DEPARTMENT OF CIVIL ENGINEERING: IIT DELHI
CVL 771: ADVANCED CONCRETE TECHNOLOGY.
MAJOR TEST. DURATION:2 hours.
FIRST SEMESTER: 2017-2018.. Maximum marks. : 40 .
DATE: - 23-11-2017   TIME:- 3.30 P.M -5.30 PM   Venue :   LH-114

ASSUME MISSING DATA SUITABLY IF REQUIRED
Draw neat sketches wherever necessary

1. State Grifith's criteria (equation for critical tensile stress) for propagation of cracks in a thin plate containing elliptic hole under tension. Explain the underlying basis for arriving at such criteria. Hence on the basis of above equation explain the variation of uniaxial cube compressive strength of concrete with water to cement ratio (W/C), aggregate type and moisture content of the specimen.   9

2. State linear (2nd order parabolic PDE) diffusion equation used often for Chloride ingress. A Commonly used closed form solution with conventional notations is:

$$C(x,t) = C_s + (C_0 - C_s)\,erf\left(\frac{x}{2\sqrt{Dt}}\right)$$

For what specific boundary and initial condition the solution is valid? State two example cases where this equation is not applicable and state one situation where this is applicable? Using an appropriate transformation (to ϕ) covert the 2nd order parabolic PDE to and ODE in transformed variable ϕ. Obtain an expression for $dC/d\phi$ with ϕ.   9

3. a) Define modulus of elasticity of concrete, in all possible manners? What factors affect the modulus of elasticity of concrete?   4½

3. b) Explain the mechanism of sulfate and sea water attack on concrete, how would you protect the concrete against such attack?   4½

4. What is the target mean strength for M30 Concrete as per Indian Standard. Assume the required water/cement ratio as 0.4 fine content computed from IS tables etc is 30.8% and water content is 186kg/m3. Assume the air content for m.s.a 20 mm is 2% and any other missing data suitably to calculate the mix proportions?   6½

5. a) Compare the development of strength of concrete with age prepared using OPC with that made by using OPC with 20% replacement by pozzuolana.   3

5. b) How can you define and quantify the particle shape how does it influence the void content of an aggregate, explain with figures and equations?   3½

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