Ex/PG/CIV/PE/T/121E/2025

M..E CIVIL ENGINEERING 1st YEAR 2nd SEMESTER EXAMINATION 2025

SUBJECT: Advanced Concrete Science and Technology

Time : 3 hours Full marks : 100

**Part – I ( 60 Marks )**

Ref No **Ex/PG/CIV/PE/T/121E/2025**

**Use separate Answer-script for each part**

**Draw neat sketches wherever necessary.**

**I.S codes and Handbooks are not allowed in the examination hall**

1 a) What are the major strategies used to achieve Net Zero Concrete? List and explain any three innovative materials or technologies currently being used or developed to reduce the carbon emissions of concrete to achieve net zero.

b) What are the challenges associated with the use of recycled aggregate in structural concrete, and how can these challenges be addressed through mix design or treatment techniques?

c) The mix design of concrete of grade M35 is as follows: Cement = 440 Kg/$m^3$ Coarse Aggregate =1050 Kg/$m^3$ fine aggregate = 820 Kg/$m^3$, water – cement ratio = 0.35. Temperature of both coarse and fine aggregates are 48 $^0$ C, temperature of cement is 33$^0$ C and that of mixing water is 29$^0$ C. Assume the aggregates are dry. The specific heat of cement and aggregate is 0.22cal/gm/$^0$ C. What will be the temperature of freshly mix concrete? If the temperature of mixing water is lowered to 10$^0$ C, what will be temperature of freshly mix concrete?

**6+6+8**

2(a) Write short notes on (with reference to microstructure analysis of concrete)

i) EDS
ii) XRD

b) What is Alkali Activated Concrete? Name the ingredients normally used in Alkali Activated Concrete? What are the differences between Alkali Activated concrete and normal concrete? State the limitations of the use of Alkali Activated Concrete.

c) Define porous concrete and explain its key components and mix proportions. How does it differ from conventional concrete in terms of structure and composition? Why is it considered an environmentally friendly construction material? **6+6+8**

[ Turn over

3a) Describe the Rapid Chloride Permeability Test of concrete and its limitations.

b) What are the different limit states in terms of durability of concrete?

c) A reinforced concrete structure is to be constructed for 60 years of service life at Kolkata (Exposure class C1 – Humid Warm).The nominal cover ( C ) to the reinforcement =30mm .A concrete mix of grade M25 has been suggested having OPC cement content of 390 Kg/$m^3$ ,water cement (w/c) ratio =0.37. Check whether the concrete mix and the nominal cover is appropriate against carbonation induced corrosion.

Assume, Ym1 =1.07 (for less than 75 yrs of design life) ,ym2 =1.05 (for medium quality control) Weather coefficient, W = 1.0, Yf =1 ( internal structure), Tp = 10 years , $CO_{2ck}$ , concentration (ppm) at Kolkata = 400, x=0.45 for OPC.

**Cd = C/ym2 ; Klck = 9.5* (w/c) -2.75 ( for OPC) ; Kld = Klck *Ym1 ;**

**Ti ( yrs) = Cd/( W* Kld *γf*($CO_{2ck}$/500) *x)**

**7+3+10**

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**M.E. CIVIL ENGINEERING FIRST YEAR SECOND SEM. EXAM. -2025**

**Subject: ADVANCED CONCRETE SCIENCE AND TECHNOLOGY**

**Time: 3 Hrs** **Full Marks 100**

**PART-II (MARKS-40)**

Use a separate Answer-Script for each part

| No. of questions | **Answer all questions** | **Marks 10+5+9+16=40** |
|---|---|---|
| 1. | Describe the effects of high temperature on hydrated cement paste and aggregate in concrete. | 10 |
| 2. | Write down the reasons behind the lacking of durability of concrete exposed in marine environment. | 5 |
| 3. | What do you mean by fiber reinforced concrete. Write down the factors effecting the fiber reinforced concrete | 2+7=9 |
| 4. | What do you mean by Self-compacting concrete. Write down the properties of Self-compacting concrete? Describe J-ring test for measuring the passing ability of Self-compacting concrete. | 2+4+10=16 |