Total No. of printed pages = 4

19/5th Sem/DCE504

2021

DESIGN OF CONCRETE STRUCTURES

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Define balance, under-reinforced and over reinforced beam sections with figure. What do you mean by modular ratio ? Determine modular ratio for M 20 concrete. 5+3=8

   (b) A beam section of size 300 mm × 500 mm effective depth is reinforced with 4–25 ϕ as tensile reinforcement. Using M 25 grade concrete and Fe 415 steel, determine

   (i) allowable moment of resistance and

   (ii) ultimate moment of resistance. 6+6=12

2. Define doubly reinforced beam sections. The cross sectional dimensions of a doubly reinforced beam section reinforced with 2–25 ϕ as compression

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reinforcement and 3–36 ϕ as tensile reinforcement is 300×550 effective depth. Determine the allowable moment on the beam section. Assume M 20 concrete and Fe 415 steel. Also determine the ultimate moment of resistance of the beam section. 2+18=20

3. (a) Differentiate between Working Stress Method (WSM) and Limit State Method (LSM). How do you determine neutral axis depth for rectangular beam section for WSM and LSM ? 4+3=7

(b) A rectangular beam of 7m span (c/c), resting on 350 mm wide simple supports, is to carry a uniformly distributed dead load (excluding self-weight) of 15 kN/m and a live load of 20 kN/m. Using Fe 415 steel, design the beam section at mid-span. Assume that the beam is subjected to moderate exposure conditions. 13

4. (a) Explain clearly the difference between flexural bond and development bond. What are the mechanisms by which bond resistance is mobilized in reinforced concrete ? Define development length. What is its significance ? 3+2+1+2=8

(b) Define shear reinforcement. A rectangular beam section of size 350 mm × 550 mm effective depth has a factored shear force of 500 kN at support and 150 kN at midspan. The tension steel consists of 4–25 ϕ bars extending upto the support. Assuming M 25 concrete and Fe 415 steel, design the beam for shear reinforcement at support and mid-span. 2+10=12

5. Write short notes on :

(i) One way slab and

(ii) Two way slab.

Design a one way slab, with a clear span of 7.0m, simply supported on 200 mm thick masonry walls, and subjected to a dead load of 4 kN/m^2 (excluding self-weight), live load of 5 kN/m^2 and a surface finish load of 1 kN/m^2 using Fe 415 steel. Assume that a slab is subjected to moderate exposure condition. 5+15=20

6. Distinguish between unsupported length and effective length of a compression member. What is meant by slenderness ratio of a compression member ? Classify column based on slenderness

ratio and define them. A column of size 400 mm × 500 mm has an unsupported length of 3m and is subjected to a load of 1500 kN. Design a column for M 20 concrete and Fe 415 steel when both the ends of the columns are effectively held in positions but not restrained against rotation.

4+2+4+10=20