

Total number of printed pages – 6

B. Tech
PEMN 6413

Eighth Semester Examination – 2008

GEOMECHANICS IN MINE DESIGN

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory
and any **five** from the rest.

The figures in the right-hand margin
indicate marks.



1. Answer the following questions :

- (i) Give one *line* definition of the following terms : 2×5
- (a) Temporary Support
 - (b) Permanent Support
 - (c) Active Support

(d) Passive Support

(e) Yielding Support

(ii) Draw the cross-section of a fully grouted rock bolt and label it. 2

(iii) The rock mass rating for a rock mass is 48. Its equivalent rock mass quality is _____ ? 2

(iv) The ratio of shear wave velocity and longitudinal wave velocity is _____ ? 2

(v) Explain in brief on the preferred shape of mine opening in a hydrostatic stress field. 2

(vi) What are the reasons for monitoring of structures ? 2

2. The stress tensors at a point are given as $\sigma_{xx} = -10.0$ MPa, $\sigma_{yy} = -3.0$ MPa and $T_{xy} = 1.0$ Mpa. If the plane $5x + y = 5$ passes

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Contd.

through the place in question, determine the normal and shear stress components on this plane. 10

3. Assess the floor stability factor in case of a coal mine entry with the following conditions :
It is a longwall panel at a depth of 195 m. The floor of 5.5 m entry wide entry is next to a yield pillar whose width and length are 6.7 m and 39.7 m respectively. Mining height is 1.8 m. The pillar load as determined is 18.3 MPa. The floor material i.e. fractured grey shale, has the properties as : density $\gamma = 1.1236 \text{ gm/cc}$, cohesion $c = 0.2 \text{ MPa}$, friction angle = 19° , uniaxial compressive strength $\sigma_c = 11.6 \text{ MPa}$. The rock mass rating is 44. The shape factors are given by equations $S_y = 1.0 - 0.4 (W_p/W_l)$ and $S_q = 1.0 + \sin \Phi (W_p/W_l)$; W_p and W_l are pillar width and length respectively. 10

4. A surface mine face is being worked to have a bench at an angle of 60° with the horizontal. At this depth the bench floor intersects a well developed joint that dips at an angle of 30° towards the quarry face. This joint is intersected by a vertical tension crack of 6.096 m back from the quarry bench face. The unit weight of the rock is 2.569 gm/cc , the cohesion along the joint plane is 4.8926 Kg/cc and the coefficient of friction angle is 25° . Determine the existing factor of safety against sliding of the block under the conditions :
- (i) If the situation is not influenced by water, and
 - (ii) if the water fills the vertical tension crack within 94.48 cm of the top of the surface mine bench. 10

5. What is rock bolting ? Compare the salient features of tensioned and non-tensioned resin rock bolting with that of the mechanical bolting.

10

6. Why do we need to determine the preexisting state of stresses in rock mechanics design ? How do we determine these stresses in the field ? Describe the principles of each method shortly.

10

7. Explain any *two* of the following terms with neat and labeled sketches :

10

(i) Angle of Break

(ii) Super critical width

(iii) Ground Reaction Curve

8. (a) In a series of triaxial compression tests on sandstone samples, the following represent the stresses at peak load

conditions. Determine values of cohesion and angle of internal friction for the material graphically.

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Test

Lateral, σ_3 (MPa)

Axial, σ_1 (MPa)

1	1.0
	9.2
2	5.0
	28.0
3	9.5
	48.7
4	15.0
	74.0

b Discuss the Hoek-Brown rock failure criteria as compared to that by Mohr-Coulomb.

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