

**Rak-32.3510 APPLIED ROCK MECHANICS FOR HARD ROCK MINING**  
**Exam, 2012-12-19**

**Part 1, questions without course material**

- 1) Describe the differences between structurally controlled failure and stress induced failure (6 p).
- 2) An open pit consists of a number of slopes with varying angles, roads and benches. Draw a vertical section of a typical open pit and name the major structures (6 p).
- 3) Describe relevant methods to detect and monitor instability of large slopes (3 p). Suggest actions to improve stability of a rock slope (3 p).
- 4) Factors influencing the performance of the cable bolting support (6 p)?
- 5) What components are shotcrete made of and why are additives used (6 p)?

**Part 2. Use of course material, your own notes, exercise papers, general dictionary and calculator allowed**

6 . A stope with rectangular cross-section, with vertical walls and horizontal roof is planned in the depth of 400 m. The stope width is 20 m, height 30 m and length 60 m. The rock is gabbro-type, coarse grained with density of 3300 kg/m<sup>3</sup>. The in-situ horizontal/vertical stress ratio is 2 and the longitudinal axis of the stope is to the north. There are three joint sets (dip direction/dip):

250/55  
80/45  
350/15

Joint surfaces are closed, planar, rough and slightly altered. Joint spacing is about 0.5 m and joint length is 1 - 2 m. Only minor local groundwater inflow has been observed. The RQD is 92%. The UCS for intact rock samples is 95 MPa.

- a) Estimate the stability of roof and sidewalls with Stability Graph -method. In this case, you can omit the short endwalls of the stope. (15 p)
- b) Design the cablebolting for the roof and sidewalls, if needed. (3 p)
- c) Calculate the modulus of elasticity, Poisson's ratio, bulk modulus, shear modulus, uniaxial compressive strength, tensile strength, cohesion and friction angle of undisturbed rock mass. (6 p)