GATE 2026 MN Question Paper with Solutions

Time Allowed :3 Hour	Maximum Marks :100	Total Questions :65

General Instructions

Please read the following instructions carefully:

1. This question paper is divided into three sections:
   - **General Aptitude (GA):** 10 questions (5 questions × 1 mark + 5 questions × 2 marks) for a total of 15 marks.
   - **Environmental Science and Engineering + Engineering Mathematics:**
     - **Part A (Mandatory):** 36 questions (1 questions × 1 mark + 19 questions × 2 marks) for a total of 55 marks.
     - **Part B (Section 1):** Candidates can choose either Part B1 (Surveying and Mapping) or Part B2 (Section 2). Each part contains 16 questions (8 questions × 1 mark + 11 questions × 2 marks) for a total of 30 marks.
2. The total number of questions is **65**, carrying a maximum of **100 marks**.
3. The duration of the exam is **3 hours**.
4. Marking scheme:
   - For 1-mark MCQs, $\frac{1}{3}$ mark will be deducted for every incorrect response.
   - For 2-mark MCQs, $\frac{2}{3}$ mark will be deducted for every incorrect response.
   - No negative marking for numerical answer type (NAT) questions.
   - No marks will be awarded for unanswered questions.
5. Ensure you attempt questions only from the optional section (Part B1 or Part B2) you have selected.
6. Follow the instructions provided during the exam for submitting your answers.

1. The primary purpose of mine ventilation is to:

(A) Cool the mine workings
(B) Supply oxygen and dilute hazardous gases
(C) Increase production rate
(D) Reduce roof pressure

Correct Answer: (B) Supply oxygen and dilute hazardous gases

Solution:

Step 1: Understanding mine ventilation.
Mine ventilation refers to the controlled circulation of air through underground mine workings. It is an essential safety system designed to maintain a healthy and safe working environment for miners.

Step 2: Identifying the primary objective.
During mining operations, harmful gases such as methane, carbon monoxide, carbon dioxide, and dust are generated. If these gases accumulate, they can cause explosions, suffocation, and serious health hazards.

Step 3: Role of ventilation air.
Ventilation air supplies fresh oxygen to miners and simultaneously dilutes, removes, and carries away hazardous gases and dust from the mine workings to the surface.

Step 4: Analysis of the given options.
(A) Cool the mine workings: Cooling is a secondary benefit, not the primary purpose.
(B) Supply oxygen and dilute hazardous gases: Correct — this is the main safety objective of mine ventilation.
(C) Increase production rate: Production may improve indirectly, but it is not the primary purpose.
(D) Reduce roof pressure: Roof pressure is controlled by rock support systems, not ventilation.

Step 5: Conclusion.
The primary purpose of mine ventilation is to ensure safety by supplying fresh oxygen and diluting hazardous gases.

Quick Tip

Mine ventilation is mainly a safety system designed to protect miners from toxic gases and oxygen deficiency.

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2. The Mohr–Coulomb failure criterion is mainly used to describe:

(A) Elastic behavior of rocks
(B) Plastic flow of rocks
(C) Shear failure of rocks
(D) Tensile failure of rocks

Correct Answer: (C) Shear failure of rocks

Solution:

Step 1: Understanding the Mohr–Coulomb failure criterion.
The Mohr–Coulomb failure criterion is a widely used theory in rock mechanics and geotechnical engineering to predict the failure of materials such as rocks and soils under stress.

Step 2: Stress components involved.
The criterion relates the shear stress acting on a plane to the normal stress on that plane, along with material properties such as cohesion and angle of internal friction.

Step 3: Nature of failure described.
According to the Mohr–Coulomb theory, failure occurs when the shear stress exceeds the shear strength of the rock material. Hence, it primarily explains shear failure rather than elastic or tensile behavior.

Step 4: Analysis of the given options.
(A) Elastic behavior of rocks: Elastic behavior occurs before failure and is not described by this criterion.
(B) Plastic flow of rocks: Plastic deformation is not the main focus of the Mohr–Coulomb model.
(C) Shear failure of rocks: Correct — the criterion predicts failure due to shear stress.
(D) Tensile failure of rocks: Tensile failure is described by different criteria.

Step 5: Conclusion.
The Mohr–Coulomb failure criterion is mainly used to describe **shear failure of rocks**.

Quick Tip

Mohr–Coulomb criterion links shear stress, normal stress, cohesion, and friction angle to predict rock failure.

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3. The instrument commonly used for measuring horizontal and vertical angles in mines is:

(A) Dumpy level
(B) Plane table
(C) Theodolite
(D) Sextant

Correct Answer: (C) Theodolite

Solution:

Step 1: Understanding the requirement of mine surveying.
Mine surveying involves the precise measurement of distances, directions, and angles inside underground and surface mines. Accurate measurement of both horizontal and vertical angles is essential for layout, alignment, and safety of mine workings.

Step 2: Identifying the function of theodolite.
A theodolite is a precision surveying instrument specifically designed to measure both horizontal angles and vertical angles accurately. It is widely used in surface as well as underground mine surveying operations.

Step 3: Analysis of the given options.
(A) Dumpy level: Used only for measuring differences in elevation, not angles.
(B) Plane table: Used mainly for graphical surveying and does not provide high accuracy for angle measurement.
(C) Theodolite: Correct — it accurately measures both horizontal and vertical angles, making it ideal for mine surveying.
(D) Sextant: Used mainly in navigation and astronomy, not suitable for mine surveying.

Step 4: Conclusion.
Since the theodolite is capable of accurately measuring both horizontal and vertical angles, it is the most commonly used instrument in mine surveying.

Quick Tip

In mine surveying, remember: **Angles → Theodolite, Levels → Dumpy level**.

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4. Which one of the following is the most widely used method for coal extraction in surface mines?

(A) Glory hole mining
(B) Strip mining
(C) Block caving
(D) Cut and fill mining

Correct Answer: (B) Strip mining

Solution:

Step 1: Understanding surface mining methods.
Surface mining methods are used when coal seams are located close to the earth's surface. These methods involve removal of overburden to expose the coal seam for extraction.

Step 2: Understanding strip mining.
Strip mining is a surface mining method in which overburden is removed in long strips to expose coal seams. After coal extraction, the overburden is often placed back into the mined-out area. This method is highly mechanized and economical for shallow coal deposits.

Step 3: Analysis of the given options.
(A) Glory hole mining: Used mainly for steeply dipping ore bodies, not commonly for coal.
(B) Strip mining: Correct — it is the most widely used surface mining method for coal extraction.
(C) Block caving: An underground mining method, not suitable for surface coal mining.
(D) Cut and fill mining: Also an underground mining method used for hard rock deposits.

Step 4: Conclusion.
Since coal seams are often shallow and extensive, **strip mining** is the most widely used method for coal extraction in surface mines.

Quick Tip

For shallow coal seams spread over large areas, **strip mining** is the most economical and commonly adopted method.

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5. In bord and pillar mining, the main load-bearing elements are:

(A) Roof bolts
(B) Timber supports
(C) Pillars
(D) Side walls

Correct Answer: (C) Pillars

Solution:

Step 1: Understanding bord and pillar mining.
Bord and pillar mining is an underground coal mining method in which coal is extracted in a network of roadways (bords), leaving blocks of coal (pillars) to support the roof.

Step 2: Load distribution in underground mines.
The weight of the overlying strata is transferred to the remaining coal blocks. These coal blocks must be strong enough to support the roof and prevent collapse of the mine workings.

Step 3: Role of pillars.
Pillars act as the primary structural supports in bord and pillar mining. They carry the load of the overburden and maintain stability of the mine. Other supports like roof bolts or timber are only auxiliary supports.

Step 4: Analysis of the given options.
(A) Roof bolts: Provide additional roof stability but do not carry the main load.
(B) Timber supports: Used as temporary or secondary support only.
(C) Pillars: Correct — they are the main load-bearing elements.
(D) Side walls: Do not serve as primary load-bearing components.

Step 5: Conclusion.
In bord and pillar mining, the stability of the mine depends mainly on the strength of the **pillars**, which act as the primary load-bearing elements.

Quick Tip

In bord and pillar mining, remember: **Pillars = main support, Roof bolts = secondary support**.

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6. Which gas is mainly responsible for explosions in coal mines?

(A) Carbon monoxide
(B) Carbon dioxide
(C) Methane
(D) Hydrogen sulphide

Correct Answer: (C) Methane

Solution:

Step 1: Understanding mine gases.
Coal mines contain various gases known as mine gases, such as methane, carbon monoxide, carbon dioxide, and hydrogen sulphide. Some of these gases are toxic, while others are explosive in nature.

Step 2: Properties of methane.
Methane is a colourless, odourless, and highly inflammable gas released naturally from coal seams. When mixed with air in certain proportions (about 5%–15%), it forms an explosive mixture.

Step 3: Cause of explosions in coal mines.
If methane accumulates due to poor ventilation and comes in contact with an ignition source such as sparks or open flames, it can cause violent explosions. Therefore, methane is considered the most dangerous explosive gas in coal mines.

Step 4: Analysis of the given options.
(A) Carbon monoxide: Highly poisonous but not primarily explosive.
(B) Carbon dioxide: An asphyxiant gas, not explosive.
(C) Methane: Correct — it is the main cause of explosions in coal mines.
(D) Hydrogen sulphide: Toxic gas but not the main cause of mine explosions.

Step 5: Conclusion.
The gas mainly responsible for explosions in coal mines is **methane**.

Quick Tip

Methane explosions are prevented by proper mine ventilation and continuous gas monitoring.

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7. The machine used for drilling blast holes in hard rock mines is:

(A) Longwall shearer
(B) Continuous miner
(C) Jack hammer drill
(D) Belt conveyor

Correct Answer: (C) Jack hammer drill

Solution:

Step 1: Understanding drilling requirements in hard rock mines.
In hard rock mining, blasting is required to break strong and compact rock formations. For this purpose, blast holes must be drilled accurately before charging explosives.

Step 2: Role of jack hammer drill.
A jack hammer drill is a portable percussive drilling machine designed specifically for drilling

blast holes in hard rock. It uses impact force combined with rotation to penetrate hard rock efficiently.

Step 3: Analysis of the given options.
(A) Longwall shearer: Used for coal cutting in longwall mining, not for drilling.
(B) Continuous miner: Used mainly in coal mining for cutting and loading coal.
(C) Jack hammer drill: Correct — commonly used for drilling blast holes in hard rock mines.
(D) Belt conveyor: Used for material transportation, not drilling.

Step 4: Conclusion.
The most suitable machine for drilling blast holes in hard rock mines is the **jack hammer drill**.

Quick Tip

Hard rock drilling for blasting is commonly done using jack hammer or pneumatic drills.
