Scheme of Instruction, Evaluation

And

Syllabi of

With effect from Academic Year 2023-24

B.E. MINING ENGINEERING

III & IV Semesters

DEPARTMENT OF MINING ENGINEERING

UNIVERSITY COLLEGE OF ENGINEERING

(Autonomous)

Esd.1917 **Hyderabad – 500 007, TS, INDIA** **Estd. 1929**

SCHEME OF INSTRUCITON, EVALUATION & SYLLABI
B.E III & IV SEM w.e.f 2023-2024

Scheme of Instruction for BE (Mining Engineering) - III Semester

S.No.	Course Code	Course Title	Scheme of Instruction			Cont. Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	BS301MT	Engineering Mathematics-III (PDE, Probability & statistics)	3	-	-	3	3	40	60	3
2	PC301MN	Development of Mineral Deposits	3	-	-	3	3	40	60	3
3	PC302MN	Mine Machinery - I	3	-	-	3	3	40	60	3
4	PC303MN	Mine Environmental Engineering-I	3	-	-	3	3	40	60	3
5	PC304MN	Geology for Mining Engineers	3	-	-	3	3	40	60	3
6	ES302CE	Introduction to Fluid Mechanics	3	-	-	3	3	40	60	3
7	ES401ME	Basics of Mechanical Engineering	3	-	-	3	3	40	60	3
PRACTICALS										
8	ES351CE	Fluid Mechanics- lab	-	-	2	2	3	25	50	1
9	PC351MN	Geology Lab for Mining Engineers	-	-	2	2	3	25	50	1
10	PW921MN	Internship-I	-	-	-	-	2	50	-	2
			21	**0**	**04**	**25**	**29**	**380**	**520**	**25**

Note: Evaluation of Internship Grade: Satisfactory/ Good/ Excellent

L : Lectures
P : Practical's
T : Tutorials

SEE : Semester End Examination
CIE : Continuous Internal Evaluation

MT301BS

ENGINEERING MATHEMATICS – III
(PDE AND PROBABILITY & STATISTICS)

Instruction	3 periods per week
Duration of Semester End Examination	3 hours
CIE	40 marks
SEE	60 marks
Credits	3

Course Objectives:	
1	Apply general methodology to solve linear first order and second order partial differential equations
2	To study the classification of second order partial differential equations and solve them by using separation of variables methods
3	To study the types of Random variables
4	To Understand different types of evaluation of statistical Parameters
5	To study the Curve fitting and Rank, Coefficient of Correlation of the data

Course Outcomes:	
CO-1	Find the solutions of first and second order PDE
CO-2	Find solutions of heat equations, wave equations and subject to the initial boundary conditions.
CO-3	To Find Discrete Random Variables and continuous Random Variables and understand their Properties.
CO-4	Solve Probability distributions, Normal evaluation of statistical Parameters
CO-5	To find the empirical relations for curve fitting, least square and correlations, regressions

Unit – I
Definition of Partial Differential Equations, First order partial differential equations, Solutions of first order linear PDEs , Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method
Unit – II
Second-order linear equations and their classification, Initial and boundary conditions, Heat diffusion and vibration problems, Separation of variables method to Solve simple problems in Cartesian coordinates.
Unit – III
Discrete random variables, expectation of discrete random variables, moments, variance of a sum, continuous random variables & their properties.
Unit – IV
Probability distributions: Binomial, Poisson and Normal, evaluation of statistical parameters for these three distributions
Unit – V
Curve fitting by the method of least squares: fitting of straight lines, second degree parabolas and more general curves, Correlation, regression and rank correlation.

SUGGESTED READING:
R.K.Jain& S.R.K Iyengar, Advanced Engineering Mathematics, Narosa Publications, 4th Edition 2014.
B.S.Grewal, Higher Engineering Mathematics, Khanna Publications, 43rd Edition.
Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons.2006.
S. Ross, "A First Course in Probability", Pearson Education India, 2002.
S.C Gupta & Kapoor: Fundamentals of Mathematical statistics, Sultan Chand & Sons, New Delhi.
B.V . Ramana, Higher Engineering Mathematics, 23 rd reprint, 2015.
H.K. Dass, Er. Rajnish Varma, higher Engineering Mathematics, S.Chand Technical 3 rd Edition.

PC301MN

DEVELOPMENT OF MINERAL DEPOSITS

Instruction	3 periods per week
Duration of Semester End Examination	*3 hours*
CIE	*40 marks*
SEE	*60 marks*
Credits	*3*

COURSE OBJECTIVES:	
1	To demonstrate the importance of mining in national economy, understand the terminology associated with the discipline and be familiar with the available regulatory mechanism to enable safe & sustainable mining operations.
2	To know the history of mining and describe the correlation between the development of mining and cultural progress.
3	To introduce the field of mining and provide basic input about mining unit operations.
4	To learn the various modes of access and study the methods of designing the access.

COURSE OUTCOMES: At the end of the course the student will be able to	
CO-1	Know the status and significance of mining Industry.
CO-2	Apply different methods of Shaft sinking according to the ground conditions.
CO-3	Know about Development of workings.
CO-4	Know about different types of supports, their advantages and disadvantages
CO-5	Know about different tunnelling methods.

UNIT-I: MINE ENTRIES

Knowledge about deposit through exploration. Classification of mining methods and their selection criteria. Scheme of mining. Opening up of deposits: Types, size and location of entries into underground coal and other minerals. Selection criteria of mode of entry between shaft, Incline and Adit. Preliminary investigations about strata for making entry and equipment.

UNIT -II: SHAFT SINKING

Location, shape and size of incline and vertical shafts. Surface arrangements for sinking shafts, tools and equipments, ordinary methods of sinking shaft, removal of debris and water, ventilation and lighting, temporary and permanent lining, widening and deepening of shafts.
Special Methods of Shaft Sinking: Pilling , Caisson , Freezing and Cementation methods. Modern techniques of shaft sinking. Design of shafts insets and pit bottoms.

UNIT -III: DEVELOPMENT OF WORKINGS

A: Drivage of cross cuts, drifts, inclines and raises by conventional and mechanized methods. Pull and progress, Calculation of OMS.
B: Arrangements for loading transportation ventilation, support, lighting, and drainage. Drilling patterns and blast design parameters for underground coal mines and hard rock mines.

UNIT -IV: ENVIRONMENTAL PROTECTION

Introduction to environmental maintenance and controlling pollutions. Restoration of land to its shape productivity and environment. Planning of mine closure. Legal provisions for development of workings.

UNIT -V: MODERN TECHNOLOGIES FOR MINE DEVELOPMENT

Modern drill zambos, modern loading and transporting equipment for development of drivages, Tunnel boring machine and its application, Mechanized methods of shaft sinking. Drop rising. Risk to health and safety of workmen, rescue, first aid.

SUGGESTED READING:	
1	Introductory mining engineering-, Howard L.Hartman, Jan M.Mutmansky/ wileyIndia (P) Ltd
2	Elements of mining technology Vol-I - D.J. Deshmukh /Denett&Company
3	Roy Piyush Pal, Blasting in ground excavations and mines, Oxford and IBH, 1st ed 1993
4	C.P. Chugh, Drilling technology handbook, Oxford and IBH, 1sted,1977

E RESOURCES:

1. https://www.nap.edu/read/10318/chapter/5#23
2. http://www.alta.eu/commodities/mining-technology/surface-mining/long-distance- beltconveyors/
3. Indian Mining Journal

PC 302MN

MINING MACHINERY-I

Instruction	3 periods per week
Duration of Semester End Examination	3 hours
CIE	40 marks
SEE	60 marks
Credits	3

Course Objectives:	
1	To understand the electrical layouts and power distribution in mine.
2	To study the rope haulage layouts, technical details and applications.
3	To study the various modes of transport means and electrical circuits.
4	To study the types of pumps, installations and design calculations.

Course Outcomes: At the end of the course, students will be able to	
CO-1	Understand Different types of motive power used in mines and different types of wire ropes and their applications
CO-2	Understand different types of rope haulages
CO-3	Understand diesel, trolley-wire, battery locomotives and machinery used in underground workings
CO-4	Understand different types of pumps and belt conveyor
CO-5	Understand how electricity will be supplied in mines.

UNIT-I: Introduction

Different types of motive power used in mines – their field of application, relative merits and demerits; transmission and distribution of compressed air in mines, compressed air in mines, compressed air drills. Elements of the transport system, classification and techno economic indices. Wire ropes – classification, construction, fields of application, rope capping and splicing; deterioration of rope in use and its prevention; testing of ropes, selection and maintenance, rope calculations.

UNIT -II: Rope haulage

Construction of the wire ropes, rope haulages–gravity, direct, balanced direct, main &tail, endless, reversible endless. Suitability of these haulages and their limitations. Dimension of ropes, drums and pulleys, care and maintenance of ropes, changing of haulage ropes, rope splicing, safety appliances in haulage road, and signaling, statutory requirements of haulages.

UNIT -III: Other transport systems

Locomotives– diesel, trolley-wire, battery locomotives, constructional features and safety devices and comparison of different types; underground and surface battery charging stations and safety measures, locomotive calculations;

Shuttle cars, underground trucks, load-haul- dumpers, SDL, aerial rope ways, gravity transport, principles of hydraulic& pneumatic transportation and their fields of application, electric layouts, man-riding systems.

UNIT -IV: Pumping& Conveying

Different types of drives, installation and maintenance of pumps and pipes in shafts and roadways, electrical layouts, various sources of water in mines, design of sumps.

Face haulage and conveyors – Various types of conveyors, Scraper chain conveyors, AFCs, belt conveyors, cable belt conveyor, shaking and vibrating conveyors, armoured flexible conveyors, high angle conveying, electrical layouts. Numerical problems in conveyors

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UNIT -V: Mine electrical engineering
Distribution of electric power in mines, types of mine cables and their fields of applications, mining switch gears and their installation in hazardous atmosphere, flame proof enclosures, intrinsically safe circuits, (examples) safety aspects and signaling. Mine telephone system and latest development in mine communications.

SUGGESTED READING:	
1	Elements of Mining Technology Vol. III, D.J. Deshmukh, Denett& Company,
2	Mine Transport – N.T. Karelin, Orient Longmans,
3	Mining and Transport – S. C. Walker, Elsevier
4	Introduction to Mining Engineers – Hartman. H.L, John Wiley & Sons.

E RESOURCES:	
1	http://www.westrac.com.au/Industries/Pages/Mining.aspx
2	http://www.springer.com/in/book/9783319477909

PC303MN

MINE ENVIRONMENTAL ENGINEERING – I

Instruction	*3*periods per week
Duration of Semester End Examination	*3 hours*
CIE	*40 marks*
SEE	*60 marks*
Credits	*3*

COURSE OBJECTIVES:	
1	Students should be aware of the principles of ventilation and basic ventilation systems.
2	To know the various ventilation systems in underground mines
3	To know the various ventilation plannings and distribution methods

COURSE OUTCOMES: At the end of the course, students will be able to	
CO-1	Understand origin, physical and chemical properties of mine gases and their physiological effects
CO-2	Understand Heat, Humidity and Air flow in mines
CO-3	Understand Principal types of mine fans, Series and parallel operation of mine fans.
CO-4	Understand Standards of ventilation and Air distribution.
CO-5	Understand Ventilation Planning and Network analysis.

UNIT -I: MINE GASES
Atmospheric air – its composition, mine air – its general composition, origin, physical and chemical properties of mine gases, physiological effects of breathing mine gases and its detection, sampling and analysis of mine air, methane drainage

UNIT -II: HEAT, HUMIDITY AND AIR FLOW
Sources of heat in mines, effects of heat and humidity, kata thermometer and hygrometer. Laws governing the airflow in mines, resistance of airways, Equivalent orifice, Natural ventilation, determination of NVP, direction of natural ventilation

UNIT-III: MECHANICAL VENTILATION
A: Principal types of mine fans, fan characteristic curves, mine characteristic curves, operating point, reversal of mine fans, Evasee and its importance. **B:** Series and parallel operation of mine fans, booster fans, Face Ventilation. Overlap ventilation systems and controlled re-circulation

UNIT -IV: STANDARDS OF VENTILATION AND AIR DISTRIBUTION
Standards of ventilation including permissible air velocities, Ascensional, Descensional, Homotropal, Antitropal ventilation, Distribution of air, ventilation stoppings, Air crossings, Measurement of air velocities and pressure.

UNIT -V: VENTILATION PLANNING
Quantity and pressure requirement. Ventilation layout for coal mining and metal mining. Calculation of air quantity and total mine head required for ventilating a mine. Introduction to Network analysis: Hardy-Cross method, Ventilation survey.

SUGGESTED READING:	
1	Mine Environment and Ventilation – G.B. Misra, Oxford University Press
2	Mine Ventilation and Air Condition – HL Hearlman,Wiley India (p) ltd
3	Environmental Engineering in Mines, Vatukuri V.S. & Lama R.D,CambridgeUnversity Press.
4	Mining and Environment, Dhar B.B, APH Publishing.

E RESOURCES:

1. http://technology.infomine.com/reviews/ventilation/welcome.asp?view=full

2. https://link.springer.com/article/10.1134/S1062739116041178

PC304MN

GEOLOGY FOR MINING ENGINEERS

Instruction : *3 periods per week*
Duration of Semester End Examination : *3 hours*
CIE : *40 marks*
SEE : *60 marks*
Credits : *3*

Course Objectives	
1	This course is designed for
2	Introducing basic concepts of geology to the mining engineers
3	Offering an understanding of the geology-related aspects of the mining industry to mining engineers
4	developing expertise in dealing the mineral exploration and extraction-related issues
5	Gaining the technical knowledge to communicate with the mining industry geologist effectively.

Course Outcomes: By the end of the course, students will be able	
CO-1	To appreciate the importance of geological science to mining engineers
CO-2	To know various geological aspects influencing the mining operations
CO-3	To understand the significance of geological structures in mineral recovery and mine operations
CO-4	To learn about the distribution of mineral resources across the world and India
CO-5	To gain expertise to maximize the mining output at the lowest cost

UNIT I: Introduction to Geology

Physical Geology: Various branches and their application in mining engineering. Geo-tectonics: internal structure of the earth, Continental Drift Theory and Plate Tectonics, Isostasy, Geological hazards.

Paleontology: Fossils and their uses in constructing the geological past.

Stratigraphy: Principles, geological time scale, Major geological formations of India, their distribution, and associated metallic and energy minerals.

UNIT II: Minerals and Rocks

Mineralogy: Minerals and their classification, Determinative properties of minerals, common rock-forming, economic and energy minerals. **Petrology:** Types of rocks, their origin, distribution, and classification. Rock Cycle, Igneous petrology; Forms of igneous intrusions. Elementary knowledge of magma and its consolidation & mineral-rock formation. Minerals are associated with hydrothermal fluids.

UNIT III: Structural Geology

Strike and Dip: Attitude of strata, strike, true and apparent dip;

Primary and Secondary Structure: Elementary knowledge of rock deformation and structural characteristics of deformed rocks; Folds: definition and associated terminology and classification. Joints: definition and classification; Faults: mechanism of formation, elements, terminology, geometric and genetic classification; Structural control of mineral deposits

UNIT IV: Economic Geology
Economic Geology: Introduction and scope; ore and gangue; processes of ore formation; Global mineral resources, occurrence, and distribution **Mineral Deposits of India:** distribution and mode of occurrence of metallic (Iron, Manganese, Copper, Lead, Zinc) and non-metallic deposits.

UNIT V: Energy Minerals
Coal: Coal chemistry, Rank, characteristics, and important constituents of coal; classification and origin of coal; chief characteristics of Indian coals; geology of the principal coalfields of India. **Petroleum:** Concept of organic constituents of petroleum origin, migration, accumulation, the concept of traps, and important petroliferous basins of India. **Nuclear minerals:** distribution and occurrence of Uranium and Thorium in India

SUGGESTED READING:	
1	P. K. Mukherjee, *A Text Book of Geology*, The World Press Pvt. Ltd., 9th Edition, 1982
2	Parbin Singh, *Engineering and General Geology.S.K. Kataria& Sons, 2008*
3	Umeshwar Prasad, *Economic Geology: Economic Mineral Deposits*, CBS Publications, 2016
4	William C. Peters, Exploration and Mining Geology, Wiley, 1987
5	Cosgrove, John W., and John A. Hudson. Structural geology and rock engineering. World Scientific Publishing Company, 2016

SUPPLEMENTARY READING	
1	Marat Abzalov, *Applied Mining Geology*, Springer International Publishing AG Switzerland, 2016
2	Chatterjee, KaulirKisor. Uses of energy, minerals and changing techniques. New Age International, 2006.
3	Stevens, Robert. Mineral exploration and mining essentials. Port Coquitlam, British Columbia, Canada: Pakawau Geo Management, 2010.
4	Aswathanarayana, U. "Principles of nuclear geology." (1985).
5	Saklani, PremSwarup, ed. Glossary of structural geology and tectonics. Satish Serial Publishing House, 2008.

ES302CE

INTRODUCTION TO FLUID MECHANICS

Instruction	3 periods per week
Duration of Semester End Examination	3 hours
CIE	40 marks
SEE	60 marks
Credits	3

Course Objectives:	
1	Understand concepts of various fluid properties
2	Understand the basic concepts of fluid motion
3	Knowledge of forces due to fluids and energy principles
4	Study of flow measurement devices
5	Study of compressible fluid flows for different conditions of expansion

Course Outcomes:	
CO-1	Understand key fluid properties, differentiate between ideal and real fluids, and grasp concepts like viscosity and surface tension
CO-2	Proficiency in describing flow patterns, identifying laminar vs. turbulent flows, and utilizing streamlines for fluid flow analysis
CO-3	Acquire the ability to calculate fluid pressure, apply continuity and Bernoulli's equations, and analyze real-world applications like venturimeters
CO-4	Develop expertise in distinguishing laminar and turbulent flows, calculating friction factors, and understanding fluid flow behavior in pipes
CO-5	Gain insight into compressibility, apply energy and momentum equations, and interpret parameters like Mach Number and stagnation properties in compressible flow scenarios

Unit – I:

Fluid Properties: Basic concepts: Specific weight, specific volume, specific mass, gravity, viscosity, bulk modulus, vapour pressure, capillarity and surface tension, viscosity-Newton’s law of viscosity, Newtonian and Non-Newtonian fluids, classification of fluids-ideal and real.

Unit – II:

Fluid Kinematics: Fundamentals of fluid flow-description of flow pattern, stream lines, path lines, streak lines, stream tubes, classification of fluids, steady and unsteady flows, laminar and turbulent flows, uniform and non-unsteady flows, rotational and irrotational flows, laminar and turbulent flows, uniform and non- uniform flow, one, two and three dimensional flows, stream function, and velocity potential function, flow net significance and use.

Unit – III:
Fluid Statics: Fluid pressure at a point, variation of pressure in a fluid, measurement of pressure - simple and differential manometers. Fluid Dynamics: Convective and local acceleration, concept of continuity, three dimensional continuity equation, body forces and surface forces, body force potential, Euler's equation of motion for 3-D flow, Bernoulli's equation by integration of Euler's equation, significance of Bernoulli's equation and its limitations, applications of Bernoulli's equation- venturimeter, pitot tube. Impulse-momentum equation and its applications- forces on a pipe bend.

Unit – IV:
Flow Through Pipes: Introduction, types of flows-laminar and turbulent, Reynolds experiment, Darcy-Weisbach equation, and steady laminar flow through circular pipes, Hagen-Poiseuille's equation, hydro-dynamically smooth and rough boundaries- criteria and resistance to flow of fluid in smooth and rough boundaries, variation of friction factor.

Unit – V:
Compressible Flow: Compressibility of liquids and gases, differential form of continuity equation, Bernoulli's energy equation for isothermal and adiabatic conditions, velocity of pressure wave, wave velocity for adiabatic and isothermal conditions, Mach Number and Mach cone, stagnation pressure and temperature.

SUGGESTED READING:	
1	K. Subramanya, 'Theory and Applications of Fluid Mechanics', Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1993
2	Vijay Gupta and Santosh K. Gupta, 'Fluid Mechanics and its applications', Wiley Eastern Ltd., New Delhi,1984
3	K.L. Kumar, 'Engineering Fluid Mechanics', Eurasia Publishing House Pvt Ltd., New Delhi, 2009
4	Valentine, H.R., 'Applied Hydrodynamics', Butterworths & Co Ltd., London, 1959 5. P.N. Modi and S.M.Seth, 'Hydraulics and Fluid Mechanics', Standard Book House, New Delhi, 2013

ES401CE

BASICS OF MECHANICAL ENGINEERING

Instruction	3 periods per week
Duration of Semester End Examination	3 hours
CIE	40 marks
SEE	60 marks
Credits	3

Course Objectives	
1	To understand basic concepts of thermodynamics.
2	To understand practical application of thermal engineering concepts in various energy consumption and energy conversion systems
3	To understand the working principles of I.C. engines, Turbines and Refrigeration systems
4	To familiarize the design and working principles of transmission drive systems.
5	To understand various manufacturing processes.

Course Outcomes After completion of the course, students will be able to	
CO-1	Differentiate between heat and work transfers and relates them with enthalpy changes
CO-2	Formulate various power cycles, represents them on p-V, T-S diagrams and also study their feasibility in practical applications
CO-3	Understand the work saving methods in functioning of Turbines and refrigeration systems
CO-4	Design belt drives and gear drives and formulate methods for balancing of rotating masses
CO-5	Demonstrate the working of various welding processes and gain knowledge of working of unconventional methods of manufacturing.

UNIT-I

Statements of zeroth law, 1st , 2nd and 3rd Laws of thermodynamics with their applications. Representation of thermodynamic processes on p-V and T-s plots. Ideal gas equation. Relations for internal energy and entropy changes, heat and work transfers for closed systems. Steady flow energy equation for an open system, and its derivation and applications in turbines, compressors, nozzles and diffusers. Relations for enthalpy changes, heat and work transfers for open systems.

UNIT-II

Power Cycles: Concept of air standard cycles- Carnot cycle, Otto, Diesel, Joule cycles and Brayton cycles with applications. Representation of Cycles on P-V and T-s plots. Calculation of Cycle efficiencies.

IC Engines: Classification of IC Engines. Mechanical components of IC Engines. Working Principles of four stroke and two stroke cycle engines. Differences between petrol and diesel engines. Calculation of engine parameters -IP, BP, Specific fuel consumption, mechanical and thermal efficiencies.

UNIT-III
Refrigeration: Working of vapour compression refrigeration system and window Air conditioners. COP calculation. Common refrigerants in use, environmental impacts of refrigerants. **Steam and Gas power plants**: Layout of simple steam power plant and working of its individual units. Simple closed cycle and open cycle gas turbine plants. Lay out and efficiency of gas turbine plants **Hydraulic Turbines and pumps**: Layout of Hydroelectric power plant. Principles and operation of Pelton wheel turbine, Francis turbine (elementary treatment only). Parts and working of centrifugal pumps. Need for priming of pumps. Working of single and double acting Reciprocating pumps.

UNIT-IV
Belt drives: Velocity ratio, effect of slip. Length of open and cross belts. Ratio of tensions, centrifugal tension and its effect on power transmission. **Gear drives**: Nomenclature and types of gears. Problems on simple and compound gear trains. **Governors**: Working of Watt, Porter and Hartnell governors. Effect and power of governor. Stability of governor and isochronism. Balancing of several masses in one plane and in several planes.

UNIT-V
Production Techniques: Welding: Principles of Arc, Gas and Resistance welding, soldering and Brazing, **Machining:** Working mechanism of Lathe, milling and drilling machines by simple sketches. Working principle of CNC machines Basic principles of USM, EDM, LBM and ECM. **Casting:** Principles of sand casting and die casting. Plastics and their moulding methods.

SUGGESTED READING

1. R.K. Rajput, "Thermal Engineering", Laxmi Publications, New Delhi, Eighth Edition, 2010.
2. P.K. Nag, " Basic and Applied Thermodynamics", Tata Mc-Graw Hill, Eigth Reprint, 2006
3. Thomas Bevan, "Theory of Machines", College Book Store (CBS) Publishers, 3rd Edn., 1986.
4. Hajra Choudary, "Elements of Workshop Technology-Vel. I and 2, Asian Publishers, 6th Edn., 1993.
5. P. N. Rao, "Manufacturing Technology", Vol. I &2, Tata McGraw- Hill, 2nd Edn., 2009.

ES351CE

FLUID MECHANICS LABORATORY

Instruction	*2 practical classes per week*
Duration of Semester End Examination	*3 hours*
CIE	*25marks*
SEE	*50 marks*
Credits	*1*

Course Objectives:	
1	Calibration of flow measuring devices
2	Verification of the Bernoulli's theorem
3	Demonstration of the various losses in pipes

Course Outcomes:	
CO-1	Ability to measure flow in closed conduits and flumes
CO-2	Application of Bernoulli's principle in Hydraulics
CO-3	Computation of various losses in pipes and pipe fittings

List of Experiments:	
1	Determination of Cd and Cv of an orifice
2	Calibration of a mouth piece
3	Determination of Cd of a mouth piece for unsteady flow in a hemi-spherical tank
4	Calibration of a rectangular notch
5	Calibration of a triangular notch
6	Calibration of a broad crested weir
7	Verification of Bernoulli's principle
8	Determination of types of flows
9	Determination of major and minor losses in the pipes
10	Calibration of a Venturi meter

MC351MN

GEOLOGY LAB FOR MINING ENGINEERS

Instruction	*2 periods per week*
Duration of Semester End Examination	*3 hours*
CIE	*25 marks*
SEE	*50 marks*
Credits	*1*

COURSE OBJECTIVES	
1	Identification and familiarizing properties of minerals, rocks, and ores
2	Interpreting and solving geological maps and structural geology problems
3	Understanding of distribution of various mineral resources and their quantification

COURSE OUTCOMES: By the end of the course, students will be able	
CO-1	to identify various metallic and non-metallic and ore-forming minerals and major rocks
CO-2	to gain knowledge to interpret various geological maps pertaining to the mining industry requirements
CO-3	to understand the significance of geological structures in mineral recovery and mine operations
CO-4	to have the expertise for maximizing the mine output
CO-5	to have the expertise for estimating mineral tonnage, grade, and reserves

List of experiments to be conducted (Any ten)	
1	**Study of minerals and rocks in hand specimens:**
i	Metallic and non-metallic minerals
ii	Igneous, metamorphic and sedimentary rocks
iii	Mohs hardness scale: characterizing and arranging the minerals
2	**Study of primary and secondary structures**
i	Study of 3-D structural models
ii	Measurement of strike and dip
iii	Effects of folds and fractures on strata/orebodies and their importance in mining operations
3	**Study the maps**
i	Geological map of India
ii	Topographical map of India
iii	Mineral province of India
4	**Quantitative mapping**
i	Determining the outcrop thickness by graphical methods
ii	Estimation of tonnage, grade, resources, and reserves

Field-based study

1. Visit to open and underground mine

SUGGESTED READING	
1	Bradley Deline, Randa Harris, and Karen Tefend, Laboratory Manual for Introductory Geology, University of North Georgia Press 2015
2	N.ChennaKesavulu Engineering Geology Lab Record / Manual, Trinity Press, 2016

PW 921MN	**INTERNSHIP- I***					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	-	2
Evaluation	**SEE**	--	**CIE**		50 Marks	

Course Objectives:	
1	To expose the students in understanding the real-life practical problems and technologies.
2	To provide an opportunity to integrate various aspects of learning reference of practical problems.
3	To enhance the confidence of the students by interaction with field professionals

Course Outcomes: Student will be	
CO-1	Able to complete the task or realize a pre specified target within a limited scope.
CO-2	Able to learn to find alternate viable solutions for a given problem based on criteria.
CO-3	Ability to learn field constraints and also documentation of technical report.

Summer Internship is introduced as part of the curricula to encourage students to work on problems of interest to industries or in a consulting organization. A batch of two or three students will be attached to Underground projects in Mining Industry for a period of two weeks. This will be during the vacation followed after the completion III semester course. Faculty member (s) will be acting as an internal guide(s) for the batches to mentor and monitor the progress and also interacts with the industry guide (s) as per the need.

After the completion of the internship, students need to submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the Department. Award of sessional are based on the performance of the student at the work place and will be judged by internal guide (s) (25 Marks) followed by presentation before the committee constituted by the Department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.

***Students have to undergo internship of 2 Weeks duration at the end of semester II (during vacations) and the credits will be awarded after evaluation in III semester.**

Scheme of Instruction for BE (Mining Engineering) - IV Semester

S.No.	Course Code	Course Title	Scheme of Instruction			Cont Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
THEORY										
1	PC401MN	Surface Mining Technology	3	-	-	3	3	40	60	3
2	PC402MN	Mining Machinery II	3	-	-	3	3	40	60	3
3	PC403MN	Rock Mechanics	3	-	-	3	3	40	60	3
4	PC404MN	Mine Surveying	3	-	-	3	3	40	60	3
5	ES404ME	Strength of Materials	3	-	-	3	3	40	60	3
6		PE - I	3			3	3	40	60	3
7	ES401EC	Basic Electronics Engineering	3	-	-	3	3	40	60	3
PRACTICALS										
8	PC451MN	Mine Surveying Lab	-	-	2	2	3	25	50	1
9	PC452MN	Mine Machinery Lab	-	-	2	2	3	25	50	1
			21	**0**	**04**	**25**	**27**	**330**	**520**	**23**

* At the end of IV semester students should undergo Survey camp (during vacation). Marks will be awarded in V semester.

CODE	PROFESSIONAL ELECTIVE-I
PE411MN	Rock Excavation Engineering
PE412MN	Sustainable Mineral Industry
PE413MN	Mineral Exploration

L : Lectures
P : Practical's
T : Tutorials

SEE : Semester End Examination
CIE : Continuous Internal Evaluation

PC401MN

SURFACE MINING TECHNOLOGY

Instruction	*:* 3 periods per week
Duration of Semester End Examination	*: 3 hours*
CIE	*: 40 marks*
SEE	*: 60 marks*
Credits	*: 3*

COURSE OBJECTIVES:	
1	The objective of this course is to provide students in mining engineering with the necessary knowledge
2	To know about excavation methods in surface mines
3	To design safe of suitable machinery for Surface mines
4	To plan efficient and environmentally responsible surface mining operations.
5	To know surface transportation methods in surface mines

COURSE OUTCOMES: At the end of the course, students will be able to	
CO-1	Understand Status of surface mining, types of surface mines and basics of surface mines.
CO-2	Design the surface mines Layouts.
CO-3	Understand Ground preparation methods and various equipment related to ground preparation
CO-4	Understand Excavation system in surface mines
CO-5	Understand different modes of transport system in surface mines and Types of waste dump

UNIT-I: Introduction
Types of surface mines, applicability and limitations, concept of stripping ratio, stripping economics, concept of ultimate pit limits, design of haul roads, elements of surface mine planning – selection of site for box cut, selection of operating parameters like bench height, width, slope, etc

UNIT -II: Layout and design of surface mine
Slopes in surface mines – Highwall and waste dumps; Working pit slope and ultimate pit slope, common modes of slope failure, factors influencing stability of slopes, development of open cast mine layouts for various shapes of deposits. Conversion of underground mine to opencast mine vis-a vis open cast mine to underground mine related problems and probable solutions.

UNIT -III: Ground preparation methods
A: Preparation of the site – ripping, drilling and blasting; types, operation, selection, applications and limitations of ground preparation equipment's-ripper, dozer **B:** Blast hole drills and rock breakers, determining number of drilling machines, dozers and rippers for planned production. Concept of ripability, blasting in open cast mines over developed galleries.

UNIT -IV: Excavation system in surface mines
Selection criteria for equipments used in surface mines. Classification, application and limitations of different types of equipments used in surface mining projects; Cycle time and productivity calculation for excavating and loading equipments. Drag line - calculation of required bucket capacity for a given handling requirement, method and cycle of operations of drag lines, front end loaders, scrapers, bucket wheel and bucket chain excavators, surface miners. Determining the capacity and number of shovels and dumpers for planned production.

UNIT -V: Transport and waste dumps
Scope and application of different modes of transport system in surface mine-trucks, synchronization of shovel and dumper capacity for required production; conveyers, mode of operations, applicability and limitations, scope and application of in-pit crusher in surface mines. types of surface mine lighting. Types of waste dump- internal and external; dump formation methods and corresponding equipment; dump stability and stabilization measures.

SUGGESTED READING:	
1	Surface Mining Technology Samir Kumar Das, Lovely Prakashan.
2	Surface Mining – GB Misra, Dhanbad Publishers
3	Principles and Practices & Modern Coal Ming, Singh R.D, New Age International.
4	Mine Planning For Coal, Mathur S.P., M.G. Consultants
5	Introductionary Mining Technology – H L Hartman, Wiley India (p) Ltd

E-RESOURCES:
http://www.edumine.com/courses/online-courses/conventional-methods-of-resource-reserveestimation/
http://www.springer.com/in/book/9783319477909

PC402MN

MINING MACHINERY II

Instruction	3 periods per week
Duration of Semester End Examination	*3 hours*
CIE	*40 marks*
SEE	*60 marks*
Credits	*3*

Course Objectives:
• To understand the functioning of winding engines and other winding accessories.
• To study surface and pit bottom layouts, various coal face machinery.
• To study the design and construction details of excavating & transporting equipment's used in surface mines.
• To know the various statutory aspects like CMR, MMR and the relevant DGMS circulars related to this course.

Course Outcomes: After completion of course, the students will be able to	
CO-1	Know about Winding engines
CO-2	Know Winding accessories and layouts
CO-3	Know coal drills, coal ploughs, cutter loaders and continuous miners and modern concepts in underground mine mechanization
CO-4	Select the Excavation and loading machinery in surface mines
CO-5	Know Classification of transport equipment's, dumpers, Tractors, trailers, dump trucks,Rippers (types), Motor Graders, Bull Dozers, Rock breakers, Road Compactors, Water Tankers.

UNIT – I
Winding engines:
Winding systems, drum winders, drives, mechanical braking of winders, safety devices in winding, overwind and over speed protection, Koepe and multi-rope friction winding, electrical layouts. Duty cycles of drum winders of different drum cross-sections. Special problems of deep shaft winding

UNIT – II
Winding accessories and layouts :
Head gear and their design, head sheave, cages and skips, suspension gear, shaft fittings and appliances – guides, keps, etc., signalling systems, winding calculations relating to rope size & numbers, capacity & power requirement for cages, skips, drum and Koepe winding systems. Surface and Pit-bottom layouts - Mine car circuits at the surface and pit bottom, creepers, skip winding – loading and discharge arrangements. Case studies, railway sidings and layouts.

UNIT – III
Coal face machinery:
Construction, salient mechanical and electrical features and operations of coal drills and their control panels, different types of mechanical loaders, coal ploughs, and continuous miners. Development road headers in face mechanization, longwall mining equipment, electrical and hydraulic layouts; Condition monitoring of mining machinery for underground, modern concepts in underground mine mechanization.

UNIT – IV
Excavation and loading machinery in surface mines:
Classification. Hydraulic system diagram. Under carriage. Design and Constructional details of Front end loaders, Hydraulic excavators and Electric Rope shovel, Backhoe, Dragline, and Bucket Wheel Excavator. Bucket Chain Excavator and Surface Miners. Condition monitoring of mining machinery for opencast mines and ore handling plants,

UNIT – V
Other machinery in surface mines:
Classification of transport equipments; Construction and technical specifications of Dumpers of different types including multi-axial dumpers,, Tractors, trailers, dump trucks, Rippers (types), Motor Graders, Bull Dozers, Rock breakers, Road Compactors, Water Tankers.

SUGGESTED READING
1. Elements of Mining Technology Vol. I & II, Deshmukh D.J., Denett & Company
2. Pumps Focus Compressors Walkar, winding & Transport, Cherkasky B.M.
3. Mine Mechanisation and Automation, Alemgren G, U.Kumar.
4. Coal Mining Series, Ernest Mason, London, 1952.

PC403MN

ROCK MECHANICS

Instruction	3 periods per week
Duration of Semester End Examination	*3 hours*
CIE	*40 marks*
SEE	*60 marks*
Credits	*3*

Course Objectives:	
1	Grasp the physical and mechanical properties of rocks, covering density, compressive strength, and other key factors
2	Gain proficiency in stress-strain analysis, failure theories, and advanced methods for evaluating rock behavior
3	Apply acquired knowledge to real-world engineering challenges, including rock mass classification and prediction of rock failures

Course Outcomes: After completion of course, the students will be able to	
CO-1	Analyze rock properties to predict mechanical behavior and suitability for engineering applications
CO-2	Apply classification systems to assess rock mass conditions and make informed decisions in engineering projects
CO-3	Evaluate stress and strain in rocks using advanced techniques for ensuring structural stability
CO-4	Estimate in-situ stress and assess dynamic deformation of rocks for engineering design
CO-5	Utilize rock failure theories to identify potential failure mechanisms and enhance rock engineering practices

UNIT I

Physio-mechanical properties of rocks:

Physical properties: Density, porosity, void ratio, moisture content, permeability.

Mechanical Properties: Preparation of rock samples, determination of mechanical properties of rocks: compressive strength, tensile strength, shear strength, modulus of elasticity, poisson's ratio, cohesion, angle of internal friction, Protodyaknov`s strength index, longitudinal wave velocity, rock burst ability index, Schmidt rebound hardness number, slake durability index.

UNIT II

Stress strain analysis: Analysis of stress and strain in two and three dimensions, Principal stress, stress ellipsoid, Determination of principal stress and strain invariants; Differential equilibrium equations; compatibility equation of stress and strains, Stress and strain transformation, Mohr's circle of stress and strain, Plane stress and plane strain condition.

UNIT III
Rock mass classification: Core recovery, Rock Quality Designation, Rock Mass Rating, Indian-geo mechanics classification, Q System, Geological strength index, Slope mass rating, rippability classification, Coal mine roof rating.

UNIT IV
Rock mass behaviour: Confining pressures, effect of water, time, temperature. Insitu stress and their estimation; flat jack method, over coring method and hydro fracturing method; Horizontal and vertical stress, intact rock strength and deformability; measuring devices for load, stress and strain. Dynamic loading of rocks Time dependent properties of rock, creep, mechanism of creep of rocks – different stages, rheological models

UNIT V
Rock failure theories: Coulomb, Mohr's – Coulomb, Hoek and Brown, Griffiths and Drucker – Prager and Its related calculations

SUGGESTED READINGS:
1. Deb D and Verma AK, "Fundamental and application of rock mechanics",. PHI publication
2. Debasis Deb, "Finite elemnt method: concepts and application in geo mechanics"
3. SP Timoshenko, JN. Goodier, "Theory of Elasticity"
4. V Singh and B P Khare, "Rock Mechanics and ground control"
5. Obert and Duvall, "Rock Mechanics and design of structures in rock"
6. Jumikis, "Rock Mechanics"
7. Goodman, "introduction to Rock Mechanics"
8. Binawiski ZT, "Engineering rock mass classification"
9. Singh & goel, " Rock mass classification"

PC404MN

MINE SURVEYING

Instruction : 3 periods per week
Duration of Semester End Examination : *3 hours*
CIE : *40 marks*
SEE : *60 marks*
Credits : *3*

Course Objectives:	
1	Ability to apply knowledge of mathematics in surveying to calculate areas and volumes for different projects.
2	Ability to identify, formulate and solve problems in the field of advanced surveying.
3	Ability to analyze survey data and design mining engineering projects.
4	Ability to engage in life- long learning with the advances in survey techniques.

Course Outcomes: At the end of the course, students will be able to	
CO-1	Understand basics and historical methods of survey.
CO-2	Understand application Leveling as a part of surveying.
CO-3	Understand traversing methods using various survey instruments.
CO-4	Understand the fundamentals of triangulation survey.
CO-5	Understand contours and using contours for calculations.

UNIT – I:

INTRODUCTION & LEVELING

Overview of Surveying, Objectives, Principles and classifications. Distance and Directions: Distance measurements using conventional methods. Use of chain and compass, meridians, Azimuths and Bearings, declination, computation of angles.

UNIT–II:

Leveling Instruments – component parts, Temporary and Permanent adjustments – methods of leveling.

Traversing: Principles of Traversing, Open and Close traverse using theodolite, Bowditch correction.

Triangulation: Principles of triangulation survey, triangulation using theodolite, basic figures used in triangulation.

UNIT–III:

CONTOURING AND THEODOLITE SURVEYING

A: Contouring: Characteristics and uses of contours, methods of conducting contour surveys – their plotting. L.S. and C.S. Surveying – their plotting, Calculation of volume from contours.

B: Theodolite Surveying: Theodolite – basic definitions, Temporary and Permanent Adjustments, Measurement of horizontal and vertical angles, Principles of Electronic Theodolite.

UNIT –IV:

Correlation survey

Basics of correlation, verticality of shafts, measurement of depth of shafts, Correlation by Weisbach triangle method, Weisbach quadrilateral method

Setting out curves: types of curves, curve ranging, design and setting out simple curves, surface and underground curves.

UNIT–V:
PHOTOGRAMMETRIC, GLOBAL POSITIONING SYSTEM
Principles of photogrammetry, Aerial Photographs, scale of vertical photographs, Terrestrial Photogrammetry. Introduction to Global Positioning System, Application of GPS in mining, Remote Sensing –basic Principles, Application of Remote Sensing. EDM and modern instruments slope and open pit surveys, statutory requirements for mine plans, open pit benches.

TEXT BOOKS:
1. Surveying (Vol-1,2& 3) by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain- Laxmi Pubicaions (P) Ltd., NewDelhi.
2. Surveying and leveling (Vol 1 & 2) – Kanitkar, A.V.G. Prakash
3. Surveying (Vol – 1,2 & 3), by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) Ltd., NewDelhi.
4. Surveying (Vol 1,2& 3), Duggal S.K. Tata Mc.Graw Hill Publishing Co.Ltd. New Delhi, 2004
5. Surveying Vol 1 & 2 & 3, Arora K R Standard Book House, Delhi,2004.

SUGGESTED READINGS::
1. Elements of Plane Surveying, Arthur R. Benton and Philip J Taetly, McGrawHill-2000
2. Plane Surveying, Chandra A M, New age International Pvt. Ltd., Publishers, New Delhi,2002.
3. Apply Principles of triangulation survey. Text book of surveying by C. Venkataramaiah, Universities Press.
4. Higher Surveying, Chandra A M. ,New age International Pvt. Ltd. Publisher, NewDelhi,2002
5. Surveying and leveling by R. Subramanian, Oxford University Press, NewDelhi

E RESOURCES:
1. http://www.ism-minesurveying.org/mine-surveying.html
2. http://www.minesurveyor.net/
3. http://www.pobonline.com/articles/84226-underground-surveying
4. http://www.ism-minesurveying.org/mine-surveying.html
5. http://www.springer.com/gp/book/9781504123679

ES404ME

STRENGTH OF MATERIALS

Instructions	*(3L) hrs per week*
Duration of SEE	*3hours*
CIE	*40 Marks*
SEE	*60 Marks*
Credits	*3*

Course Objectives:	
1	Understand the concept of stress, strain and elastic behaviour of materials
2	Know the concepts of strain energy, principal stress and principal planes
3	Learn the bending moment, shear force and the corresponding stress distribution
4	Study the deflections and its applications
5	Understand the theory of torsion and stresses in springs

Course Outcomes:	
CO-1	Apply the fundamental concepts of stress and strain
CO-2	Determine principal stresses and principal planes of a state of stress
CO-3	Analyze the structural members subjected to tension, compression, bending, torsion and combined stresses
CO-4	Determine the deflections of beams
CO-5	Solve the stresses in springs

UNIT - I

Simple Stresses and Strains: Types of stresses and strains, Hook's law, stress-strain curve for ductile materials, moduli of elasticity, Poisson's ratio, linear strain, volumetric strain, relation between elastic constants, bars of varying sections, bar of uniform strength, compound bars and temperature stresses.

UNIT - II

Shear Force and Bending Moment: Relation between intensity of loading, shear force and bending moment, shear force and bending moment diagrams for cantilever and simply supported beams with and without overhanging for point loads, uniformly distributed loads, uniformly varying loads and couples. Compound Stresses: Stresses on oblique planes, principle stresses and principle planes, Mohr circle of stress and ellipse of stress.

UNIT - III

Theory of Simple Bending: Assumptions, derivation of basic equation, section modulus, moment of resistance, determination of flexural stresses. Direct and Bending Stresses: Basic concepts, core for rectangular solid and hollow circular and I sections. Distribution of Shear Stress: Equation of shear stress, distribution across rectangular, circular, diamond, T and I sections.

UNIT - IV

Torsion: Theory of pure torsion, derivation of basic equation, hollow circular shafts, strain energy, transmission of power, combined bending and torsion. Springs: Close and open coiled helical springs subjected to axial loads and axial couples, strain energy in springs, carriage springs.

UNIT - V
Deflections: Deflections of cantilever and simply supported beams including overhanging beams for point loads and uniformly distributed loads by double integration and Macaulay's method. Strain Energy: Strain energy in bars due to gradually applied loads, sudden loads, impact loads and shock loads.

SUGGESTED READING:
1. Ferdinand P Beer et.al., Mechanics of Materials, Tata McGraw-Hill, 2004.
2. B.C. Punmia, Strength of Materials, Laxmi Publishers, 2000.
3. S. Ramamrutham, Strength of Materials, Dhanpat Rai& Sons, 1993.
4. D.S. Prakash Rao, Strength of Materials - A Practical Approach, Universities Press, 1999.
5. R.K. Rajput, Strength of Materials, S. Chand & Co., 2003.
6. G.H. Ryder, Strength of Materials, Third Edition in SI units, Macmillan Indian Limited, Delhi, 2002.

PE411MN

ROCK EXCAVATION ENGINEERING

Instruction	3 periods per week
Duration of Semester End Examination	*3 hours*
CIE	*30marks*
SEE	*70 marks*
Credits	*3*

Course Objectives:
This course introduces
• Rock excavation engineering, physico-mechanical and geotechnical properties, selection of excavation method.
• Mechanics of rock drilling and rock fragmentation by explosives, selection of explosives for rock excavation.
• Advances in blast design for underground excavation, Tunnel boring machines.

Course Outcomes: After completion of course, the students will be able to	
CO-1	Understand Physico-mechanical and geotechnical properties of rocks Vis-à-vis excavation method
CO-2	Understand Mechanics of rock drilling, problems of drilling, economics of drilling.
CO-3	Understand Mechanics of rock fragmentation by explosives and Advanced blast initiation systems
CO-4	Understand Design of Blasting
CO-5	Understand Theories of rock tool interaction for surface excavation machinery.

UNIT -I:
INTRODUCTION
Scope and importance, Rock excavation engineering in mining and construction industries; Physico-mechanical and geotechnical properties of rocks Vis-à-vis excavation methods; selection of excavation methods.

UNIT -II:
MECHANICS OF DRILLING
Mechanics of rock drilling, design and operating parameters of surface and underground drilling, evaluation of drill performance, mechanism of bit Wear, bit selection, problems of drilling, economics of drilling.

UNIT -III:
MECHANICS OF BLASTING
Mechanics of rock fragmentation by explosives; advances in explosives and their selection criteria for rock excavation, blast design for surface excavations and optimization. Advanced blast initiation systems, cast blasting, techno - economic and safety aspects of surface and underground blasting.

UNIT -IV:
DESIGN OF BLASTING
Advances in blast design for underground excavations, contour blasting, computer aided blast designs, review of tunnel blasting techniques in recent advances.

UNIT-V: **ROCK CUTTING**
Theories of rock tool interaction for surface excavation machinery – rippers, bucket wheel excavators, continuous surface miners; theories of rock tool interaction for underground excavation machinery- Ploughs, Shearers, road headers, continuous miners. Selection criteria for cutting tools; advanced rock cutting techniques – high pressure water jet assisted cutting.

SUGGESTED READINGS:
1. Principles of Rock fragmentation, Cark G.B—John Wiley & Sons
2. Rock fragmentation by blasting- Pradeep K.Singh et.al
3. Diamond Drilling, Chugh C.P.- Oxford Publication
4. Blasting in ground excavation & mines- B. Singh et.al

E RESOURCES
1. http//technology.infomine.com/reviews/Blasting/welcome.asp?view=full
2. https//link.springer.com/chapter/10.1007/978-981-10-1989-0_16

PE412MN

SUSTAINABLE MINERAL INDUSTRY

Instruction	*: 3 periods per week*
Duration of Semester End Examination	*: 3 hours*
CIE	*: 40marks*
SEE	*: 60 marks*
Credits	*: 3*

Course Objectives:	
1	Understand the principles and importance of sustainable development in the mining industry from the perspective of mineral professionals
2	Familiarize with international sustainability reporting and measurement tools used in the mining sector
3	Gain knowledge of legislative measures and regulations, such as the MMRD Act and star rating of Indian mines, pertaining to sustainable development in the mining industry
4	Analyze the impact of current mining practices on sustainability and explore national mineral policies in mineral-based countries
5	Learn about innovative mining practices and technologies aimed at achieving sustainability, including clean coal technologies, waste management methods, and water and air pollution control measures
6	Analyze case studies of successful sustainable mining practices and understand the benefits and significance of sustainability in the mining industry

Course Outcomes: After completion of course, the students will be able to	
CO-1	Assess the importance of sustainable development in the mining industry and its relevance to mineral professionals
CO-2	Apply international sustainability reporting and measurement tools to evaluate and monitor sustainability in mining operations
CO-3	Analyze the impact of legislative measures and regulations on sustainable development in the mining industry
CO-4	Evaluate the current mining practices and their effects on sustainability, and understand the significance of national mineral policies
CO-5	Apply knowledge of innovative mining practices and technologies for achieving sustainability, and understand their benefits and advantages

UNIT I
Concept of Sustainable development for mining industry-Sustainable development –a perspective of mineral professional community. International sustainability reporting and tools for measurement of sustainability. Milos statement on Sustainable mineral industry. Legislative measures for sustainable development- MMRD Act- star rating of Indian mines (Non-coal), Environmental responsibility – Corporate social responsibility. District mineral fund, its collection, utilisation etc.

UNIT II
Current status of mining practices and their impact on sustainability. Mining and environmental frame work, National mineral policies in mineral based countries. Indian national mineral policy, its historical development with the changing goals and sustainable practices. Issues of leases, auctions for mineral development in India.

UNIT III
Clean coal technologies, Coal bed methane, abandoned coal mine methane, Underground gasification of coal. Leaching of old dumps and recovery of metals. Recycling of metals. Application of new techniques for sustainable development.

UNIT IV
Mine water- Water conservation Acts and rules in India. New Initiatives in mines. Underground mine water, Water pollution and control measures, Phyto-remediation, Sewage and effluent treatment plants, their use and benfits. Waste management- processing of overburden material for underground stowing and innovative methods for utilisation of waste from mines.
Air quality in open pit mines, dust control measures, noise levels- pollution, monitoring and control.
Bio-divrsity- Land reclamation and plantation. Mine closure plan- Collection and disbursement of Mine closure fund for both open pit and underground mines in India.

UNIT V
Best mining practices for Sustainable mining. - Case studies. Innovative practices for achievement of sustainability. Benefits of sustainability.

SUGGESTED READINGS:
MMRD Act 2015 and amendments, Ministry of Mines
Mineral concession Rules
Guidelines of MOEF and Climate change.
Annual reports of MOEF&CC.
Guidelines of Ministry of Coal in India,
Sustainable mining practices –A global perspective by Vasudevan Rajaram, Subijoy Dutta, Krishna Paremeswaran, ISBN-90-5809-689-0

PE413MN

MINERAL EXPLORATION

Instruction	3 periods per week
Duration of Semester End Examination	*3 hours*
CIE	*40 marks*
SEE	*60 marks*
Credits	*3*

COURSE OBJECTIVES:	
1	To know the importance of exploration of minerals.
2	To know the various methods of reserve estimation
3	To know various methods of exploration and sampling.

COURSE OUTCOMES: At the end of the course the student will be able to	
CO-1	Understand diverse exploration criteria and methods, enabling effective planning based on geological, mineralogical, and geochemical factors
CO-2	Proficiency in drill core logging, litholog preparation, and cross section interpretation for accurate mineral reserve estimation
CO-3	Acquire skills in surface prospecting, borehole exploration, and data processing for efficient mineral resource discovery
CO-4	Master sampling theory, geological evaluation, and cut-off grade concepts for precise mineral reserve estimation
CO-5	Develop expertise in geochemical exploration, including pathfinders and dispersion, as well as grasp basics of geophysical methods and remote sensing for mineral identification

UNIT - I
Introduction: Definition, objectives and criteria for mineral exploration, guides for ore search: Physiographic, stratiographic, lithographical, structural mineralogical, geochemical, geobotonical and hydro geological

UNIT - II
Reserve Estimation: Types of drilling, drill core sample logging, data compilation, preparation of litholog of the bore hole – isocore and isopatch maps preparation of geological cross sections, interpretation of the coalmining and exploration deposit reserve estimation.

UNIT - III
Exploration: Introduction to important mineral resources in India and worldwide, surface and aerial prospecting, reconnaissance, application of exploration methods Preliminary and detailed exploration by boring, exploratory mining by shafts, drifts, cross-cuts, collection and compilation of data for computer processing

UNIT - IV
Sampling: theory and methods; Geological plans and sections for orebody evaluation; Exploration drilling, drill core logging and sampling Cut-off grade concepts and applications; Resources and Reserves. Estimation of reserves – methods and practice.

UNIT - V
Geological Exploration: Geochemistry, geochemical exploration; distribution of elements in igneous rocks and minerals, primary haloes and primary dispersion; chemical weathering, mobility in secondary environment, displaced anomaties, pathfinders and their application **Geo Physcial Exploration:** Basic concepts of geophysical exploration, Methods of geophysical exploration: Gravity, Seismic, electrical. Remote Sensing, Application of remote sensing in mineral exploration, visual image & satellite data interpretation

SUGGESTED READINGS
1. M S Krishnaswamy," Mineral Deposits"
2. Arogyaswamy , "A Text book of Mining Geology"
3. William l Smith, " Remote sensing application in mineral exploration"

ES401EC

BASIC ELECTRONICS ENGINEERING

Instruction	3 periods per week
Duration of Semester End Examination	*3 hours*
CIE	*40marks*
SEE	*60 marks*
Credits	*3*

Course Objectives:	
1	To analyze the behavior of semiconductor diodes in Forward and Reverse bias.
2	To design of Half wave and Full wave rectifiers with L,C, LC & CLC Filters.
3	To explore V-I characteristics of Bipolar Junction Transistor in CB, CE & CC configurations.
4	To explain feedback concept and different oscillators.
5	To analyze Digital logic basics and Photo Electric devices.

Course Outcomes: At the end of the course the student will be able to	
CO-1	Grasp the fundamentals of semiconductor theory, P-N junction diodes, and rectifier circuits, enabling the analysis and design of basic semiconductor devices
CO-2	Attain proficiency in analyzing transistor characteristics and configurations, specifically focusing on amplifier circuits using BJTs and JFETs
CO-3	Understand feedback principles, basic oscillator criteria, and operational amplifier applications, enhancing skills in analyzing and designing amplifier circuits
CO-4	Acquire knowledge of fundamental digital logic gates, adders, and subtractors, along with an introduction to data acquisition systems and transducers
CO-5	Develop an understanding of photoelectric and industrial devices like photo diodes, photo transistors, SCR, and UJT, as well as construction and applications of display systems like C.R.O

UNIT-I
Semi-Conductor Theory: Energy Levels, Intrinsic and Extrinsic Semiconductors, Mobility, Diffusion and Drift current. Hall Effect, Characteristics of P-N Junction diode, Parameters and Applications. **Rectifiers:** Half wave and Full wave Rectifiers (Bridge, center tapped) with and with out filters, ripple regulation and efficiency. Zener diode regulator.

UNIT-II
Bipolar Junction Transistor: BJT, Current components, CE, CB, CC configurations, characteristics, Transistor as amplifier. Analysis of CE, CB, CC Amplifiers (qualitative treatment only).**JFET:** Construction and working, parameters, CS, CG, CD Characteristics, CS amplifier.

UNIT-III
Feedback Concepts – Properties of Negative Feedback Amplifiers, Classification, Parameters. Oscillators – Barkhausen Criterion, LC Type and RC Type Oscillators and Crystal Oscillators. (Qualitative treatment only).

UNIT-IV
Operational Amplifiers – Introduction to OP Amp, characteristics and applications –Inverting and Non-inverting Amplifiers, Summer, Integrator, Differentiator, Instrumentation Amplifier. **Digital Systems:** Basic Logic Gates, half, Full Adder and Subtractors.

UNIT – V
Data Acquisition Systems: Study of transducer (LVDT, Strain gauge, Temperature, andForce). Photo Electric Devices and Industrial Devices: Photo diode, Photo Transistor, LED,LCD, SCR, UJT Construction and Characteristics only. **Display Systems:** Constructional details of C.R.O and Applications

SUGGESTED READINGS:
1. Jocob Millman, Christos C. Halkias and Satyabrata Jit, *Electronics Devices andCircuits,*3rd Edition, McGraw Hill Education (India) Private Limited, 2010.
2. Rama Kanth A. Gaykward, *Op-AMPS and Linear Integrated Circuit*, 4thEditionPrentice Hall of India, 2000.
3. M. Morris Mano, *Digital Design*, 3rdEdition, Prentice Hall of India, 2002.
4. William D Cooper, and A.D. Helfrick, *Electronic Measurements and Instrumentations Techniques*, 2ndEdition, Prentice Hall of India, 2008.
5. S. Shalivahan, N. Suresh Kumar, A. Vallava Raj, *Electronic Devices and Circuits*,2ndEdition., McGraw Hill Education (India) Private Limited, 2007.

PC451MN

MINE SURVEYING LAB

Instruction	*2* periods per week
Duration of Semester End Examination	*2 hours*
CEE	*25 marks*
SEE	*50 marks*
Credits	*1*

Course Objectives:
To familiarize with the various surveying instruments and methods.

Course Outcomes	
CO-1	At the end of the course, students will be able to
CO-2	Do the Range and to measure the distance between two points.
CO-3	Conduct the chain triangulation survey.
CO-4	Determine the area by using different methods.
CO-5	Determine the elevation of a given point.
CO-6	Use the instruments used in the surveying.
CO-7	Conduct the correlation by two shaft co-planar method.
CO-8	Conduct the correlation by shaft weisbatch methods and shaft Weiss quadrilateral methods.
CO-9	Set a curve by ranging offsets from long chord and ranging ranking method.

LIST OF EXPERIMENTS:
Ranging a line, measuring the distance between two points, pacing.
1. Chain triangulation, booking, calculation of areas and plotting.
2. Traversing with compass.
3. Introduction to levels.
4. Fly leveling.
5. Profile leveling and plotting the section.
6. Contouring
7. Measurement of horizontal and vertical angle.
8. Theodolite Traversing
9. Finding distance between two in-accessible points.
10. Determination of elevation of various points with dumpy level by collimation plane method and rise & fall method.
11. Correlation by single shaft /two shafts by total station.
12. Correlation by single shaft weiss quadrilateral by total station.
13. Curve ranging offsets from long chord
14. Reading mine plans
15. Study of opencast map.
16. Study of underground map

PC 452MN

MINING MACHINERY LAB

Instruction	*2* periods per week
Duration of Semester End Examination	*2 hours*
CEE	*25 marks*
SEE	*50 marks*
Credits	*1*

Course Objectives:
• To study the various machineries, ropes, conveyors and different types of loading machines.

Course Outcomes: After completion of course, the students will be able to	
CO-1	Understand the safety and efficiency of various haulage layouts and devices
CO-2	Understand the safety and efficiency of various Winding arrangements and devices
CO-3	Understand the safety and efficiency of various Pit top layouts and devices
CO-4	Understand the safety and efficiency of various Pit bottom layouts and devices
CO-5	Understand the safety and efficiency of various machineries used at coal faces.

List of Experiments:
1. Study of jack Hammer, lubricator and air leg.
2. Study of construction of different types of wire ropes.
3. Study of safety hooks used in winding.
4. Study of different types of haulage systems and attachment of tubs to the rope.
5. Study of tensioning arrangement in endless haulage and different types of haulage clips.
6. Study of haulage track, curves, diamond crossing.
7. Study of construction of mine tubs and cars along with their couplings.
8. Study of safety devices provided of haulage roads
9. Study of submersible pumps.
10. Study of Electrical and hydraulic layouts for longwall faces
11. Study of aerial rope ways.
12. Study of various types of head gear-fleet angle, Study of shaft fittings-signal systems, guides,
safety dogs and protective roofing, study of guides– methods of support and tensioning
arrangements.

PW941MN

SURVEY CAMP

CIE : *50 marks*
Credits : *2*

Course Objectives:	
1	Know the importance of Theodolite, Total station and their practical applications
2	Analyze the horizontal and vertical curves for survey work related to Buildings
3	Study the various applications of GPS, GIS and remote sensing for field work.

Course Outcomes:	
CO-1	Understand use Total station to calculate linear measurements of structures
CO-2	Apply corrections to the measured values
CO-3	Ability to Compute omitted measurements and areas

The students will be given basic training of handling various survey instruments including the Total stations. The students are given certain tasks on all the instruments and equipment to solve the real practical problems in the vicinity of campus which enables them to learn and apply to the real life survey problems.

After the completion of the survey camp, students need to submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the Department. Award of sessional are based on the performance of the student at the work place and will be judged by internal guide (s) (25 Marks) followed by presentation before the committee constituted by the Department (25 Marks). One faculty member will coordinate the overall activity of Survey camp.

***Students have to undergo Survey camp for 2 Weeks duration at the end of semester IV and the credits will be awarded after evaluation in V semester.**