



**SARDAR PATEL UNIVERSITY, BALAGHAT (MP)**  
School of Engineering and Technology  
**Syllabus**

**Course:** B.Tech  
**Semester:** III

**Branch:** Mining Engineering  
**Academic Session:** 2024-25

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**SUBJECT – ENGINEERING MATHEMATICS**  
SUBJECT CODE – BMI031

**Course Objective**

The objective of this course is to equip students with a comprehensive understanding of various numerical and analytical techniques essential for solving mathematical problems encountered in engineering. Students will develop problem-solving skills using numerical methods, transform calculus, and probability theory, with a focus on practical applications.

**Unit 1: Numerical Methods – I**

Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

**Unit 2: Numerical Methods – II**

Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of Simultaneous Linear Algebraic Equations by Gauss's Elimination, Gauss's Jordan, Crout's methods, Jacobi's, Gauss-Seidal, and Relaxation method.

**Unit 3: Numerical Methods – III**

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. RungeKutta method of fourth order for solving first and second order equations. Milne's and Adam's predictor-corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender- Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

**Unit 4: Transform Calculus**

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method, Fourier transforms.

**Unit 5: Concept of Probability**

Probability Mass function, Probability Density Function, Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution.



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**Course Outcomes**

- CO1** Solve polynomial and transcendental equations using methods like Bisection, Newton-Raphson, and Regula-Falsi, and apply interpolation techniques for equal and unequal intervals.
- CO2** Apply numerical differentiation, integration techniques, and solve simultaneous linear equations using methods like Gauss's Elimination, Jacobi, and Gauss-Seidel.
- CO3** Solve ordinary and partial differential equations using methods like Runge-Kutta, Euler, Milne's, and finite difference methods for heat and wave equations.
- CO4** Use Laplace and Fourier transforms to solve ODEs, evaluate integrals, and analyze periodic functions with convolution theorem
- CO5** Understand and apply probability mass and density functions, and analyze discrete and continuous distributions such as Binomial, Poisson, and Normal distributions.

**Textbooks:**

1. B. S. Grewal, "Higher Engineering Mathematics", 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10/e, John Wiley & Sons, 2011.

**References:**

1. N. P. Bali, "Engineering Mathematics", Lakshmi Publications.
2. George B. Thomas, Maurice D. Weir and Joel Hass, "Thomas Calculus", 13/e, Pearson Publishers, 2013.
3. H. K. Dass, "Advanced Engineering Mathematics", S. Chand and company Pvt. Ltd.



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**SUBJECT – INTRODUCTION TO MINING**  
SUBJECT CODE – BMI032

**Course Objective**

The objective of this course is to provide students with a foundational understanding of mining principles, techniques, and equipment, with a focus on both coal and non-coal mineral resources. By exploring different methods of resource extraction, students will gain a comprehensive overview of mining operations, from prospecting to transportation.

**Unit 1: Mining Terminologies & Mineral Resources**

Mining Terminology/Definitions, Mineral Resource of India, Mineral and energy resources of world, Mineral resources of Madhya Pradesh & Chhattisgarh, Minerals - their occurrences, production trend and uses.

**Unit 2: Exploration and Prospecting**

Prospecting & Exploration- Reconnaissance, Principles and methods, Trenching & Pitting.

Boring- Principles of boring, surface layout, Chief uses of boreholes, percussive method by rigid rods, rope drilling, boring tools used in percussive method.

Rotary Boring- various systems, different types of bits, water flushing & drilling mud, mud flushing, core recovery, single tube & double tube core barrel, wire line core barrel, diamond drilling. Borehole logging.

Trouble during boring operations- caving of wall of borehole, loss of water, deviation of borehole, survey of bore holes, loss of bit, rod damage or disengagement inside the hole, excessive wear of bit, breakage or loss of diamond

**Unit 3: Introduction to Mining Methods**

Elementary ideas about Mining, Underground, Opencast/Surface Mining for Coal (and Lignite) and Non-Coal Minerals, Comparison of underground and surface mining, Coal Bed Methane (CBM), Placer Mining, Sea Bed Mining etc.

**Unit 4: Access to Mineral Deposits**

Shaft Access in Underground Mining, Adit Access and Its Applications in Mining, Tunnel Access Methods for Mineral Deposits, Incline Access in Underground Mining, Bench Design and Access in Open-Pit Mining.

**Unit 5: Haulage and Transportation**

Basic haulage equipment and their application, Basic idea about Transportation equipment and their application/use in mines.



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#### Course Outcomes

- CO1** Define key mining terms and describe mineral resources, their occurrences, production trends, and uses in India, MP, Chhattisgarh, and globally.
- CO2** Explain prospecting methods, boring techniques, rotary boring systems, and address challenges during boring operations.
- CO3** Compare underground and surface mining methods for coal and non-coal minerals, including advanced techniques like CBM and seabed mining.
- CO4** Evaluate different access methods to mineral deposits, including shaft, adit, tunnel, incline, and open-pit bench design.
- CO5** Identify and explain the function and application of loading and transportation equipment in mining operations.

#### Textbooks:

1. Dr. G.K.Pradhan, Explosives & Blasting Techniques, Mintech Publications, Bhubaneswar
2. D.J.Deshmukh, Elements of Mining Technology, Vol. I, Denett & Co., Nagpur
3. Dr. T.N.Singh, Surface Mining, Lovely Prakashan, Dhanbad
4. Dr. S.K.Das, A Handbook on Surface Mining Technology, Lovely Prakashan, Dhanbad

#### References:

1. Dr. G.K.Pradhan, Explosives & Blasting Techniques, Mintech Publications, Bhubaneswar
2. R.D. Singh, Principles & Practices of Modern Coal Mining, New Age International Pvt.Ltd., New Delhi.
3. Dr. S.M.Kole, Khuli Khan Ka Ayojan, CMPDIL Publication



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**SUBJECT – APPLIED GEOLOGY-I**  
SUBJECT CODE – BMI033

**Course Objective**

The objective of this course is to provide students with a solid understanding of geological processes, mineralogy, and rock classification, with an emphasis on their application in mining and mineral exploration. Through this course, students will learn how to interpret and apply geological data to enhance exploration and extraction efficiency.

**Unit 1: The Earth in Space and Time**

Solar System; Size, Shape, Mass and Density of Earth; A Brief idea of the origin and the age of the Earth; Interior of the Earth- seismic data, Density and Pressure within the Earth; The internal structure and composition of Earth; Elementary knowledge of Diastrophism, earthquakes and volcanism, Volcanic and earthquake belts, and their relationship with plate tectonics.

**Unit 2: Mineralogy**

Physical Properties of Minerals; Classification of various Rock forming Minerals; Introduction and preliminary study of principle Rock forming Mineral groups - Garnet, Pyroxene, Amphibole, Mica, Feldspar and Felspethoid, Megascopic properties of Economically important non Silicate Minerals.

**Unit 3: Igneous and Metamorphic Petrology**

Elementary knowledge of Magma and its Crystallization; Classification of Igneous Rocks; Textures and Structures of Igneous Rocks; Petrographic Description of Common Igneous Rocks; Agents and Types of Metamorphism; Depth zones, Facies and Grades of Metamorphism and Petrographic Description of Common Metamorphic Rocks.

**Unit 4: Sedimentary Petrology**

Textures and Structures of Sedimentary Rocks; Sedimentary Processes- Weathering, Transportation and Deposition; Classification and Petrographic Description of Common Sedimentary Rocks.

**Unit 5: Structural Geology**

Concept of Deformation; Primary and Secondary Planer and Linear structure of Rocks; Topography and its representations; Altitude of strata- Dip and strike; Outcrop patterns; Width of Outcrop and thickness of beds; Structural Contours; Geological Maps; Study of Unconformity; Folds, Joints, Faults and their influence in Mining Operations.



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**Course Outcomes**

- CO1** Analyze Earth's structure, seismic data, and processes like diastrophism, earthquakes, and volcanism to assess their impact on mining and mineral exploration.
- CO2** Identify and classify rock-forming minerals, including economically important non-silicate minerals, based on their physical and Megascopic properties for mining applications.
- CO3** Classify and describe igneous and metamorphic rocks, understanding magma crystallization and metamorphic processes relevant to the exploration and extraction of mineral resources.
- CO4** Interpret sedimentary rock textures, structures, and processes like weathering and deposition to aid in locating sedimentary mineral deposits.
- CO5** Analyze geological structures like folds, faults, and unconformities, and evaluate their influence on mining operations and the extraction of mineral resources.

**Textbooks:**

1. Parbin Singh, *"Engineering and General Geology"*
2. S.K. Garg, *"Physical and Engineering Geology"*
3. H.H.Read, *"Rutley's Elements of Mineralogy"*
4. G.W.Tyrell, *"Principles of Petrology"*
5. M.P.Billings, *"Structural Geology"*
6. G.W.Chiplonkar, *"Geological Maps"*
7. P.K. Mukherjee, *"A Text Book of Geology"*
8. S. Banger, *"Applied Geology"*



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**SUBJECT – MINE SURVEYING - I**  
SUBJECT CODE – BMI034

**Course Objective**

The objective of this course is to provide students with a strong foundation in surveying techniques and their application in mining operations. Students will develop the skills needed to measure, map, and analyze land and underground spaces accurately, ensuring efficient and safe mining activities.

**Unit 1: Chain Survey**

Linear Measurements; Types of chains; Tapes; Errors in chaining and corrections in linear measurements; Direct and indirect Ranging; Principles of chain surveying offsets; Limiting length of offsets; Booking field notes; Obstacles in chaining; Instruments for setting out right angles.

**Unit 2: Compass Survey**

Theory of Magnetism; Dip of Magnetic needle; Prismatic Compass; Surveyor's Compass; Bearings; Designation of Bearings; Calculation of Included Angles; Local Attraction; Magnetic Declination.

**Unit 3: Plane Table Surveying**

Principles of Plane Tabling; Working operations; Methods of Plane Table Surveying; Two and Three point problems.

**Unit 4: Miner's Dial**

Construction; Use; Tests and Adjustments; Loose and fast Needle surveying; Common sources of errors in Dial surveying; Methods of elimination and compensation.

**Unit 5: Levelling**

Definitions of important terms used in levelling; Development in levelling Instruments; Types and Constructional details; Temporary and Permanent Adjustments; Methods of levelling; Straight edge levelling; Fly levelling; Check levelling; Reciprocal levelling; Longitudinal Sections; Cross- Sectioning; Trigonometric levelling; Methods of booking and reduction of levels; Levelling through drifts and shafts (Including steeply inclined shafts) ; Plumbing measurements of depth of shaft and subsidence.



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**Course Outcomes**

- CO1** Understand basic surveying principles, including chain and compass surveying, for accurate measurement and mapping in mining operations.
- CO2** Apply levelling techniques and contouring methods to create elevation profiles and topographic maps crucial for mine planning and excavation.
- CO3** Use theodolites for precise angular measurements and traverse surveys to establish control points and boundaries in underground and surface mining.
- CO4** Implement tachometric surveying techniques for rapid distance and elevation calculations, improving the efficiency of mine site surveys.
- CO5** Set out curves in underground and surface mines, ensuring the accurate alignment of haulage roads, tunnels, and other mining structures.

**Textbooks:**

1. Frederick Winniberg, "*Metalliferous Mine Surveying*"
2. Kanetkar and Deshpande, "*Surveying and leveling*"



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**SUBJECT – ENGINEERING MATERIALS**

SUBJECT CODE – BMI035

**Course Objective**

The objective of this course is to provide students with a fundamental understanding of engineering materials, focusing on their properties, treatment, and applications in the mining industry. Students will learn how to select and enhance materials for various mining operations, ensuring safety, efficiency, and durability.

**Unit 1: General**

Introduction, Classification of Engineering Materials, Structure of Metals and Alloys, Iron-carbon phase diagram.

**Unit 2: Heat Treatment of Iron & Steel**

Different Types of Steels, their Properties and Uses, Different Types of Heat Treatment Techniques viz. Hardening, Annealing, Normalizing & Tempering and their Uses in Mining Industry.

**Unit 3: Wire Rope**

Types and Construction, Wire Rope Lays, Non- Stranded Ropes, Selection of Wire Ropes, Ropes used for different purpose, Mass & Strength of Wire Ropes.

**Unit 4: Constructional Materials**

Cements – Classification & Properties, Quick Setting Cement, Resin Capsule, R.C.C., Shot Encapsulization, Shotcreting, Brick & Stone Masonries, Hollow blocks, Application of Fly Ash in Mining - mine filling.

**Unit 5: Engineering Behavior of Some Materials**

Stress-Strain Curves of typical Engineering Materials, Elastic and Plastic Deformation, Fracture, Fatigue and Creep.



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**Course Outcomes**

- CO1** Classify engineering materials and explain the structure of metals and alloys, with an emphasis on understanding the iron-carbon phase diagram for material selection in mining.
- CO2** Apply various heat treatment techniques like hardening, annealing, normalizing, and tempering to improve the properties of steels used in mining equipment and structures.
- CO3** Select appropriate types of wire ropes based on their construction, mass, and strength for different mining applications such as hoisting, haulage, and lifting.
- CO4** Understand the properties and applications of construction materials like cements, resin capsules, and fly ash, particularly in mine filling, shotcreting, and structural support systems in mining.
- CO5** Analyze stress-strain behavior, elastic and plastic deformation, fracture, fatigue, and creep characteristics of materials used in mining operations.

**Textbooks:**

1. B.K. Agrawal, *“Introduction to Engineering Materials”*
2. D.J. Deshmukh, *“Elements of Mining Technology, Vol. I”*

**References:**

1. Surendra Singh, *“Engineering Materials”*
2. M.L.Gambhir, *“Concrete Technology”*



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**SUBJECT – INTRODUCTION TO MINING LAB**  
SUBJECT CODE – BMI032P

<b>S. No.</b>	<b>List of Experiments</b>
1	Study of accessories of boring machines and boring rig.
2	Study, sketch & use of the boring and fishing tools.
3	Study and sketch of Hydraulic feed mechanism of the drilling machine.
4	Study and sketch of double tube core barrel.
5	Study and sketch of various types of detonators and relay.
6	Study of different types of exploders.
7	Study of construction and use of stemming rods, scraper cum break.
8	detector, blasting cable, circuit tester etc.
9	Study and sketch of approved types of explosive magazines.
10	Study & sketch of different types of initiation.
11	Study & sketch of Hydraulic Splitter / Cordex.



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**SUBJECT – APPLIED GEOLOGY – I LAB**  
SUBJECT CODE – BMI033P

<b>S. No.</b>	<b>List of Experiments</b>
1	Megascopic Description of Rock Forming Minerals.
2	Megascopic Description of important Igneous, Sedimentary, Metamorphic Rocks.
3	Basic Concept of Contours, Attitude of Beds, Width of Outcrop, True and Apparent Dips, Rules of V's.
4	Study of Geological Maps and Preparation of Cross Sections.



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**SUBJECT – MINE SURVEYING – I LAB**  
SUBJECT CODE – BMI034P

- S. No.**      **List of Experiments** (*At least Ten experiments are to be performed by each student*)
- 1      Ranging and Chaining of line of 50 Meter.
  - 2      Determination of width of an obstacle which can be seen across but can't be chained.
  - 3      Determination of area of a field by Cross staff survey.
  - 4      Study of various types of chained.
  - 5      Determination of included angle with the help of a Prismatic Compass.
  - 6      Plotting a closed traverse and elimination of errors.
  - 7      Determination of width of an inaccessible obstacle by intersection.
  - 8      Determination of location of instrument station by two point problem.
  - 9      Determination of location of instrument station by two point problem.
  - 10     Determination of location of instrument station by three point problem.
  - 11     Study of Miner's dial.
  - 12     Study of Dumpy level.
  - 13     Determination of difference in elevation and gradient between two stations using dumpy level.
  - 14     Fly leveling by Tilting level.
  - 15     Longitudinal sectioning by Level.



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**SUBJECT – COMPUTER PROGRAMMING IN C LAB**  
SUBJECT CODE – BMI036P

- S. No.**            **List of Experiments** *(At least Ten experiments are to be performed by each student)*
- 1     Write a program to take the radius of a sphere as input and print the volume and surface and surface area of that sphere.
  - 2     Write a program to take a 5-digit number as input and calculate the sum of its digits.
  - 3     Write a program to take three sides of a triangle as input and verify whether the triangle is an isosceles, scalene or an equilateral triangle.
  - 4     Write a program that will take 3 positive integers as input and verify whether or not they form a Pythagorean triplet or not
  - 5     Write a program to print all the Prime numbers between a given range.
  - 6     Write a program to define a function that will take an integer as argument and return the sum of digits of that integer
  - 7     Write a program to define a macro that can calculate the greater of two of its arguments. Use this macro to calculate the greatest of 4 integers.
  - 8     Write a program to define a recursive function that will print the reverse of its integer argument.
  - 9     Write a program to print the sum of first N even numbers using recursive function.
  - 10    Write a program to sort an array using Bubble sort technique.
  - 11    Write a program that will take the elements of two integer arrays of 5 element each, and insert the common elements of both the array into a third array (Set intersection)
  - 12    Write a program to take 5 names as input and print the longest name.
  - 13    Write a program to define a structure Student that will contain the roll number, name and total marks of a student. The program will ask the user to input the details of 5 students and print the detail of all the students whose total marks is greater than a given value.
  - 14    Write a program to define a union Contact that will contain the members Mobile no and E- mail id. Now define a structure Employee that will contain name, roll number, mode of contact (mob/e-mail) and a variable of type Contact as members. The program will ask the user to give the details of two Employees including mode of contact and the contact num/ E- mail. Print the details of both the Employees.
  - 15    Write a program that will ask the user to input a file name and copy the contents of that file into another file.
  - 16    Write a program that will take any number of integers from the command line as argument and print the sum of all those integers.

**References:**

1. Let us C – Yashwant Kanetkar BPB Publication
2. Programming in ANSI C – E. Balaguruswamy Tata Mc-Graw Hill