DESIGN OF REINFORCED CONCRETE STRUCTURE (3360601)

ASSIGNMENT-1

INTRODUCTION TO IS 456:2000

1. Give Definition
   i. Limit state
   ii. Characteristic Strength
   iii. Characteristic Load
   iv. Partial Safety Factor
   v. Design Strength
   vi. Design Load
2. State Different Form of Serviceability Limit State
3. Draw An Acceptable Stress-Strain Curve For Concrete In Limit State.
4. State the Design Strength in Compression for M-30 Grade of Concrete.
5. State Maximum Compressive Strainin Concrete in Axial Compression
6. State Tensile Strength of M-25 Grade of Concrete.
7. State Necessity of Reinforcement in R.C.C Structures.
8. Explain Limit State Of Collapse And Limit State Of Serviceability In Flexure

ASSIGNMENT-2

SINGLY R.C. BEAM

1. For a limiting section 225x400 mm effective. Determine the following, it is reinforced with an effective cover of 50 mm, Take M 20 concrete mix and Fy 250 N/mm².Find out
   i. Maximum compression stress in concrete and maximum tensile stress.
   ii. Lever arm
   iii. Total tension, total compression

2. For a limiting section 400 x 500mm effective. Determine the following if M 20 concrete mix and Fy 415 stress is used. Calculate
   i. Total compression in section
   ii. Area of tensile steel
   iii. Limiting section

3. A rectangular beam 225 x 375 mm over all section reinforced with 3 nos. of 20 mm diameter bars. Grade of concrete is M 20 and grade of steel is Fe 250 effective cover is 50 mm. Calculate
   i. Depth of neutral axis (Xu).
   ii. Lever arm (Z).
   iii. Moment of resistance (Mu).

4. Calculate limiting moment of resistance and area of steel for single reinforced beam section 250 mm wide and 400 mm deep effective. Take steel grade of Fe 250 and concrete M 20.

5. A singly R.C beam 250 x 550 mm is reinforced with 3 bars of 22 mm diameter at an effective cover of 30 mm effective span of beam is 4m. Use M 20 grade of concrete and Fe 415 steel. Find allowable live load on the beam.

ASSIGNMENT-4

DOUBLY R.C. BEAM

1. Explain singly and doubly reinforcement section. When doubly reinforcement is provided?

2. Explain Stress – Strain diagram for doubly R.C beam.

3. Find factored moment for a rectangular beam 300 x 550 mm overall. If it is reinforced with 5 nos. of 22 mm dia. of an effective cover of 50 mm as tension reinforcement and 3 nos. of 16 dia. At an effective cover of 50 mm as compression reinforcement. Use M 15 concrete mix and Fy 415 steel.

4. A R.C beam rectangular section 230 x 530 mm overall. It is reinforced with 5-20 dia. Bars as tension reinforced and 5-16 dia. Bars and compression reinforcement with effective cover 55mm on each side. Calculate depth of N.A and moment of resistance. Use M15 concrete and Fe 415 steel.

5. Find moment of resistance of following doubly reinforced beam:
   Width = 250 mm
   Effective depth =450 mm
   Compression reinforcement = 3 bars-16 mm dia. M.S.
   Tensile reinforcement = 6 bars-16 mm dia. M.S.
   Cover to compression reinforcement = 25 mm.
   Concrete = M 15

6. Calculate main reinforcement required for a rectangular doubly reinforced beam section 300 x 600 mm (effective) to resist a factored moment of 400 KN/m. Effective cover to each reinforcement is 50 mm. Use M 20 concrete and Fe 415 steel.

7. Find area of tensile and compressive steel required for a rectangular beam 250 x 450 mm for factored moment of 160 KN/m. Effective cover for tensile and compression steel are 50 mm and 40 mm respectively.
   Take M 20 concrete mix & Fy 415 steel as reinforcement.

8. A rectangular beam of size 300 x 580 mm overall to resist a factored load of 350 KN/m. Use concrete M 15 and steel Fe 415 and calculate required reinforcement. Assume effective cover 40 mm wherever necessary.

9. A reinforced concrete beam of rectangular section 230 x 500 mm deep is reinforced with tensile and compression reinforcement 4 nos. 20 mm dia. and 2 nos. 16 mm dia. at effective cover of 50 mm on both side. Use M 20 concrete & Fy 250. Calculate moment of resistance of the beam.

10. Design for tension and compression reinforcement for a rectangular beam of 300 x 700 mm overall. Beam is singly supported on 6 m span and subjected to super imposed load of 80 KN/m over entire span. Use M 20 concrete mix and Fe 415 steel reinforcement show the reinforcement details of beam.

ASSIGNMENT-5
TEE-BEAM

1. Calculate flange width of a T-beam from following data.
   i. Depth of flange = 120mm
   ii. Width of rib = 350 mm
   iii. Effective span = 7000 mm

2. A R.C.C, T-beam section reinforced for tension has following data:
   i. Flange width = 1500 mm
   ii. Thickness of flange = 120 mm
   iii. Effective span = 750 mm
   iv. Width of rib = 350 mm
   Determine the limiting moment of resistance of the section. Take M-20 concrete and fe-415 steel.

3. Find out limiting value of M.R of T-beam for the following data:
   i. Width of flange = 1800 mm
   ii. Depth of flange = 120 mm
   iii. Width of web = 250 mm
   iv. Effective depth = 450 mm
   v. Reinforcement 4 nos. 25 mm dia. of Fe-415 grade steel.
   vi. Concrete grade M-15

4. Find M.R of T-beam with the following data:
   i. Flange width = 1500 mm
   ii. Depth of flange = 100 mm
   iii. Width of web = 300 mm
   iv. Effective depth = 450 mm
   v. Steel 3nos-28 dia.
   vi. Use M-15 & Fe-415 steel.

5. A T-beam has the following dimensions:
   i. Effective width of flange =1500 mm
   ii. Thickness of slab =100 mm
   iii. Width of rib = 300 mm
   iv. Effective depth = 560 mm
   v. Tension reinforcement = 3-28dia. + 3-25dia.
   vi. Concrete M-15 & steel Fe-415 grade.

6. A T-beam has following dimensions:
    i. Effective width of flange = 1500 mm
    ii. Thickness of slab =100 mm
    iii. Width of rib = 300 mm
    iv. Effective depth =560 mm
    v. Tension reinforcement = 5-25 mm dia.
    vi. Concrete M-15 & Steel Fe-415 grade.

7. A flanged beam has following dimensions:
    i. Width of flange = 1200 mm
    ii. Width of rib = 350 mm
    iii. Thickness of slab = 130 mm
    iv. Overall depth = 550 mm
    v. Effective cover = 50 mm
    vi. Tension reinforcement = 2827 mm^2
    vii. Concrete grade = M-20
    viii. Grade of steel = Fe-415

    Find out moment of resistance of the beam.

ASSIGNMENT-6

DEVELOPMENT LENGTH AND SHEAR REINFORCEMENT

1. Determine in limit state method Development length for 20mm diameter,Fe-415 grade steel bar in compression. Concrete grade is M-20.

2. Determine the development length for 16mm diameter bar,
   Fe-415 grade steel in compression and concrete M-25

3. A simply supported beam 250mm × 500mm effective is supported on 5m span and subjected to total service. U.D.L. of 40kN/m over entire span. 4 Nos. of 22mm dia tensile bars are provided.Design for shear reinforcement. Use M-20 concrete mix and Fe-415 steel. Show the longitudinal section and cross section with details of reinforcement. Take Υ_f=1.5

4. A reinforced concrete beam 250mm × 400mm effective,is subjected to ultimate design shear force of 150kN at the critical section near supported.The tension reinforcement at the section near support is 0.5%. Design the shear stirrups near the support also design minimum shear reinforcement at the mid span.
   Use M-20 concrete and Fe-250 grade bars

5. A reinforced concrete beam of section 300mm × 450mm is reinforced with 3-20mm dia bars of Fe-250 at an Effective cover of 30mm. The Ultimate shear section 140kN Design shear reinforcement considering one 20mm dia bar bentup at 45°
   Use concrete M-20 and stirrups 8mm dia of mild steel.

6. Find spacing of 8 mm dia mild steel stirrups for a cantilever beam projecting 2 m from the wall. The effective cross section of the beam is 250 mm × 500 mm and is reinforced with 0.75% steel. The beam is subjected to a total u.d.l. of 35 KN/m throughout the span and it is also subjected to a point load of 80 KN at the free end.
   Take M-20 and Fe-415.

7. 4.8m simply supported beam having width and effective depth respectively as 250mm & 550mm, is reinforced with 3-20 mm ϕ steel

bar in tension. It carries a factored u.d.l. of 80 KN/m over its full length. Design and detail the stirrups at support.
Take M-20 and Fe-415.

ASSIGNMENT-7
AXIALLY LOADED COLUMNS

1. Determine the Ultimate load capacity of a rectangular column section of 400mm × 600mm reinforced with 6no.s 28 mm diameter bar. Consider concrete of grade M-25 and steel of grade Fe-415. Assume the e_{min} is less than 0.05 times the lateral dimension.

2. Design an axially loaded braced column for the following Data:
   i. Ultimate axial load Pu = 3000kN
   ii. Unsupported length of column=3.25m
   iii. Effective length lex=3.0m
   iv. Effective length ley=2.75m
   v. Use M20 concrete and Fe-415 steel.

   Design rectangular section and square section

3. Design a short axially loaded square column 500mm×500mm for a service load of 2000kN. Use M-20 concrete and fe-415 steel.

4. Design a short square R.C. column for an axial compressive factored load of 1500kN. The grade of concrete is M-20 and steel fe-415. Use minimum percentage of longitudinal reinforcement. Also design lateral ties. Sketch the details.

5. Design a circular column to carry an axial load of 1600kN. Using helical reinforcement. M-25 grade of concrete and Fe-415 grade of steel is used. Sketch the reinforcement details.

ASSIGNMENT-8

ISOLATED COLUMN FOOTING

1. Design an isolated square footing for a square column 400mm x 400mm for axial load of 800kN. Use concrete grade M-20 and Fe-250 steel grade. Take safe bearing capacity of soil 120 kN/m². Check for shear is not required. Also draw neat sketch showing section elevation and plan.

2. Design a square footing for an isolated column 500 mm x 500 mm size carrying an axial load of 1600 kN. Safe bearing capacity of soil is 200 kN/m². Use M-20 concrete and steel grade Fe-415. Check for shear is not required. Draw neat sketch.

3. The detail of column and pad footing are as under:
   i. Size of column 400 mm x 400 mm.
   ii. Size of footing 2500 mm x 2500 mm x 550 mm.
   iii. Factor soil pressure 120 kN/m².
   iv. Reinforcement 15 Nos. 12 mm dia.bars both ways.
   v. Effective cover 50 mm.
   vi. Concrete M 20 and Fe 415 are used.
      a. Check for footing in one way shear.
      b. Check for footing in two way shear.
      c. Check for development length of bar.

4. A R.C. column of size 400 mm x 400 mm size carries an axial compressive load of 1200 kN. Safe bearing capacity of soil 200 kN/m². Design an isolated sloped footing for column and neat sketch showing sectional elevation. Use concrete grade M-20 and steel grade Fe-415.

5. A square isolated footing 3.0 m x 3.0 m for a square column of 500 mm side is having its sloping depth 200 mm to 850 mm.
   The column is reinforced with 8 nos.of 25 mm diameter longitudinal bar with lateral ties 8 mm diameter of 350 mm center to center and it is under an axial load of 1200 kN.
   The footing is reinforced with 12 mm dia. of 200 mm center to center both ways.
   Check the footing for two-way shear if bearing capacity of soil is 200 kN/m².
   Show the details of reinforcement of column and footing, if M-20 concrete mix and Fe-415 steel is used in both column and footing.

6. Design a square isolated sloped footing for a column of size 450 x 450 mm, carrying an axial factored load 1500 kN. Safe bearing capacity of soil is 200 kN/m². Use M-25 grade of concrete ans Fe-500 steel. Check for shear and bearing pressure not required. Draw neat sketch.

7. Design an isolated square pad footing for a square column 320 mm x 320 mm for axial load of 700 kN. Use concrete grade M-20 and Fe-250 steel grade. Take safe bearing capacity of soil 140 kN/m². Check for shear is not required. Also draw neat sketch.

ASSIGNMENT-9
ONE WAY SLAB

1. Design the slab for the room for office building 3.2m x 9.2m. The slab is resting on 300 mm thick wall and resisting live load of 2.5 kN/m².
   Use M-20 concrete mix and fy-415 as steel as reinforcement.
   Check the slab for control of deflection and cracking. Show reinforcement details.
2. Design a simply supported one way slab for an effective span of 3.0 m to carry total factored load of 9 kN/m².Use M-20 concrete and Fe-250 steel. Draw sketch with all required details.
3. Design a simply supported slab on 350 mm wide brick masonry for a clear room size 4 m x 10 m. Use material grade M-20 & Fe-250. Take live load as 3.5 kN/m² and floor finish as 1 kN/m². Check your design for any two as shear (b) Development length (c) Deflection control and cracking.
4. Design a simply supported slab on 300 mm wide brick masonry wall for a clean room dimension 3 m x 6 m. Assume floor finish 0.75kN/m² and live load 3kN/m². Check for limit state of serviceability.
5. Design a continuous one way slab having three equal span of 4.0 m effective each with following data:
   1) Imposed load 4 kN/m².
   2) Floor finished load 1 kN/m².
   3) Concrete M-20 and steel Fe-250 grade.
   4) ɣf=1.5
6. design a continuous one-way slab having three equal span of 3.5 m each with following data:
   Impose load 5 kN/m².
   Floor finished load 1 kN/m².
   Concrete M-20 and steel Fe-415 grade.
7. A one way continuous slab of 120 mm thickness resting on 250 mm wide supports spaced at 3.2 m c/c. considering live load as 3 kN/m² and floor finished as 0.6 kN/m², design the reinforcement for span moments and support moment. Assume four span of the slab.
   Use M-20 concrete and Fe-415 steel. Check the slab for development length and limit state of serviceability. Also draw the section of the slab, with complete reinforcement details.

ASSIGNMENT-10
TWO WAY SLAB

1. Design a simply supported two-way slab of 3.0m × 3.0m clear span supported on 300mm thick wallon four sides.
   i. Live load=3KN/m^2
   ii. Floor finish=1KN/m^2
   iii. M-20 concrete and Fe-415 grade steel
   iv. Corners are not held down.

Draw reinforcement details.

2. Design a simply supported two way slab of 3.0m × 4.0m clear span supported on 300mm thick wall on four sides. Assume live load 4KN/m^2 and floor finish 0.5KN/m^2 . use M-20 concrete and Fe-250 steel. Corners are not held down.
Draw cross section of slab along both direction and show required reinforcement details.

3.Design a simply supported two way slab for a clear size 3m × 4m for a live load of 3KN/$m^2$by limit state method. Use concrete grade M-20 and steel Fe-415. Wall thickness is 250mm. assume corners are held down.

4. Design a two way simply supported slab 3m×3.5m clear span, supported on 300mm wide walls on all four sides. Assume live load 5KN/$m^2$and floor finish 1 KN/m^2 corners are held down. Draw Cross-section of slab.
Use M-20 concrete, Fe-415 steel,