

B.E. (MN) Part-III 6th Semester Examination, 2010

**Rock Mechanics Applications
(MN-601)**

Time : 3 hours

Full Marks : 70

Use separate answerscript for each half.

FIRST HALF

(Answer O.No.1 and any TWO from the rest)

1. a) A coal mine is being mined at 500 ft with stable pillar and roofs, and mining is planned at 1100 ft. What square pillar should be selected at that depth? Given that $h=10\text{ft}$, $w=36\text{ft}$ and $B=18\text{ft}$.
b) Describe step-by-step pillar design procedure for a bord and pillar coal mine. [6+7]
2. Write short note on the followings: [4+4+31]
 - a) Borehole deformation gauge
 - b) Convergence meter
 - c) Flat Jack
3. Assess the floor stability in a coal mine entry under the following conditions:
Longwall panel at the depth of 600 ft. The floor of the 18 ft wide entry is next to a yield pillar with $B=22\text{ ft}$ and $L=136\text{ ft}$. Entry height. $h=6\text{ ft}$. The properties of the fractured shale, which is the floor material, are: $\gamma=70\text{ lb/ft}^3$, cohesion, $c=28\text{ psi}$, friction angle $\phi=20^\circ$. Uniaxial compressive strength. $\sigma_c=1680\text{ psi}$. The rock mass rating, $\text{RMR}=46$
4. a) What do you understand by rock bursts?
b) Write down causative factors of rock bursts.
c) How would you localize rock bursts? [2+5+4]
5. a) What are the different types of coal bumps?
b) What are the contributing factors for coal bumps?
c) Write down the remedial measures of coal bumps. [2+5+4]

SECOND HALF**Answer O.No.5 and anu TWO from the rest)**

6. a) What is Patton's expression for shear strength on rough discontinuity surfaces? How it is modified by Barton?
 b) How the JCS is estimated?
 c) Define Hydraulic Conductivity and Permeability. How ground water flow is affected if smooth, parallel discontinuities are present in rock? **K2+3)+3+(3+2]**
7. a) What are the general conditions of plan failure?
 b) Assuming that a tension crack is present at the upper surface of the slope, discuss the assumptions needed for slope failure analysis.
 c) Explain briefly the various techniques of rock slope stabilization by reinforcement. **(3+5+3]**
8. a) Discuss the in-situ state of stress and its variation depending on vertical stress, horizontal stress and Poisson's ratio.
 b) Explain the general procedures for designing or evaluating the stability of a single opening in competent rock.
 c) Write the expressions for radial, tangential and shear stresses for a single circular opening, using general notations. **[4+4+3]**
9. a) Discuss the variation of pressure abutments for a logwall excavation.
 b) Explain the method of Influence Function for determination of subsidence.
 c) The following are the results of a hydraulic fracturing tests:-

Depth, m	Breakdown Pressure, MPa	Shut-in Pressure, MPa
500	14.0	8.0
1000	24.5	16.0

Given, the tensile strength = 10 MPa. Estimate the value of three principal stresses at two depths and state whether the two sets of result are consistent with each other or not. Assume any further conditions if required. **[4+3+4]**

10. Comment/discuss on the following statements:-
- a) Pure shear condition.
 b) Effects of shape and size of core samples in uniaxial compression testing.
 c) Impact of CHILE and DIANE rock material on rock mechanics analysis
 d) Stress distribution around an opening of a given shape is independent of size of the excavation. **[3+3+3+2]**