

Date : October 11, 2025
Total Marks : 100
Writing Time : 150 minutes (2.5 hours)
Reading Time : 15 minutes (prior to writing time)

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is to check the number of pages of Question Paper, printing errors, clarify doubts and to read the instructions. You are NOT permitted to write during this time.
3. This paper consists of **TWO SECTIONS**, namely SECTION A & SECTION B:
 - **SECTION A** has two parts:

Part I - 30 Multiple Choice Questions

Part II - 5 Short Answer Questions

All questions under SECTION A are **COMPULSORY**.
 - **SECTION B** consists of two options. Choose only **ONE** option.
4. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.
5. All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating the Section, Part and Question Number will NOT be evaluated and no marks will be awarded.
6. Begin each Section and Part on a fresh page of the Answer Booklet.
7. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
8. Use of any other paper including paper for rough work is not permitted.
9. **You must hand over the Answer Booklet to the Invigilator before leaving the examination hall.**
10. This paper has **8 printed pages**, including this instruction page.

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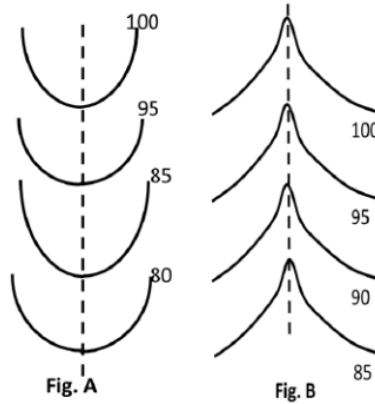
SECTION A

PART I: Multiple Choice Questions [30 marks]

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 31 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. Minimum metal percentage, at which mining is profitable, is known as:
 - a) Average grade.
 - b) Cut-off grade.
 - c) Mill grade.
 - d) Economical grade.
2. What is Salting in Mine Valuation?
 - a) Adding high-grade mineral samples to lower-grade ore during sampling or core drilling to inflate the value of mining property
 - b) Adding low-grade mineral samples to high-grade ore during sampling or core drilling to inflate the value of mining property
 - c) Adding high-grade mineral samples to higher-grade ore during sampling or core drilling to inflate the value of mining property
 - d) Adding low-grade mineral samples to lower-grade ore during sampling or core drilling to inflate the value of mining property
3. Project A has an internal rate of return (IRR) of 21 percent. Project B has an IRR of 7 percent. Project C has an IRR of 31 percent. Project D has an IRR of 25 percent. Which of these would be the BEST project?
 - a) Project B
 - b) Project C
 - c) Project D
 - d) Project A
4. In a mine for one shovel, six trucks are assigned. The shovel loading time per truck is 5 minute, and truck cycle time is 20 minutes. Calculate the match factor.
 - a) 0.7
 - b) 1.2
 - c) 1.0
 - d) 1.5
5. As per classification of mineral resources, “reserve “means
 - a) Identified resources
 - b) Identified and techno-economically viable resources
 - c) Hypothetical resources
 - d) Inferred resources

6. If the Fig. A and B represents contour plots in a terrain then the correct statement is



- a) Fig. A shows ridge and Fig. B shows valley
 b) Fig. A shows anticline and Fig. B shows syncline
 c) Fig. A shows syncline and Fig. B shows anticline
 d) Fig. A shows valley and Fig. B shows ridge
7. In the context of mine planning, match the following:

Technique/Algorithm	Preferred Applications
A. Lerchs-Grossman algorithm	1. Reserve Estimation
B. Krigging	2. Mine life
C. Lane's Theory	3. cut-off grade optimization
D. Taylor's Rule	4. ultimate pit limit

- a) A -1, B-2, C-3, D-4
 b) A-4, B-1, C-3, D-2
 c) A-3, B-2, C-4, D-1
 d) A-1, B-2, C-3, D-4
8. A FMFS report is a document containing
- a) In reasonable detail, the technical, financial, environmental and social impact analyses required prior to the approval of a mining lease.
 b) An EIA report including all scoping and baseline studies
 c) Mine plan but no environmental management plan
 d) A detail of geological report
9. The point beyond which the mineral cannot be economically extracted is called
- a) Stripping ratio
 b) Cost of stripping ratio
 c) Break-even ratio
 d) Limit of extraction

10. Which of the following excavator is preferred to be used for a bench height of 30 m or more?
 - a) Bucket wheel excavator
 - b) Excavator
 - c) Dragline
 - d) Front end loader
11. The ratio of weight per unit volume of solid rock mass in the bench is 162 and weight per unit volume of loose rock mass after blasting or loosening is called?
 - a) Bucket factor
 - b) Swing factor
 - c) Swell factor
 - d) Drill factor
12. The term Representative Factor (RF) is associated with
 - a) Mine drainage
 - b) Mine plan
 - c) Mine ventilation
 - d) Mine air sampling
13. Under what conditions blasting may not be carried out?
 - a) Thunderstorm
 - b) Strong wind
 - c) At temperatures exceeding 300C°
 - d) Heavy rain
14. When explosive charges in a hole is separated by air gaps in stead stemming materials, then the process is known as
 - a) Deck charging'
 - b) Priming
 - c) Detonating
 - d) air decking
15. In a mine deploying shovel and dumper, the distance from the crest of the bench to the centre of the dumper including safety berm and clearance is 7.5m, the dumping radius and the cutting radii of the shovel are 15m and 12m respectively. The width of the working bench of the mine in m is;
 - a) 30.5
 - b) 32.5
 - c) 34.5
 - d) 36.5
16. The rocks that are formed by the cooling of molten material (called magma) at or relatively near the earth surface is called
 - a) Igneous rock
 - b) Metamorphic
 - c) Sedimentary rock
 - d) Crystalline

17. VOD is the property of:
- detonator
 - explosives
 - dumper
 - dragline
18. As per the provisions of the MMR 2002, under '*Environmental restoration bond*' the lessee shall deposit an environmental bond to the Government as security for:-
- Carrying out the mining/quarrying operations not as per the approved FMFS report and other relevant rules & regulations set up by the government
 - Mine reclamation and environmental restoration in the mine and for ensuring that the negative impacts on the surrounding environment are minimized.
 - Claiming the interest given on the security bond by the government for increasing the mining activities in the country.
 - Taking out loans from the financial institutions to carry out the mining/quarrying operations in the Country
19. The boundary of a mine is plotted on a scale of 1:2000. If a planimeter measures the plotted area as 58 cm² the actual mine area in m² is
- 6800
 - 11700
 - 23200
 - 28000
20. Ad valorem royalty for export of minerals is levied at;
- mine exit points
 - country exit point
 - the destination
 - the weighbridge
21. In an open-pit mine design, the ultimate pit limit is primarily determined by
- Drilling pattern
 - Bench height
 - Slope stability
 - Stripping ratio and economics
22. Ultimate Pit slope is the angle made by the imaginary line joining the –
- Average of the all bench angles.
 - Top most crest of the bench to bottom most toe of the bench.
 - Top most toe of the bench to the bottom most toe of the bench.
 - Top most crest of the bench to bottom most crest of the bench.
23. What are Contours in a topographic map?
- Lines joining the point of same elevations.
 - Shows the level of depth of mine.
 - Used for calculating the area.
 - None of the above

24. In the Moho's Scale of hardness, the minerals in increasing order of hardness are;
- a) Calcite, gypsum, topaz, diamond
 - b) Topaz, gypsum, calcite, diamond
 - c) Gypsum, calcite, topaz, diamond
 - d) Calcite, gypsum, diamond, topaz
25. As per MMMA 1995, a mining lease shall be granted for a mining area
- a) based on the approval of the FMFS report only
 - b) only after clearance of such area has been received from all concerned authorities of the Government
 - c) if the mining area is demarcated by the applicant
 - d) after putting an application for mining lease in Form A
26. As per MMR 2022, In case of accidents in the Mine, the lessee shall serve the
- a) Notice of Accident in Form I within one week of the occurrence of the accident with copy to concerned Dzongdag
 - b) Notice of Accident in Form J within one week of the occurrence of the accident with copy to concerned Dzongdag
 - c) Notice of Accident in Form K within one week of the occurrence of the accident with copy to concerned Dzongdag
27. Which of the following statement is NOT CORRECT?
- a) Controlled blasting is done to avoid fly rock
 - b) Secondary blasting is done for big size boulders
 - c) Secondary blasting is done to avoid the toe formation
 - d) Stemming is required to avoid the blown-out shots
28. The extension of all boundaries of the mining area shall be?
- a) Downward, vertically without limit
 - b) Downward, vertically with the limit
 - c) Sideward, horizontally with the limit
 - d) Sideward, horizontally without limit
29. Coal formation takes place in the following order
- a) Peat- lignite – anthracite – bituminous
 - b) Peat – lignite – bituminous – anthracite
 - c) Bituminous – peat – lignite – anthracite
 - d) Lignite – peat – bituminous – anthracite
30. Mineral levies in Bhutan are collected based on:
- a) Volume of the material
 - b) Quantity in metric tons
 - c) Quantity in Kilograms
 - d) None of above

PART II – Short Answer Questions [25 marks]

This part has 5 Short Answer Questions. Answer 5 questions. Each question carries 5 marks

1. Why it is necessary to carry out Break Even Analysis in a mining business? The handling figures for the Pugli Limestone Mine for the year 2024-25 are the following: The OB handling = 5,00,000 MT, ore production = 2,00,000 MT and densities of OB and Ore are 2.5 and 3 respectively. Find the stripping ratio for the year 2024-25. Find out the stripping ratio for the year 2024-25. **(5 marks)**
2. Explain the Environment Restoration Bond Formula and its mode of payment. Calculate the upfront ERB from the following given data; **(5 marks)**
Area = 9.66 acres
OB = 53,714 m³
3. A shovel operates 300 days in a year, 2 shifts in a day, and 4 hours in a shift to achieve the target production of 30 Million MT per annum. The following parameters related to the loading operations. Find out the number of shovels required to achieve the planned production target. **(5 marks)**
Bucket capacity of shovel: 15 m³
Shovel cycle time: 44 s
Bucket fill factor: 0.85
Bulk density of the muck: 3.00 t
4. Draw a simple risk matrix and how would you manage risk in mines when you are posted to Regional offices of the department as Regional Coordinator? **(5 marks)**
5. Describe different problems that are associated with environment during surface mining operations? **(5 marks)**

SECTION B: Case Study [45 marks]

Choose either Option I OR Option II from this section. Each option carries 45 marks.

OPTION I:

1. Discuss the factors influencing the choice between open-pit and underground mining methods. **(10 marks)**
2. What is mine planning? Explain mine planning and its components. Explain the different between Geological reserve and Mineable reserve. **(10 marks)**
3. A bench in an open-pit mine is 15 m high with a bench face angle of 65°. If the factor of safety against sliding is calculated as 1.1, discuss whether the bench is safe and what corrective measures may be required. **(5 marks)**

4. Discuss the role of Automation and AI in modern Mining Operations. **(10 marks)**
5. What are the two mineral royalty system of Bhutan? Elaborate on the process of levying the Domestic and Export Mineral Royalty system of Bhutan. List down the advantage and disadvantage of having mix mode of royalty system in the country. **(10 marks)**

OPTION II:

1. When an accident takes place in a mine area, what is lessee or the mines manager supposed to do to the department? **(5 marks)**
2. A shovel with a 2 m³ bucket (fill factor 0.85, density 2.2 t/m³) loads trucks with 35 t capacity at 90% fill. Shovel cycle time = 40 sec. Haul road = 2.5 km (loaded 25 km/h, empty 35 km/h). Spot/loading = 2.8 min, dumping = 1.2 min. Find the number of trucks required if shovel works continuously. **(10 marks)**
3. Briefly describe various operations involved in Surface Mining. Give classification of Surface mining method in relation to equipment used. **(10 marks)**
4. Find out the cost per cubic meter of rocks to be blasted based on the following data; **(10 marks)**
Explosive cost = ₹250/kg,
consumption = 8 kg/m³,
Burden = 3 m, spacing = 4 m,
Bench height = 10 m.
5. What is productivity in Mining and elaborate on overall mining operations with respect to the machines and drilling operations. **(10 marks)**

TASHI DELEK