DEPARTMENT OF CIVIL ENGINEERING: IIT DELHI

CVL141: CIVIL ENGG MATERIALS

MAJOR EXAMINATION

DURATION: 2 hours

Ist Semester 2016-2017.

Max. Marks: 40

DATE: - 19-11-2016

TIME: -18.00 -20.00

Venue: LH121

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DRAW DIAGRAMS TO EXPLAIN YOUR ANSWER WHERE EVER REQUIRED

BE BRIEF AND ANSWER TO THE POINT

ASSUME MISSING DATA SUITABLY IF REQUIRED

1. Calculate the capillary porosity of hardened cement paste for W/C values of 0.45 and 0.65.Draw figures relating permeability of paste with capillary porosity and W/C, Draw diagrams of porous paste, and explain the observed permeation behavior of paste evident through these curves. Hence explain why upper limit of W/C is lower than 0.65 for structural concrete from durability concern. From the figures drawn by you, state the accepted upper limit of W/C for M20 grade of concrete.   10

2. a) Explain why metallic structure is considered poly crystalline? Draw diagram to illustrate the effect of grain size on yield strength of steel, aluminum alloy, and zinc. Draw a diagram to explain strain hardening. Explain the effect of heating strain hardened metal above 0.3 T . 0.5T, where T is melting temperature.   7

   b) Draw a diagram and explain how 24 hour water absorption is related to strength of brick? Explain the basis of selection of appropriate mortar for masonry knowing unit strength.   3

3. a) Typical elastic modulus E of concrete is 25-30 GPa and Poisson's ratio v is 0.2. Compressive strength tests were conducted on concrete cubes of size $15\times15\times15$ cm^3 in standard condition and manner, the strength obtained is 30 MPa. Now it is decided to use sheets of a material having E equals to 10 GPa and $v = 0.3$, between machine plates and cube specimens, will the strength exhibited by the cubes be same, less or more? Draw diagram of failure pattern of cubes to justify your answer.   5

   A concrete is made with OPC (C) having mean (average) 28 day strength 38 MPa, with W/C 0.48. The water content is 180 kg/m^3. When 25% Fly ash (F) in cementitious material, i.e., (cement + Fly ash) is used with water content can be reduced by 10% while maintaining same workability with overall increase in the cementitious material being 15% for maintaining the grade of concrete same. Compare the strength of the two concretes with age through a figure. Addition of appropriate HRWRA say SNF can reduce the water requirement for same slump by another 20%, however W/(C+F) must be maintained same as before for strength requirement. Calculate saving in OPC content by addition of F and HRWRA?   7

5. Distinguish among homo-polymer and different types of co-polymer. Identify the class for VHRWRA –poly-carboxylate class of hyper plasticizer used in concrete   4

6. a) Consider plastic concrete as a Bingham fluid and relate the parameters of such fluid to compact-ability and mobility.   2

   b) Explain the basis for estimating minimum paste content in concrete mix for obtaining adequate workability.   2

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