Fayoum University **Faculty of Engineering**

Civil Department – Geotechnical Engineering

Rock Mechanics Sheet No. 2

Q1.

a) Explain the point load strength test and show the importance of this test.

b) Estimate the point load strength index and the uniaxial compressive strength (UCS) for the given samples as shown below, then classify each of them according to the strength.

Sample	Sample cross section shape	Sample dim. (mm)	Load test (kN)
1- Silt stone	Circular	Diameter (30 mm)	2.52
2- Sand stone	Square	L (35 mm)	5.25
3- Shale stone	Rectangular	L*B (40*30 mm)	6.50
4- Lime stone	Trapezoidal	L1*L2*h (35*30*30 mm)	7.55

Q2.

a) Which is better in studying rock mechanics Hoek-Brown criteria or Mohr-Coulomb criteria and state why?

b) Write the generalized Hoek-Brown (GHB) criteria and explain each term in this equation.

c) A blocky rock with good quality surface condition has the following properties:

UCS = 50000 kPa $m_i = 15$

Estimate the following requirements:-

1- GHB parameters (m_b, s and a)
2- Using GHB calculate the major stress if the minor stress equals 300 kPa.
3- Draw the relation between minor stress and major stress (principal stresses) in case that the range of minor stress [10 kPa to 200 kPa] based on GHB.
4- Shear strength parameters (cohesion, internal angle of friction) considering that maximum minor stress 200 kPa based on GHB.

Q3.

a) Based on GHB criteria estimate the uniaxial compressive for intact rock (UCS) and material constant mi.

b) Using GHB criteria to estimate the uniaxial compressive strength for rock mass in terms of uniaxial compressive strength for intact rock (UCS) and GHB parameters (material constants).

c) For the following given data find:
   1- Compressive strength for rock mass.
   2- Tensile strength for rock mass.
   3- Rock mass strength.
   4- Shear strength parameters.

   Data:- UCS = 400 kg/cm^2 GSI = 50 $m_i = 13$

Q4.

A triaxial test has been conducted on a sedimentary rock, the following results were obtained.

Cell pressure (kPa)	-8.19072	-2.12352	10.3142	16.3814	49.1443	109.665
Deviator pressure (kPa)	24.5722	95.255	244.963	231.615	327.932	494.022

Based on the previous table results estimate the following:

1- UCS.
2- m_i.
3- If the geological strength index (GSI) = 65, estimated the shear strength parameters according to MC and GHB for the maximum minor stress 109.665 kPa.

Q5.

Find the shear strength parameters can be deduced from the following data in the cases 1, 2 and 3:

a) UCS = 15000 kPa GSI = 35 m_i = 7 D = 1
b) UCS = 20000 kPa GSI = 55 m_i = 8 D = 0.5
c) UCS = 40000 kPa GSI = 65 m_i = 8 D = 0

1- General case.
2- Slope case (slope height = 20 m , rock unit weight = 20 kN/m^3)
3- Tunnel case (depth of tunnel underground = 35 m , rock unit weight = 22 kN/m^3)

Q6.

A direct shear box test has been conducted on a sedimentary rock, the following results were obtained.

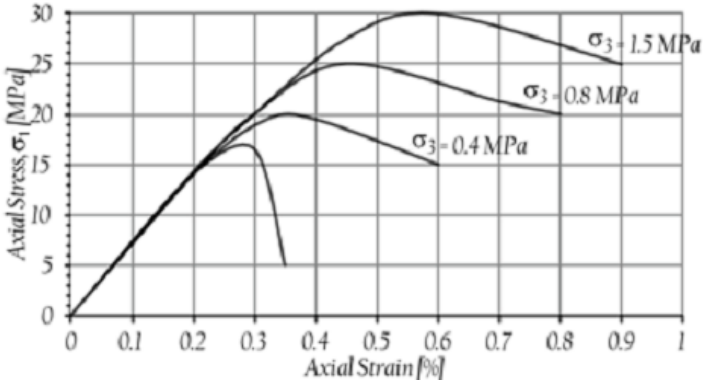
Normal stress (kPa)	10	20	30	40	50	60
Shear stress (kPa)	125.77	131.55	137.32	143.09	148.87	154.64

Based on the previous table results estimate the following:

1- Shear strength parameters using MC.
2- UCS.
3- m_i.
4- The rock mass of the sedimentary rock under study can be described as a disintegrated rock with fair surface quality condition. Find the following;
   4.1) GHB parameters.
   4.2) Compressive strength for rock mass.
   4.3) Tensile strength for rock mass.
   4.4) Rock mass strength.

Q7.

A series of triaxial compression tests has been carried out on intact shale samples and the following results are obtained:



Based on the previous curves estimate the following:

1- Shear strength parameters.
2- Find the value of minor stress that corresponds to the curve with the lowest peak strength. What type of test does this curve represent?
3- The rock mass of the shale under study can be described as a disintegrated rock with poor surface quality condition. Find the following;
   3.1) GHB parameters.
   3.2) Compressive strength for rock mass.
   3.3) Tensile strength for rock mass.
   3.4) Rock mass strength.

With My Best Wishes
Dr. Mohammed Hussien ----- Fayoum in 12-2014