

BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
B.E. 5TH SEMESTER (MINING ENGINEERING) FINAL EXAMINATIONS, 2012
Fundamental of Rock Mechanics (MN 502)

Full Marks: 70

Time: 3 hrs

First Half

Question number 1 is compulsory. Answer any two from the rest.

1. Write short notes on: Post failure behavior in compression, Creep, Cohesion and angle of internal friction, Point Load Index of irregular specimens, Porosity
(3 X 5 = 15)
2. Explain the terms normal and shear strain. Derive the normal and shear strain expressions from the known displacements of a body.
(3+7)
3. How do you find out the principal strains using a delta strain gage rosette? (10)
4. a) The following represents the state of stress on a point:
 $\sigma_x = 20 \text{ MPa}$, $\sigma_y = 15 \text{ MPa}$, $\tau_{xy} = 14 \text{ MPa}$
Draw (hand drawing) the Mohr's circle on x-y plane showing clearly all notations.
b) A sample in a triaxial experiment is subjected to a confining stress of 5 MPa and the sample fails at an axial stress of 25 MPa making an angle of 30 degree with the vertical.
Calculate the shear strength of the sample.
(5+5)
5. Why the determination of shear strength of a discontinuity is important? How can you find it out in the laboratory?
(3+7)

2ND HALF

Answer question no. 6 and any two from the rests.

6. Comment on the applicability of each of the Griffith, Mohr-Coulomb and Hoek-Brown criteria for the following triaxial test results on quartzite:

$(\sigma_1 + \sigma_3)/2$, MPa	-6.65	100	135	160	200	298	435
$(\sigma_1 - \sigma_3)/2$, MPa	6.65	100	130	150	180	248	335

(15)

7. a) Define cohesion and angle of internal friction.
b) What do you mean by fracturing?
c) Derive the relationship between shear stress and normal stress at the fracture surface as per Mohr-Coulomb criteria. (3+2+5)

8. A series of triaxial compression tests on specimens of marble gave the following results.

σ_3 , MPa	0	3.45	6.9	13.8	20.7	27.6	34.5	48.3
σ_1 , MPa	134.6	144.2	157.7	182.7	196.2	215.4	244.2	276.9

Establish the Coulomb's shear strength criterion for this marble that best fits the data. Assume the plot is linear. ¹⁰
(3+7)

9. a) What is the purpose of doing rock mass classification?
b) A tunnel is to be driven in a Basalt rock mass. The following parameters have been determined for the rock mass. The core rock sample having a diameter of 60 mm fails at 291 KN. In a drill core run of 2.5 m, core pieces obtained are having the lengths as 345 mm, 365 mm, 105 mm, 425 mm, 97 mm, 103 mm, 75 mm, 180 mm, 25 mm, 296 mm, 64 mm, 20 mm, 210 mm and 190 mm respectively. Discontinuities are spaced at 60 cm interval. Discontinuities are having slightly rough surfaces having a separation < 1mm and with slightly weathered walls. Groundwater condition in the strata is wet. The tunnel has been oriented such that the discontinuity set becomes unfavourable. Determine rock mass rating for this application. (2+8)

10. a) Write down the characteristics of discontinuities.
b) A limestone has cohesion of 20 MPa and angle of friction of 60° . What axial stress would be required to break a specimen subjected to a confining pressure of 25 MPa? (5+5)