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201CV001

Ph.D./M.S.(Engg.) by Research Degree Examination, Nov./Dec.2024
Advanced Design of RC Structures

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of IS456-2000 and SP16 is permitted.
3. Any missing data may be suitably assumed.

Module-1

1 **a.** Derive the expression for ultimate moment capacity of an isotropically reinforced simply supported square slab subjected to udl over its entire surface. **(10 Marks)**

b. Calculate the permissible load for a simply supported $6m \times 6m$ square slab, reinforced with 10 mm dia 415 steel bars at 180 mm spacing and an average effective depth of 120 mm (overall 150 mm) using M20 grade concrete. **(10 Marks)**

OR

2 A flat slab system consists of $5m \times 6m$ panels without drop and column head. Intended to support a live load of 4 kN/m^2 and a finishing load of 1 kN/m^2. Utilize M20 grade concrete and Fe415 steel. Given column size is $500\ mm \times 500mm$ and a floor to floor height of 4.5 m. Calculate design moments in interior and exterior panels at column and middle strip in both direction. **(20 Marks)**

Module-2

3 A RC grid floor is to be designed to cover a floor area of $12m \times 16m$. The spacing of the ribs in mutually perpendicular direction is 2 m c/c. Live load on floor is 1.5 KN/m^2. Adopt M20 grade concrete and Fe 415 grade HYSD bars. Assume ends are simply supported. Analyze the grid floor by IS 456:2000 method and design suitable reinforcement in the grid floor. **(20 Marks)**

OR

4 Design a continuous rectangular beam of span 7 m to carry a dead load of 12 KN/m and a live load of 16 KN/m. The beam is continuous over more than 3 spans and is supported by columns. Use M20 concrete and Fe415 steel. **(20 Marks)**

Module-3

5 Design a 70 m high Chimney and assess stress in bars considering external diameter at top as 4 m and at base 4.8 m, shell thickness at the top as 200 mm and at the base 400 mm, wind intensity of 1.8 KN/m^2 throughout. Fire brick lining thickness of 100 mm, air gap of 100mm, temperature difference of $70^\circ C$, co-efficient of thermal expansion $11 \times 10^{-6} /^\circ C$, Modulus of Elasticity E as $210 \times 10^3\ N/mm^2$, unit weight of brick line as 20 KN/m^3. Utilize M25 concrete and Fe 415 steel. **(20 Marks)**

OR

6 **a.** Describe the steps involved in the design of reinforced concrete chimneys. **(10 Marks)**

b. Calculate the stress induced by the temperature gradient in a circular reinforced concrete chimney with a constant shell thickness of 300 mm, an external diameter of 4 m and 1% steel reinforcement located 50 mm from the outer face. The temperature difference between the inside and outside faces is $70^\circ C$ with a modulus of elasticity for steel as 210 KN/mm^2 and for concrete as 19 KN/mm^2 and both material having a co-efficient of expansion of $11 \times 10^{-6} /^\circ C$. **(10 Marks)**

Module-4

7 Design the side walls and hopper bottom of a $3m \times 3m$ square bunker to store 30 tonnes of coal. Density of coal is 9 KN/m^3 and angle of repose is 30°. Adopt M20 grade concrete and Fe 415 HYSD bars. Sketch the details of reinforcements in the bunker. **(20 Marks)**

OR

8 Design a what storage silo with an internal diameter of 5.5 m, cylindrical portion height of 18 m and a central opening of 0.5 m utilize M20 grade concrete and Fe 415 steel considering given parameters, unit weight of wheat = 8.5 KN/m^3, angle of internal friction = 28°, wall friction angle = 0.75 ϕ while filling and 0.6 ϕ while emptying and pressure ratio K = 0.5 during filling. Apply Janssen's theory for pressure calculations. **(20 Marks)**

Module-5

9 **a.** List and explain the safe practice checklist for formwork. **(10 Marks)**

b. Explain briefly about various steps involved in erection of form work. **(10 Marks)**

OR

10 **a.** Write a short note on requirement of good formwork. **(10 Marks)**

b. Briefly explain shuttering for Beam and slab floor. **(10 Marks)**

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