

No literature

Write on every examination paper

- **Code, name and date of the exam**
- **Your name, student number and department**

1. Explain hydration process of Portland cement either by means of seeding theory. Point out the stages of hydration process, name and describe main hydration products, and draw the heat development curve.

6 p.
2. Alkali aggregate reaction (AAR). Indicate two possible types of AAR and describe the deterioration mechanisms. Describe possible prevention methods (aggregate choice, concrete mix composition)

6 p.
3. Explain phenomenon of secondary ettringite formation. Describe the formation mechanism and consequences to the durability. Describe how to recognise concrete which was deteriorated due to secondary ettringite formation and indicate what can be done to rescue the structure.

6 p.
4. Silica fume. Describe origin of that material, effects on hydration of Portland cement, effects of fresh and hardened concrete properties. Indicate situations where application of that material is especially beneficial.

6 p.
5. Explain methodology for mix design of the following types of concretes:
 - a) Ultrahigh strength concrete (based of Reactive Powder Concrete having 28-day compressive strength of >200 MPa)
 - b) Self-Compacting Concrete (not TTK method based on statistical model used during lab exercises)

The following should be addressed: how mixture of aggregates is optimized, how grading curve differs from normal concretes, what is the usual binder composition how does it differ from normal concretes, curing – how does it differ from normal concretes (if at all).

6 p.
6. Polymer modified concrete. Explain basic principle; list at least 3 types of polymer modified concretes. Indicate potential applications and explain possible benefits over normal concretes.

6 p.