(3 HRS)   Maximum Marks: 80

N.B.

1. Question no. **1 is compulsory**. Attempt any **THREE** out of reaming **FIVE** questions.

2. Assume suitable data **if necessary** but justify the same.

3. Use of IS code is **NOT** permitted.

Q.1 Attempt any **FOUR.**   20

    a.   What is Bond? How can we increase the bond between steel and concrete? (5)

    b.   State the assumptions made in the Limit State of Collapse (flexure) in RCC. Also draw strain and stress diagram across the section. (5)

    c.   What are the functions of distribution steel in one way slab? (5)

    d.   What are the steps for the design of a column subjected to axial load and biaxial bending? (5)

    e.   Write any four assumptions in Ultimate Load Design method in RCC. Also sketch the stress block used in this method. (5)

    f.   What is combined footing? Sketch plan and elevation of any two types of combined footing. (5)

Q.2 Attempt the following.   20

    a.   Determine the limiting moment of resistance of the beam having dimensions 300mm X 550 mm (effective), is reinforced with 4-20mm dia.bars in tension zone. Use (i) M_{20} concrete and Fe_{415} steel.(ii) M_{20} concrete and Fe_{250} steel. (10)

    b.   A beam of size 300 x 550 mm overall, is subjected to a factored bending moment of 260 kNm .Compute the reinforcement required at an effective cover of 50 mm to compression and tension reinforcement. Use M 20 concrete and Fe 415 steel. (10)

d'/d	0.05	0.100	0.15	0.20
f_{sc} (MPa)	355	353	342	329

Q.3 Attempt the following.   20

    a.   A reinforced concrete beam of 300 x 550 mm overall is reinforced with 6 bars of 20 mm φ HYSD steel of grade Fe 415, placed at an effective cover of 50 mm. The beam carries a factored UDL of 120 kN/m over a simply supported clear span of 5 m. Design the shear reinforcement if two bars are bent up at support making an angle of 45□. Use M 20 and Fe 415. Also sketch the shear reinforcement details. (10)

pt%	0.50	0.75	1.0	1.25	1.5	1.75
τ_c MPa	0.48	0.56	0.62	0.67	0.72	0.75

b. A tee beam having 1250 mm effective width of flange has a (10)
    thickness of flange equal to 115 mm. The effective depth of the
    beam is 550 mm and width of the web is 300 mm. It is reinforced
    with 8 bars of 20 mm φ on the tension side. Determine limiting
    moment of resistance if M 20 concrete and Fe 415 steel is used.

Q.4 Attempt the following.   **20**

a. A short RCC column is subjected to a factored load of 1900 kN (6)
    within the limit of minimum eccentricity. Design the column and
    show reinforcement details. Use M 30 and Fe 415.

b. A hall of a residential building measures 4.2 m x 6m. It is   (14)
    supported by 230 mm thick wall on all four sides. Design the
    simply supported slab using M 20 and HYSD Fe 415 steel.
    Assume the live load on the slab as 3kN/m² and the floor finish
    load as 1kN/m². Apply checks for shear, deflection and
    development length. Sketch the reinforcement details along both
    spans.

Ly/Lx	1.3	1.4	1.5	1.75
α_x	0.093	0.099	0.104	0.113
α_y	0.055	0.051	0.046	0.037

Q.5 Attempt the following.   **20**

a. Write step by step procedure to design isolated footing of uniform (4)
    thickness.

b. A rectangular beam of size 250 x 400 mm overall is reinforced   (8)
    with 3 bars of 16 mm φ as tension reinforcement. It is subjected to
    a shear force of 18 kN and a bending moment of 18 kN m. In
    addition to this it also carries a torsional moment of 1.8 kN m.
    Design the beam for combined BM,SF and TM.

c. A simply supported one way slab over a passage of a public   (8)
    building has a clear span of 2.5 m. It is supported on 230 mm thick
    wall. Design the slab using M 20 and Fe 415 steel. Assume live
    load as 5 kN/m² and floor finish load as 0.75 kN/m². Apply all
    required checks. Sketch the reinforcement details.

Q.6 Design the combined footing for two columns C1 and C2 of size 500 x **20**
     500 mm each, spaced at 4 m apart, carrying an axial compressive load
     of 1500 kN on each column. The available width restriction is 2.2m.
     The SBC of the soil is 150 kN/m². Use M 25 and Fe 415. Sketch
     reinforcement details.

MD-Con. 8000-15.