Prince of Songkla University

Faculty of Engineering

Midterm Examination : Semester I
Date : 5 August 2007
Subject : 220–624 Rock Mechanics

Academic Year : 2007
Time : 09.00-12.00 p.m.
Room : R 300

Instructions

1. Do all questions (5 pages) and answer them in the given papers and do rear papers allowed.
2. Allowed all books or notes and a calculator programming capability.
3. Write your name in answer page including graphs and returned all papers to controllers.
4. Total points are 90 or 25 % of course.

"ทุจริตในการสอบ โทษขั้นต่ำปรับตกในรายวิชานั้น และพักการเรียน 1 ภาคการศึกษา สูงสุด ให้ออก"

No. Problem	Full Points	Assigned Points
1	30	
2	30	
3	30	
Total Points	90	

Name ..... **Surname** ..... **ID** .....

Bonne Chance et bon courage
Danupon Tonnayopas
29 July 2007

1. The U-Thapao River Auxillary Tunnel is a water supply tunnel in the city of Songkhla. The tunnel, whose inside diameter 6.7 m, extends 2800 m between the intake and the outlet. It is excavated through shale and granite at a maximum depth of 61 m below the surface. Three major geological zones were distinguished along the tunnel route, consisted of following:

   1. Shale and granite zones, constituting 85% of the tunnel,
   2. Fractured rock zones (very blocky and seamy), between station 23+10 m and 31+10 m,
   3. Three faulted zones, one near station 57+50 m and the others at 89+30 m and 95+50 m.

   Bedding and jointing are generally north/south, which is perpendicular to the tunnel axis (tunnel runs west to east). The bedding 10 cm thick and generally dipping between 15° and 20°, whereas spacing of the joints 25 cm and steeply dipping, between 70° and 90°. The joint in the shale have slightly weathered, separation 0.8 mm to 1.1 mm, rough surfaces and many are very thin and healed with calcite

   General condition of groundwater is dripping. Core sample were selected from 21 localities within the tunnel, near the crown to determine the uniaxial compressive strength 22.4-90.3 MPa average 53.4 MPa, modulus of elasticity 1.38-34.5 MPa or average 14.5 MPa. The parameter values for the two zones are given in Table below. Determine the rock mass classification of RMR for tunnel and roof support method. (30 points)

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2. A sandstone slope has a 30 m high slope with a face angle of 60° is found to have a bedding plane running through it at a dip = 30°. A tension crack occurs 10 m behind the crest of the slope and the tension crack is also found to have a depth of 13 m. The bulk density of sandstone is 2.5 g/cm^3. Assuming that the cohesive strength of the bedding plane = 47.88 kPa and the friction angle is 35°. (30 points)

   a) Find the factor of safety of the slope.

   b) If earthquake acceleration of 0.08 g, how about that factor of safety.

   c) From the case of a) calculate applied bolts to reinforcing force for safety of factor increases to 2.

3. It is investigated that structural mapping that the following geometrical and structural features have been identified:

Feature	dip°	dip direction °
Overall slope face	50	200
Individual benches	70	200
Sheet joint	35	190
Joint set J_1	80	233
Joint set J_2	80	040
Joint set J_3	70	325

Check slope stability both the overall slope and the individual benches by stereo-net and measure direction of potential slide. (30 points)

Name ..... Surname ..... ID .....

LAMBERT EQUAL-AREA PROJECTION