

**1) MINE SURVEYING-II**

**2) UNDERGROUND METAL MINING TECH**

**3) MINE MECHANIZATION-II**

**4) MINE ENVIRONMANTAL ENGG-II**

# **MINE SURVEYING-II**

## B.Tech III Year - II Semester Examination – Academic Year (2016-2017)

## MINE SURVEYING-II

Time: 3 hours

Max. Marks: 75

**Note:** This question paper contains two parts.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as a sub questions.

**Part-A****(25 Marks)**

1. a) Define the term super elevation? (2)
- b) State the principle of tacheometric surveying? (3)
- c) Define the term Photogrammetry? (2)
- d) Define the terms Longitude and Latitude? (3)
- e) List the various correlation methods for surface and underground? (2)
- f) State the purpose of correlation? (3)
- g) List the application of remote sensing in mining? (2)
- h) List the fundamental measurement by Total Station? (3)
- i) What are different types of EDM instruments? (2)
- j) List various GIS software used in mining field? (3)

**Part-B****(50 Marks)**

2. (a) The stadia reading with horizontal sight on a vertical staff held at 50 m from a tacheometer are 1.285 and 1.780. The focal length of the object glass is 25 cm and the distance between the object glass and the vertical axis of the tacheometer is 15 cm. the stadia interval in mm?  
(b) Explain the terms Simple curve and Compound curve? (5+5)

**OR**

3. (a) The two underground roads AB and BC intersect at the deflection angle is  $105^{\circ}$ . These roads are to be connected by a circular curve of 150 m radius. Calculate (i) Tangent distance (ii) Main Chord (iii) Length of the curve?  
(b) Derive the expression for tacheometric constant? (5+5)

4. (a) Determine the number of photographs required to cover an area 25 km x 20 km If the scale is 1 in 10,000 and the format is 230 x 230 mm, Take longitudinal lap as 60 % and the side lap as 30 %.

- (b) Explain what you understand by (i) Apparent time (ii) Local mean time (6+4)

**OR**

5. (a) Vertical photographs of an area lying 500 m above the mean sea level are to be taken at a scale of 1:20000 from an aircraft. If the camera has a focal length of 210 mm, calculate the flying height of the air craft above the mean sea level in meters?

- (b) Explain the procedure for determination of Azimuth? (6+4)

6. Describe the method of correlation by direct traversing? (10)

**OR**

7.(a) Explain the method of measurement of depth of shafts?

(b) Explain the survey for connecting national grid? (5+5)

8. (a) State the fundamentals of GPS?

(b) Explain the term Scale and Resolution? (5+5)

**OR**

9.(a) Explain about GPS receivers GPS observable and data processing?

(b) State the different components of Total Station instrument? (5+5)

10.(a) Explain the procedure of finding out the given area of setting out a work using EDM?

(b) List various statutory requirements of mine surveying? (5+5)

**OR**

11(a) Explain the working principle of Electro Magnetic Distance measuring system?

(b). Explain about the Geographical Information System? (5+5)

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**Part-A****(25 Marks)**

1. a) State the limitations of tangential tacheometry? (2)
- b) What is degree of the curve in Arc definition and Chord definition? (3)
- c) Distinguish between aerial and terrestrial photogrammetry? (2)
- d) Define latitude and longitude in geodetic astronomy? (3)
- e) What is verticality of shaft? (2)
- f) Write down the difference between GIS and RS? (3)
- g) List advantages of total station? (2)
- h) What is coordinate calculation in total station? (3)
- i) Write short notes on Distomat? (2)
- j) What are the features of the GIS? (3)

**Part-B****(50 Marks)**

2. A Tacheometer was setup at station A and the following readings were obtained on a vertically held staff:

Instrument station	Staff Station	Vertical Angle	Hair Reading	Remarks
A	B.M	$-2^{\circ}18'$	3.225, 3.550, 3.875	R.L of B.M=437.655m
A	B	$+8^{\circ}36'$	1.650, 2.515, 3.380	

Calculate the horizontal distance from A to B and the R.L of B if the multiplying constant and additive constant of the instrument were 100 and 0.4 respectively? (10)

**OR**

3. Two tangents intersect at chainage of 1500 m, the deflection angle being 300. Calculate the necessary data for setting out a curve of radius 300 m by the method of offsets from the chord produced, taking a peg interval of 30 m? (10)

4.(a) Derive the expression of scale of vertical photographs?

(b) A section line AB appears to be 10.16 cm on a photograph for which the focal length is 16 cm. The corresponding line measures 2.54 cm on a map which is to a scale 1/50,000. The terrain has an average elevation of 200 m above mean sea level. Calculate the flying altitude of the aircraft, above mean sea level, when the photograph was taken? (4+6)

**OR**

5. The following observations of three angles A, B and C were taken at one station:

A = $75^{\circ} 32' 46''.3$	weight	3
B = $55^{\circ} 09' 53''.2$	weight	2
C = $108^{\circ} 09' 28''.8$	weight	2
A+B = $130^{\circ} 42' 41''.6$	weight	2
B+C = $163^{\circ} 19' 22''.5$	weight	1
A+B+C = $238^{\circ} 52' 09''.8$	weight	1

Determine the most probable value of each angle? (10)

6.(a) Explain the method for transferring surface line down shafts and setting out underground line?

(b) Explain weisbach triangle method for setting out underground correlation survey? (5+5)

**OR**

7.(a) State the basic principle of Remote Sensing? Describe the different platforms are used in Remote Sensing?

(b) What is GIS data type? Distinguish the various GIS data type briefly? (5+5)

8). Define Total Station? Describe the constructional features of Total Station with neat sketch? State the uses of the Total Station? (2+6+2)

**OR**

9).(a) Explain the fundamental measurements made by a Total Station?

(b) Describe the procedure about mapping by using Total Station? (5+5)

10).(a) Define the term EDM? State the basic principle of EDM instruments?

(b) A wave transmitted from the point A and received at the point B. The whole number of wavelengths travelled by the wave is 6 and having wave length 20 m each. The phases of the wave at transmitted point A and received point B are  $0^{\circ}$  and  $180^{\circ}$  respectively. Calculate the distance between A and B? (5+5)

**OR**

11) Write down the statutory requirements for mine plans and sections as per DGMS? (10)

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Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as a sub questions.

**Part-A****(25 Marks)**

1. a) What is the formula of horizontal distance and R.L of staff station when line of sight is horizontal and staff is held vertically? (2)
- b) Compute the radius of a simple curve of 60 taking the chord length is 30 m? (3)
- c) What is mapping? (2)
- d) Define most probable error and residual error? (3)
- e) What is national grid? (2)
- f) Distinguish the different types of RS system? (3)
- g) List the uses of Total Station? (2)
- h) What is ATR in Total Station? (3)
- i) State the difference between Tellurometer and Geodimeter? (2)
- j) List out different GIS softwares? (3)

**Part-B****(50 Marks)**

- 2.(a) Derive an expression for horizontal distance and elevation in the fixed hair method when the staff is held vertical and line of sight is inclined?
- (b) An observation with a percentage theodolite gave staff readings of 1.052 m and 2.502 m for angles of elevation of 5% and 6% respectively. On sighting the graduation corresponding to the height of the instrument axis above the ground, the vertical angle was 5.25%. Compute the horizontal distance and the elevation of the staff station if the instrument station has an elevation of 942.552 meters? (5+5)

**OR**

- 3.(a) Derive the expression for setting out the simple circular curve by deflection distances method or offsets from the chords produced?
- (b) Two straight lines AB and BC intersect at chainage 2060 m. The intersection angle is being  $140^{\circ}$ . Calculate the radius and chainage of the tangent points of a circular curve connecting the two lines if  $D = 60^{\circ}$ ? (5+5)

- 4.(a) Define terrestrial photogrammetry? Write down the basic principles of terrestrial photogrammetry? Explain different types of terrestrial photogrammetry?
- (b) A vertical photograph was taken at an altitude of 1200 meters above mean sea level. Determine the scale of the photograph for terrain lying at elevations of 80 meters and 300 meters if the focal length of the camera is 15 cm? (5+5)

**OR**

5).(a) From the normal equations for x, y and z in the following equations of equal weight :

$$3x+3y+z-4=0$$

$$x+2y+2z-6=0$$

$$5x+y+4z-21=0$$

(b) The following are the three angles A, B and C observed at a station P closing the horizon, along with their probable errors of measurement. Determine their corrected values.

$$A = 78^{\circ} 12' 12'' \pm 2'', B = 136^{\circ} 48' 30'' \pm 4'', C = 144^{\circ} 59' 08'' \pm 5'' \quad (5+5)$$

6).(a) Describe the procedure for measurement of depth of mine shaft with neat sketch?

(b) The center line of a tunnel is represented by two plumb lines P and Q is 4 meters apart, hanging vertically in a shaft, the whole circle bearing of the line PQ being  $80^{\circ} 40' 15''$ . A theodolite is set up underground at a point R distance 3.902 meter and roughly east of the nearer plumb line Q and the observed value of the angle PQR is found to be  $16' 12''$ . Using Weisbach triangle methods calculate the bearing of the line PR and the perpendicular distance of R from the centre line of the tunnel (5+5)

**OR**

7).(a) Define the term RS? Distinguish different types of RS? State the idealized components of RS system with sketch?

(b) Define the term GIS? Write the working principle of GIS? (5+5)

8).Define Total Station? State the description of the important operations of Total Station? What are the advantages of using Total Station? (10)

**OR**

9).(a) A total station is placed over a terrain having ground elevation is 150 meter and height of instrument is 2.135 m. The distance between the total station and the target is 1000 meter and height of the target from the ground is 2 m. Find out the elevation of the ground beneath the reflector if zenith angle is  $60^{\circ}$ ?

(b) Write the types of surveys by using Total Station (5+5)

10).(a) Define the term EDM? Describe the types of different EDM instruments depending upon the carrier wave?

(b) Write down the methods of open pit surveying? (5+5)

**OR**

11) What details should be incorporated in a water danger plan? What are the surveyor's responsibilities and duties to avoid inundation of a mine as per Coal Mine Regulations, 1957?

(3+7)

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**UNDERGROUND METAL MINING TECH.**

**B.Tech III Year - II Semester – Academic Year (2016-2017)**  
**UNDERGROUND METAL MINING TECHNOLOGY**

**Time: 3 hours**

**Max. Marks: 75**

Note: This question paper contains two parts.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each questions carries 10 marks and may have a, b, c as a sub questions.

**Part-A**

**(25 Marks)**

1. a) What are the difference between coal and metal mining? (2)
- b) Differentiate between overhand and underhand stoping. (3)
- c) What is the difference between stoping and caving methods? (2)
- d) What are the factors affecting the choice of stoping method? (3)
- e) What is resuing? (2)
- f) What are the merits of square set stoping? (3)
- g) What are the types of haulages used in underground metal mining? (2)
- h) What are the equipments used in dumping? (3)
- i) Compare between maintenance and ventilation cost in caving method. (2)
- j) What are the scopes of in-situ leaching? (3)

**Part-B**

**(50 Marks)**

2. Explain the peculiarities of Metalliferous deposits with their scope and limitations of underground metal mines?

**OR**

3. Write notes on:

- a) Layout of drift
- b) Raise and winze
- c) Cross-cut

4. Explain briefly the different types of raising methods used for metal mines?

**OR**

5. Write notes on:

- a) Shrinkage stoping
- b) Cut and fill stoping

6. Explain briefly the working principle of block caving. What are the merits and demerits of block caving?

**OR**

7. Write notes on:

- a) Sub-level caving
- b) VCR method

8. Write the applicability conditions for the following methods:

- a) Sub-level stoping
- b) Room and pillar method
- c) Top slicing

**OR**

9. Write notes on:

- a) Stope layout for sub-level stoping
- b) Ventilation in metalliferous mining

10. Write the principle and applicability conditions of in-situ leaching. What are the merits of in-situ leaching?

**OR**

11. Describe the following terms:

- a) Limitation of in-situ leaching
- b) Cost analysis of stoping methods

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**B.Tech III Year - II Semester – Academic Year (2016-2017)**

**UNDERGROUND METAL MINING TECHNOLOGY**

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Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each questions carries 10 marks and may have a, b, c as a sub questions.

**Part-A**

**(25 Marks)**

1. a) What are the difference between raise and winze? (2)
- b) Define stope, level and cross-cut in metal mining. (3)
- c) Write the merits of room and pillar stoping. (2)
- d) What are the applicability conditions for Alimak raise climber? (3)
- e) What is square set stoping? (2)
- f) What are the demerits of VCR method of working? (3)
- g) Write about the ventilation systems used at the underground metal mining? (2)
- h) What are the equipments used in ground breaking? (3)
- i) What is pumping cost in metal mining methods? (2)
- j) What are the applicability conditions of in-situ leaching? (3)

**Part-B**

**(50 Marks)**

2. Explain briefly the mine development for working of vein and lode deposits?

**OR**

3. Write notes on:

- a) Layout of drift
- b) Factors affecting the choice of level intervals
- c) Overhand and underhand stoping

4. Write notes on:

- a) Two compartment method of raising
- b) Raising by Jora raise lift

**OR**

5. Classify the stoping method used in underground metalliferous mining. Describe about the shrinkage stoping briefly with its merits and demerits.

6. Explain briefly the working principle of sub-level caving. What are the merits and demerits of sub-level caving?

**OR**

7. Write notes on:

- a) Top slicing
- b) Long hole stoping

8. Write the applicability conditions for the following methods:

- a) Sub-level stoping

- b) Room and pillar method
- c) Longwall mining

**OR**

9. Write notes on:

- a) Stope layout for cut and fill stoping
- b) Supports in metal mining

10. Describe briefly the productivity and cost analysis of metal mining in Indian conditions.

**OR**

11. Describe the following terms:

- a) Merits and demerits of In-situ leaching
- b) Cost analysis of caving methods

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**B.Tech III Year - II Semester – Academic Year (2016-2017)**

**UNDERGROUND METAL MINING TECHNOLOGY**

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**Part-A**

**(25 Marks)**

1. a) What are the types of mineral deposits for metal found normally? (2)
- b) What is underhand stoping? What are the merits of underhand stoping? (3)
- c) What are the factors affecting the selection of a raising method? (2)
- d) Write the classification of stoping methods. (3)
- e) What are the methods used for working of inclined deposits? (2)
- f) Differentiate between resuing and longwall mining. (3)
- g) How we will select a place for dumping in underground metal mining? (2)
- h) What are the applicability conditions for long-hole stoping? (3)
- i) Draw a pumping arrangement for an underground mine. (2)
- j) What are the drilling and blasting cost in case of caving method and stoping method? (3)

**Part-B**

**(50 Marks)**

2. Write notes on:

- a) Layout of cross-cut
- b) Method for development of a winze

**OR**

3. Write notes on:

- a) Method for making a drift
- b) Shape and size of stope development working

4. What are the factors affecting the choice of a stoping method? Describe about the method of working in sub-level stoping.

**OR**

5. Write notes on:

- a) Jora raise lift
- b) Alimak raise climber

6. What are the methods of working of thin seam in metal mining? Write briefly about any one method which is used in India.

**OR**

7. Write notes on:

- a) Sub-level caving
- b) Merits and demerits of block caving

8. Write the applicability conditions for the following methods:

- a) Room and pillar stoping
- b) Cut and fill stoping
- c) VCR method of mining

**OR**

9. Write about the ventilation and support systems used in underground metal mining with a layout.

10. Describe briefly about the scope and limitations of in-situ leaching. Write an example of in-situ leaching being used and describe the procedure.

**OR**

11. Describe the following terms:

- a) Principle of in-situ leaching
- b) Cost analysis of raising methods

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# **MINE MECHNIZATION-II**

**B.Tech III Year - II Semester – Academic Year (2016-2017)**  
**MINE MECHANIZATION-II**

**Time: 3 hours**

**Max. Marks: 75**

Note: This question paper contains two parts.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as a sub questions.

**Part-A**

**(25 Marks)**

1. a) Explain the functioning of head gear (2)
- b) What is mechanism and purpose of speed indicator? (3)
- c) Explain the types of man riding systems underground coal mines? (2)
- d) Explain ripper with neat sketch? (3)
- e) Explain the working of dragline? (2)
- f) Explain the types of winders? (3)
- g) Explain capping and recapping of haulage rope? (2)
- h) Explain safety devices of a winder? (3)
- i) Describe safety hook used in winder? (2)
- j) Explain shuttle cars? (3)

**Part-B**

**(50 Marks)**

2. Explain cage & suspension gear? (10)
- OR**
3. Explain koepe winding system with neat sketch? (10)
  4. Explain the electrical & mechanical braking system of winding engine? (10)
- OR**
5. Explain the capacity & operation of SDL & LHD? (10)
  6. Explain working of continuous miner with layouts? (10)
- OR**
7. Draw layouts for working of SDL & LHD and explain in detail? (10)
  8. Explain functioning of centrifugal & turbine pumps with neat sketches? (10)
- OR**
9. Explain the application of shovel dumper combination in open cast mines? (10)
  10. Explain working of dragline in opencast mine? (10)
- OR**
11. Explain blast hole drilling practice in open cast mine? (10)

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**Time: 3 hours**

**Max. Marks: 75**

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Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as a sub questions.

**Part-A**

**(25 Marks)**

1. a) Describe head gear pulley? (2)
- b) Explain rope guides? (3)
- c) Explain koepe winder? (2)
- d) What are the rope attachments to cage? (3)
- e) Explain utility of face machinery? (2)
- f) Describe cutter loader? (3)
- g) Explain power loaders? (2)
- h) What is blast hole drill? (3)
- i) Explain SDL? (2)
- j) Explain bucket wheel excavator? (3)

**Part-B**

**(50 Marks)**

2. Explain drum winder & Friction winder? (10)
- OR**
3. Explain cage suspension gear system in detail? (10)
  4. Explain in detail safety devices in winders? (10)
- OR**
5. Explain mechanical braking system in winders with suitable sketches? (10)
  6. Explain man riding systems in underground coal mines with limitations? (10)
- OR**
7. Application of SDL & LHD with operating limitations? (10)
  8. Explain double drum shear and its application in underground coal mines? (10)
- OR**
9. Draw layout for continuous miner? (10)
  10. Explain different types of shovels and their application? (10)
- OR**
11. Explain the limitations of surface miner in opencast mine and its operation features? (10)

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**Part-A**

**(25 Marks)**

1. a) Explain the construction of head gear structure? (2)
- b) Explain the types of guides used in winding shaft? (3)
- c) Explain the types of winders used in mines? (2)
- d) What is the purpose of bell plate used in shaft? (3)
- e) Explain armoured face conveyor used in longwall mining? (2)
- f) Explain shearer used in longwall mining? (3)
- g) Explain LHD and its utility? (2)
- h) Explain the types of pumps used in underground mining? (3)
- i) What is cutter loader and it's functioning? (2)
- j) Explain beam stage loader? (3)

**Part-B**

**(50 Marks)**

2. What is Koepe system of winding and explain its application? (10)
- OR**
3. Draw a neat diagram of head gear with dimensions? (10)
  4. Explain the construction of winding drum? (10)
- OR**
5. Explain the mechanical braking system in winding? (10)
  6. Explain the belt conveyor system for transporting coal from the face to surface with neat sketch? (10)
- OR**
7. Explain SDL and LHD capacity and operating limitations in detail? (10)
  8. Explain continuous miner working system with suitable layout? (10)
- OR**
9. Explain the types of pumps used in underground with relevant sketches? (10)
  10. What is drill hole blasting, explain in detail? (10)
- OR**
11. Explain shovel dumper combination used in open cast mine? (10)

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# **MINE ENVIRONMENTAL ENGG-II**

## B.Tech III Year - II Semester Examination – Academic Year (2016-2017)

## MINE ENVIRONMENTAL ENGINEERING-II

Time: 3 hours

Max. Marks: 75

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Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as a sub questions.

**Part-A****(25 Marks)**

1. a).What is dust plan? (2)
- b) What are the commonly used processes of artificial respiration? (3)
- c) What are the methods used for the detection of spontaneous heating? (2)
- d)What is the possible size of coal dust cause explosion? (3)
- e) Rescue team consists of how many members? (2)
- f) Describe about Pitot tube? (3)
- g) When do you seal the district? (2)
- h) What do you understand of Cowards upper limits of explosibility? (3)
- i)What is the purpose of stone dust barriers?? (2)
- j) What is sampling plans? (3)

**Part-B****(50 Marks)**

2. What steps are to be taken as a precautionary measure to prevent accidental fires in underground coal mine? (10)
- OR**
3. Describe the classification of fires? (10)
  4. What are the factors to be considered for reopening the sealed off area? (10)
- OR**
5. What are organizations fire fighting arrangements? (10)
- OR**
- 6).What factors the inflammability coal dust depends? (10)
- OR**
- 7) What precautions are to be observed to prevent the formation of coal dust in mines? (10)
  - 8).Write about statistical data of Indian coal mine after nationalization of coal mines? (10)
- OR**
- 9).Brief about check on measures of coal dusts? (10)
  - 10) a) What the standards of illuminations in below ground workings?  
b) What are recommended noise levels as per ILO? (5+5)

**OR**

- 7.(a) What is rescue room and its equipments?  
(b) What is rescue station and its equipments??

(5+5)

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**Part-A****(25 Marks)**

1. a) Explain spontaneous combustion ? (2)
- b) What are the factors governing proneness of seam to spontaneous combustion? (3)
- c) Name portable fire extinguishers? (2)
- d) What is upper limit of explosibility? (3)
- e) Write brief about grahams ratio? (2)
- f) What is incubation period? (3)
- g) Explain principle of flame safety lamp? (2)
- h) What is Cowards diagram? (3)
- i) What is percentage of Co/O<sub>2</sub> indicates? (2)
- j) How many types of fire extinguishers are there? (3)

**Part-B****(50 Marks)**

2. What are factors governing proneness of coal seam to spontaneous combustion?

**OR**

3. What are the steps to be observed to avoid spontaneous heating while working?
4. Name the fire fighting equipments and brief each of them?

**OR**

5. What are the methods used to re open the sealed-off area?

6. Calculate the Co/O<sub>2</sub> deficiency ratio from the results of analysis given below O<sub>2</sub>=20.62%, CO=0.008%, CO<sub>2</sub>=0.43% and N<sub>2</sub>=78.94% (fresh air contains O<sub>2</sub>=20.93%, N<sub>2</sub>=79.04% and CO<sub>2</sub>=0.03%)

**OR**

7. Discuss about a study of a mine in which coal dust explosion occurred?

8. What are the various causes of inundation in coal mines?

**OR**

9. Give a statistical data of inundation in Indian coal mines after nationalization?

10. What are the common types of flame safety lamps and explain its principle?

**OR**

- 11.a) Write about lamp room design and organization?
- b) Write about of construction of flame safety lamp?

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**Note:** This question paper contains two parts.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as a sub questions.

**Part-A****(25 Marks)**

1. a) What is meant by water seal? (2)
- b) What is breathing of a fire stopping? (3)
- c) What are the location of stone dust barriers? (2)
- d) To whom the manager inform after explosion? (3)
- e) What are the surfaces precautions against danger from water? (2)
- f) Brief about self contained apparatus? (3)
- g) Write about noise levels? (2)
- h) What is the standard of mine underground lighting? (3)
- i) What is smoke helmet? (2)
- j) What are the limitations of self rescuers? (3)

**Part-B****(50 Marks)**

2. What precautions are to be observed to prevent spontaneous heating in underground coal mine?
- OR**
3. What are the various method adopted to detect spontaneous heating and explain each?
  4. Discuss about Grahams ratio.

**OR**

5. What are the requirements in construction of isolation stopping and fittings on it?
6. Calculate CO/O<sub>2</sub> deficiency ratio of the samples drawn from the intake and return side of a district having following composition.

**Intake side**

O<sub>2</sub>=20.57%  
 CO=0.001%  
 CO<sub>2</sub>=0.44%  
 CH<sub>4</sub>= 78.919%  
 N<sub>2</sub>=78.919%

**Return side**

O<sub>2</sub>=19.97%  
 CO=0.008%  
 CO<sub>2</sub>=0.85%  
 CH<sub>4</sub>=4.25%  
 N<sub>2</sub>=75.727%

**OR**

7. What are the causes of coal dust explosion?
8. What are the preventive measures against coal dust explosion?

**OR**

9. Discuss about dust plan and sampling plan?

10. What are general lighting used in mines as per CMR 1957

**OR**

11. What are the lighting standards in opencast mines?

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