Name: _____

University of California, Berkeley
Civil and Environmental Engineering

Structural Engineering, Mechanics & Materials
Spring Semester, 2020

Comprehensive Examination - Materials

Problem 1

I) Plot the heat evolution vs. time for regular concrete and for concrete containing large amount of fly ash substitution

II) Describe the hydration reaction of the dicalcium silicate.

III) Would the use of biofuels eliminate the generation of CO_2 during the production of portland cement?

IV) Discuss the following statement: "If we use Type V cement for a concrete structure, we don't have to worry about sulfate attack".

V) Why and when is gypsum added to portland cement during production?

Problem 2

I) For a 9500-psi concrete, a contractor has an option of using the aggregate from **source A** with elastic modulus of 50 GPa or from **source B** with elastic modulus of 30 GPa.

a) Which concrete will have a higher compressive strength?

b) Which concrete will have higher creep?

c) Which concrete will have higher shrinkage?

d) Would the answers be different if instead of 9500 psi concrete, the job requires a 4000 psi concrete?

II) Describe the advantage and disadvantage of using $CaCl_2$ in concrete.

Name: _____

University of California, Berkeley
Civil and Environmental Engineering

Structural Engineering, Mechanics & Materials
Spring Semester, 2019

MATERIALS EXAM
Please justify your answers

Problem 1

I) List four major consequences if an engineer is foolish enough to build a concrete column without aggregate.

II) Consider the following mix proportions:

Mix A (lb/yd3)
Cement: 450
Gravel: 1200
Water: 230

Mix B (lb/yd3)
Cement: 360
Fly-Ash: 90
Gravel: 1200
Water: 230

Mix C (lb/yd3)
Cement: 450
Fly-Ash: 90
Gravel: 1200
Water: 230

a) which mix will generate the highest amount of heat?
b) which mix will be the cheapest?
c) comparing the mixes A and B: which one will have higher early-age compressive strength?
d) comparing the mixes A and B: which one will have higher late-age compressive strength?
e) comparing the mixes A and B: which one will generate higher amount of heat?

Problem 2

I) Describe the corrosion mechanism in reinforced concrete and three methods to avoid this reaction.

II) How does presence of free water in a sample affect a) the strength of concrete and b) the elastic modulus of concrete

III) How does the relative humidity affect the corrosion of reinforced concrete?