DESIGN OF RCC STRUCTURE

Full Marks – 70

Pass Marks - 28

Time – Three hours

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

Answer question number 7 and any *five* from the rest.

1. Define balanced, under-reinforced and over reinforced section with diagrams. Design a reinforced concrete beam section using M25 grade concrete and Fe 415 steel. Take the effective depth of the beam section twice the width.

4+8=12

2. A reinforced concrete beam section having width 300 mm and effective depth 550 mm is reinforced with 2-25 ϕ as compression and 3-36 ϕ as tensile reinforcement. Determine the stresses in concrete and steel corrosponding to a service moment of 175 kNm. Further, determine the allowable moment on the beam section. Assume M 20 concrete and Fe 415 steel.

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3. Explain one-way slabs and two-way slabs with diagram. Determine the allowable moment of 200 mm thick slab reinforced with 12 mm diameter bars @ 200 mm c/c spacing located at an effective depth of 150 mm. Assume M 25 concrete and Fe 415 steel. 4+8=12

4. What is meant by slenderness ratio of a compression member ? Classify columns based on slenderness ratio and define them. Distinguish between unsupported length and effective length of a compression member. 12

5. (a) Explain in brief working stress method and limit state method. Which method among the two is more advantageous and why ? 5

   (b) A reinforced concrete beam section heaving width 350 mm and effective depth 650 mm is reinforced with 4 numbers of 25 mm diameter bars as tensile reinforcement. Determine the ultimate moment of resistance of the beam section considering : 7

       (i) M20 concrete and Fe 250 steel

       (ii) M20 concrete and Fe 415 steel.

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6. (a) A reinforced concrete beam of size 250 mm width and 450 mm effective depth is reinforced with 4 nos. of 25 mm diameter bars as tensile reinforcement. The shear reinforcement consists of 2- legged 8 mm diameter bars @ 150 mm c/c spacing. Estimate the shear capacity of the section for M20 grade concrete and Fe 415 steel.   7

   (b) What is bond in reinforced concrete ? What are the mechanisms by which bond resistance is mobilised in reinforced concrete ? Also explain in brief flexural bond and development bond.   5

7. Answer any *five* questions :   2×5=10

   (a) Why does the code limit the compresive strength of concrete in structural design to $0.67f_{ck}$ and not f_{ck} ?

   (b) Why is the cube strength different from the cylinder strength for same grade of concrete ?

   (c) What do the term stiffining. setting and hardening mean, with reference to cement paste ?

(d) What do you mean by creep of concrete ? What are its effect on reinforced concrete structure ?

(e) Define admixtures. What are different types of admixtures ?

(f) Show that the neutral axis depth factor (K_b) of a balanced (WSM) section depends only on the permissible tensile stress (δ_{st}) in steel.

(g) What is modular ratio ? How does creep of concrete affect modular ratio ?