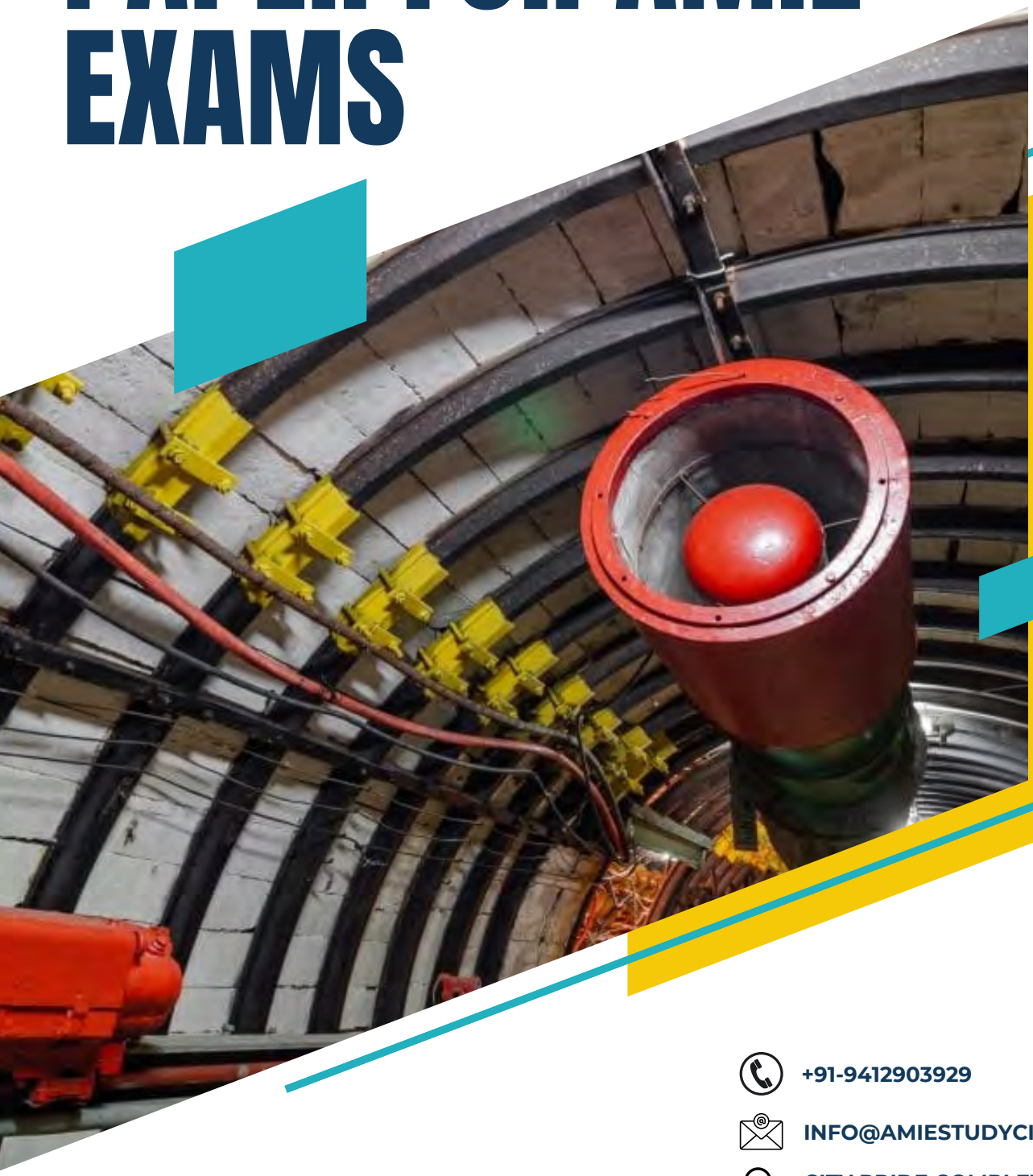
MODEL TEST PAPER FOR AMIE EXAMS



MINE VENTILATION AND ENVIRONMENTAL HAZARDS

TEST PAPER 1

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MINE VENTILATION AND ENVIRONMENTAL HAZARDS

***Time**: Three Hours*

***Maximum Marks**: 100*

Answer five questions, taking ANY TWO from Group A, any two from Group B and all from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches.

Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Explain the physiological effect of high temperature and humidity. 10

   (b) Describe in detail how will you carry out ventilation survey of a large underground mine. 10

2. (a) Indicate whether you “agree” or “disagree” with the following statements. Justify your opinion with appropriate reasoning: 10

   (i) Wet bulb temperature the single most important indicator of thermal stress of an underground mine climate.

   (ii) The positional efficiency is higher if the mine air conditioning plant is constructed on surface, rather than underground.

   (b) Write short note on Pitot tube. A standard Pitot static tube placed at the centre of a 400 mm diameter circular duct records a velocity pressure of 250 Pa. Calculate the air quantity flowing in the duct if the air temperature is 303 K and the barometer reads 108 kPa. Assuming the air to be dry and the method factor to be equal to the 0.85. 10

3. (a) What are the illumination norms/standards applicable to underground coal mines? Identify the characteristic problems that pose challenge to provide good illumination in these mines. 10

   (b) Explain with a neat sketch, the working principle of a sound level meter. 10

What precautions should be taken during its use?

4. (a) State the fan laws and explain their usefulness with examples. What is "characteristic curve"? Differentiate between mine characteristics and fan characteristics. 8

(b) What do you understand by equivalent orifice of a mine? Derive a relation between the equivalent orifice and the ventilating resistance of mine. 6

(c) What is a fan operating point? How does it get affected by the natural ventilation? A mine fan delivers a quantity of 55 m3/s at a fan drift pressure of 700 Pa. The natural ventilation pressure favouring the air flow is of the order of 150 Pa. If the fan was to be shut down, what would be the amount of air flow through the mine assuming NVP remains unchanged? 6

Group B

5. (a) How is black damp formed in mines? The analysis of a sample of air from old workings is reported to be O2 – 19.3%, CO2 – 0.4%, N2 = 79.8%, CH4 – 0.5%. Find the percentage of air and black damp in the sample as well as composition of black damp. 10

(b) What are the hazardous gases pertaining to underground coal mining activity? For the following mine gases, state the safe limits and usual detection methods (i) carbon monoxide (ii) fire damp (iii) sulphur dioxide (iv) carbon dioxide. 10

6. (a) What may be the method of detection, and what are the physiological effects associated with the following gases, when present n an underground atmosphere? 10

(i) CO

(ii) SO_2

(ii) NO_x

(iv) H_2S

(b) A part of the coal mine had been sealed due to underground fire. Now, it is decided to re-open the area. What factors and conditions should be considered prior to re-opening? Enumerate various methods for re-opening the area and explain in detail any one method. 10

7. (a) What are the distinguishing differences between the coal dust and the firedamp explosions? How do stone dust barrier help in arresting explosions in coal mines? Enumerate various types of stone dust barriers. 10

(b) Write short notes on the following: 10

(i) Coward diagram

(ii) High expansion foam plug

8. (a) State the measures to be adopted to avoid inundation of an underground mine due to surface causes. 10

(b) Construct the Coward flammability diagram and classify the following samples of "normal air and methane mixtures" in terms of their explosibility characteristics: 10

(i) CH_4: 5% andO_2: 12%

(ii) CH_4: 10% and O_2: 10%

(iii) CH_4: 7.5% and O_2: 16%

(iv) CH_4: 10% and O_2: 20%

Group C

9. Answer the following in brief: 20

(i) In a 300 m deep mine, the average density of the air in down-cast shaft is 1.18 kg/m^3 while that of the up-cast shaft is 1.15 kg/m^3. The natural ventilation pressure, in Pa, in the mine can be assumed to be

(a) 159

(b) 235

(c) 76

(d) 88

(ii) Nose limit in Coward flammability diagram does NOT represent the following region:

(a) explosive region

(b) potentially explosive region

(c) impossible mixture region

(d) non-explosive region

(iii) Backlash in an underground explosion is essentially the result of

(a) excess methane

(b) narrow roadway conditions

(c) mixed explosion

(d) condensation of hot gases and water vapour

(iv) Specific gravity of methane is

(a) 0.5545

(b) 0.6505

(c) 1.5273

(d) None of these

(v) A flammable mixture of methane and air which can either burn or explode when ignited, is called

(a) afterdamp

(b) blackdamp

(c) whitedamp

(d) firedamp

(vi) Methane is explosive in mine air in the concentration range of

(a) 3.5% - 4.75%

(b) 5% - 15%

(c) 17% - 19%

(d) 20% - 21%

(vii) Workers should not be employed for a period of 8 hours where the carbon-monoxide content exceeds

(a) 50 ppm

(6) 5 ppm

(c) 2.5 ppm

(d) 500 ppm

(viii) (iv) As per the Indian coal mining norms the percentage of inflammable gas should not exceed — in the general body of return air of any ventilating district, and — in any place in the mine respectively.

(a) 0.75, 1.25

(6) 1.25, 0.75

(c) 0.5, 1.0

(d) 1.0, 0.5

(ix) A ventilation network has 9 nodes and 17 branches. The number of unique equations that satisfy Kirchhoff's I law and the Kirchhoff's II law for the flow distribution in network are ——, —— respectively.

(a) 12, 5

(b) 9, 8

(c) 6, 11

(d) 8, 9

(x) Type of stopping constructed to seal-off fire

(a) Preparatory Stopping

(b) Permanent Stopping

(c) Emergency Stopping

(d) Any one of the above.

(Refer our course material for answers)