

PRACTICE SET
End Semester Examination, December, 2025

Program: BTECH (MINING)
Semester: VII
Subject: MINE SAFETY ENGINEERING
Subject Code: 8PECMiEEL404

Course Outcome:

On the completion of the Course, the students will be able to:

| Course Outcomes | Description |
|------------------------|--|
| CO1 | Understand the basic concepts of safety, hazard, risk, and accident, including their definitions, classifications, and the cost implications of accidents, along with the DGMS and NIOSH proposed risk analysis procedure |
| CO2 | Explain and apply the principles of risk management, including objectives, processes, components, and methods of hazard identification and risk assessment (HIRA) in mining and industrial environments |
| CO3 | Analyze and evaluate different risk analysis methods such as HAZOP, FMEA, FMECA, JSA, PHA, and Fault Tree Analysis for identifying potential system failures and improving workplace safety |
| CO4 | Examine and integrate system safety engineering approaches using models such as the Domino Model, Swiss Cheese Model (HFACS), STAMP, Structural Equation Modelling |

UNIT I

Section A (5 Marks)

1. Define safety, hazard, risk and accident with reference to mining. (CO1) (Understand)
2. Classify accidents and injuries in mines. (CO1) (Understand)
3. Differentiate between direct and indirect costs of accidents? (CO1) (Understand)
4. Differentiate between **unsafe act** and **unsafe condition**. (CO1) (Understand)

Section B (10 Marks)

5. Plan the precautions which you will take in mine to prevent spontaneous heating. (CO1) (Apply)
6. Recommend the various preventive measures which can be taken to control underground mine fire. (CO1) (Apply)



7. Compare the major causes for Surface and Underground fire. Discuss in detail. (CO1) (Understand)
8. Discuss about the permanent stopping with its specification. Draw suitable diagram. (CO 1) (Understand)
9. Define Spontaneous Heating. Interpret the factors for occurrence of spontaneous heating and stages involve with it. (CO1) (Apply)
10. Suggest various types of Flame Proof Extinguisher's which are used in mines and discuss about their applicability condition for different types of Fire. (CO1) (Apply)

Section C (20 Marks)

11. In underground you have seen various types of stopping used for sealing a fire, classify them. Illustrate about the permanent stopping with its specification. Sketch suitable diagram. (CO1) (Apply)
12. A study was conducted on an underground coal miners to assess the effect of respirable dust exposure on lung disease.

| Group | No. of Workers | No. of Lung disease cases |
|---------------------|----------------|---------------------------|
| Exposed to dust | 250 | 50 |
| Not exposed to dust | 300 | 15 |

Interpret the followings from the above given data in the table

- (a) Attack rate in both group
- (b) Relative risk
- (c) Interpretation. (Evaluate) (CO1)

UNIT II

Section A (5 Marks)

13. Discuss the Human Factors and scope of its study. (CO2) (Understand)
14. Explain the term disaster. (CO2) (Understand)
15. Illustrate the catastrophic accidents in mines. (CO2) (Understand)

Section B (10 Marks)

16. Discuss about the fatality rate and severity rate by assuming the values. (CO2) (Understand)
17. Write short notes on:
 - a. Safety Management Plan.
 - b. Risk Assessment approach. (CO2) (Remember)
18. Discuss in detail about the various types of injuries suffered by mine workers in a mine. (CO2) (Understand)
19. A survey of underground coal miners was conducted on 1st July 2025. Out of 1,200 miners examined, 96 were found to have silicosis at that time. Calculate the Point prevalence (%) of silicosis on 1st July 2025. (CO2) (Apply)
20. Illustrate the incident cause analysis approach. (CO2) (Understand)
21. Plan the steps which can be taken for Risk assessment in the mines. (CO2) (Apply)
22. A study conducted on musculoskeletal disorders among 900 mine workers (700 male, 200 female) found: 105 males and 60 females reported chronic back pain. Calculate the prevalence among male and female.(CO2) (Apply)



23. By using the following given data in the table, calculate the risk index for the all age groups

| Age range | No. of injuries | % Age | % Age population | Risk Index |
|-----------|-----------------|-------|------------------|------------|
| 18-24 | 5 | 12.50 | 5.41 | |
| 25-34 | 7 | 17.50 | 23.74 | |
| 35-44 | 17 | 42.50 | 40.98 | |
| 45-54 | 4 | 10.00 | 18.46 | |
| 55-60 | 7 | 17.50 | 11.38 | |

(CO2) (Evaluate)

UNIT III

Section A (5 Marks)

24. Differentiate ignition temperature and lag on ignition. (CO3) (Understand)

25. Compare FMEA and FMECA in detail. (CO3) (Understand)

Section B (10 Marks)

26. Describe the procedure of HAZOP study with an example. (CO3) (Understand)

27. Write short notes on the followings :

(a) Incident (b) Near miss (CO3) (Understand)

28. Demonstrate the NIOSH based approach using two variables of severity and probability? (CO3) (Apply)

29. Discuss Failure Mode Effect Critical Analysis. (CO3) (Understand)

30. Discuss the steps of DGMS proposed risk analysis procedure. (CO3) (Understand)

Section C (20 Marks)

31. A miner consumes 1.5 L of oxygen per minute during manual coal loading.

Given that 1 L O₂ = 20.1 kJ, compute total energy expenditure per hour and classify physical workload. CO 3 (Evaluate)

| Energy (KJ/min) | Workload |
|-----------------|----------|
| <12 | Light |
| 12-20 | Moderate |
| >20 | Heavy |

32. Explain accidents and hazards? Cause wise data for injuries in an underground coal mine for a five year period is given below :

| Causes of injury | Number of injuries |
|------------------|--------------------|
| Roof Fall | 27 |
| Fall of person | 22 |
| Rope haulage | 17 |
| Explosive | 5 |
| other | 4 |

Calculate the cumulative probability of injury due to roof fall and fall of person? (CO3) (Apply)



UNIT IV

Section A (5 Marks)

- 33. Explain the **Domino Model** of accident causation.. (CO4) (Remember)
- 34. Write short notes on **Swiss Cheese Mode**. (CO4) (Understand)
- 35. Define **STAMP model** in system safety. (CO4) (Remember)

Section B (10 Marks)

- 36. Discuss the **HFACS framework** in detail in the context of mining and why it is crucial for the accident investigation. (CO4) (Remember)
- 37. Discuss the structural equation modelling by design a path modelling diagram. (CO4) (Understand)

Section C (20 Marks)

- 38. Conclude the Swiss cheese model by using the suitable diagram incorporating all the defense system with reference to mining accident prevention? (CO4) (Evaluate)
- 39. A case-control study has been conducted for the miners of an underground coal mine on a respiratory outcome .Compute the Odds Ratio (OR) based on the following data given in the table :

| | Exposed | Unexposed | Total |
|--------------------|----------------|------------------|--------------|
| Case (A) | 80 | 40 | 120 |
| Control (B) | 60 | 120 | 180 |

(CO4) (Evaluate)

Summary Sheet

CO Wise

| CO | Q. No | Marks |
|--------------|--|--------------|
| CO1 | 1,2,3,4,5,6,7,8,9,10,11 | 115 |
| CO2 | 12,13,14,15,16,17 | 70 |
| CO3 | 18,19,20,21,22,23,24,25,26,27 | 100 |
| CO4 | 28,29,30,31,32,33,34,35,36,37,38,39,40 | 70 |
| Total | | 355 |



Unit Wise

| Unit | Q. No | Marks |
|--------------|--|--------------|
| Unit 1 | 1,2,3,4,5,6,7,8,9,10,11 | 115 |
| Unit 2 | 12,13,14,15,16,17 | 70 |
| Unit 3 | 18,19,20,21,22,23,24,25,26,27 | 100 |
| Unit 4 | 28,29,30,31,32,33,34,35,36,37,38,39,40 | 70 |
| Total | | 355 |

Blooms Taxonomy Level (BTL) Wise

| BTL | Q. No | Marks |
|--------------|--|--------------|
| LOT | 1,2,3,4,5,6,7,9,12,13,14,16,18,19,20,21,22,24,25,28,29, 30,31,32,33,34,36 | 165 |
| HOT | 8,10,11,15,17,23,26,27,26,27,34,35 | 190 |
| Total | | 355 |

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Disclaimer: - This is a practice set. The Question in End term examination will differ from the practice set. This practice set is meant for practice only.