CE2330: Quiz I – October 17, 2014 20 marks

Note: The answers with blue pen are the perfect answer.

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For all the questions, -1 mark will be awarded if the answer is wrong. Do not write in the left, right, top and bottom margins.

PART A (Materials)

Questions 1 through 5 [1 mark each]

1. Cast iron contains more carbon than that in mild steel and is more hard than mild steel.

2. After the surface treatment called anodizing, the surface hardness of aluminium is increased. This enhanced property makes it resistant against surface damage due to the possible rough handling on construction sites.

3. In concrete technology, CH and C-S-H stands for calcium hydroxide and calcium silicate hydrate.

4. Clinker and slag are interground to produce Ordinary Portland Cement.

5. Fly ash, slag, silica fume, metakaolin, and rice husk ash can be used as supplementary cementitious materials for making concrete.

Questions 6 through 10 [3 marks each]

6. For long span bridge construction (like metro bridges), why are we using the 7-wire prestressing steel strands in addition to the typical Fe 415 or Fe 500 steel rebars?
   The yield strength of prestressed steel strands is 1860MPa (4.5 times normal steel strands). The 7-wire strands thereby enhance the tensile strength that the structure can withstand. These strands increase the lateral stability & due to their low relaxation, are excellent for long span bridge construction.

7. You are designing a tension member of an aluminium truss structure. State whether you will consider ultimate tensile strength or yield strength while designing for in-service load conditions. Why?
   Yield strength is considered for in-service load condition as it is so as the material undergoes permanent deformation beyond yield strength. The material properties change and increase in wear cycles will increase the probability of failure in short run itself. So choosing yield strength has higher performance due to elastic loading in long run.
8. As discussed in class, list the five types of cements specified by the Bureau of Indian Standards (BIS).

i) Ordinary Portland Cement - Grade 33, 43, 53
ii) Portland Cement, Low Heat
iii) Rapid Hardening Portland Cement
iv) PPC (Portland Pozzolano Cement)
v) PSC (Portland Slag Cement)

9. Write the typical pozzolanic reaction. Why do you think river sand, which contains silica, cannot be ground and used as SCM?

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S + CH + H \rightarrow CSH
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Silica Calcium Water Calcium Silicate Hydrate

* SCM must have finely ground amorphous siliceous matter for reaction to occur at faster rate which is not the case with river sand.
* River sand contains water with it which makes calcium hydroxide dissolve in it (basically CH is unstable in water)
* Due to above reasons, river sand can’t be used as SCM.

10. What are four major elements that can penetrate through covercrete and cause corrosion of embedded steel rebars? How does curing helps in achieving durable concrete?

vi) Chlorides
vii) O₂ (oxygen)
viii) CO₂ (carbon dioxide)
ix) Water

How does curing helps in achieving durable concrete?

During compacting, the microstructure of the cover-concrete due to which it becomes less permeable to above mentioned elements, lowers permeability and porosity enhances durability of concrete.