

**SYLLABUS FOR ASSISTANT CONTROLLER OF MINES  
UNDER COMMERCE & INDUSTRIES DEPARTMENT,  
GOVERNMENT OF MIZORAM**

The examination will comprise of the following papers:

<b>Sl. No.</b>	<b>Subject</b>	<b>Marks Allotted</b>	<b>Duration</b>
(1)	Paper - I	: 200	3 hrs.
(2)	Paper - II	: 200	3 hrs.
(3)	Paper - III	: 200	3 hrs.
(4)	Paper - IV	: 200	3 hrs.
	Total	: 800	
	Personal Interview	: 100	

**DETAILS OF SYLLABUS :**

**(1) Paper-I**

- (a) Current events of national and international importance.
- (b) Indian Polity and Indian Constitution,
- (c) General issues on Environmental Ecology, Bio-diversity and Climate Change - that do not require subject specialization.
- (d) General awareness on Mizo culture, its heritage and society.
- (e) English Comprehension.
- (f) English Language (Class XII level).
- (g) Interpersonal skills including communication skills.
- (h) Logical reasoning and analytical ability.
- (i) Decision-making and problem-solving.

**Note:** Paper II, Paper III and Paper IV shall be classified as Technical Papers.

**PERSONAL INTERVIEW:**

The total marks allotted for personal interview for the post of Assistant Controller of Mines under Commerce & Industries Department, Government of Mizoram shall be as prescribed in "The Mizoram Direct Recruitment (Conduct of Examination) Guidelines, 2018 as amended issued vide No. A.12026/1/2017-P&AR (GSW) dt. 09.02.2018 or as prescribed by the Government from time to time.

## **(2) Paper-II (Technical)**

### **Mining Engineering Paper -1**

**(Mining Methods; Rock Mechanics & Ground Control; Mine Ventilation; Mining Geology)**

#### **Section — A: Mining Methods (70 Marks)**

Underground Coal Mining: Rank of Coal, Banded constituent of Coal, Size gradation of Coal, Analysis of Coal (Ultimate Analysis & Proximate Analysis), Types of Coal (Non-Coking Coal & Coking Coal), Caking or Agglutinating Index, Protodyaknov Index, Composition of Different Coal Burning Gases, Incubation period of Coal. Coal Mining Methods: Board & Pillar Mining (Dimension of Pillar and Galleries at different depths, Percentage of Extraction, Tributary Area, Load acting on pillar, Strength of pillar, Factor of safety of pillar, Line of extraction), Hydraulic Mining, Auger Mining, Contour Mining, Strip Mining; Underground Metalliferous Mining: Gestation Period, Cut-off Grade, Break-Even Cut-off Grade, Raise or Winze, Raising Methods (Open Raising by drilling, blasting, mucking, Two or Three Compartmental raising, Raising by long hole drilling, Raising with Alimak Raise Climber, Raise borers, Drop Raising Method), Sampling, Average grade of an ore block, Metal Mining Methods (Overhand Stopping, Underhand Stopping, Breast Stopping, Sub-Level Stopping, Long Hole Stopping or Blast Hole Stopping, Room and Pillar Mining, Shrinkage Stopping, Cut and fill Stopping, Square Set Stopping, Block Caving, Sub Level Caving); Opencast Mining Methods: Stripping Ratio, Break Even Stripping Ratio, Parameters of the working Bench, DGMS norms in Opencast Mining, Types of Ramps, Determination of Powder factor, Types of Slope Failure, Determination of Factor of Safety of Slope, Pit Limit Optimization; Subsidence in Mines: Angle of Draw, Caving height or Thickness of the immediate roof.

#### **Section - B: Rock Mechanics & Ground Control (50 Marks)**

Methods of Rock Exploration: By direct penetration, Geophysical Prospecting (Seismic Method, Electrical Method, Gravity Method, Magnetic Method); Rock Quality Designation (RQD); Physical and Mechanical Properties of Rocks: Unit Weight, Specific Gravity of Solids, Determination of Specific Gravity of a Soil Sample, Void Ratio, Porosity, Density, Dry Density, Bulk Density, Saturated Density; Moisture Content; Degree of Saturation; Permeability; Anisotropy and Isotropy; Stress; Strain; Strain Energy; Modulus of Elasticity of Rock; Poisson Ratio; Unit Volume Change Relationship between Elastic Constants; Deformability; Hardness; Classification of Rock Strength: Compressive Strength, Tensile Strength & Shear Strength); Seismic Velocities related to material properties; Rock Mass Strength Indices: Point Load Strength Index & Slake Durability Index; Testing of Rock Samples: Uni-axial Compressive Strength Test, Brazilian Test, Bending Test, Punch Shear Test; Types of classification of Rock Masses; Determination of Shear Strength; Principle Stress; Mohr's Circle Analyses; Shearing on an inclined plane; Generalized Hoek-Brown Strength Criterion; Determination of Factor of Safety of Slope: Plane Failure & Circular Failure; Stress and Displacement Distribution in Circular Excavation; Determination of Length of Roof Bolt; Determination of mean Shear Strength using short anchor tests.

### **Section — C: Mine Ventilation (40 Marks)**

Composition of Mine Air; Layer of Gasses in Mine Atmosphere; Damps in Underground Mine Atmosphere; Permissible Concentrations of different Gasses in Indian Underground Mines; Degree of Gassiness of Coal Mines; Gas Monitoring Instruments; Coward Diagram; Dealing with firedamp in Mines; Methane Layering Number; Graham's Ratio and its Importance; Rescue/Escape/Reviving apparatus; Air Flow through Mine Openings: Nature of Flow, Pressure drop in Mine Airway, Shock Loss at Area Changes and Bends, Co-efficient of Contraction; Equivalent Resistance; Air Power; Equivalent Orifice; Methods of Velocity Measurement; Natural and Mechanical Ventilation: NVP (Natural Ventilation Pressure),

Motive Column, Head (H.) Generation by Mine Fan, Fan Laws, Ventilation Survey, Measurement of Velocity of Airflow, Measurement of Quantity of Airflow, Measurement of Relative Humidity.

### **Section - D: Mining Geology (40 Marks)**

Mineralogy: Origin of Minerals, Physical and Chemical properties of Minerals; Petrology: Igneous Rocks, Sedimentary Rocks, Metamorphic Rocks; Structural Geology: Dip and Strike, Joints, Faults, Folds, Structural Discontinuities - Impact on Workability, Mining/Quarrying of Rock Deposits; Paleontology: Mode of preservation of fossils, Uses of fossils, Standard Geological Time Scale; Economic Geology: Process of formation of Mineral Deposits, Classification of Mineral deposits, Important economic minerals of India.

## **(3) Paper-III (Technical)**

### **Mining Engineering Paper - II**

**(Mine Environment; Mine Surveying; Mining Machinery; Explosives, Drilling and Blasting Techniques in Mines)**

### **Section — A: Mine Environment (50 Marks)**

Air Pollution: Air Pollutants: Standards, Sources of Air Pollution in Mining Industries, Air Pollution Control Devices, Miner's Disease and Dust Hazards, Dust Sampling Methods; Noise Pollution: Measurement of Noise, Equivalent Noise level, Frequency Spectrum, Frequency Weighing, Sound Wave propagation (Point Source & Line Source), Noise Pollution Standards (Worksite Standards & Ambient Standards); Water Pollution: Water Pollution Parameters — pH, Total: Suspended Solids, Bio-chemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Standards of Effluents Discharge from Coal Mining; Illumination: Definitions of Important terms of Photometry. — Intensity, Horizontal Illuminance, Vertical illuminance, Mean Spherical Candle Power (m.s.c.p); illumination, Lumen (lm), Lux, Footcandle (fc); Illumination Standards in Mines (Opencast Mining Areas & Underground Working Areas).

### **Section — B: Mine Surveying (40 Marks)**

Representative Factor; Distance Measuring Instruments; Correction Factors in Line Measurement: Correction Factor due.to Incorrect Chain, Slope Correction Factor, Correction " for Absolute Length, Correction for Temperature, Correction for Pull, Correction for Sag; Traversing: Bearing of Lines, True meridians or Geographical Meridians, Magnetic Meridian, Arbitrary meridian, Magnetic Declination, Designation of Bearing (Whole Circle Bearing, Quadrantal or Reduced Bearing & Fore or Back Bearing; Theodolite: Magnification or Magnifying Power,

Error in Theodolite Traverse (Permissible Linear Error & Permissible Angular Error), Relation between Angular And Linear Measurement, Latitude and Longitude of a Line, Close Traverse Survey, Computation of Areas of Irregular Boundaries (Mid Ordinate Rule, Average Ordinate Rule, Trapezoidal Rule & Simpson's Rule); Levelling: Classification of Levelling (Differential Levelling, Check Levelling, Profile Levelling, Cross Sectioning, Reciprocal Levelling, Barometric Levelling, Hypsometry, Trigonometric Levelling), Determination of Reduced Level (RL), Correction Factor in Levelling (Correction for Curvature & Correction for Refraction); Tacheometric Survey: Method of Tacheometry, Determination of Horizontal and Vertical Distance in Different Conditions; Triangulation Adjustments: Definition of Various Observation and Error Parameters, The Most Probable Values of Quantities (Direct Observation of Equal Weight, Direct Observation of Unequal Weight, Indirect Observation on independent quantities of Equal Weight, Indirect Observation on independent quantities of Unequal Weight, Indirect Observation on conditioned quantities), The Probable Error (Direct Observation of Equal Weight, Direct Observation of Unequal Weight, Laws of Weight, Computed Quantities), Correlation (Weisbach Triangle Method), Global Positioning System(GPS) - How it Works & Its Application in Mining Industry, Photogrammetry - Aerial Photogrammetry (Distortion due to Height or Relief, Flight Planning, Determination of number of Photographs for a Particular Area, Intervals Between Exposures).

### **Section — C: Mining Machinery (50 Marks)**

Types of Clutches; Types of Gears - Gear Calculations; Wire Ropes: Classification of Wire Ropes (On the Basis of Operation & On the basis of Construction), Application of Wire Ropes in Mines, Space Factor, Mass of Rope, Strength of Rope, Rope Splicing, Capping of Rope; Winding System: Types of Winding System in Underground Mines (Drum Winding & Friction Winding or Koepe Winding), Pit Top/Bottom Track Arrangement in Winding System; Underground Haulage System: Types of Haulage System - Direct Rope Haulage, Endless Haulage, Main and Tail Rope Haulage, Tail Rope Haulage, Gravity Haulage; Super Elevation; Safety devices used in Haulage Arrangement; Power Requirement of the Motor to Run Haulage; Direct Rope Haulage & Endless Rope Haulage; Locomotive Transport; Conveyor Transport: Belt Conveyor, Cable Belt Conveyor, Disc Conveyors, High Angle Conveyor; Mine Pump: Pressure to Head conversion formula, Types of Head, Power and Efficiency, Specific Speed, The Affinity Laws.

### **Section - D: Explosives, Drilling and Blasting Techniques in Mines (60 Marks)**

Definition of Explosives; Classification of Explosives; Types of explosives; Permitted Explosives; Theory of Rock Fragmentation by Blasting; Blast Design Parameters; Characteristics of Explosives; Powder Factor; Maximum permissible charge in a shot hole; Detonator; Velocity of Detonation (VOD); Detonating Pressure; Types of Detonators and their Characteristics; DGMS Stipulation on ground vibration; DGMS Stipulation on Delay Intervals; Drilling pattern; Warning system; Misfires; Drilling methods and their Rock Cut Principles; Standards for Drill Hole Diameters and core sizes; General Safety measures to control blast induced vibration; Threshold value of Ground Vibration; Transportation of Explosives and Magazines.

#### **(4) Paper-IV (Technical)**

##### **Mining Engineering Paper - III**

**(Mine Economics & Geo-statistics; Mineral Dressing; Mine Legislation & General Safety; Aptitude Test)**

##### **Section — A: Mine Economics & Geo-statistics (40 Marks)**

Appraisal Techniques (Non-Discounting Techniques & Discounting Techniques); Determination of Future Worth; Depreciation; Redemption; Depletion; Arithmetic Mean; Median; Mode; Standard Deviation; Mean Deviation or the Average Deviation; Coefficient of Variation; Probability Distribution Function; Normal Distribution; Poisson Distribution; Exponential Distribution; Expectation of Variate; Skewness; Probability.

##### **Section - B: Mineral Dressing (30 Marks)**

Classification; Crushers: Types — Primary Crushers, Secondary Crushers & Tertiary Crushers or Impact Crushers; Grinding Mills; Tumbling Mills (Rod Mill and Ball Mill, Autogenous Mills), Stirred Mills; Principles of Classification in Liquid Medium: Free Settling, Hindered Setting, Jigging, Dense Media Separation / Heavy Media Separation, Froth Floatation, Washing.

##### **Section - C: Mine Legislation & General Safety (80 Marks)**

The Mines & Minerals (Development and Regulation Act, 1957; The Minerals Conservation and Development Rules, 2017; The Mineral Concession Rules, 1960; The Mines Act, 1952; The Mines Rules, 1955; The Oil Mines Regulations, 2017; The Coal Mines Regulations 2017; The Metalliferous Mines Regulations 1961; The Mizoram Minor Minerals Concession Rules, 2000; The Oilfields (Regulation & Development) Act, 1948; The Petroleum and Natural Gas Rules, 1959; The Explosives Act, 1884; The Explosives Substance Act, 1908; The Explosives Rules, 2008; DGMS Circulars; National Mineral Policy, 2019.

##### **Section — D: Aptitude Test (50 Marks)**

- *Numerical and Figure work Tests: (16 Marks)*

These tests are reflections of fluency with numbers and calculations. It shows how easily a person can think with numbers. The subject will be given a series of numbers.

His/ Her task is to see how the numbers go together to form a relationship with each other. He/ She have to choose a number which would go next in the series.

- *Verbal Analysis and Vocabulary Tests: (14 Marks)*

These tests measure the degree of comfort and fluency with the English language. These tests will measure how a person will reason with words. The subject will be given questions with alternative answers that will reflect his/her command of the rule and use of English language.

- *Visual And Spatial/3-D Ability Tests: (10 Marks)*

These tests are used to measure perceptual speed and acuity. The subject will be shown pictures where he/she is asked to identify the odd one out; or which comes next in the sequence or explores how easily he/she can see and turn around objects in space.

- *Abstract Reasoning Tests: (10 Marks)*

This test measures the ability to analyse information and solve problems on a complex, thought based level. It measures a person's ability to quickly identify patterns, logical rules and trends in new data, integrate this information, and apply it to solve problems.

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