Birla Institute of Science & Technology, Pilani, Pilani Campus, Rajasthan 333031

Comprehensive Examination – May 2022

Subject: Advanced Concrete Technology (CE G562)

Total marks: 90 (Closed book)   **Time: 3 hours**

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1) Choose the correct option for the following questions. **(For each wrong answer negative 0.5 mark will be given.)**   **(1 × 5 = 5 Marks)**

    a) Reduction in volume of cement paste due to shrinkage is not equal to the volumetric loss of water. (True/False)

    b) Sheltered parts of the structure undergo carbonation induced corrosion at a slower rate than those exposed to rain. (True/False)

    c) Which of the following is not true?
      i. C_3A helps in binding the free chloride
      ii. High C_3A content makes the concrete susceptible in sulphate attack
      iii. C_3S helps in binding the free chloride
      iv. C_4AF helps in binding the free chloride

    d) Fluid movement under concentration differential is known as –
      i. Sorption
      ii. Diffusion
      iii. Permeability
      iv. Absorption

    e) Which of the following tests is associated with cement characterization?
      i. Angularity number
      ii. Consistency
      iii. Abrasion test
      iv. Petrographic analysis

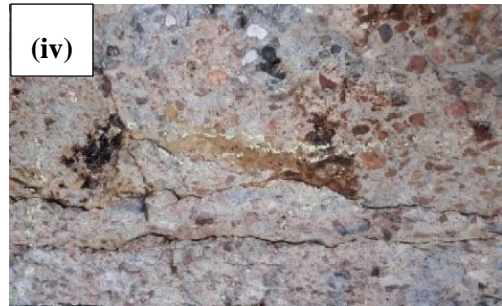2) Answer the following questions.   **(3 × 5 = 15 Marks)**

    a) Will the accelerated carbonation method of preparing fresh concrete lead to an early corrosion of reinforcement in concrete? Justify your answer.

    b) How faster oxygen will diffuse with respect to carbon dioxide?

    c) Why low permeable concrete exhibits spalling at a lower temperature when exposed to fire?

    d) What is the physical difference observed between initial setting time and final setting time of cement paste? Why is it essential to determine before preparing a concrete mix?

    e) The compressive strength of a 152 mm concrete cube is measured to be 35 MPa after 7 days of curing. What will be the strength of the same concrete if it is measured using a cylindrical specimen having diameter 100 mm and height 200 mm after 28 days of curing? (Assume the 7 days compressive strength of concrete is about 70% of 28 days strength.)

3) Answer the following questions.   **(5 × 8 = 40 Marks)**

    a) A ship carrying an inflammable liquid collided with a bridge pier and started to burn there. The fire could only be controlled after 15 hours, which caused damage to the concrete pier of the bridge. You are assigned as an expert of the committee to ensure the present serviceability status

of the bridge after its exposure to heavy fire. Based on what scientific analyses you will report your recommendations.

b) Explain the different procedures to determine the modulus of elasticity of concrete.

c) Autogenous shrinkage is a significant part of total shrinkage only in huge concrete structures (e.g., dam). Is it true or false? Explain your answer with proper justification.

d) Ettringite formation due to sulphate attack in hardened concrete can severely reduce the strength of a concrete structure. Explain how and why?

e) Explain the influence of statistical size effect while using different procedures and specimens to determine the tensile strength of concrete.

f) Explain why a concrete cylinder subjected to uniaxial compression using a rigid platen exhibits a very different failure pattern than a cylinder loaded using flexible platen.

g) Why concrete is weak in tension?

h) Viewing the following figures, identify the cause of the cracks or damages in concrete with relevant justification.

(i)

(ii)

(iii)

(iv)

(v)

4) Answer the following questions. **(15 × 2 = 30 Marks)**

a) Discuss the chloride induced corrosion of reinforcement in detail. How is it different from carbonation induced corrosion?

b) Write short notes on
(i) Plastic shrinkage, (ii) Freeze-thaw damage of concrete, and (iii) Alkali carbonate reaction

-------- **All the Best** --------