble.

Unit 4:

Structural Geology:

- Dip and Strike, Apparent dip and True dip.
- Folds- Elements of folds, Anticline and Syncline, Limbs, Axial of folds, Types of folds- Symmetrical, Asymmetrical, Overturned, Recumbent, Isoclinal, Plunging folds, Anticlinorium, Synclinorium , Open fold, Close fold ,Dome and Basin.
- Faults – Fault Terminology, Fault- Plan, Hade, Dip and strike, Throw, Heave, Slip, Hanging wall and footwall. Classification of faults- Normal and reverse faults, Dip fault, strike fault and Oblique faults, High and low angle faults , Parallel faults, Steps- faults, Graben, Horst, Radial faults, Peripheral faults.
- Unconformities- definition, Types – Angular unconformity, Disconformity, Nonconformity.
- Joints- Classification- Strike joints, Dip joints, Oblique joints, Bedding joints, Master Joints, Sheet Joints and columnar joints.

References:

- A Text book of Geology K.M. Banger | Engineering and General Geology Prabin Singh
- Laboratory Manual of Geology Ajay Kumar Sen.

BVM305P
**INDUSTRIAL TRAINING/ON JOB TRAINING/
WORKSHOP**



SEMESTER-04

BVM401

MINE HAZARDS-II

Course Objectives:

- To learn about different statutory provisions of 'The Mines Rescue Rules, 1985'.
- To learn about different rescue apparatus used in rescue operations in mines.
- To be aware of the problem of lighting in mines and the standards of illumination to be maintained in mines.
- To know about the impact on the environment by mining activities.
- To be familiar with different hazards in opencast mines and controlling measures for the same.

Course outcomes:

- Understand different statutory provisions of 'The Mines Rescue Rules, 1985'.
- Use his acquired knowledge in selection and use of some rescue apparatus in need.
- Take necessary steps in maintenance of illumination standards as per DGMS guidelines.

Unit 1:

08

The Mines Rescue Rules, 1985:

- Rescue Stations and functions of Rescue Stations
- Rescue Rooms and functions of Rescue Rooms
- Organisations and equipment in mines: Telephone communication, Rescue Tracings, Appointment of Rescue Trained Persons in mines, selection of persons for training in rescue work;
- Entry into below ground mines for rescue or recovery work
- Fresh air bases, Rescue team

Unit 2:

08

Rescue apparatus:

- Self-contained breathing apparatus;
- Gas mask;
- Smoke helmets;
- Self-rescuer;
- Reviving apparatus;

Mine Lighting:

- Problems of lighting in mines;
- Standard of illumination in underground coal and metalliferous mines;
- Standard of illumination in opencast coal and metalliferous mines;
- Construction and working principles of cap lamps; topping up operation and charging of cap lamp;
- Lamp room layout and organisation;
- LED cap lamp: Important features, advantages;



Unit 3:

07

Pollution due to Mining operations:

- Air pollution due to dust- smoke -fumes- gases, control measures;
- Water pollution due to mining, control measures;
- Noise pollution, control measures;
- Heat addition, control measures.

Additional Environmental impact due to mining operations:

- Land damage and land degradation;
- Damages on forest – effects on flora and fauna;
- Global warming and greenhouse effect;
- Radioactive emission; Cultural degradation;
- Damage to local inhabitants.

Unit 4:

07

Safety aspects in opencast mining:

- **Vibration** - its effects, precautionary measures to control ground vibration due to blasting in Opencast mines;
- **Problems of fly rock** – causes of fly rock – control of fly rock.
- **Accidents in Opencast mines** - cause wise and place wise (elementary ideas only) , preventive measures (elementary ideas only).

References:

- The Mines Rescue Rules, 1985 | DGMS Circulars and orders
- Legislation in Indian Mines: A Critical Appraisal by S.D. Prasad and Rakesh
- Environmental effects of mining – wikipedia | Elements of mining technology Vol. 2. By D.J. Deshmukh



BVM402

UNDERGROUND METALLIFEROUS MINING

Course Objectives:

Following are the objectives of this course:

- To become familiar with ore deposits of metalliferous mines.
- To know different metal mining terminologies.
- To understand different methods of entries to an underground Metal Mine.
- To understand stone drifting and blasting patterns in stone.
- To understand the development of an underground metal mine.
- To know different sampling methods in metal mining.
- To have knowledge about different mining methods under different geo-mining conditions.

Course outcomes:

After completing this course, student will be able to

- Differentiate Coal and Metal Mining
- Distinguish and use different approaches to underground ore bodies
- Understand & Use different blasting patterns in different rock conditions.
- Understand and supervise different drive, cross cut, raising, winzing etc. methods in underground
- Identify and use different sampling methods.
- Identify and use different underground methods of operation practised in the Metal Mining Industry

Unit-1:

08

Introduction:

- Present status of Metal Mining sector particularly in India.
- Geological conditions and characteristics of ore deposit.
- Important Metal Mining Terminologies.
- Coal Mining vs Metal Mining.

Unit-2:

08

Mode of Entry:

- Adit, Tunnel, Ramp -Application, Advantage & Disadvantage
- Vertical shaft, Incline, Vertical shaft in ore, Vertical shaft Hang wall, Vertical Shaft in Hang wall, Comparison between vertical and incline shaft ,Shaft pillar
- Mode of entry related regulations.

Unit-3:

07

Stone Drifting:

- Application of stone drifting, Method of driving drift, Different patterns of shot holes for blasting- Burn Cut, Coromant Cut, Ring drilling, Fan Cut, Drag cut, Cone cut & Wedge Cut.

Mine Development:

- Salient points to be considered at the time of development.
- Different Raising Methods- Open Raising, Double Compartment Raising, Drop Raising/Long Hole Raising, Alimak Raising, Jora Raising, Raise Boring
- Development of Drive, Cross cut, Winze,
- Ore Bin, Brow Bin, Kimberley chute, Ore Pass, Shaft Station, Grizzly, Secondary breaking at grizzly, Underground Chambers

Unit-4:

07

Sampling in Metal Mines:

- Objectives and Principles; Classification of sampling methods, Channel sampling, Chip sampling, Bulk sampling, Drill sampling, Grab Sampling, Car sampling
- Salting, Assaying and Assay Map, Coning & Quartering

Stoping Methods:

- Selection of stoping methods; Classification of stoping methods- Underhand stoping, Overhand stoping, Breast stoping, Shrinkage stoping, Cut & fill stoping, Post-pillar method of stoping, Sub-level stoping- Application, Preparation, Workings, Merits & Demerits.
- Elementary idea on Square set stoping, Top slicing, Sublevel caving and block caving

References:

- Deshmukh D. J. (2010) Elements of Mining Technology. Vol.1&2 (8th Edition). Denett and Company, Nagpur.
- Kannavena S. (2017) Advanced Metal Mining Methods. (1st Edition). Planet Book House, Kothi
- Chacharkar. Y.P. (1994) A Study of Metalliferous Mining Methods. (1st Edition). Lovely Prakashan, Ddanbad
- Hartman Howard L. (1992). SME Mining Engineering Handbook. Vol.1(2nd Edition). Society for Mining, Metallurgy, and Exploration, Inc. Littleton, Colorado

BVM403

WINING AND WORKING METALS

Course Objectives:

- students should be able to understand the nature and characteristics of irregular metalliferous ore deposits, differentiate between various types of ore deposits (such as lode, vein, etc.), and comprehend the mode of ore deposition.
- students should be able to design and define entry methods for mining operations, including the shape, size, and construction of shafts (circular, rectangular, elliptical), and understand the principles of inclined shafts and shaft filling.
- Students should have a grasp of the preparatory tasks involved in mining operations, including the creation of stations, cross cuts, ore bins, and grizzlies. They should understand the establishment of connections between levels and raises, and be familiar with the transportation of broken ore from the stope to the surface. Additionally, they should comprehend primary crushing techniques performed underground.
- Students should be able to differentiate between various methods of stopping, understand their suitability and conditions of applicability, and categorize methods into open stopes (under hand, over hand, breast), supported stopes (cut and fill, shrinkage, square set, sub-level), and caving methods (sub-level caving, block caving, top slicing, undercutting).
- Students should be able to study and analyze the operations of significant underground metalliferous mines such as Kolar Gold Mines, Bharveli Manganese Ore Mine (Balaghat), Musabani Copper Mines, and Khetri Copper Mines. They should understand the challenges and complexities associated with deep mining and mining of specific metal ores.

Course Outcomes:

- Students will gain an understanding of various irregular ore deposits, including their nature and mode of formation, such as lodes, veins, and other types. They will learn to identify different ore deposit structures and their significance in mining operations.
- Students will comprehend the design and characteristics of shafts used for entry into underground mines, including circular, rectangular, and elliptical shapes. They will also learn about inclined shafts and the process of shaft filling.
- Students will acquire knowledge about essential preparatory work in underground mining, such as forming stations, cross cuts, ore bins, grizzlies, and connections between levels and raises. They will also understand the transportation of broken ore from stopes to the surface and the process of primary crushing underground.
- Students will learn about various stopping methods, their suitability, and the conditions in which they are applicable. They will understand different stopping techniques, such as open stopes, underhand, overhand, and breast stopping. Moreover, they will be familiar with supported stopes like cut and fill stopping, shrinkage stopping, square set stopping, sub-level stopping, glory holes, and caving methods of stopping.
- Students will study and analyze significant metalliferous underground mines. They will understand the unique aspects, challenges, and best practices associated with these mining operations.

| | |
|--|-----------|
| Unit 1: | 08 |
| • Irregular Deposits: (Metalliferous Ores) Nature of ore deposits. Mode of ore deposit Code, vein etc | |
| Unit 2: | 08 |
| • Mode of Entry: shaft-shape and size, circular, rectangular or elliptical. Incline Inclined shaft. Shaft filling | |
| Unit 3: | 07 |
| • Preparatory Work: formation of stations, cross cuts, ore bins, grizzlies. Level and raise winz connections, ore blocks. Transportation of Broken ore from stope to surface. Primary crushing underground | |
| Unit 4: | 07 |
| • Stopping: Various methods of stopping, their suitability conditions of applicability and methods of stopping. Open stopes. Under hand, over hand and breast stoping. Supported stops– <ul style="list-style-type: none">❖ Cut and fill stoping❖ Shrinkage Stoping❖ Square set stoping❖ Sub level stoping❖ Gloryholes❖ Caving methods of stopping:<ul style="list-style-type: none">a. Sub level caving.b. Block Cavingc. Top Slicing | |
| • Study of Important Metalliferous U/G Mines: <ul style="list-style-type: none">❖ Kolar gold mines- problems of deep mining.❖ Manganese ore mine- Bharveli (Balaghat).❖ Musabanicopper mines.❖ Khetri copper mines. | |
| References: | |
| • Mines planning for coal by S.P. Mathur Surface Mining Technology by Sameer Kumar DGS | |
| • Coal mine ground control Vol- II by Syd. S. Peng Underground Winning of coal by T.N. Singh | |
| • Mine Working Part I & II by H.N. Karmkar | |

BVM404

ELECTRO-TECHNOLOGY IN MINING

Course Objectives:

- To have an introductory idea about electrical power, its transmission and three phase systems.
- To have a working idea about DC Motor and Generators.
- To have working ideas about Three phase induction motors (Cage motors and Slip-ring Motors), Transformers.
- To know about lead-acid storage batteries.
- To know about various electrical hazards and earthing requirements.

Course outcomes:

After completing this course, student will be able to:

- Understand the requirement of electrical energy in mines.
- Apply the acquired knowledge of the DC Generators and DC Motors in mines, particularly during their maintenance
- Know how storage batteries work and are used in different fields.
- Understand about electrical hazards and take preventive measures.

Unit-1:

08

Introduction to Electrical Power:

- Energy Sources – Conventional and non-conventional.
- Generation, Transmission and Distribution of Electrical Power (Only fundamental)
- Three phase supply: star and delta circuit, Line and phase current and voltage relation, expression of three phase power, simple problems.

Unit-2:

08

D.C. Machines:

- DC Generators: Construction - main parts, materials they are made of, function of the parts.
- Field and armature connection diagrams and classification of the generators, on the basis of these connections.
- Deduction of emf equation and simple problems on DC Generators.
- Application of D.C. Generators.
- DC Motors: Principle of operation and classification. Back emf; deduction of expression for torque, simple problems.
- Speed control of shunt and series motor-armature resistance control and field control only; reversal of direction of rotation.
- Application of D.C. motors.

Unit-3:

A.C. Machines Transformers:

- Construction & principle of operation of single-phase transformers.
- E.M.F. equation and deduction of the relations - $N_1/N_2 = E_1/E_2 = I_1/I_2$
- Various losses (only names and basic concepts); Simple numerical problems.
- Connections of 3 phase transformers:
 - Star / Star
 - Delta/Delta
 - Star/ Delta
 - Delta /Star (connections only)
- Applications of Transformers.

Three Phase Induction Motors:

- Construction, principle of operation and classification (squirrel cage, slip ring motors)
- Definition and relationship of syn. Speed, actual speed, slip and frequency of rotor current, solve simple problems.
- Starters: DOL and Star/delta for cage motors; Rotor- Rheostat starter for slip ring motor
- Reversal of direction of rotation & Industrial Application of both squirrel cage and slip ring induction motor.

Unit-4:

Storage Batteries (Lead Acid cell):

- Construction - different parts, materials they are made of and their functions.
- Charging - different methods, conditions of full charge.
- Defects, maintenance & uses.

Electrical Hazards (Shock & Fire) and Earthing:

- Electric Shock, Effects of Electrical Current on the human body, Precautions to be taken, Treatment for electric shock.
- Fire – Different types of Fire, their causes, Fire Extinguishers and their applications.
- **Earthing** – Necessity of earthing, types of earthing, Earth resistance values as per latest CEA Regulations.

References:

- A text book of Electrical Technology Vol-I & II, B.L. Thereja
- Basic Electrical Engineering, J.B. Gupta
- Installation, Commissioning & Maintenance of Electrical Equipments, Tarlok Singh
- A Study of CEA Regulations, 2010 by L.C.Kaku

BVM405P

INDUSTRIAL TRAINING/ON JOB TRAINING/ WORKSHOP

SEMESTER-05

BVM501

ADVANCE MINING GEOLOGY

Course Objectives:-

- Understand Indian stratigraphy, geological time scale, and rock formations; Identify economic minerals; explain the significance of Deccan traps and fossils.
- Classify coal ranks, analyze coal properties, and describe petroleum formation; Recognize different types of coal and petroleum traps; Explore occurrence of coal and petroleum in India.
- Comprehend groundwater occurrence, differentiate aeration and saturation zones, and define hydrological properties; Explain aquifers and basic groundwater flow principles.

Course Outcomes:

- By the end of this unit, students will be able to classify and analyze Indian rock formations and identify the economic mineral potential within different stratigraphic systems.
- Upon completing this unit, students will understand the formation and significance of coal and petroleum deposits, and the methods used for their exploration and extraction.
- At the end of this unit, students will be able to assess groundwater occurrence and apply a range of prospecting methods to evaluate geological resources.
- By completing this unit, students will have the skills to utilize remote sensing techniques and tools for geological mapping and understand the role of GIS and GPS in geology.

Unit 1:

08

Indian Stratigraphy:

- Geological Time scale, Principles of stratigraphy, Principle of correlation, Stratigraphic classification of Indian rock formations.
- Physiographic division India, peninsular India, Indo-gangetic plan and extra peninsular India.
- **Archaean system** – A brief account of the Dharwar system, Sausor group, Iron ore group, Archaean rocks of Rajasthan, economic minerals of Archaean rocks.
- **Cuddapah system** – Cuddapah rocks of cuddapah basin Andhra pradesh, Delhi system, economic minerals of cuddapah rocks.
- **Vindhyan system** - A brief account of the vindhyan rocks of North India, economic minerals of vindhyan rocks.
- **Gondwana system** - A brief account of the gondwana rocks of India, economic minerals of gondwana rocks.
- **Deccan traps** - A brief account of the deccan traps of India, economic importance of deccan traps.
- **Fossils** – Definition, mode of occurrence, use of fossils.

Ore Deposit:

- Concept of mineral, Gangue and Tenor of ores, a brief outline of the classification of ore deposits.
- Magmatic ore deposit – Early magmatic, Late magmatic.
- Pegmatite deposits, Sublimation deposits, Contact metasomatic deposits,
- **Hydrothermal deposits** – classification of hydrothermal deposits, cavity filling deposits, types of cavity filling deposits, replacement deposits, types of replacement deposits.
- Sedimentation deposits, Evaporation deposits, Residual deposits, Mechanical concentration deposits (Placer deposits), types of placer deposits.
- Oxidation and super gene enrichment deposits, metamorphic deposits.
- **Control of ore deposition** – Structural controls, stratigraphic control, physical and chemical controls.

Unit -2:

Coal and Petroleum:

- **Rank of coal, classification of coal** – Peat, Lignite, Bituminous, Anthracite and Cannel coal.
- Banded constituents of coal, chemical properties of coal, structural features of coal seams.
- **Origin of coal** – In situ theory, Drift theory, formation of coal preservation, Biochemical change, Carbonization and metamorphism.
- Occurrence of coal in India, A brief outline of the lower Gondwana fields.
- Petroleum, origin of petroleum, migration of petroleum, oil traps, types of oil traps, petroleum deposits of India.

Ores and Mineral Deposits of India:

- A brief account of the origin, occurrence, distribution in India and economic use of the following ores and minerals – Gold, Iron-ore, Manganese ore, Copper ore, Lead and Zinc ore, Aluminum ore, Chromite and Mica.

Unit 3:

Ground Water:

- Elementary idea of ground water, occurrence of ground water, zone of aeration, saturation, static water table, hydrological properties of rocks porosity and permeability, Aquifer.

Prospecting Methods:

- **Ground prospecting methods** – A brief outline of the various prospecting methods, surface prospecting methods, Geological mapping, and Trenching, Pitting, Auguring and wash boring and drilling.
- **Geophysical prospecting methods** – Elementary study of gravity, magnetic, electrical resistivity and seismic methods of geophysical prospecting.

Unit 4:

Remote Sensing:

- Remote sensing an introduction, application in various fields, G.P.S.(Global Positioning System), G.I.S.(Geographic Information System).

References:

- A text book of Geology by K.M.Banger
- Engineering and general Geology by Prabin Singh
- Ore deposits of India by Gokhle and Rao
- Geology of India and Burma by Krishnan M.S.
- Ground water and tube well by S.P.Garg
- Mineral Economics by Sinha and Sharma

BVM502

MINE, MACHINERY AND MAINTENANCE

Course Objectives:

- Able to understand the construction, testing, and maintenance of wire ropes used in mining operations, as well as grasp the principles and components of winding systems and head gears.
- Students should possess the ability to classify and describe the mechanization methods for coal faces, comprehend the operation and applications of various mechanized machines like drills, loaders, and L.H.D. equipment, and understand the principles of remote control and flameproof equipment.
- Able to compare the use of compressed air power with electrical power, analyze different types of compressors, calculate work done and efficiency, and understand the applications of compressed air machines in mining, particularly drills and pneumatic tools.
- Students should have a clear understanding of the various types of aerial ropeways and their potential applications in mining operations.

Course Outcomes:

- Understand types of wire ropes, their construction, testing, splicing, and maintenance in mining operations.
- Gain knowledge about different winding systems, head gear components, safety measures, and coal face mechanisation techniques.
- Learn about compressed air power, compressors, and their efficiency, along with the use of compressed air machines in mining.
- Recognize various types of aerial ropeways and their suitability and applications in mine transportation systems.

Unit 1:

08

- **Wire Ropes:** Types of wire ropes- winding, haulage and guide ropes. constructional details of wire ropes; rope laying. Testing of wire ropes: calculation of size of ropes: factor of safety: rope troubles. capping and recapping of ropes. splicing of haulage ropes: factor of safety. Care and maintenance of wire ropes in use and its storage.
- **Winding:** Different types of winders. Head gear: headgear sheave, different types of rope cattles, suspension gear, rope cattles, safety hooks. Breaks-post brake, cage and its fitting keps gears, rigid & flexible rope guides: suspension of rope guides. Over wind & over speed prevention. Factors governing height of the head-gear: dead load: live load and wind pressure.

Unit 2:

08

- **Coal Face Mechanization:** Face mechanization (B & P)classification, Electric coal drill, Loaders-Powers loaders, operation and use. L.H.D. and S.D.L., operation and uses. Longwall face mechanization stage loads, AFC, Crush
- **Gate End box:** Purpose of remote control. General Principle of working of gate end box. Protection of machineries through remote control. Flameproof and intrinsic safety.
- **Compressed Air Machines:** Compressed air power, comparison, and compressors. Different kinds of compression and compressors. Calculation of work done and H.P. for given pressure and quantity of free air. Efficiency of compressors. Advantage and limitation of compressed air power over electrical power. Compressed air machines used in mines drills : air leg, pneumatic picks etc.

Unit 3:

07

- **Introduction to Aerial Ropeways:** Different types of aerial ropeways. Monocable and bicable ropeways. Suitability and use.

Unit 4:

07

- **Concept of Preventive Maintenance:** Concept of preventive maintenance and its importance.

References:

- Elements of Mining Technology by D,J. Deshmukh
- Science and Art of Mining Digest by C.M.P.D.I. Pub.
- MineTransport by Karelin
- Heat Engine by Pandya & Shah
- Course in mining Geology by R.N.P.Arogyaswamy

BVM503

DRILLING AND BLASTING PRACTICES IN MINES

Course Objectives:

- The concepts of explosive energy, work energy, and waste energy, as well as comprehend the mechanisms of rock breakage. They should also be familiar with various types of explosives, detonators, and detonating fuses, and understand the safety precautions and statutory provisions related to shot firing.
- To evaluate factors influencing blast design, select appropriate blast parameters such as burden, spacing, stemming distance, and bench height, and understand the principles of deck charging, column loading, and controlled blasting. They should also be able to calculate charge per hole and powder factor, and comprehend techniques to minimize ground vibration in surface blasting operations.
- To recognize various cuts, determine burden, spacing, depth of hole, and stemming during underground blasting, and follow the best practices for solid blasting techniques.
- To explain the mechanisms of rock fragmentation, identify factors influencing rock fragmentation, and understand techniques used to improve rock fragmentation.
- The potential environmental impacts of blasting, including back break, over break, fly rock, ground vibration, air blast, and noise. They should also be familiar with the measurement, prediction, and control measures related to these impacts.

Course Outcomes:

- Understand explosive energy, breakage mechanism, types of explosives, detonators, and safety precautions during shot firing.
- Learn factors affecting blast design, selection of blast parameters, types of explosives used in open-cast mines, and controlled blasting techniques.
- Comprehend underground blasting practices, including various cuts, burden, spacing, and stemming.
- Understand the mechanism of rock fragmentation and techniques to improve rock fragmentation.
- Identify environmental impacts of blasting and measures to control back break, over break, fly rock, ground vibration, air blast, and noise.

Unit 1:

08

- **Explosive Energy and Breakage Mechanism:** Explosive energy, work energy, waste energy. Breakage mechanism, various theories of rock breakage Type of explosive - low explosive, high explosive, permitted explosive. Detonators, types of detonators, detonating fuses, Electric detonator, advantage, precautions in handling Misfires, precautions, statutory provisions related to shot firing

Unit 2:

08

- **Surface Blasting:** Factors affecting blast design, selection of various blast parameters, Burden, Spacing, Stemming distance, Subgrade drilling, depth of hole, bench height, diameter of hole, Different types of explosives used in o/c mines, Liquid Oxygen, ANFO, O.C.G., Slurries, SMS, Emulsion explosive Deck charging and column loading, calculation of charge per hole and powder factor, controlled blasting, special blasting technique. Secondary blasting – Pop shooting and Plaster shooting Ground vibration measurement – is limitations

Unit 3:

07

- **Underground Blasting:** Various cuts, Burden, spacing, depth of hole, stemming of hole, precaution during blasting. Solid blasting practice.

Unit 4:

07

- **Rock Fragmentation:** Mechanism of rock fragmentation, factors affecting rock fragmentation, Techniques to improve rock fragmentation
- **Environmental Impact of Blasting:** Back break, Over break, fly rock, Ground vibration- measurement, Prediction & control measures, air blast, noise

References:

- Elements of mining technology –Vol-I by D.J. Deshmukh
- Explosive & Blasting Practice in mines by Sameer Kumar Das
- Open cost mining by Sameer Kumar Das
- Explosive & Blasting Practice in mines by Pradhan
- Open cost mine working by B. Ghosh

BVM504

MINE FIRES, EXPLOSION, INUNDATION, RESCUE AND RECOVERY

Course Objectives:

- Identify mine fire causes and understand preventive measures.
- Differentiate gas explosion types, recognize limits, and apply precautions.
- Recognize dust explosion risks, employ preventive measures, and assess coal dust concentration.
- Understand sources of inundation, implement preventive actions, and comprehend dam construction.

Course Outcomes:

- At the end of this unit, students will be able to Identify mine fire factors, differentiate gas explosion types, and recognize water accumulation sources.
- Understand mine fire causes, classify gas explosions, and grasp factors causing water accumulation.
- At the end of this unit, students will be able to analyze fire factors, differentiate gas explosion types, and recognize water accumulation sources.

Unit 1:

08

Mine Fires:

- Factors responsible for mine fire. Causes of mine fire.
- Accidental fire, spontaneous heating; factors responsible for spontaneous heating.
- Incubation period, crossing point, ignition point.
- Precaution against spontaneous heating. Preventive measures against mine fires.
- Fire stoppings-purpose, constructional details.
- Opening of a sealed area.

Unit 2:

08

Gas Explosion:

- Types of gas explosion. Causes of firedamp explosion.
- Upper and lower limit of firedamp explosion; coward's diagram.
- Precaution against firedamp explosion.
- Study of some important gas explosions in Indian coal mines.

Unit 3:

07

Dust Explosion:

- Upper and lower limit of inflammability of dust. Index of inflammability.
- Causes of formation of dust and causes of coal dust explosion.
- Study of some important dust explosion cases in Indian coal mines.
- Precaution & preventive measures against dust explosion.
- Stone dust quality of stone dust; stone dusting; stone dust barriers.
- Water barriers, handling of stone dust.
- Use of chemicals and chemical foams against coal dust hazards, health hazards due to coal dust,
- Measurement of coal dust concentration in the general body of air.

Unit 4:

Inundation:

- Sources of dangerous accumulation of water in mines.
- Factors responsible for inundation in mines.
- Precautions and preventive measures for inundation.
- Precaution for approaching water logged areas and working below water logged area.
- Dams – Purpose, site of dam, types of dam and their constructional details.
- Study of some important inundation cases in Indian mines
- Additional precaution in the rainy season in the mines located near by the rivers.

Mine Rescue and Recovery Work:

- Rescue apparatus, self-breathing apparatus, reviving apparatus, Drager BG – 4 self-contained breathing apparatus, Maxaman- reviving apparatus, self-contained, self-rescuer – Fenzy biocell, Oxybocks, RZ-25, Universal tester for testing of drager BG-174 and BG-4, Quester- II and Quester-III, Computerized testing machines, Drager power pump.
- Rescue stations – equipment used in rescue stations, rescue organization and working, training of officials.
- Method of rescue and recovery work
- Emergency organization and rescue plan
- Recovery of mines after explosion, fire and inundation
- Sealing of fire area (u/g fire)

References:

- Elements of mining technology –Vol-II D.J. Deshmukh
- Mine Disaster and Mine rescue by M.A.Ramlu

BVM505P
**INDUSTRIAL TRAINING/ON JOB TRAINING/
WORKSHOP**



SEMESTER-06

BVM601

MINE ECONOMICS AND BENEFICIATION

Course Objectives:

- To enable students to comprehend the foundational concepts of economics, including wealth, value, consumption, demand, supply, and capital. Through this, students will develop the ability to analyze economic dynamics, recognize the significance of consumption in meeting human needs, grasp the principles of demand and supply, and appreciate the role of capital and money in shaping economic activities.
- To equip students with a comprehensive understanding of the mineral industry's role in a national economy. By exploring Indian mineral resources, mineral policies, and conservation measures, students will gain insights into sustainable resource utilization. Additionally, students will learn about the constitution of companies and the labor aspects within the mining sector, fostering a holistic understanding of the mining industry's economic and social dimensions.
- To provide students with a solid grasp of sampling methods and their importance in the field of mining and mineral exploration. By delving into different sampling techniques, error sources, and methods for tonnage estimation, students will develop the ability to critically evaluate sampling procedures and their implications, facilitating accurate assessment and estimation in resource evaluation.

Course Outcomes:

- By the end of this unit, students should be able to understand the fundamental concepts of economics, including wealth, value, goods, price, income, investment, saving, consumption, and their interrelations. They should be capable of analyzing the principles of demand and supply, elasticity, and the role of capital and money in the economy.
- Upon completing this unit, students should possess a comprehensive understanding of the mineral industry's significance in a national economy. They should be capable of analyzing Indian mineral resources, mineral policies, conservation measures, and the constitution of companies under the Companies Act.
- By the completion of this unit, students should have a clear understanding of sampling methods, their significance, and the challenges involved. They should be able to differentiate between various sampling techniques, including surface and underground sampling, and understand the concept of errors in sampling.
- Upon completing this unit, students should be equipped with the knowledge and skills to understand the valuation of mineral properties and assets. They should be able to calculate the life of a mine, assess the risk in mining calculations, and prepare valuation reports.

Unit- 1:

General Economics:

- **Economics terms:**
 - a) Wealth
 - b) Value: -
 - i. Value in use and.
 - ii. Value in exchange.
 - c) Goods.
 - d) Price.
 - e) Income.
 - f) Investment.
 - g) Saving.

- **Consumption and its importance:**
 - a) Consumption- satisfaction- needs.
 - b) Types of consumption.
 - c) Importance of Consumption.

- **Wants-** wants and economic activities, classification of wants-
 - a) Law of diminishing utility
 - b) Law of equi-marginal utility.

- **Utility-** Meaning measurement, marginal and total utility.

- **Demand-** definition, demand schedule and demand curve.
 - a) Law of Demand.
 - b) Extension and contraction in demand.
 - c) Increase and decrease in demand.
 - d) Elasticity of demand.

- **Supply**
 - a) Supply of price.
 - b) Supply schedule.
 - c) Supply curve
 - d) Supply function.
 - e) Law of supply.
 - f) Elasticity of supply.

- **Capital-** Meaning, definition-
 - a) Characteristics of capital.
 - b) Wealth and Capital.
 - c) Capital and Labour.
 - d) Capital and lands.
 - e) Importance and function of Capital

- **Money:**
 - a) Definition of money
 - b) Function of money
 - c) Classification of money

Unit-2:

08

Mine economics:

Mineral industry - its role in national economy.

- Indian mineral resources and their statistics.
- Mineral policies.
- Conservation of minerals including Coal Company.

Constitution of companies under companies act.

- Types of companies.
- Private and public sector, merits and demerits. Govt. undertakings.
- Nationalization of coal industry formation of CIL and its subsidiaries.

- **Elementary introduction of the following companies.**

- a) HCL
- b) BGML
- c) BALCO
- d) MOIL

- **Labour**

- a) Efficiency of Labour.
- b) Labour welfare.
- c) Social securities.
- d) Trade unions.

Unit 3:

07

- **Sampling:**

- a) Methods and importance of sampling.
- b) Size of samples.
- c) Class of samples.
- d) Different methods of sampling.
- e) Surface sampling.
- f) Underground sampling.
- g) Sampling of alluvial deposits.
- h) Errors in Sampling.

- **Salting**

- a) Method of salting
- b) Safe guards against salting.
- c) Sampling records.

d) Computation for tonnage- Average assay value - Average sloping width – Clear width – Willing width – Length average - Average of block and total average – Prismoidal averaging

Unit 4:

Valuation:

- Methods of valuation
- Cases requiring valuation risk in calculation of mines
- Calculation of life of amine
- Valuation reports
- Mine as a wasting assets
- Redemption of capital depreciation
- Valuation of mineral property and preparation of report

References:

- Industrial economics by V.C.Sinha and Pushpa Sinha
- Mineral economics by R.K.Sinha and N.L.Sharma
- Mineral and mine economics by R.T.Deshmukh

BVM602

OPEN CAST MINING AND LAND RECLAMATION

Course Objectives:

- Understand open-cast mine classifications, their scope, advantages, and limitations. Identify factors influencing their use.
- Learn about box cuts, access trenches, layout design, pit stability, and drainage. Recognize machinery suitability and limitations.
- Explore strata removal methods: machinery (scrapers, shovels) and blasting. Grasp blast techniques, explosive types, and vibration monitoring.
- Familiarize with loading equipment (shovels, draglines, loaders) and their capacities. Calculate output through time studies.
- Understand transport methods (rail, conveyors, and dumpers), haul road design, and dump-site considerations. Learn about land reclamation and slope stabilization, including a for estation.

Course Outlines:

- Able to Understand and classify open-cast mines based on mechanization levels. Evaluate advantages and disadvantages of open-cast mining. Identify key factors influencing the choice of mining method. Recognize and describe machinery used in open-cast mining operations.
- Upon completing this unit, students will be able to Design access methods like box cuts and access trenches. Plan bench layout, dimensions, and pit slope stability. Manage drainage within the pit and slopes. Assess machinery suitability and limitations in varying terrains and materials.
- Differentiate techniques for soft and hard strata removal. Analyze blast hole patterns, explosive types, and loading methods. Calculate blast parameters and apply control blasting techniques. Understand secondary blasting methods, ground vibration measurement, and safety protocols.
- Identify loading machinery - shovels, draglines, loaders, etc. Evaluate their applications and capacities. Conduct time studies and output calculations for loading machinery.
- Explain transportation methods - rail, trackless, conveyors, dumpers. Understand haul road design principles. Design efficient dump sites to minimize double handling. Recognize land reclamation methods and their environmental implications.

Unit 1:

08

- **Open Cast Mining:** Classification of O.C. mine, manual, semi mechanized & mechanized. Scope and limitation of O/C mines, Advantages and disadvantages of O/Cmining. Factors deciding the O/Cmining. Machineries used in O/Cmines.

Unit 2:

08

- **Opening of O/C Mine:** box cut and access trenches. layout and design – bench, dimensions, height and width, overall pit slope; stability, general layout of O/Cmine. Drainage in pit and slope. Suitability & limitations of O/Machineries.

Unit 3:

07

- **Removal of Strata:** By scrapers, Dozers, Graders, Draglines for soft strata. Shovels and haul packs surface miners and bucket wheel excavators. By drilling and blasting for hard strata; primary & secondary blasting. Blast hole pattern; burden, spacing, diameter and depth of blast holes. Drilling blast holes and drill machines. Blast hole geometry, toe formation, sub grade drilling, creator theory. Different types of explosive used in O/C mines liquid oxygen, ANFO, OCG, slurries, side mixed slurry (SMS) , Emulsion explosive Deck charging, & column loading; calculation of powder factor/ charge factor. calculation of charge /hole, control blasting technique- Special blasting technique. detonators- blasting fuses, detonating fuses, Electric detonators, Nonel & Raydets detonators. Secondary blasting – pop shooting and plaster shooting, snake holing, Ground vibration measurement- its limitations.

Unit 4:

07

- **Loading Machineries:** Different machines used for loading – shovels, dragline, Multi bucket excavators, front end loader, pay loader and cranes- their application, scope N& capacity. Time study and calculation of out-put with shovel, dumper& dragline.
- **Transportation:** Rail transport; trackless transport, Dumpers, conveyors; spreaders, transport haul road gradient width and slope. Dumps-site, slope and prevention of double handling.
- **Landreclamation:** Physical restoration of mined out areas. Slope stabilization. Various methods for land reclamation; afforestation cultivation etc.

References:

- Elements of mining technology Vol –I by D.J. Deshmukh
- Surface mining technology by Sameer Das
- Explosive & Blasting practice in mines by Sameer Das

BVM603

MINE MANAGEMENT LEGISLATION AND GENERAL SAFETY

Course Objectives:

- Students will be able to assess the impact of scientific management principles on organizational performance and demonstrate comprehension of the core elements of directing and controlling within a managerial context.
- Students will be capable of examining the multifaceted causes of workplace accidents, formulating strategies to mitigate potential risks, and articulating the financial ramifications of accidents in a workplace setting.
- Students will be equipped to analyze the jurisdiction of pollution control boards in the mining sector, interpret the implications of mineral concession rules and the Mine and Mineral Act, and evaluate the processes involved in land requisition for mining operations according to state land revenue codes.

Course Outcomes:

- By the end of this unit, students will be able to understand and apply the principles of scientific management and demonstrate proficiency in various managerial functions.
- Upon completing this unit, students will have a comprehensive understanding of safety management, including accident prevention, causes, and the importance of effective safety reporting.
- At the end of this unit, students will possess knowledge about relevant legislative frameworks related to environmental protection, mining operations, pollution control, and land requisition.

Unit- 1:

10

Management:

- General principles of scientific management.
- **Managerial function of the following in brief-**
 - a) Planning.
 - b) Organizing
 - c) Staffing
 - d) Direction and control.
 - e) Motivation
- **Work study in brief-**
 - a) Motion study
 - b) Time study

Unit-2:

10

Safety:

- **Accidents**
 - a) Classification
 - b) causes
 - c) Remedial measures and Provisions in regulation.
 - d) Cost of accident
 - e) Report writing.

Unit-3:

10

Legislation:

- Prevention and control of pollution Acts and rules (Air and water) Environment (Protection) Act 1986 Provisions applicable to mining operation only.
- Provisions of reclamation mined out land and afforestation as per forest Conservation Act 1980.
- Authority of pollution control Board over mining Industry and returns to be filed to board.
- Provisions of land requisition for mining operations. The land revenue Code of the state and procedure for the same.
- Elementary Knowledge about the Provisions of mineral concession rule 1960 and mine and mineral (Regulation & Development) Act 1957.

References:

- Mines Act | Coal mines Regulations
- Metalliferous Mine Regulations
- Mine rules | Indian dispute Act
- Environment (Protection) Act 1986.
- Environment (Protection) Rules 1986.
- Indian forest Act 1927 | The hazardous wastes Act 1988
- Forest conservation Act 1980.
- Commentaries on water air | Pollution and Environment (Protection) Laws.
- Mineral concession rules 1960 | Mines and Mineral (Regulation and development Act 1957).
- Land revenue code | Contract Labour and abolition rule.
- Rescue rules | V.T. Rules | Trade Union Act.

BVM604

ADVANCE MINE SURVEYING

Course Objectives:

- To understand the concepts of latitudes and departures, and to perform calculations of partial and total latitudes and departures for various surveying scenarios.
- To introduce students to the properties of circular curves, teach them how to calculate curve elements, and enable them to choose and employ suitable ranging methods for circular curve layout.
- To provide students with knowledge about stope surveying techniques for different ore deposit inclinations, allowing them to determine the most suitable methods for accurate stope design.
- To familiarize students with the concept of correlation surveying, teach them different methods for aligning surveys, and enable them to choose the appropriate method for specific surveying scenarios

Course Outcomes:

- By the end of this unit, students will be able to apply the principles of rectangular coordinate systems to calculate and analyze partial and total latitudes, departures, lengths, bearings, and areas using both partial and total coordinates.
- Upon completing this unit, students will have the ability to analyze and design simple circular curves, select appropriate ranging methods, and apply super elevation concepts in curve surveying.
- By the end of this unit, students will be proficient in surveying methods for stope design in various ore deposit inclinations, including flat, moderate, and steeply inclined deposits.
- Upon completing this unit, students will possess the skills to correlate different survey measurements and orientations, using a variety of methods including direct methods, assumed bearing methods, and precise magnetic methods.

Unit- 1:

08

- **Rectangular Coordinate System:** Definitions; latitudes & departures. Partial latitude and partial departures. Calculation of Partial latitude and partial departures. Total latitude and total departures. Calculation of Total latitude and total departures, Calculation of length & bearing from total coordinates. Calculation of Area by Partial coordinate, Calculation of Area by total coordinates Methods, National grid system. To join colliery survey with N.G.
- **Tacheometry:** General, Stadia Diaphragm and its principle. Theory of anal lattices. Determination of multiply and additive constant. Tachometric survey.

Unit -2:

Curve:

- Definition & properties of circle
- Types of Curves
- Nomenclature of a simple circular curve
- Elements of simple curve (Circular)
- Pet Interval, Degree of curve
- Classification of curve ranging method
- **Methods of simple circular curve ranging:**
 - ❖ **Chain and tape**
 - By successive bisection of arc
 - By taking perpendicular offsets from tangents
 - by taking perpendicular offsets from long chord
 - Chord and off set method
 - ❖ **Instrumental methods**
 - Chord and angle method (tangential angle method method)
 - by taking angles from single station .(ranking
 - By taking angles from two stations
 - ❖ **U/G curve ranging methods**
 - chord and off set methods
 - Chord and angle methods Super Elevation. Numerical Problems on simple circular curve.

Triangulation Survey:

- Definition & principle of Triangulation survey.
- Classification of Triangulation survey
- Fixing of Stations.
- Selection of site for Baseline.
- Sequence of operation before base line measurement.
- Equipments required for base line measurement.
- measurement of baseline
- Correction required in base line measurement.
- Prolongation of a base line.
- Adjustment of horizontal angles.
- Colliery Triangulation
- Precautions in Measuring angles and baseline.
- Triangulation and precise traversing.
- True north determination (App Method)
- Methods of determining true north astronomical Method.
- Determination of True north in day time by observing sun.
- Method of determining latitude and longitude of a survey station determination
- Definition of astronomical survey and important terms, of azimuth by astronomical observation.

Unit – 3:

Stop surveying:

- Definition and Introduction, purpose of stop survey.
- Methods of Stop surveying for flat, moderate inclined or steeply inclined ore deposits.

Open Cast Mine Surveying

- Fixing of stations around boundary.
- Fixing of stations on benches.
- Taking tachometric observation to check the position of stations.
- Levelling operation to determine the R.L. of Station points.
- To conduct traverse survey to determine the exact position of stations.
- To conduct off set survey to determine the position of bench.

Unit- 4:

Correlation Survey:

- Purpose of correlation survey
- Classification of methods of orientation
- Direct methods of traversing
- Assumed bearing method (Two shaft method)
- Exact alignment method
- Approximate alignment method
- Wiess quadrilateral method
- Special chain of tape method
- Precise magnetic method
- Gyro theodolite method
- Correlation with national grid and local scale factor

Drift and Fault problem:

- Definition, fault, normal, reverse and trans current fault, plane hade of fault, throw, want heave, excess. Numerical problems on drift and fault.

Introduction to Modern Survey Techniques:

- Digital theodolite, electronic distance measuring equipment, Geometer; Tellurometer, Total station, Diatomite, software's related to mine surveying.

Introduction to Aerial Photography:

- General Principle; Photo theodolite; Stereo photographic surveying; aerial surveying- field of application ; Vertical and oblique photographs; aerial photography; preparation of photographic maps by simple methods;

References:

- Mining Surveying Vol-I& II by S.Ghatak
- Surveying and leveling Vol-II by Kanetkar and Kulkarni
- Surveying Vol-II by B.C. Punamia
- Advance Surveying by Alam chand
- Advance mine Surveying by D.C. Clark
- Surveying Vol-I& II & III by Arora

BVM605P

INDUSTRIAL TRAINING/ON JOB TRAINING/ WORKSHOP





RAIPUR | INDIA

KALINGA UNIVERSITY

KALINGA UNIVERSITY, KOTNI , NEAR MANTRALAYA, NAYA RAIPUR - 492101, CHHATTISGARH

CALL: +91-9907252100