CBCS SCHEME

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18MN55

# Fifth Semester B.E. Degree Examination, June/July 2023
## Rock Mechanics

Time: 3 hrs. Max. Marks: 100

***Note: Answer any FIVE full questions, choosing ONE full question from each module.***



### Module-1

1 a. Define Rock Mechanics. Discuss about application of Rock Mechanics in the field of Mining Engineering. **(06 Marks)**

b. Define the ten parameters used to describe discontinuous in rocks with suitable sketch. **(14 Marks)**

**OR**

2 a. Explain Barton's shear strength model with suitable sketch. **(06 Marks)**

b. Estimate joint shear strength of joint using Barton-Bandis model assuming that the joint roughness coefficient = 7.1, joint wall compressive strength = 170.5 MPa, residual friction angle = 28.4° and effective normal stress = 3 MPa. **(05 Marks)**

c. Write step to step procedure to plot discontinuities planes in a stereographic projection with help of neat sketches. **(09 Marks)**

### Module-2

3 a. Define principal stresses and its planes. Give expressions to calculate the same and define the parameters used. **(06 Marks)**

b. For the state of plane stress given Fig.Q3(b), determine the principal planes, the principal stresses and the maximum shear stress by graphical method. Also find the stress components on the element after it is rotated by 20° counter clockwise.

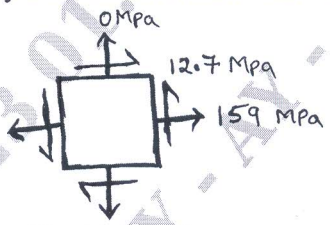


Fig.Q3(b) **(14 Marks)**

**OR**

4 a. $\epsilon_x = 340\ \mu$, $\epsilon_y = 110\ \mu$ and $\gamma_{xy} = 180\ \mu$. Determine the strains for $\theta = 30°$, Principal strains and their planes, maximum shear strain by analytical method. [Refer Fig.Q4(a) ]

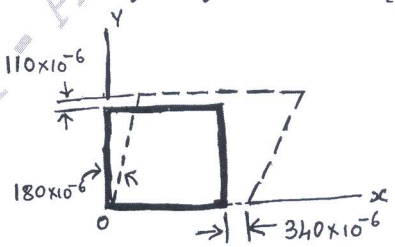


Fig.Q4(a) **(14 Marks)**

b. Discuss in brief, the elasto-plastic behaviours of rocks with help of neat graphs. **(06 Marks)**

## Module-3

5 a. With a neat sketch, explain longitudinal method to determine permeability of rock in laboratory. **(15 Marks)**

b. For determination of tensile strength of a rock specimen cylindrical core specimen was loaded on the curved surface keeping its axis horizontal. If the failure load was 10 kN for a core diameter 4.2 cm, determine tensile strength of a rock specimen. **(05 Marks)**

**OR**

6 a. Discuss the factors responsible for rock strength. **(06 Marks)**

b. Explain with a neat sketch, how to determine uniaxial compressive strength of the rock. **(10 Marks)**

c. In a point load strength test a 50mm diameter core sample ruptured at 5 kN load. Determine unconfined compressive strength of the sample. **(04 Marks)**

## Module-4

7 a. Discuss the selection of test site and requirements for in-situ tests. **(08 Marks)**

b. Explain with neat sketch, the plate load test to determine state deformability by in-situ method. **(12 Marks)**

**OR**

8 a. 10 tonnes of load is proposed on an area of 60cm × 60cm. If modulus of elasticity of the rock material is $2.4\times10^3$ kg/cm$^2$ and Poisson's ratio is 0.3, evaluate the expected surface displacement on the rock surface. Displacement coefficient for a square area may be taken as 0.95. **(05 Marks)**

b. Explain with neat sketch, the shear test to determine insitu shear stress and normal stress. **(15 Marks)**

## Module-5

9 a. Explain the Mohr's – Coulomb theory of failure of rock and mention its limitations. **(08 Marks)**

b. Comment on the applicability of each of the 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 |

**(12 Marks)**

**OR**

10 a. Explain the Hoek and Brown's theory of rock mass failure **(10 Marks)**

b. Explain the Griffith theory of rock mass failure. **(10 Marks)**

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