

Time: Three hours

Answer Any Five questions.

1. (a) Explain the significance of In-situ stresses in design and maintenance of mining structures. [2]
 (b) Through a neat diagram, explain (i) Breakdown pressure, (ii) Re-opening pressure, and (iii) Shut-in pressure, with regard to Hydraulic fracturing method of insitu stress measurement [2]
 (c) With the help of neat sketches only, explain the various conditions of stress concentration in a multi section underground working. [4]

2. (a) Explain the basics of various design approaches generally used for estimating support requirement in a Bord and pillar depillaring working. [4]
 (b) Estimate the support load density requirement for a depillaring panel planned to be worked under the following geo-mining condition : Depth of working - 240 m, ratio of horizontal to vertical in-situ stress - 0.3, width of gallery - 4.2 m and average RMR of immediate roof - 45 [4]

3. (a) What do you understand by caving behaviour of strata? Enumerate the important parameters to be studied for its complete understanding. [4]
 (b) A longwall working is to be planned to extract a coal seam 3 m thick, lying at a depth of 300 m. The thickness and strength properties of roof layers are given in Table below. Estimate the span of first local fall, main fall, successive local fall and periodic caving using suitable design formula. [4]

Roof layer	Thickness, m	Flexural strength, MPa	Unit weight, MPa/m	Elastic modulus, GPa
Immediate roof	4	1.2	0.021	2500
Main roof	8	2.1	0.023	4800
Loading layer	2	1.6	0.021	3500

4. (a) Explain the design functions of different types of pillars used in mines. [2]
 (b) Explain the various factors that affect loading behaviour of a pillar. Also enumerate the basic limitations of Tributary Area theory. [4]
 (c) What do you mean by Post failure behaviour of a pillar. Explain its significance in design of Support pillars. [2]

5. (a) Describe the working mechanism of full length grouted pre-tensioned rock bolt. Also explain the role of axial and shear stiffness of bolt-grout-rock interface on performance of such rock bolts. [4]
 (b) Explain Yielding type roof bolts and its scope for supporting mining excavations. [2]
 (c) Why is it necessary to decide an optimum length of rock bolt? Explain with suitable examples. [2]

6. What are the different mechanisms of Rock Burst? Explain the factors that increase the liability of such strata control hazards. [8]

7. (i) Sketch the profiles of Sub critical, Critical and Supercritical subsidence in terms of their strain, vertical displacement and slope. Also indicate (a) Angle of draw (b) Angle of break (c) Off set distance [4]
 (ii) Discuss various methods to control mining induced subsidence. [2]
 (iii) Enumerate the important advantages and limitations of Profile Function method as compared to Influence Function method of subsidence prediction. [2]

8. Explain each of the following in short: [8]
 (a) Zone of influence and zone of failure (b) Microseismic monitoring (c) Rock-support interaction curve (d) Mean Load Density of Powered-roof support (e) Parting plane controlled caving (f) Drilling Yield technique (g) Cavability of a rock bed (h) TWAR

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