



M.E DEGREE EXAMINATIONS: NOV/ DEC 2024

(Regulation 2024)

First Semester

STRUCTURAL ENGINEERING

24STI504: Advanced Concrete Technology

IS 10262:2019 code is permitted

COURSE OUTCOMES

- CO1:** Explain the role of constituent materials and admixtures in concrete composition and Performance.
- CO2:** Analyze the flow properties, setting, and hardening characteristics of fresh concrete and SCC.
- CO3:** Design mix proportions for special concrete and suggest advanced methods of concrete manufacture and placement.
- CO4:** Evaluate the durability and resistance properties of concrete and demonstrate NDT tests.
- CO5:** Recommend appropriate concreting methods and equipment for specialized applications and future trends in concrete technology.

Time: Three Hours

Maximum Marks: 100

PART A (4*20 = 80 Marks)

1. Scenario:
You are a project engineer overseeing the construction of a high-rise building in a metropolitan area. Due to the structural and environmental demands, the concrete must exhibit high strength, durability, and workability. To achieve these properties, you decide to use mineral and chemical admixtures in the concrete mix.

a)	Recommend any two mineral admixtures suitable for the project.	8	CO1	[K ₃]
b)	Recommend any two chemical admixtures suitable for the project.	8	CO1	[K ₃]
c)	List the various types of cement and the chemical composition of cement.	4	CO1	[K ₂]

2. a) An industrial RC building is designed with concrete grade equal to M30. How will you estimate the modulus of elasticity of the concrete by conducting an appropriate test? Also compare the value obtained with the value recommended by IS code.

8		8	CO2	[K ₃]
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- b) An RC slab of size 10 m x 15 m is to be checked for its reinforcements, spacing and cover depth. Recommend a suitable test and explain the procedure in detail with neat sketches to identify the reinforcements, spacing and its cover depth. 8 CO2 [K₃]
- c) Explain any one fresh concrete test to be done on SCC with a neat sketch. 4 CO2 [K₂]
3. The project involved constructing a 20-story commercial building in an urban area. To ensure the reliability of the structure, a rigorous testing and durability analysis program was implemented throughout the construction phase.
- a) Estimate the alkali aggregate reaction in the mix if the coarse aggregate is of reactive type. 8 CO4 [K₃]
- b) How will you evaluate the microstructure characterization of the concrete using SEM analysis? 8 CO4 [K₃]
- c) Analyze the degree of carbonation in the building after 15 years. 4 CO4 [K₂]
- A case study examines the application of concreting machinery, equipment, and specialized concreting methods in a complex infrastructure project. The project involved challenging conditions, including underwater concreting, extreme weather concreting, and the use of vacuum dewatering techniques.
4. a) Analyze the advantages and disadvantages of underwater concreting method with the detailed procedure. 8 CO5 [K₃]
- b) If the project involves precast concrete structure, explain the various elements of the precast concrete building with suitable sketches. 8 CO5 [K₂]
- c) Outline the process of 3D printing concrete and its advantages. 4 CO5 [K₂]

Answer any ONE Question
PART B (1*20 = 20 Marks)

5. a) Design a concrete mix for SCC concrete of grade M30 with the following stipulations for proportioning. Assume any required data. 20 CO3 [K₄]
- a) Grade designation: M35
- b) Type of cement: OPC: 43

- c) Nominal maximum size of aggregate: 20 mm
- d) Exposure conditions as per Table 3 and Table 5 of IS 456: Severe (for reinforced concrete)
- e) Characteristics of SCC
 - 1) Slump flow class: SF3 (slump flow 760 mm – 850 mm)
 - 2) Passing ability by L box test: Ratio of $h_2/h_1 = 0.9$
 - 3) V- Funnel flow time (Viscosity): Class V1 (flow time 8s)
 - 4) Sieve segregation resistance: SR1(15percent)
- f) Degree of site control: Good
- g) Type of aggregate: Crushed angular aggregate
- h) Maximum cement content (OPC Content) : 450 kg/m³
- j) Chemical admixtures type
 - 1) Superplasticizer: normal (PCE type)
 - 2) Viscosity modifying agent
- k) Mineral admixture: Fly ash conforming to IS 3812 (Part 1)

TEST DATA

Specific gravity of cement: 3.15

Specific gravity of

- 1) Coarse aggregate (at SSD condition): 2.74
- 2) Fine aggregate (at SSD condition) : 2.65
- 3) Chemical admixture: 1.08

e) Water absorption

- 1) Coarse aggregate: 0.5 percent
- 2) Fine aggregate: 1.0 percent

f) Free (surface) moisture

- 1) Coarse aggregate: Nil (absorbed moisture also nil)
- 2) Fine aggregate: Nil (absorbed moisture also nil)

OR

- 6. a) Design a high strength concrete of grade M75 using silica fume fly ash with 20 CO3 [K4] the following test data. Assume any required data.
 - a) Cement used: OPC 53 Grade conforming to IS 269

- b) Specific gravity of cement: 3.15
- c) Specific gravity of
 - 1) Coarse aggregate (at SSD condition) : 2.74
 - 2) Fine aggregate (at SSD condition): 2.65
 - 3) Fly ash : 2.20
 - 4) Silica fume : 2.20
 - 5) Chemical admixture: 1.08
- d) Workability: 120 mm (slump)
- e) Water absorption
 - 1) Coarse aggregate: 0.5 percent
 - 2) Fine aggregate: 1.0 percent
